Business Connectivity Market Review - Annexes

Review of competition in the provision of leased lines

Redacted for publication [✂]

Consultation

Publication date: 15 May 2015

Closing Date for Responses: 31 July 2015

Contents

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 31 July 2015**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://stakeholders.ofcom.org.uk/consultations/bcmr-2015/howtorespond/form, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email business.review@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Keith Hatfield
Ofcom, 4th floor
Riverside House
2A Southwark Bridge Road
London SE1 9HA

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex X. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you. You can respond to a sub-set of questions and are under no obligation to respond to all of the questions.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Keith Hatfield on 020 7981 3417.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether

all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/terms-of-use/

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a statement in early 2016.

A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/email-updates/

Ofcom's consultation processes

A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Graham Howell, Secretary to the Corporation, who is Ofcom's consultation champion:

Graham Howell
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA

Tel: 020 7981 3601

Email Graham.Howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A2.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A2.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at http://stakeholders.ofcom.org.uk/consultations/consultation-response-coversheet/.

A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here. ☐

Name

Signed (if hard copy)

Annex 4

Consultation questions

Question 4.1: Do you agree with our approach to wholesale product market definition and our proposed wholesale product market definitions in relation to services provided using contemporary interfaces? In particular, do you agree with our proposal to define a single product market for Contemporary Interface Symmetric Broadband Origination (CISBO) services? If not, what alternative would you propose and why?

Question 4.2: Do you agree with our assessment of competitive conditions for very high CISBO services? If not, what alternative would you propose and why?

Question 4.3: Do you agree with our approach to geographic market definition and our proposed geographic market definitions? In particular do you agree with our proposals to define the Central London Area (CLA) and the London Periphery (LP) as separate geographic markets? If not, what alternative would you propose and why?

Question 4.4: Do you agree with our approach to SMP assessment? In particular, do you agree with our proposals to find no CP to have SMP in the market for CISBO services in the Central London Area (CLA), and to find BT to have SMP in the markets for CISBO services in the London Periphery (LP) and the Rest of the UK (RoUK). If not, what alternative would you propose and why?

Question 4.5: Do you agree with our approach to product and geographic market definition for wholesale CI core conveyance services and do you agree with our proposed market definitions for wholesale CI core? If not, what alternative would you propose and why?

Question 4.6: Do you consider that our list of candidate competitive exchange and data centre locations is correct?

Question 4.7: Do you agree with our assessment that connectivity between additional candidate nodes and data centres are competitive?

Question 5.1: Do you agree with our proposal to identify a single product market for Traditional Interface Symmetric Broadband Origination (TISBO) services at low bandwidths with a single geographic market for the UK (excluding Hull)? If not, what alternative would you propose and why?

Question 5.2: Do you agree with our proposal not to identify any other Traditional Interface Symmetric Broadband Origination (TISBO) services above 2Mbit/s? If not, what alternative would you propose and why?

Question 5.3: Do you agree with our SMP assessment with respect to low bandwidth TISBO services? If not, what alternative would you propose and why?

Question 5.4: Do you agree with our approach to,and proposed product and geographic market definition for, wholesale TI trunk, including our proposal to treat 'regional trunk' segments as part of the TISBO market? If not, what alternative would you propose and why?

Question 6.1: Do you agree with our approach to (wholesale and retail) market definition in the Hull Area? If not, what alternative would you propose and why?

Question 6.2: Do you agree with our assessment of SMP to the markets for low bandwidth TISBO and CISBO services in the Hull Area? If not, what alternative would you propose and why?

Question 6.3: Do you agree with our assessment of SMP for the markets for low bandwidth TI and CI services in the Hull Area? If not, what alternative would you propose and why?

Question 6.4: Do you agree with our assessment of wholesale remedies not being sufficient to sustain effective competition in retail markets in the Hull Area? If not, what alternative would you propose and why?

Question 6.5: Do you agree with our finding that the three criteria test is met when applied to the retail markets in the Hull Area?

Question 7.1: Do you agree with our approach to assessing what remedies are appropriate to address the competition problems we have identified in the markets in which we propose to find that BT and KCOM have SMP? If not, please explain why, and what alternative approach you consider we should take.

Question 7.2: Do you agree with our assessment of the benefits that a package of passive and active remedies can offer relative to a package of active remedies only? If not, please explain why, giving your views on our assessment of these benefits, and providing any relevant evidence in support.

Question 7.3: Do you agree with our assessment of the risks associated with imposing passive remedies? If not, please explain why, giving your views on our assessment of these risks, and providing any relevant evidence in support.

Question 7.4: Do you agree that our proposal of a dark fibre remedy priced and designed in the way we have described in this consultation provides the best balance between the benefits and risks that we have identified? If not, please explain why, providing any relevant evidence in support, referencing specific aspects of our proposed remedy design where appropriate, and taking into account any comments you have made in response to questions 7.2 and 7.3.

Question 7.5: Do you agree with our assessment of passive remedies, and our proposal to include dark fibre in the package of remedies we propose to impose on BT? If not, please explain why.

Question 8.1: Do you agree with the general remedies that we propose for BT in the wholesale TISBO and CISBO markets? If not, what alternative remedies would you propose and why?

Question 9.1: Do you agree with our proposals in relation to the dark fibre remedy? If not, what alternative dark fibre remedy would you propose and why?

Question 9.2: Do you agree with our proposals in relation to the pricing of dark fibre? If not, please explain why, and what alternative approach you consider we should take.

Question 10.1: Do you agree with the specific active remedies that we propose for BT in the wholesale CISBO markets? If not, what alternative active remedies would you propose and why?

Question 11.1: Do you agree with the PPC Direction that we propose for BT in the wholesale TISBO market? If not, what alternative would you propose and why?

Question 12.1: Do you agree with the interconnection and accommodation remedies that we propose for BT in the wholesale TISBO and CISBO markets? If not, what alternative remedies would you propose and why?

Question 13.1: Do you agree with our assessment of Openreach's Ethernet provisioning process, how it has been working in practice, the root causes of performance deterioration and process developments? Does our assessment reflect your experiences and understanding of Openreach's wholesale Ethernet provisioning performance? If not, please explain why and provide us with any supporting evidence.

Question 13.2: Do you agree with our provisional conclusions on Openreach's performance? If not, please explain why, and provide us with any further supporting evidence.

Question 13.3: Have we accurately captured the reported impact of poor performance? If not, please explain why and provide us with any further supporting evidence.

Question 13.4: Do you agree with our assessment of Openreach's incentives to deliver acceptable Ethernet provisioning quality of service? If not, please explain why and provide us with any further supporting evidence.

Question 13.5: Do you agree that it is appropriate to exclude customer caused delays from the minimum standard performance measures for provision activities? If not, please explain why.

Question 13.6: Do you agree that it is appropriate to include the "non-customer" delays (also including Third Party delay in Openreach data) in the minimum standard performance measures for provision activities? If not, please explain why.

Question 13.7: Do you agree that it is appropriate to include delays due to events covered by MBORC declarations in the minimum standard performance measures for provision and repair activities? If not, please explain why.

Question 13.8: Do you agree that it is appropriate to apply the minimum standards nationally? If not, please explain why.

Question 13.9: Do you agree with our proposals regarding the application of minimum standards over the three year period of this review? If not, please set out your reasons and alternative proposals.

Question 13.10: Do you agree that it is appropriate to use a combination of initial CDD and TTP as the basis around which to set the new delivery date certainty minimum standards? Please provide reasoning for your answer. If you do not agree, please also give your proposed alternative including reasoning.

Question 13.11: Do you agree that it is appropriate to set the metrics for the delivery time certainty minimum standard to the initial value of 80% and final value of 90%? Please provide reasoning for your answer. If you do not agree, please also give your proposed alternative.

Question 13.12: Do you agree that it is appropriate to apply limits to mean TTP and upper (97%) and lower (40%) percentiles as the basis for the lead time minimum standard? Please provide reasoning for your answer. If you do not agree, please also give your proposed alternative.

Question 13.13: Do you agree that it is appropriate to set the upper percentile initial and final values to 159 and 118 working days and the lower percentile initial and final values to 30 and 29 working days for the lead time minimum standard to the values? Please provide reasoning for your answer. If you do not agree, please also give your proposed alternative.

Question 13.14: Do you agree that it is appropriate to set the repair time minimum standard to 94%? Please provide reasoning for your answer. If you do not agree, please also give your proposed alternative.

Question 13.15: Do you agree with our proposal to set a new SMP services condition which provides for Ofcom to direct BT to comply with all such quality of service requirements in relation to network access provided by BT pursuant to our proposed general and specific network access requirements? If not, please explain why.

Question 13.16: Do you agree that it is appropriate to assess compliance with the proposed minimum standards on an annual basis? If not, please explain why.

Question 13.17: Do you agree with our proposals to direct BT to comply with minimum performance standards for setting initial contractual delivery dates, delivery against initial contractual delivery dates, fault repair performance and overall mean time to provide? If not, please explain why, and set out your proposed alternative.

Question 13.18: Do you agree with our proposals to direct BT to provide the KPIs we have specified? If not, please explain why, and set out your proposed alternative.

Question 13.19: Do you agree with our proposals to maintain the existing SLG Direction? If not, please explain why, and set out your proposed alternative.

Question 13.20: Do you agree with our proposals regarding the conduct of, and principles and criteria to be applied from now on, to contractual negotiations concerning SLAs/SLGs for the provision of Ethernet services? If not, please explain why, and set out your proposed alternative.

Question 14.1: Do you agree with the remedies that we propose for KCOM in the retail TI and AI markets? If not, what alternative remedies would you propose and why?

Question 14.2: Do you agree with the remedies that we propose for KCOM in the wholesale TISBO and CISBO markets? If not, what alternative remedies would you propose and why?

Annex 5

List of respondents to our consultations

Domestic consultation

A5.1 On 1 April 2014, we published a Call for Inputs (the April 2014 CFI) to gather stakeholders' views on the key issues for our review before starting our substantive analysis of competitive conditions in leased lines markets, specifically inviting views on matters such as market definition, SMP assessment and remedies.[1] The closing date for responses was 27 May 2014 and the following stakeholders responded in writing:

- BT;
- Cinven Partners LLP;
- City of London Corporation;
- Colt;
- Grange Hotels;
- KCOM;
- MBNL;
- SSE plc;
- Sky;
- Talktalk;
- The Bit Commons;
- UKCTA;
- Verizon;
- Virgin Media;
- Vodafone; and
- One other CP who requested anonymity.

A5.2 Where respondents provided non-confidential versions of their responses, we have published them on our website.[2]

[1] http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/summary/Business-Connectivity-Market-Review.pdf

[2] http://stakeholders.ofcom.org.uk/consultations/business-connectivity-market-review/

A5.3 On 8 October 2014, we published our interim consultation (the October 2014 BCMR Consultation) setting out an explanation of the data we have requested from CPs and the methodologies, assumptions and judgments we have used to check and clean that data. We also presented an indicative set of network reach and service share calculations in order to assist stakeholders in commenting on this data collection and processing exercise.[3] The closing date for responses was 19 November 2014 and the following stakeholders responded in writing:

- BT;
- Colt;
- MBNL;
- Sky;
- Surf;
- Verizon;
- Virgin (response confidential); and
- Vodafone.

A5.4 Where respondents provided non-confidential versions of their responses, we have published them on our website.[4]

A5.5 On 5 November 2014, we published our preliminary consultation (the November 2014 BCMR Consultation) discussing the framework for assessing the role of passive remedies, the potential costs and benefits of passive remedies and the high level aspects of the design and scope of any passive access product.[5] The closing date for responses was 5 January 2015 and the following stakeholders responded in writing:

- BT
- CityFibre
- Colt
- FCS
- GTC
- Hyperoptic

[3] http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-data-analysis/summary/BCMR_Data_Consultation.pdf

[4] http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/

[5] http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-passives/summary/BCMR_passives.pdf

- INCA
- KCOM
- Level 3
- MBNL
- Passive Access Group
- Six Degrees Group
- Sky
- Talk Talk
- The Bit Commons
- Telefonica
- UKB Networks
- Updata (response confidential)
- Virgin Media
- Vodafone
- WarwickNet; and
- One other CP who requested anonymity.

A5.6 Where respondents provided non-confidential versions of their responses, we have published them on our website.[6]

[6] http://stakeholders.ofcom.org.uk/consultations/bcmr-passives/?showResponses=true

Annex 6

Draft legal instruments

NOTIFICATION OF PROPOSALS UNDER SECTIONS 48A AND 80A OF THE COMMUNICATIONS ACT 2003

Proposals for identifying markets, making market power determinations and setting SMP services conditions in relation to BT and KCOM under section 45 of the Communications Act 2003

Background

1. In June 2004, Ofcom completed its first market review in relation to retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments under the new EU regulatory framework that has applied since 25 July 2003, by setting out its main conclusions in a statement entitled "*Review of the retail leased lines, symmetric broadband origination and wholesale trunk segments markets — Final Statement and Notification — Identification and analysis of markets, determination of market power and setting of SMP conditions*".[7]

2. On 8 December 2008, Ofcom published a joint statement and consultation document entitled "*Business Connectivity Market Review — Review of the retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments*" ("**2008 BCMR Statement**").[8] That document set out Ofcom's main conclusions of its second review of the retail and wholesale markets for leased lines in the UK, by identifying markets, making certain market determinations and setting SMP conditions. At Annex 8 to that document, Ofcom published a notification under section 48(1) of the Act dated 8 December 2008 containing its market identifications, market power determinations and the setting of SMP conditions to be applied to BT and KCOM, respectively (with the exception of the SMP conditions imposing various charge controls on BT, see paragraph 4 below) ("**December 2008 Notification**").

3. On 13 February 2009, Ofcom published another statement entitled "*Business Connectivity Market Review — Review of the retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments markets*".[9] In that document, Ofcom concluded its consultation on the proposals set out in the 2008 BCMR Statement by deciding that no undertaking, individually or jointly with others, has significant market power in relation to the market for the provision of alternative interface symmetric broadband origination with a bandwidth capacity above one gigabit per second within the Hull Area.

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[7] http://stakeholders.ofcom.org.uk/binaries/consultations/llmr/statement/state_note.pdf

[8] http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr08/summary/bcmr08.pdf

[9] http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr08/statement/statement.pdf

4. On 2 July 2009, Ofcom published a statement entitled "*Leased Lines Charge Control — A new charge control framework for wholesale traditional interface and alternative interface products and services*".[10] In that document, Ofcom set out its conclusions on the charge controls for wholesale traditional and alternative interface leased lines services supplied by BT in markets which it was found to have significant market power as concluded in the 2008 BCMR Statement, by setting SMP conditions to be applied to BT under a notification under section 48(1) of the Act as dated 2 July 2009 and published at Annex 9 to that document ("**July 2009 Notification**").

5. On 30 September 2010, Ofcom published a statement entitled "*Leased Lines Charge Control — Adoption of Revised SMP Services Conditions following the Competition Appeal Tribunal's Directions of 20 September 2010*".[11] In that document, Ofcom made various modifications to the SMP conditions set out in Annex 9 to the July 2009 Notification in accordance with the directions given by the Competition Appeal Tribunal.

6. On 28 March 2013, Ofcom published a statement entitled "*Business Connectivity Market Review, Review of retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments*"[12]. That document set out Ofcom's conclusions on its third review of the relevant markets relating to leased lines and backhaul circuits used by businesses and communication providers, by identifying markets, making certain market determinations and setting SMP conditions (including charge control conditions). At Annexes 7 and 8 to that document, Ofcom published notifications under sections 48 and 49 of the Act, dated 28 March 2013, containing its market identifications, market power determinations and the setting of SMP conditions and directions to be applied to BT and KCOM, respectively ("**March 2013 Notification**").

7. On 20 December 2013, Ofcom published a consultation document entitled "*Regulatory Financial Reporting – A Review*" ("**2013 RFR Consultation**"). In that consultation, Ofcom made proposals in relation to the regulatory accounting SMP obligations of BT. In particular, Ofcom no longer proposed to apply to BT the regulatory accounting conditions set out in the regulatory statement "*The regulatory financial reporting obligations on BT and Kingston Communications Final statement and notification – Accounting separation and cost accounting: Final Statement notification*" ("**2004 RFR Statement**"). Ofcom proposed no changes to the regulatory accounting SMP obligations of KCOM.

8. On 20 May 2014, following consideration of the responses to the 2013 RFR Consultation and the making of such modifications to its proposals as it considered appropriate, Ofcom published a policy statement entitled "*Regulatory Financial Reporting: Final Statement*" ("**2014 RFR Statement**")[13] which set out (among other things) Ofcom's conclusions on the regulatory financial reporting policy that it considered should be applied to BT.

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[10] http://stakeholders.ofcom.org.uk/consultations/llcc/statement/

[11] http://stakeholders.ofcom.org.uk/binaries/consultations/llcc/statement/LLCC_decision_final.pdf

[12] http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/

[13] http://stakeholders.ofcom.org.uk/binaries/consultations/bt-transparency/statement/financial-reporting-statement-may14.pdf

9. Ofcom is now publishing, on 15 May 2015, a consultation document entitled "*Business Connectivity Market Review: Review of competition in the provision of leased lines*". In this document, Ofcom is consulting on new proposals identifying markets, making certain market power determinations and setting SMP services conditions on BT and KCOM respectively. These proposals include proposals for charge control conditions to be applied on BT. A consultation and corresponding notification will be published shortly with proposals for charge controls on BT when the charge control conditions set out in the March 2013 Notification expire on 31 March 2016.

Determinations for the United Kingdom outside the Hull Area

Proposals for market identifications and market power determinations

10. Ofcom is proposing to identify the following markets listed in Column 1 of Table A below for the purposes of making a proposed determination that the person specified in the corresponding row in Column 2 of that Table has significant market power in that identified services market.

Table A: Market identifications and market power determinations in the UK outside the Hull Area

Column 1: Market identification	***Column 2: Market power determination***
(a) Wholesale market for low bandwidth traditional interface symmetric broadband origination in the UK excluding the Hull Area, at bandwidths up to and including 8Mbit/s.	BT
(b) Wholesale market for contemporary interface symmetric broadband origination in the Rest of the UK excluding the Hull Area	BT
(c) Wholesale market for contemporary interface symmetric broadband origination in the CLA	[--]
(d) Wholesale market for contemporary interface symmetric broadband origination in the London Periphery	BT

11. For the avoidance of doubt, Ofcom proposes to determine that the markets listed at (c) in Table A above are effectively competitive and, therefore, that no person has significant market power in those markets.

12. The effect of, and Ofcom's reasons for, identifying the markets and making the market power determinations referred to in **paragraph 10** above are set out in the consultation document accompanying this notification.

Proposals to set and apply, modify and revoke SMP services conditions

Proposals to set and apply SMP services conditions

13. Ofcom is proposing to set, in relation to each of the services markets in which Ofcom is proposing to make the market power determinations as listed at **(a), (b) and (d)** in **Table A** above, the SMP conditions set out in **Schedule 6** to this notification to be applied to BT to the extent specified in that Schedule, which SMP conditions shall, unless otherwise is stated in that Schedule, take effect from the date of any notification under sections 48(1) and 79(4) of the Act adopting the proposals set out in this notification.

14. The proposals referred to in **paragraph 13** above include proposals to set the regulatory accounting SMP conditions which Ofcom considered in the 2014 RFR Statement should be applied to BT following Ofcom's review of the regulatory financial reporting policy.

Proposals to revoke SMP services conditions

15. Ofcom is proposing to revoke the SMP conditions applied to BT as set out in the March 2013 Notification (with the exceptions of SMP conditions 5.1 to 5.7 inclusive which relate to charge controls) on the date of publication of any subsequent notification under section 48(1) of the Act revoking those conditions.

16. The proposals referred to in **paragraph 15** above include proposals to revoke the SMP conditions which were set out in the 2004 RFR Statement (as amended by paragraph 15 above) insofar as they apply to the markets set out in paragraph 10 above.

17. The effect of, and Ofcom's reasons for making, the proposals in relation to the SMP conditions referred to in **paragraphs 13 to 16** above are set out in the consultation document accompanying this notification.

Charge controls

18. Insofar as SMP condition 5, as set out in Schedule 6 and regarding our proposals regarding network access pricing, is concerned, these SMP conditions will be contained in a separate notification under sections 48A and 80A of the Act.

Determinations for the Hull Area

Proposals for market identifications and market power determinations

19. Ofcom is proposing to identify the following relevant markets listed in Column 1 of **Table B** below for the purposes of making a proposed determination that the person specified in the corresponding row in Column 2 of that Table has significant market power in that identified services market.

Table B: Market identifications and market power determinations for the Hull Area

Column 1: Market identification	***Column 2: Market power determination (if any)***
(a) Wholesale market for low bandwidth traditional interface symmetric broadband origination in the Hull Area, at bandwidths up to and including 8Mbit/s	KCOM
(b) Wholesale market for contemporary interface symmetric broadband origination in the Hull Area	KCOM
(c) Retail market for low bandwidth traditional interface leased lines in the Hull Area, at bandwidths up to and including 8Mbit/s	KCOM
(d) Retail market for contemporary interface symmetric broadband origination in the Hull Area	KCOM

20. The effect of, and Ofcom's reasons for making, the proposals for identifying the markets and making the market power determinations referred to in **paragraph 19** above are set out in the consultation document accompanying this notification.

Proposals to set and apply, modify and revoke SMP services conditions

<u>Proposals to set and apply or modify SMP services conditions</u>

21. Ofcom is proposing to set, in relation to each of the services markets in which Ofcom is making the market power determinations as listed at **(a) to (d)** in Table B above, the SMP conditions set out in **Schedule 7** to this notification to be applied to KCOM to the extent specified in that Schedule, which SMP conditions shall, unless otherwise stated in that Schedule, take effect from the date of the notification under sections 48(1) and 79(4) of the Act adopting the proposals set out in this notification.

22. Ofcom is also proposing to set, in relation to each of the services markets in which Ofcom is making the market power determinations as listed at **(a) to (d)** in Table B above, the SMP conditions OB1 to OB27 and OB31 to OB33 to be applied to KCOM, but excluding subparagraphs (a) to (c) and (f) of SMP condition OB23, set out in the July 2004 (KCOM) Notification, but as read in light of the modifications to that Notification set out in **paragraph 23** below. Those SMP conditions shall, unless otherwise is stated in that Schedule, take effect on the date of the notification under sections 48(1) and 79(4) of the Act adopting the proposals set out in this notification.

23. Ofcom is proposing to modify the July 2004 (KCOM) Notification as follows—

a) in paragraph 4(a)(ii), the words "and 9 to 12" shall be replaced with the words "and 9 and 10";

b) in Part 1 (entitled "Wholesale Markets") of Schedule 1—
   (i) the market 10, being identified as "Wholesale market for medium bandwidth traditional interface symmetric broadband origination in the Hull Area, at bandwidths above 8Mbit/s and up to and including 45Mbit/s" shall be deleted and replaced with a new market 10, to be identified as "Wholesale market for contemporary interface symmetric broadband origination in the Hull Area";
   (ii) the market 11, being identified as "Wholesale market for high bandwidth traditional interface symmetric broadband origination in the Hull Area, at bandwidths above 45Mbit/s and up to and including 155Mbit/s" shall be deleted;
   (iii) the market 11a, being identified as "Wholesale market for very high bandwidth traditional interface symmetric broadband origination in the Hull Area, at bandwidths of 622Mbit/s" shall be deleted;
   (iv) the market 12, being identified as "Wholesale market for low bandwidth alternative interface symmetric broadband origination in the Hull Area, at bandwidths up to and including 1Gbit/s" shall be deleted; and
   (v) in the Column entitled "Date", for the dates specified in relation to the markets 9 to 12 there shall be substituted for the proposed markets 9 and 10 the date of Ofcom's publication of a notification under section 48(1) of the Act following the end of the EU consultation.

c) in Part 2 (entitled "Retail Markets") of Schedule 1:

   (i) the following two new Columns shall be added –
      a. "Retail market for low bandwidth traditional interface leased lines in the Hull Area, at bandwidths up to and including

8Mbit/s"; and

b. "Retail market for contemporary interface symmetric broadband origination in the Hull Area";

(ii) in the Column entitled "Date" there shall be added for the proposed markets referred to in paragraphs 23(c)(i)(a) and (b) above the date of Ofcom's publication of a notification under section 48(1) of the Act following the end of the EU consultation.

Proposals to revoke SMP services conditions

24. Ofcom is proposing to revoke the SMP conditions to be applied to KCOM as set out in the March 2013 Notification on the date of publication of any subsequent notification under section 48(1) of the Act revoking those conditions.

25. The effect of, and Ofcom's reasons for making, the proposals in relation to the SMP conditions referred to in **paragraphs 21 to 24** above are set out in the consultation document accompanying this notification.

Ofcom's duties and legal tests

26. In identifying and analysing the markets referred to in **paragraphs 10 and 19** above, and in considering whether to make the corresponding proposals set out in this notification, Ofcom has, in accordance with section 79 of the Act, taken due account of all applicable guidelines and recommendations which have been issued or made by the European Commission in pursuance of the provisions of an EU instrument and which relate to market identification and analysis or the determination of what constitutes significant market power. In so doing, pursuant to Article 3(3) of Regulation (EC) No 1211/2009, Ofcom has also taken the utmost account of any relevant opinion, recommendation, guidelines, advice or regulatory practice adopted by BEREC.

27. Ofcom considers that the proposed SMP conditions above comply with the requirements of sections 45 to 47, 87, 88 and 91 of the Act, as appropriate and relevant to each such SMP condition, and further that the proposed modifications and revocations of the SMP conditions referred to above comply with the requirements of sections 45 to 47, 87, 88 and 91 of the Act as appropriate and relevant to them.

28. In making all of the proposals referred to in this notification, Ofcom has considered and acted in accordance with its general duties set out in section 3 of the Act and the six Community requirements in section 4 of the Act. In accordance with section 4A of

the Act, Ofcom has also taken due account of all applicable recommendations issued by the European Commission under Article 19(1) of the Framework Directive.

Making representations

29. Representations may be made to Ofcom about any of the proposals set out in this notification and the accompanying consultation document by no later than 31 July 2015.

30. Copies of this notification and the accompanying consultation document have been sent to the Secretary of State in accordance with sections 48C(1) and 81(1) of the Act.

Interpretation

31. For the purpose of interpreting this notification—

a) except in so far as the context otherwise requires, words or expressions shall have the meaning assigned to them in paragraph 32 below, and otherwise any word or expression shall have the same meaning as it has in the Act;
b) headings and titles shall be disregarded;

c) expressions cognate with those referred to in this notification shall be construed accordingly; and
d) the Interpretation Act 1978 (c. 30) shall apply as if this notification were an Act of Parliament.

32. In this notification—

a) "2004 RFR Statement" has the meaning given to it by paragraph 7 of this notification;

b) "2008 BCMR Statement" has the meaning given to it by paragraph 2 of this notification;

c) "2013 RFR Consultation" has the meaning given to it by paragraph 7 of this notification;

d) "2014 RFR Statement"

has the given to it by paragraph 8 of this notification;

e) "Act" means the Communications Act 2003 (c. 21);

f) "BT" means British Telecommunications plc, whose registered company number is 1800000 and any British Telecommunications plc subsidiary or holding company, or any subsidiary of that holding company, all as defined in section 1159 of the Companies Act 2006;

g) "CLA" means the area consisting of the postal sectors set out in Schedule 1 to this notification;

h) "December 2008 Notification" has the meaning given to it by paragraph 2 of this notification;

i) "Hull Area" means the area defined as the 'Licensed Area' in the licence granted on 30 November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and KCOM Group plc;

j) "London Periphery" means the area consisting of the postal sectors set out in Schedule 2 to this Notification;

k) "March 2013 Notification" has the meaning given to it by paragraph 6 of this notification;

l) "July 2004 (KCOM) Notification" means the notification under sections 48(1) and 86(1) of the Act as dated 22 July 2004 and published at Annex 3 to the 2004 RFR Statement, as subsequently

amended by Ofcom;

m) "July 2009 Notification" has the meaning given to it by paragraph 4 of this notification;

n) "KCOM" means KCOM Group plc, whose registered company number is 2150618, and any of its subsidiaries or holding companies, or any subsidiary of such holding companies, all as defined in section 1159 of the Companies Act 2006;

o) "Ofcom" means the Office of Communications;

p) "Rest of the UK" means the area consisting of the UK excluding the CLA and the London Periphery;

q) "United Kingdom" has the meaning given to it in the Interpretation Act 1978 (1978 c30).

33. The Schedules to this notification shall form part of this notification.

M. Gibbs

Competition Policy Director, Ofcom

A person duly authorised in accordance with paragraph 18 of the Schedule to the Office of Communications Act 2002

15 May 2015

Schedule 1: List of postal sectors constituting the CLA

E1 0	EC1Y 0	EC3M 1	EC4V 2	SW7 1	W1K 2	WC1B 5
E1 1	EC1Y 1	EC3M 3	EC4V 3	W14 8	W1K 3	WC1E 6
E1 2	EC1Y 2	EC3M 4	EC4V 4	W1A 1	W1K 4	WC1E 7
E1 3	EC1Y 4	EC3M 5	EC4V 5	W1A 9	W1K 5	WC1H 0
E14 2	EC1Y 8	EC3M 6	EC4V 6	W1B 1	W1K 6	WC1H 8
E14 4	EC2A 1	EC3M 7	EC4Y 0	W1B 2	W1K 7	WC1H 9
E14 5	EC2A 2	EC3M 8	EC4Y 1	W1B 3	W1S 1	WC1N 1
E14 9	EC2A 3	EC3N 1	EC4Y 7	W1B 4	W1S 2	WC1N 2
E1 6	EC2A 4	EC3N 2	EC4Y 8	W1B 5	W1S 3	WC1N 3
E1 7	EC2M 1	EC3N 3	EC4Y 9	W1C 1	W1S 4	WC1R 4
E1 8	EC2M 2	EC3P 3	NW1 0	W1C 2	W1T 1	WC1R 5
E1W 2	EC2M 3	EC3R 5	NW1 1	W1D 1	W1T 2	WC1V 6
E1W 3	EC2M 4	EC3R 6	NW1 2	W1D 2	W1T 3	WC1V 7
EC1A 1	EC2M 5	EC3R 7	NW1 3	W1D 3	W1T 4	WC1X 0
EC1A 2	EC2M 6	EC3R 8	NW1 5	W1D 4	W1T 5	WC1X 8
EC1A 4	EC2M 7	EC3V 0	NW1 6	W1D 5	W1T 6	WC1X 9
EC1A 7	EC2N 1	EC3V 1	SE1 0	W1D 6	W1T 7	WC2A 1
EC1A 9	EC2N 2	EC3V 3	SE1 1	W1D 7	W1U 1	WC2A 2
EC1M 3	EC2N 3	EC3V 4	SE1 9	W1F 0	W1U 2	WC2A 3
EC1M 4	EC2N 4	EC3V 9	SW1A 1	W1F 7	W1U 3	WC2B 4

EC1M 5	EC2P 2	EC4A 1	SW1A 2	W1F 8	W1U 4	WC2B 5
EC1M 6	EC2R 5	EC4A 2	SW1E 5	W1F 9	W1U 5	WC2B 6
EC1M 7	EC2R 6	EC4A 3	SW1E 6	W1G 0	W1U 6	WC2E 7
EC1N 2	EC2R 7	EC4A 4	SW1H 0	W1G 6	W1U 7	WC2E 8
EC1N 6	EC2R 8	EC4M 5	SW1H 9	W1G 7	W1U 8	WC2E 9
EC1N 7	EC2V 5	EC4M 6	SW1P 1	W1G 8	W1W 5	WC2H 0
EC1N 8	EC2V 6	EC4M 7	SW1P 2	W1G 9	W1W 6	WC2H 7
EC1R 0	EC2V 7	EC4M 8	SW1P 3	W1H 1	W1W 7	WC2H 8
EC1R 1	EC2V 8	EC4M 9	SW1P 4	W1H 2	W1W 8	WC2H 9
EC1R 3	EC2Y 5	EC4N 1	SW1V 1	W1H 4	W2 1	WC2N 4
EC1R 4	EC2Y 8	EC4N 4	SW1W 0	W1H 5	W2 2	WC2N 5
EC1R 5	EC2Y 9	EC4N 5	SW1W 9	W1H 6	W6 7	WC2N 6
EC1V 0	EC3A 1	EC4N 6	SW1X 0	W1H 7	W8 4	WC2R 0
EC1V 1	EC3A 2	EC4N 7	SW1X 7	W1J 0	W8 5	WC2R 1
EC1V 2	EC3A 3	EC4N 8	SW1X 8	W1J 5	W8 6	WC2R 2
EC1V 3	EC3A 4	EC4R 0	SW1X 9	W1J 6	W8 7	WC2R 3
EC1V 4	EC3A 5	EC4R 1	SW1Y 4	W1J 7	WC1A 1	
EC1V 7	EC3A 6	EC4R 2	SW1Y 5	W1J 8	WC1A 2	
EC1V 8	EC3A 7	EC4R 3	SW1Y 6	W1J 9	WC1B 3	
EC1V 9	EC3A 8	EC4R 9	SW3 1	W1K 1	WC1B 4	

Schedule 2: List of postal sectors constituting the London Periphery

E14 0	SE1 7	TW5 0	W13 0
E14 1	SE1 8	TW5 9	W13 8
E14 3	SE8 5	TW6 2	W14 0
E14 6	SL1 0	TW7 4	W1A 3
E14 7	SL1 1	TW7 5	W2 3
E14 8	SL1 2	TW8 0	W2 4
E1 5	SL1 3	TW8 8	W2 6
E1W 1	SL1 4	TW8 9	W3 6
E2 6	SL1 5	UB10 0	W4 1
E2 7	SL1 6	UB1 1	W4 2
E3 2	SL2 5	UB11 1	W4 3
E3 3	SL3 9	UB1 3	W4 4
E77 1	SL6 0	UB18 7	W4 5
E98 1	SL6 1	UB18 9	W5 2
EC3M 2	SL6 2	UB3 1	W5 3
EC3N 4	SL6 4	UB3 2	W5 5
N1 0	SL6 8	UB3 3	W5 9
N1 6	SL9 7	UB3 4	W6 0
N1 7	SW1A 0	UB3 5	W6 6
N1 8	SW1V 2	UB4 0	W6 8

N1 9	SW3 2	UB5 6	W6 9
N1C 4	SW3 3	UB6 8	W7 1
NW10 5	SW7 2	UB6 9	W7 3
NW10 6	SW7 4	UB7 0	W8 9
NW10 7	SW7 5	UB7 7	W9 3
NW1 7	SW8 1	UB7 8	
NW1 8	SW8 5	UB7 9	
NW1 9	SW95 9	UB8 1	
NW3 3	TW13 4	UB8 2	
NW5 2	TW13 5	UB8 3	
NW6 4	TW14 8	UB8 9	
NW8 0	TW16 7	UB9 4	
SE11 5	TW3 1	W10 5	
SE11 6	TW3 2	W10 6	
SE1 2	TW3 3	W11 1	
SE1 3	TW3 4	W11 2	
SE1 4	TW3 9	W12 0	
SE1 6	TW4 5	W12 6	
SE16 2	TW4 6	W12 7	
SE16 4	TW4 7	W12 8	

Schedule 3: List of Core Nodes

Column 1: Core Nodes	Column 2: Dominant Provider's operational buildings
Core Node 1	Inverness Macdhui
Core Node 2	Portadown
Core Node 3	Yeovil
Core Node 4	Aberystwyth
Core Node 5	Bridgwater
Core Node 6	Swansea
Core Node 7	Southend On Sea
Core Node 8	Lincoln
Core Node 9	Truro
Core Node 10	Plymouth
Core Node 11	Dundee Tay
Core Node 12	Norwich City
Core Node 13	Pontefract
Core Node 14	Wrexham Grosvenor
Core Node 15	Bangor (Wales)
Core Node 16	Ashford
Core Node 17	Tunbridge Wells
Core Node 18	Bedford Town

Core Node 19	Bournemouth
Core Node 20	Hemel Hempstead
Core Node 21	Shrewsbury

Schedule 4: List of Data Centre Core Nodes

City Lifeline - Lifeline House
Colt London 3, WGC
Computacenter Romford
Computacenter Salford Quays
Coreix Limited datacentre
CyrusOne - London
Digital Realty Redhill
Equinix LD1 - London City
Equinix LD2 - London West
Equinix LD3 - Park Royal
Equinix LD4 - Slough
Global Crossing London datacentre
Global Switch London #1
Global Switch London #2
Interoute - Hoddesdon
Interxion LON1
Interxion LON2
Iomart London
Level 3 Braham Street datacentre
Level 3 London datacentre
MDS Technologies - Crawley
Navisite - Woking
Next Generation Data Newport
Node 4 - Derby
Node 4 - Leeds
Pulsant - Reading East
Pulsant -Milton Keynes
Pulsant - Reading Central
Pulsant - Newbridge
QiComm - Tutis Point
Savvis LO6
Sentrum - Sutton
Sentrum - Watford
Sentrum - Woking
SSE - Fareham
Sungard London Technology Centre
Tata Communications Cressex
Tata Communications Stratford
Telecity - Kilburn House
Telecity - Meridian Gate
Telecity - Williams House
Telecity - 6&7 Harbour Exchange
Telecity - 8&9 Harbour Exchange
Telecity - Bonnington House
Telecity - Joule House
Telecity - Oliver's Yard
Telecity - Powergate
Telecity - Sovereign House
Telehouse East
Telehouse Metro
Telehouse North
Telehouse West
TeliaSonera HEX/A
Telstra - Docklands
The Bunker - Ash
Docklands Data Centre Ltd - Tutis Point
Virtus LONDON1
Vital - Park Royal
Wildcard Networks IFL2
Wildcard Networks IFL3

Schedule 5: Trunk Aggregation Nodes

Column 1: Trunk Aggregation Nodes	Column 2: Dominant Provider's operational buildings
Aberdeen	Aberdeen Central
Barnsley	Barnsley
Basingstoke	Basingstoke/Bounty
Bedford	Bedford
Belfast	Belfast/City; Belfast/Seymour
Birmingham	Birmingham Central; Birmingham Midland; Birmingham Perryfields (Bromsgrove); Erdington; Chelmsley Wood; Acocks Green; Blackheath; Halesowen
Bishops Stortford	Bishops Stortford, Ware
Brighton	Brighton Hove; Portslade
Bristol	Bedminster; Bristol Redcliffe; Bristol North
Cambridge	Cambridge Trunks; Cambridge Science Park
Cardiff/Newport	Cardiff; Newport (Gwent)
Carlisle	Carlisle
Chelmsford	Chelmsford Town
Coventry	Coventry Greyfriar; Leamington Spa; Binley
Crawley	Crawley
Croydon	Croydon; Beckenham; Beulah Hill; Bromley; Mitcham; Wallington

Darlington	Darlington
Derby	Derby
Doncaster	Doncaster; Balby
Dundee	Dundee Main
Edinburgh	Edinburgh Donaldson
Exeter	Exeter Castle
Falkirk	Falkirk
Gillingham	Gillingham; Strood; Sittingbourne
Glasgow/Clyde Valley	Glasgow Central; Glasgow Douglas
Gloucester	Gloucester
Greenock	Greenock
Grimsby	Grimsby
Guildford	Guildford/Martyr, Aldershot
Hamilton	Hamilton
Ipswich	Colchester Town; Ipswich Town;
Irvine	Irvine
Kendal	Kendal
Kettering	Kettering
Kingston	Kingston
Leeds	Bradford (2); Leeds (3); Keighley; Shipley; Low Moor; Halifax; Brighouse; Castleford
Leicester	Leicester Montfort; Leicester Central; Glenfield

Liverpool	Liverpool Central
Livingston	Livingston Station
London Central	BT Tower (West Block); Covent Garden, Faraday Te (Moorgate), South Kensington; Southbank; Whitehall; Gerrard St (Soho); Monument; Bishopsgate; Shoreditch; Kings Cross; Euston; Marylebone; Paddington; Kingsland Green; Hackney
London Docklands	Bermondsey; Stepney Green; Poplar; Mile End
London East	Hornchurch, Kidbrooke, Upton Park; Woodford; Bexley Heath; Ingrebourne; Leytonstone
London North	Colindale; Wembley; Cricklewood; Golders Green; Willesden; Kenton Road; South Harrow
London West	Ealing; Southall; Isleworth; Hammersmith; Shepherd's Bush; Fulham
Luton	Luton Ate/Tower Block
Maidstone	Maidstone; West Malling
Manchester	Bolton; Dial House (Manchester); Oldham; Pendleton; Trafford; Central; Woodley; Radcliffe
Middlesbrough	Middlesbrough
Milton Keynes	Milton Keynes
Newbury	Newbury
Newcastle	Newcastle Central; South Shields
Northampton	Northampton; Kingsthorpe
Norwich	Norwich City; Norwich West
Nottingham	Nottingham Longbow; Trentside

Oxford	Oxford City; Cowley
Perth	Perth
Peterborough	Peterborough Wentw; Ortons
Plymouth	Plymouth; Crownhill
Portsmouth/Southampton	Cosham; Southampton; Eastleigh; Woolston
Potters Bar	Potters Bar, Enfield, Palmers Green
Preston	Preston (Lancs)
Reading	Bracknell; Reading; Tilehurst
Rugby	Rugby
Salisbury	Salisbury
Sheffield	Chesterfield; Sheffield Cutler; Attercliffe; Intake
Slough	High Wycombe; Slough; Egham; Uxbridge
Southend	Southend; South Benfleet
Stoke	Stoke Trinity/Pott; Newcastle Under Lyme
Swindon	Swindon
Warrington	Ashton In Makerfield; Northwich; Warrington
Watford	Watford, Hemel Hempstead, St Albans
Wolverhampton	Walsall Central; Wolverhampton Central; Bilston
York	Malton

Schedule 6: SMP conditions (BT)

Part 1: Application

1. The SMP conditions in Part 3 of this Schedule 6 shall, except where specified otherwise, apply to the Dominant Provider in each of the relevant markets listed in Column 1 of **Table 1** below to the extent specified in Column 2 of **Table 1**.

Table 1: Relevant markets for the purposes of this Schedule

Column 1: Relevant market	***Column 2: Applicable SMP conditions as set out in Part 3 of this Schedule 6***
Wholesale market for low bandwidth traditional interface symmetric broadband origination in the UK excluding the Hull Area, at bandwidths up to and including 8Mbit/s	Condition 1 Condition 3 Conditions 5 to 11 inclusive
Wholesale market for contemporary interface symmetric broadband origination in the Rest of the UK excluding the Hull Area	Conditions 1 to 11 inclusive
Wholesale market for contemporary interface symmetric broadband origination in the London Periphery	Conditions 1 to 11 inclusive

The Conditions referred to in Column 2 of **Table 1** are entitled as follows—

Condition 1	Network access on reasonable request
Condition 2	Specific forms of network access
Condition 3	No undue discrimination (wholesale)
Condition 4	Equivalence of Inputs basis
Condition 5	Basis of charges and charge controls
Condition 6	Publication of a Reference Offer
Condition 7	Notification of charges and terms and conditions
Condition 8	Quality of service
Condition 9	Notification of technical information
Condition 10	Requests for new forms of network access
Condition 11	Regulatory Financial Reporting

Part 2: Definitions and interpretation

1. In this Schedule 6—

(a) "Accepted Order" means an Order that has been validated and accepted by the Dominant Provider;

(b) "Access Charge Change" means any amendment to the charges, terms and conditions on which the Dominant Provider provides network access or in relation to any charges for new network access;

(c) "Access Charge Change Notice" means a notice given by the Dominant Provider of an Access Charge Change;

(d) "Access Agreement" means an agreement entered into between the Dominant Provider and a Third Party for the provision of network access in accordance with Condition 1;

(e) "Access Segment" means network access connecting an end user premise to—

(a) Local Access Node; or
(b) an operational building of the Dominant Provider; or
(c) an operational building of a Third Party.

(f) "Accommodation Services" means the provision of space permitting a Third Party to occupy part of an MDF/ODF Site reasonably sufficient to permit the use of network access provided by the Dominant Provider in accordance with Condition 1 and Condition 2 (as applicable), and in particular to permit the connection of the Dominant Provider's electronic communications network with that of a Third Party at that location and having the following characteristics—

(a) the Third Party's electronic communications network is situated in an area of the MDF/ODF Site which—

(i) is a single undivided space;

(ii) after proper performance by the Dominant Provider of its obligation to provide network access pursuant to Condition 1 and Condition 2 (as applicable), would permit the normal operation of the Third Party's electronic communications network (or would permit if the Dominant Provider removed any object or substance whether toxic or not, which might reasonably prevent or hinder the occupation of the MDF/ODF Site for such use); and

(iii) if so requested by the Third Party, is not unreasonably distant from the Dominant Provider's electronic communications network within the MDF/ODF Site;

(b) no permanent physical partition is erected in the space between the Third Party's electronic communications network and the Dominant Provider's electronic communications network; and

(c) the Third Party's electronic communications network is neither owned nor run by the Dominant Provider or by any person acting on the Dominant Provider's behalf;

(g) "Act" means the Communications Act 2003 (c. 21);

(h) "Backhaul Segment" means network access connecting either—

(a) an operational building of the Dominant Provider to—
(i) another operational building of the Dominant Provider; or
(ii) an operational building of a Third Party;

or

(a) an operational building of a Third Party to—
(i) another operational building of the Third Party; or
(ii) an operational building of the Dominant Provider.

(i) "CLA" means the area consisting of the postal sectors set out in Schedule 1 to this

Notification;

(j) "Commercial Information" means information of a commercially confidential nature relating to products and services to which Condition 4 applies, and which relates to any or all of the following in relation thereto—

(a) product development;

(b) pricing;

(c) marketing strategy and intelligence;

(d) product launch dates;

(e) cost;

(f) projected sales volumes; or

(g) network coverage and capabilities;

save for any such information in relation to which Ofcom consents in writing.

(k) "Competitive Core Node" means a node which is either: (i) at an operational building of the Dominant Provider set out in Column 2 of Schedule 5; or (ii) a Data Centre Core Node;

(l) "Completed Order" means an Accepted Order that has been provisioned and for which all related work has been carried out;

(m) "Connection Point" means an end user premise or such other termination point as shall be nominated by the Third Party including a joint box, man hole or street cabinet or structure belonging to the Third Party or its customer.

(n) "Core Node" means a node listed in Column 1 of Schedule 3 to this Notification consisting of an operational building of the Dominant Provider listed in Column 2 of Schedule 3;

(o) "Customer-Sited Handover" means interconnection between the electronic communications network of the Dominant Provider and the electronic communications network of a Third Party at an operational building of the Third Party;

(p) "Dominant Provider" means British Telecommunications plc, whose registered company number is 1800000 and any British Telecommunications plc subsidiary or holding company, or any subsidiary of that holding company, all as defined in

section 1159 of the Companies Act 2006;

(q) "Dark Fibre Segment" means network access connecting a Connection Point to -

(a) Local Access Node; or
(b) an operational building of the Dominant Provider; or
(c) an operational building of a Third Party;

(r) "Dark Fibre Service" means a service providing network access to one or more optical fibres suitable for the transmission of electromagnetic energy to convey Signals in relation to one or more of the following:

(a) Dark Fibre Segment;
(b) Backhaul Segment;
(c) Wholesale End-to-End Segment;

(s) "Data Centre Core Nodes" means the nodes listed in Schedule 4 to this Notification;

(t) "Equivalence of Inputs" means that the Dominant Provider provides, in respect of a particular product or service, the same product or service to all Third Parties (including itself) on the same timescales, terms and conditions (including price and service levels) by means of the same systems and processes, and includes the provision to all Third Parties (including itself) of the same Commercial Information about such products, services, systems and processes as the Dominant Provider provides to its own divisions, subsidiaries or partners subject only to: (a) trivial differences; and (b) differences relating to; (i) credit vetting procedures, (ii) payment procedures, (iii) matters of national and crime-related security (which for the avoidance of doubt includes for purposes related to the Regulation of Investigatory Powers Act 2000), physical security, security required to protect the operational integrity of the network, (iv) provisions relating to the termination of a contract, or (v) contractual provisions relating to requirements for a safe working environment. For the avoidance of any doubt, unless seeking Ofcom's consent, the Dominant Provider may not show any other reasons in seeking to objectively justify the provision in a different manner. In particular, it includes the use by the Dominant Provider of such systems and processes in the same way as other Third Parties and with the same degree of reliability and performance as experienced by other Third Parties;

(u) "Ethernet Services" means services presented with the standard networking protocol defined under that name in IEEE 802.3 and published by the Institute of Electrical and Electronics Engineers;

(v) "Hull Area" means the area defined as the 'Licensed Area' in the licence granted on November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and KCOM

Group plc;

(w) "In-Building Handover" means interconnection between the electronic communications network of the Dominant Provider and the electronic communications network of a Third Party within an operational building of the Dominant Provider;

(x) "Initial Contractual Delivery Date" means the first date provided by the Dominant Provider to a Third Party Customer on which an Order is planned to become a Completed Order;

(y) "In-Span Handover" means interconnection between the electronic communications network of the Dominant Provider and the electronic communications network of a Third Party in an external structure located reasonably adjacent to an operational building of the Dominant Provider such as, but not limited to, a manhole;

(z) "In-Span Handover Extension" means interconnection between the electronic communications network of the Dominant Provider and the electronic communications network of a Third Party in an external structure located remote from an operational building of the Dominant Provider such as, but not limited to, a manhole;

(aa) "Interconnection Services" means each of the following, individually and collectively—

(a) In-Span Handover (in relation to traditional interface services only);

(b) Customer-Sited Handover;

(c) In-Span Handover Extension (in relation to traditional interface services only); and

(d) In-Building Handover;

(bb) "Local Access Node" means an operational building of the Dominant Provider which supports the provision of services to end users and to which the end user is directly connected. For the avoidance of doubt, such nodes include sites housing a main distribution frame or an optical distribution frame;

(cc) "London Periphery" means the area consisting of the postal sectors set out in Schedule 2 to this Notification;

(dd) "MDF/ODF Site" means the site of an operational building of the Dominant Provider that houses a main distribution frame or an optical distribution frame;

(ee) "Network Termination Point" means the physical point at which a customer is provided with access to an electronic communications network;

(ff) “Order” means a request for the Relevant Ethernet Service or the Dark Fibre Service (as applicable) submitted to the Dominant Provider by a Third Party;

(gg) “Reference Offer” means the terms and conditions on which the Dominant Provider is willing to enter into an Access Agreement;

(hh) “Relevant Ethernet Services” means those Ethernet Services offered by the Dominant Provider to a Third Party under the product or service names of (i) Ethernet Access Direct, (ii) Ethernet Backhaul Direct or (iii) Cablelink including, in relation to each:

(a) all product variants except where Ofcom agrees otherwise, and
(b) the introduction by the Dominant Provider of a new product and/or service wholly or substantially in substitution for that existing product and/or service;

(ii) “Special Offer” means a temporary price reduction for a particular product or service, applicable to all customers on a non-discriminatory basis, which is stated to apply for a limited and predefined period and where the price immediately on expiry of that period is no higher than the price immediately before the start of that period;

(jj) “Third Party” means a person providing a public electronic communications service or a person providing a public electronic communications network;

(kk) ''Trunk Aggregation Node'' means a node listed in Column 1 of Schedule 5 to this Notification consisting of any one or more of the Dominant Provider’s operational buildings as listed in Column 2 of Schedule 5 ;

(ll) ''Trunk Segment'' means a service connecting any two Competitive Core Nodes, excluding any service connecting any two of the Dominant Provider’s operational buildings listed in Column 2 of Schedule 5 which are within the same Trunk Aggregation Node as listed in Column 1 of Schedule 5 (for example, a service connecting Potters Bar and Bracknell would constitute a Trunk Segment but not one connecting Bracknell and Reading);

(mm) “WDM Services” means services provided using wavelength division multiplexing equipment located at the customer’s premises and which is capable of supporting multiple leased line services over a single fibre or pair of fibres;

(nn) “Wholesale End-to-End Segments” means network access connecting an end user premise and another end user premise; and

(oo) **"**Working Day**"** means any day other than Saturdays, Sundays, public holidays or bank holidays in the United Kingdom.

2. For the purpose of interpreting this Schedule—

(a) except in so far as the context otherwise requires, words or expressions shall have the meaning assigned to them in paragraph 1 of this Part 2, and otherwise any word or expression shall have the same meaning as it has in the Act;

(b) headings and titles shall be disregarded;

(c) expressions cognate with those referred to in this Schedule shall be construed accordingly; and

(d) the Interpretation Act 1978 (c. 30) shall apply as if this Schedule were an Act of Parliament.

Part 3: SMP conditions

Condition 1 – Network access on reasonable request

1.1 The Dominant Provider must provide network access to a Third Party where that Third Party, in writing, reasonably requests it.

1.2 Except where Condition 1.3 applies, the provision of network access by the Dominant Provider in accordance with this Condition must:

(a) take place as soon as reasonably practicable after receiving the request from a Third Party (and, in any event, in accordance with Condition 8);

(b) be on:

(i) fair and reasonable terms, conditions and charges; and

(ii) such terms, conditions and charges as Ofcom may from time to time direct.

1.3 Where Condition 5 applies, the provision of network access by the Dominant Provider in accordance with this Condition must:

(a) take place as soon as reasonably practicable after receiving the request from a Third Party (and, in any event, in accordance with Condition 8);

(b) be on:

(i) fair and reasonable terms and conditions (excluding charges); and

(ii) such terms, conditions and charges as Ofcom may from time to time direct.

1.4 The provision of network access by the Dominant Provider in accordance with this Condition shall also include such associated facilities as are reasonably necessary for the provision of network access and such other entitlements as Ofcom may from time to time direct and, for the avoidance of doubt, associated facilities include Accommodation Services and Interconnection Services.

1.5 The Dominant Provider must comply with any direction Ofcom may make from time to time under this Condition.

Condition 2 – Specific forms of network access

2.1 Without prejudice to the generality of Condition 1, the provision of network access under Condition 1 shall include the following specific forms of network access—

(a) Ethernet Services (which do not contain a Trunk Segment) including the provision of the following services:

(i) Access Segments;

(ii) Backhaul Segments;

(iii) Wholesale End-to-End Segments, up to a maximum straight-line distance of 25km;

(b) WDM Services (which do not contain a Trunk Segment) including the provision of the following services:

(i) Backhaul Segments;

(ii) Wholesale End-to-End Segments;

(c) Dark Fibre Services up to a maximum straight-line distance of 50 km (which do not contain a Trunk Segment) including the provision of the services corresponding to the optical fibre elements of each of the services made available pursuant to Condition 2.1(a) and 2.1(b) above.

2.2 In providing Dark Fibre Services the Dominant Provider shall ensure that, where a service is provided which corresponds to the optical fibre elements of a service made available pursuant to Conditions 2.1(a) or 2.1(b) above, save in respect of objectively justifiable differences, it shall be provided:

(a) in accordance with the same systems and processes;

(b) in the same manner;

(c) within the same or shorter period of time

as applicable to the optical fibre elements of the corresponding service.

2.3 The provision of network access by the Dominant Provider in accordance with this Condition shall also include such other entitlements as Ofcom may from time to time direct.

2.4 Condition 2.1(c) shall enter into force on [one year after other Conditions come into force – date to be inserted].

2.5 The Dominant Provider must comply with any direction Ofcom may make from time

to time under this Condition.

Condition 3 – No undue discrimination

3.1 The Dominant Provider must not unduly discriminate against particular persons or against a particular description of persons, in relation to the provision of network access in accordance with Conditions 1 and 2 (as applicable).

3.2 In this Condition, the Dominant Provider may be deemed to have shown undue discrimination if it unfairly favours to a material extent an activity carried on by it so as to place one or more Third Parties at a competitive disadvantage in relation to activities carried on by the Dominant Provider.

Condition 4 – Equivalence of Inputs basis

4.1 Subject to Condition 4.2, the Dominant Provider must provide network access in accordance with Conditions 1 and 2 (as applicable) on an Equivalence of Inputs basis.

4.2 The obligation in Condition 4.1 to provide network access on an Equivalence of Inputs basis shall not apply to:

(a) Accommodation Services other than in relation to the allocation of space (to be allocated on a first-come-first-serve basis) and power in operational buildings belonging to the Dominant Provider;

(b) a Backhaul Segment connecting:

(i) the operational building of the Dominant Provider which is a Core Node and another Core Node; or

(ii) the operational building of the Dominant Provider which is a Core Node and a Competitive Core Node; or

(ii) two operational buildings of the Dominant Provider within a Trunk Aggregation Node.

(c) WDM Services with a straight line distance of more than 70km;

(d) WDM Services and single service Ethernet Services at bandwidths above 1Gbit/s provided within the London Periphery;

(e) network access which the Dominant Provider was providing otherwise than on an Equivalence of Inputs basis as at 31 March 2013; or

(f) such provision of network access as Ofcom may from time to time otherwise consent in writing.

4.3 Where WDM Services provided by the Dominant Provider to a Third Party differs from WDM Services provided by the Dominant Provider to itself only in respect of the interface used:

(a) subject to Condition 4.3(b), the obligation in Condition 4.1 shall apply;

(b) the obligation in Condition 4.1 shall not apply to the price for the provision of such WDM Services, but the Dominant Provider must ensure that such a price is not unduly discriminatory within the meaning of Condition 3.

4.4 Without prejudice to the generality of Condition 4.1, the Dominant Provider must not provide (or seek to provide) network access for its own services (including for those of its retail divisions, subsidiaries or partners), unless at the same time the Dominant Provider provides and/or offers to provide such network access to Third Parties on an Equivalence of Inputs basis.

4.5 For the avoidance of doubt, the obligations set out in this Condition 4 shall apply in addition to the obligations set out in Condition 3.

Condition 5 – Basis of charges and charge controls

Please see June 2015 LLCC Consultation.

Condition 6 – Publication of a Reference Offer

6.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall publish a Reference Offer in relation to the provision of network access pursuant to Conditions 1 and 2 (as applicable) and act in the manner set out below.

6.2 Subject to Condition 6.9, the Dominant Provider shall ensure that a Reference Offer in relation to the provision of network access pursuant to Conditions 1 and 2 (as applicable) includes, where applicable, at least the following:

(a) a description of the network access to be provided, including technical characteristics (which shall include information on network configuration where necessary to make effective use of network access);

(b) the locations at which network access will be provided;

(c) any relevant technical standards for network access (including any usage restrictions and other security issues);

(d) the conditions for access to ancillary, supplementary and advanced services (including operational support systems, information systems or databases for pre-ordering, provisioning, ordering, maintenance and repair requests and billing);

(e) any ordering and provisioning procedures, including the provision of an Initial Contractual Delivery Date;

(f) relevant charges, terms of payment and billing procedures;

(g) details of interoperability tests;

(h) details of maintenance and quality as follows:

(i) specific time scales for the acceptance or refusal of a request for supply and for completion, testing and hand-over or delivery of services and facilities, for provision of support services (such as fault handling and repair);

(ii) service level commitments, namely the quality standards that each party must meet when performing its contractual obligations;

(iii) the amount of compensation payable by one party to another for failure to perform contractual commitments;

(iv) a definition and limitation of liability and indemnity; and

(v) procedures in the event of alterations being proposed to the service offerings, for example, launch of new services, changes to existing services or change to prices;

(i) details of any relevant intellectual property rights;

(j) a dispute resolution procedure to be used between the parties;

(k) details of duration and renegotiation of agreements;

(l) provisions regarding confidentiality of the agreements;

(m) rules of allocation between the parties when supply is limited (for example, for the purpose of co-location or location of masts);

(n) the standard terms and conditions for the provision of network access.

6.3 The Dominant Provider shall ensure that a Reference Offer in relation to the provision of network access pursuant to Condition 2.1(c) separately sets out, in addition to the matters set out in Condition 6.2(a) to 6.2(n), an explanation of differences (if any) between:

(a) the matters set out in Condition 6.2(a) to 6.2(n) which apply to the provision of the Dark Fibre Services; and

(b) the matters set out in Condition 6.2(a) to 6.2(n) which apply to the provision of the corresponding services.

6.4 To the extent that the Dominant Provider provides to itself network access that—

(a) is the same, similar or equivalent to that provided to any Third Party; or

(b) may be used for a purpose that is the same, similar or equivalent to that provided to any Third Party;

in a manner that differs from that detailed in a Reference Offer in relation to network access provided to any Third Party, the Dominant Provider shall ensure that it publishes a Reference Offer in relation to the network access that it provides to itself which includes, where relevant, at least those matters detailed in Condition 6.2(a) to 6.2(n).

6.5 Except where Condition 6.6 applies, the Dominant Provider shall:

(a) within one month of the date that this Condition enters into force, publish a Reference Offer in relation to any network access that it is providing as at the date that this Condition enters into force; and

(b) update and publish the Reference Offer in relation to any amendments or in relation to any further network access provided after the date that this Condition enters into force.

6.6 In relation to forms of network access to be provided under Condition 2.1(c), the Dominant Provider shall:

(a) within four months of the date that this Condition enters into force, publish a draft Reference Offer in relation to the Dark Fibre Services;

(b) within seven months of the date that this Condition enters into force, publish a Reference Offer in relation to the Dark Fibre Services that it is providing at that time; and

(c) update and publish the Reference Offer in relation to any amendments or in relation to any further network access provided after [one year after other Conditions come into force – date to be inserted].

6.7 Publication referred to above shall be effected by the Dominant Provider placing a copy of the Reference Offer on any relevant publically available website operated or controlled by the Dominant Provider.

6.8 The Dominant Provider shall send a copy of the current version of the Reference Offer to any person at that person's written request (or such parts as have been requested).

6.9 The Dominant Provider shall make such modifications to the Reference Offer as Ofcom may direct from time to time.

6.10 The Dominant Provider shall provide network access at the charges, terms and conditions in the relevant Reference Offer and shall not depart therefrom either directly or indirectly.

6.11 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 7 – Notification of charges and terms and conditions

7.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall publish charges, terms and conditions and act in the manner set out in this Condition.

7.2 Where it proposes an Access Charge Change, the Dominant Provider shall send to every person with which it has entered into an Access Agreement pursuant to Conditions 1 and 2 (as applicable), an Access Charge Change Notice.

7.3 The obligation in Condition 7.2 shall not apply where the Access Charge Change is directed or determined by Ofcom or required by a notification or enforcement notification issued by Ofcom under sections 96A or 96C of the Act.

7.4 An Access Charge Change Notice must:

(a) in the case of an Access Charge Change involving new network access, be sent not less than 28 days before any such amendment comes into effect;

(b) in the case of an Access Charge Change relating solely to a reduction in the price of existing network access (including, for the avoidance of doubt, a Special Offer), be sent not less than 28 days before any such amendment comes into effect; and

(c) in the case of any other Access Charge Change involving existing network access, be sent not less than 90 days before any such amendment comes into effect.

For the avoidance of doubt, where the Dominant Provider provides network access under a Special Offer, the Dominant Provider is not required to give an Access Charge Change Notice when the price is increased in accordance with the stated terms of the Special Offer.

7.5 The Dominant Provider shall ensure that an Access Charge Change Notice includes:

(a) a description of the network access in question;

(b) a reference to the location in the Dominant Provider's current Reference Offer of the terms and conditions associated with the provision of that network access; and

(c) the date on which, or the period for which, the Access Charge Change will take effect (the "effective date").

7.6 The Dominant Provider shall not apply any Access Charge Change identified in an Access Charge Change Notice before the effective date.

7.7 To the extent that the Dominant Provider provides to itself network access that:

(a) is the same, similar or equivalent to that provided to any other person; or

(b) may be used for a purpose that is the same, similar or equivalent to that provided to any other person, in a manner that differs from that detailed in an Access Charge Change Notice in relation to network access provided to any other person,

the Dominant Provider shall ensure that it sends to Ofcom a notice in relation to the network access that it provides to itself which includes, where relevant, at least those matters detailed in Condition 7.5(a) to (c) and, where the Dominant Provider amends the charges, terms and conditions on which it provides itself with provides network access, it shall ensure it sends to Ofcom a notice equivalent to an Access Charge Change Notice.

Condition 8 – Quality of service

8.1 The Dominant Provider must comply with all such quality of service requirements as Ofcom may from time to time direct in relation to network access provided by the Dominant Provider pursuant to Conditions 1 and 2 (as applicable).

Condition 9 – Notification of technical information

9.1 Except in so far as Ofcom may from time to time otherwise consent in writing, where the Dominant Provider provides network access pursuant to Conditions 1 and 2 (as applicable) and proposes new or amended terms and conditions relating to the following:

(a) technical characteristics (including information on network configuration, where necessary, to make effective use of the network access provided);

(b) the locations at which network access will be provided; or

(c) technical standards (including any usage restrictions and other security issues),

the Dominant Provider shall publish a written notice (the "Notice") of the new or amended terms and conditions within a reasonable time period but not less than 90 days before either the Dominant Provider enters into an Access Agreement to provide the new network access or the amended terms and conditions of the existing Access Agreement come into effect.

9.2 The obligation in Condition 9.1 shall not apply:

(a) where the new or amended charges or terms and conditions are directed or determined by Ofcom or are required by a notification or enforcement notification issued by Ofcom under sections 96A or 96C of the Act; or

(b) in relation to new or amended technical specifications determined by NICC Standards Limited, whose registered company number is 6613589.

9.3 The Dominant Provider shall ensure that the Notice includes:

(a) a description of the network access in question;

(b) a reference to the location in the Dominant Provider's Reference Offer of the relevant terms and conditions;

(c) the date on which or the period for which the Dominant Provider may enter into an Access Agreement to provide the new network access or any amendments to the relevant terms and conditions will take effect (the "effective date").

9.4 The Dominant Provider shall not enter into an Access Agreement containing the terms and conditions identified in the Notice or apply any new relevant terms and conditions identified in the Notice before the effective date.

9.5 Publication referred to in Condition 9.1 shall be effected by the Dominant Provider:

(a) placing a copy of the Notice on any relevant publically available website operated or controlled by the Dominant Provider; and

(b) sending a copy of the Notice to any person at that person's written request, and where the Notice identifies a modification to existing relevant terms and conditions, to every person with which the Dominant Provider has entered into an Access Agreement pursuant to Conditions 1 and 2 (as applicable). The provision of such a copy of the Notice by the Dominant Provider may be subject to a reasonable charge.

Condition 10 – Requests for new forms of network access

10.1 The Dominant Provider shall, for the purposes of transparency, publish guidelines in relation to requests for new forms of network access made to it. Such guidelines shall detail:

(a) the form in which such a request should be made;

(b) the information that the Dominant Provider requires in order to consider a request for a new form of network access; and

(c) the timescales in which such requests will be handled by the Dominant Provider in accordance with this Condition.

10.2 Such guidelines shall be published within two months of the date that this Condition enters into force following a consultation with Ofcom and Third Parties. The Dominant Provider shall keep the guidelines under review and consult with relevant Third Parties and Ofcom before making any amendments to the guidelines. The Dominant Provider shall make such amendments to the guidelines as Ofcom may direct from time to time.

10.3 The Dominant Provider shall, upon a reasonable request from a Third Party considering making a request for a new form of network access, provide that Third Party with information so as to enable that Third Party to make a request for a new form of network access. Such information shall be provided within a reasonable period.

10.4 On receipt of a written request for a new form of network access, the Dominant Provider shall ensure that the requirements of this Condition are met. A modification of a request for a new form of network access which has previously been submitted to the Dominant Provider, and rejected by the Dominant Provider, shall be considered as a new request.

10.5 Within five Working Days of receipt of a request under Condition 10.4, the Dominant Provider shall acknowledge that request in writing.

10.6 Within fifteen Working Days of receipt of a request under Condition 10.4 the Dominant Provider shall respond in writing to the requesting Third Party in one of the following ways:

(a) the Dominant Provider shall confirm that the request will be met and shall confirm that the following will be prepared—

(i) the timetable for the provision of network access;

(ii) an initial offer of terms and conditions for the provision of network access; and

(iii) the timetable for the agreement of technical issues;

(b) the Dominant Provider shall confirm that a feasibility study is reasonably required in order to determine whether the request made is reasonable and the Dominant Provider shall set out its objective reasons for the need for such a study;

(c) the Dominant Provider shall confirm that the request is not sufficiently well formulated and, where it does so, the Dominant Provider shall detail all of the defects in the request which has been made; or

(d) the Dominant Provider shall confirm that the request is refused on the basis that it is not reasonable and, where it does so, the Dominant Provider shall detail its reasons for refusal.

10.7 Where the Dominant Provider responds to a request under Condition 10.4 in accordance with Condition 10.6(a) it shall, within thirty five Working Days of receipt of a request under Condition 10.4, respond further to the requesting Third Party in writing and:

(a) confirm the timetable for the provision of network access;

(b) provide an initial offer of terms and conditions for the provision of network access; and

(c) confirm the timetable for the agreement of technical issues.

10.8 Where the Dominant Provider responds to a request under Condition 10.4 in accordance with Condition 10.6(a) and determines, due to a genuine error of fact, that it reasonably needs to complete a feasibility study, it may, as soon as practicable and in any event, within thirty five Working Days of receipt of a request under Condition 10.4, inform the requesting Third Party that a feasibility study is reasonably required and set out its objective reasons for such a study.

10.9 Where Condition 10.8 applies the Dominant Provider shall, within forty five Working Days from the date that the Dominant Provider informs the requesting Third Party that a feasibility study is reasonably required, respond further to the requesting Third Party, in writing, in one of the following ways:

(a) the Dominant Provider shall confirm that the request will be met and shall:

(i) confirm the timetable for the provision of network access;

(ii) provide an initial offer of terms and conditions for the provision of network access; and

(iii) confirm the timetable for the agreement of technical issues.

(b) the Dominant Provider shall confirm that the request is refused on the basis that it is not reasonable and, where it does so, the Dominant Provider shall detail its reasons for refusal. The Dominant Provider shall provide to Ofcom a copy of the

feasibility study and shall provide to the requesting Third Party a non-confidential copy of the feasibility study.

10.10 The time limit set out in Condition 10.9 above shall be extended up to seventy Working Days from the date that the Dominant Provider informs the requesting Third Party that a feasibility study is reasonably required pursuant to Condition 10.8, if—

(a) circumstances have arisen which, despite the Dominant Provider using its best endeavours, prevent it from completing the feasibility study within forty five Working Days of the date that the requesting Third Party was informed of the need for a feasibility study pursuant to Condition 10.8; or

(b) the Third Party and the Dominant Provider agree to extend the time limit up to seventy Working Days.

10.11 The time limit set out in Condition 10.9 above shall be extended beyond seventy Working Days from the date that the Dominant Provider informs the requesting Third Party that a feasibility study is reasonably required pursuant to Condition 10.8, if:

(a) Ofcom agrees; or

(b) the Third Party and the Dominant Provider agree to extend the time limit beyond seventy Working Days.

10.12 Where the Dominant Provider responds to a request under Condition 10.4 in accordance with Condition 10.6(b), the Dominant Provider shall, within sixty Working Days of receipt of a request under Condition 10.4, respond further to the requesting Third Party, in writing, in one of the following ways:

(a) the Dominant Provider shall confirm that the request will be met and shall:

(i) confirm the timetable for the provision of network access;

(ii) provide an initial offer of terms and conditions for the provision of network access; and

(iii) confirm the timetable for the agreement of technical issues.

(b) the Dominant Provider shall confirm that the request is refused on the basis that it is not reasonable and, where it does so, the Dominant Provider shall detail its reasons for refusal. The Dominant Provider shall provide to Ofcom a copy of the feasibility study and shall provide to the requesting Third Party a non-confidential copy of the feasibility study.

10.13 The time limit set out in Condition 10.12 above shall be extended up to eighty five Working Days of receipt of a request under Condition 10.4, if:

(a) circumstances have arisen which, despite the Dominant Provider using its best endeavours, prevent it from completing the feasibility study within sixty Working Days of receipt of a request under Condition 10.4; or

(b) the Third Party and the Dominant Provider agree to extend the time limit up to eighty five Working Days.

10.14 The time limit set out in Condition 10.12 above shall be extended beyond eighty five Working Days of receipt of a request under Condition 10.4, if—

(a) Ofcom agrees; or

(b) the Third Party and the Dominant Provider agree to extend the time limit beyond eighty five Working Days.

10.15 The Dominant Provider shall keep the processes it has put in place to ensure compliance with this Condition (a description of which has been provided to Ofcom) under review to ensure that they remain adequate for that purpose.

10.16 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 11 – Regulatory Financial Reporting

11.1 The Dominant Provider must maintain a separation for accounting purposes between such different matters relating to network access to the relevant network or the availability of the relevant facilities, as required by conditions 11.3 to 11.35 including as Ofcom may from time to time direct under those conditions 11.3 to 11.35.

11.2 The Dominant Provider must comply with such rules made by Ofcom about the use of cost accounting systems as required by conditions 11.3 to 11.35 and must comply with such requirements about the description to be made available to the public of the cost accounting system as required by conditions 11.3 to 11.35 in each case including as Ofcom may from time to time direct under conditions 11.3 to 11.35.

11.3 Except in so far as Ofcom may consent otherwise in writing, the Dominant Provider shall act in the manner set out in these conditions.

11.4 Ofcom may from time to time make such directions as they consider appropriate in relation to the Dominant Provider's obligations under these conditions.

11.5 The Dominant Provider shall comply with any direction Ofcom may make from time to time under these conditions.

11.6 Where the Dominant Provider is required to comply with:

(i) these conditions;

(ii) the Regulatory Accounting Guidelines; and

(iii) the Regulatory Accounting Principles,

and it appears to the Dominant Provider that any of these requirements conflict with each other in a particular case, the Dominant Provider must resolve such conflict by giving priority to them in the order in which they are set out above.

11.7 For the purpose of these conditions, publication shall be effected by:

(i) placing a copy of the relevant information on any relevant publicly available website operated or controlled by the Dominant Provider; and

(ii) sending a copy of the relevant information to any person at that person's written request.

Requirements relating to the preparation, audit, delivery and publication of the Regulatory Financial Statements

11.8 The Dominant Provider shall in respect of the Market, Technical Areas, Products, Network Components and Network Services (as applicable), for each Financial Year:

(i) prepare such Regulatory Financial Statements as directed by Ofcom from time to time in accordance with these conditions, the Regulatory Accounting Guidelines, the Regulatory Accounting Principles and the Accounting Methodology Documents (the relevant Accounting Methodology Documents to be identified in the Regulatory Financial Statements by reference to their date);

(ii) prepare a reconciliation report as set out in condition 11.23;

(iii) secure the expression of an audit opinion upon the Regulatory Financial Statements as notified by Ofcom from time to time and on the reconciliation report as set out in condition 11.24;

(iv) secure the approval of the Regulatory Financial Statements by the board of directors of the Dominant Provider and secure the signature of the Regulatory Financial Statements by a director of the Dominant Provider for and on behalf of the board of directors;

(v) deliver to Ofcom copies of the Regulatory Financial Statements, the reconciliation report and any corresponding audit opinion, each and all of which shall be in the form in which they are ultimately to be published, at least two weeks before they are required to be published;

(vi) publish the Regulatory Financial Statements, the reconciliation report and any corresponding audit opinion, within four months after the end of the Financial Year to which they relate;

(vii) ensure that any Regulatory Financial Statement and corresponding audit opinion that it delivers to Ofcom and/or publishes are fit for such purpose (or purposes), if any, as notified by Ofcom in writing; and

(viii) publish with the Regulatory Financial Statements any written statement made by Ofcom and provided to the Dominant Provider commenting on the figures in, the notes to or the presentation of any or all of the Regulatory Financial Statements, the reconciliation report and/or the Accounting Methodology Documents.

11.9 The Dominant Provider shall make such amendments to the form and content of the Regulatory Financial Statements as are necessary to give effect fully to the requirements of these conditions. The Dominant Provider shall provide to Ofcom particulars of any such amendment, the reasons for it and its effect, when it delivers the Regulatory Financial Statements to Ofcom.

11.10 The Dominant Provider shall prepare all Regulatory Financial Statements, explanations or other information required by virtue of these conditions on a regulatory asset value adjusted current cost basis as directed by Ofcom from time to time and shall be capable of doing so in relation to any period. Such Regulatory Financial Statements, explanations or other information shall be, in the opinion of Ofcom, meaningfully reconcilable to the Statutory Financial Statements.

11.11 Each Regulatory Financial Statement shall include Prior Year Comparatives which shall be prepared on a basis consistent with Current Year Figures. The Dominant Provider may depart from this requirement in preparing the Regulatory Financial Statements for a Financial Year if there are reasons for doing so provided that the particulars of the departure, the reasons for it and its effect are stated in a note in the Regulatory Financial Statements in accordance with the Statutory Accounting Standards.

Requirements relating to audit of the Regulatory Financial Statements

11.12 The Regulatory Auditor that the Dominant Provider from time to time appoints shall at all times be satisfactory to Ofcom having regard to such matters as Ofcom consider appropriate. The Dominant Provider shall notify Ofcom in writing of the Regulatory Auditor appointed to secure compliance with these conditions before the Regulatory Auditor carries out any work for that purpose. The Dominant Provider shall notify Ofcom of any proposed change of Regulatory Auditor 28 days before effect is given to that change.

11.13 In the event that the Regulatory Auditor is in the opinion of Ofcom unsatisfactory, the Dominant Provider shall appoint and instruct an Alternative Regulatory Auditor that is at all times satisfactory to Ofcom having regard to such matters as Ofcom consider appropriate. The Dominant Provider shall ensure that the Alternative Regulatory Auditor:

(i) carries out such on-going duties as are required to secure compliance with these conditions;

(ii) carries out work or further work, in addition to that performed by the Statutory Auditor and/or by the former Regulatory Auditor, in relation to such matters connected to compliance with these conditions as are of concern to Ofcom and notified to the Dominant Provider in writing; and/or

(iii) re-performs work previously performed by the Statutory Auditor and/or by the former Regulatory Auditor in relation to such matters connected to compliance with this condition as are of concern to Ofcom and notified to the Dominant Provider in writing.

11.14 The Dominant Provider shall extend to the Alternative Regulatory Auditor such assistance and co-operation as would be extended to the Statutory Auditor and/or to the Regulatory Auditor and, to the extent similar assistance and co-operation may be required from the Statutory Auditor and/or from the former Regulatory Auditor, the Dominant Provider shall use its best endeavours to secure such assistance and co-operation.

11.15 The Dominant Provider's letter of engagement appointing the Regulatory Auditor or Alternative Regulatory Auditor shall include such provisions acknowledging the acceptance by the Regulatory Auditor or Alternative Regulatory Auditor of duties and responsibilities to Ofcom in respect of its audit work, audit report and audit opinion as are consistent with the ICAEW Guidance.

11.16 The Dominant Provider shall use its best endeavours to obtain from the Regulatory Auditor or Alternative Regulatory Auditor any further explanation and clarification of any audit opinion required under these conditions and any other information in respect of the matters which are the subject of that audit opinion as Ofcom shall require.

11.17 The Dominant Provider shall obtain such assurance statement in the form of the Agreed Upon Procedures in relation to the Dominant Provider's obligations under these conditions as directed by Ofcom.

Requirements relating to the Accounting Methodology Documents

11.18 The Dominant Provider must prepare, maintain and keep up-to-date the Accounting Methodology Documents in accordance with these conditions, with the Regulatory Accounting Guidelines, and with the Regulatory Accounting Principles.

11.19 The Dominant Provider must include in the Accounting Methodology Documents documentation setting out a description of each of the Attribution Methods, the Transfer Charge System Methodology, the Accounting Policies and the Long Run Incremental Cost Methodology, to the extent not covered in the Regulatory Accounting Guidelines.

11.20 The Dominant Provider must deliver an up-to-date version of the Accounting Methodology Documents to Ofcom when it delivers the Regulatory Financial Statements to Ofcom in accordance with condition 11.8 and publish such up-to-date version on or before the day of publication of the Regulatory Financial Statements which have been prepared in accordance with such version.

Requirements relating to changes to the Regulatory Accounting Methodology and the correction of Material Errors

11.21 The Dominant Provider must publish and deliver to Ofcom a list of each and every change to the Regulatory Accounting Methodology, by 31 March of the Financial Year in which the change to the Regulatory Accounting Methodology is to be made (the "Change Control Notification"). The Change Control Notification must be accompanied by a description of each of the changes, the reason for making each of the changes (including by reference to their compliance with the Regulatory Accounting Guidelines and the Regulatory Accounting Principles), and the impact of each of the changes on the figures at the level of the Markets and Technical Areas (as applicable) by setting out the figures which were presented in the previous Financial Year alongside the figures that would have been presented had such changes been made in the previous Financial Year.

11.22 Where in Ofcom's opinion any change referred to in condition 11.21 does not comply with these conditions, the Regulatory Accounting Principles or the Regulatory Accounting Guidelines, the Dominant Provider shall not make such change, if so directed by Ofcom.

11.23 The Dominant Provider must prepare a reconciliation report as referred to in condition 11.8 and as directed by Ofcom from time to time, which sets out changes to the Regulatory Accounting Methodology and the impact of such changes on the Regulatory Financial Statements, and Material Errors corrected in the Regulatory Financial Statements and the impact of such Material Errors on the Regulatory Financial Statements.

11.24 The Dominant Provider must obtain an audit opinion on the reconciliation report as directed by Ofcom from time to time.

Requirements relating to the Regulatory Accounting System

11.25 The Dominant Provider's Regulatory Accounting System must be able to produce the Regulatory Financial Statements as directed by Ofcom under condition 11.8 in accordance with these conditions, the Regulatory Accounting Guidelines, the Regulatory Accounting Principles and the Accounting Methodology Documents.

11.26 Where the Dominant Provider replaces the whole or part of its Regulatory Accounting System, or substantially modifies such Regulatory Accounting System, the Dominant Provider must:

(i) notify Ofcom in a timely manner of the replacement or modification, and, where so requested by Ofcom, inform Ofcom of progress towards completion and such other information as Ofcom may reasonably request;

(ii) ensure, to the best of its ability, that the replacement or modification does not cause the figures contained in the Regulatory Financial Statements to be different from the figures that would have been contained in the Regulatory Financial Statements had such Regulatory Financial Statements been prepared using the old or unmodified Regulatory Accounting System;

(iii) in relation to the final Financial Year for which the Regulatory Financial Statements are prepared using the old or unmodified Regulatory Accounting System, prepare a systems reconciliation report, which must:

a. set out the difference between the Current Year Figures presented in the Regulatory Financial Statements and the Current Year Figures had such Regulatory Financial Statements been prepared on the basis of the new or modified Regulatory Accounting System, expressed as a percentage change; and

b. explain each and every Material Difference between the Current Year Figures presented in the Regulatory Financial Statements and the Current Year Figures had such Regulatory Financial Statements been prepared on the basis of the new or modified Regulatory Accounting System;

(iv) publish and deliver the systems reconciliation report to Ofcom by 31 December of the Financial Year for which the figures will be prepared using the new or modified Regulatory Accounting System for the first time;

(v) obtain an assurance statement in the form of Agreed Upon Procedures on the systems reconciliation report, which must report:

a. whether the figures in the systems reconciliation report referred to in condition 11.26(iii)(a) have been properly extracted from the old or unmodified Regulatory Accounting System and the new or modified Regulatory Accounting System respectively;

b. whether each and every difference in the systems reconciliation report referred to in condition 11.26(iii)(a) has been correctly calculated; and

c. whether the explanation of each and every Material Difference in the systems reconciliation report referred to in condition 11.26(iii)(b) is an accurate representation of the cause of each such Material Difference.

(vi) deliver the assurance statement in the form of the Agreed Upon Procedures to Ofcom when it delivers the systems reconciliation report to Ofcom in accordance with condition 11.26(iv).

(vii) where the systems reconciliation report referred to in condition 11.26(iii) indicates that the replacement or modification causes the Current Year Figures contained in the Regulatory Financial Statements to be significantly different, either individually or in aggregate, from the Current Year Figures that would have been contained in the Regulatory Financial Statements had such Regulatory Financial Statements been prepared using the new or modified Regulatory Accounting System, prepare, if so directed by Ofcom, the Regulatory Financial Statements on a basis consistent with the old or unmodified Regulatory Accounting System.

Requirements relating to deficiencies in the Regulatory Financial Statements and the Accounting Methodology Documents

11.27 Where Ofcom have reasonable grounds to believe that any or all of the Regulatory Financial Statements and/or Accounting Methodology Documents are deficient, the Dominant Provider shall, where directed by Ofcom:

(i) amend the Accounting Methodology Documents in order to remedy the deficiencies identified by Ofcom;

(ii) restate the Regulatory Financial Statements identified by Ofcom as requiring restatement in accordance with the Accounting Methodology Documents which have, where necessary, been amended pursuant to condition 11.27(i);

(iii) prepare a reconciliation report as set out in condition 11.23, whereby any reference to the Regulatory Financial Statements should be understood as a reference to the restated Regulatory Financial Statements;

(iv) secure in accordance with any relevant notification of Ofcom under this condition the expression of an audit opinion on the restated Regulatory Financial Statements;

(v) deliver to Ofcom the restated Regulatory Financial Statements, the reconciliation report and corresponding audit opinion; and

(vi) publish the restated Regulatory Financial Statements, the reconciliation report and corresponding audit opinion.

Requirements relating to the maintenance of sufficient accounting records

11.28 The Dominant Provider shall maintain accounting records for a period of six years from the date on which each Regulatory Financial Statement is delivered to Ofcom.

11.29 The Dominant Provider shall maintain the accounting records in accordance with these conditions, the Regulatory Accounting Guidelines, the Regulatory Accounting Principles and the Accounting Methodology Documents.

11.30 The Dominant Provider shall maintain accounting records in a form which, on a historical cost basis and on a current cost basis:

(i) separately identifies each of the Markets, Technical Areas, Products, Network Components and Network Services;

(ii) separately attributes the costs, revenues, assets and liabilities of each of the Markets, Technical Areas, Products, Network Components and Network Services; and

(iii) shows and explains the transactions underlying each of the Markets, Technical Areas, Products, Network Components and Network Services.

11.31 The Dominant Provider shall maintain the accounting records so that they are sufficient:

(i) to provide an adequate explanation of each Regulatory Financial Statement;

(ii) to show that charges are non-discriminatory; and

(iii) to provide a complete justification of the Dominant Provider's charges for Network Access.

Requirement to facilitate on-demand reporting

11.32 The Dominant Provider shall ensure that its Regulatory Accounting System and accounting records are sufficient to enable the Dominant Provider, at all times, to be capable of preparing in relation to any specified calendar month or months a financial statement in accordance with the Accounting Methodology Documents.

Requirements relating to the preparation and maintenance of a Wholesale Catalogue

11.33 The Dominant Provider must prepare, maintain and keep up-to-date a Wholesale Catalogue. Such Wholesale Catalogue should separately identify and describe:

(i) External Wholesale Services;

(ii) Internal Wholesale Services;

(iii) Wholesale Services supplied both externally and internally; and

(iv) Network Services and the extent to which these activities are used in the course of supplying Wholesale Services.

11.34 The Dominant Provider must deliver an up-to-date version of the Wholesale Catalogue to Ofcom when it delivers the Regulatory Financial Statements to Ofcom in accordance with condition 11.8 and publish such up-to-date version on or before the day of publication of the Regulatory Financial Statements which have been prepared by reference to such version.

Requirements relating to the demonstration of non-discrimination

11.35 The Dominant Provider shall ensure it is able to demonstrate that at any point in time:

(i) where a Network Service or combination of Network Services is used by the Dominant Provider in providing Internal Wholesale Services, the amount applied and incorporated in the Transfer Charge for the Internal Wholesale Service in respect of the use of the Network Service or combination of Network Services is equivalent to the amount applied and incorporated for the use of the Network Services or combination of Network Services in the charge payable for an equivalent External Wholesale Service;

(ii) the same amount as applied and incorporated in the Transfer Charge for the Internal Wholesale Service in condition 11.35(i) in respect of the use of the Network Service or combination of Network Services is applied to the Network Service or combination of Network Services whenever it is or they are used by the Dominant Provider in providing that same Internal Wholesale Service; and

(iii) the same amount as applied and incorporated in the Transfer Charge for the equivalent External Wholesale Service in condition 11.35(i) in respect of the use of the Network Service or combination of Network Services is applied to the Network Service or combination of Network Services whenever it is or they are used by the Dominant Provider in providing that same External Wholesale Service;

(iv) the amount applied and incorporated in the Transfer Charge for the Internal Wholesale Service in condition 11.32(i) in respect of the use of the Network Service or combination of Network Services shall be the cost of those Network Services unless the Network Service concerned is provided from a Market which is different from the Market which comprises the Internal Wholesale Service.

11. 36 In this condition 11:

a) "Accounting Methodology Documents" means the documentation maintained by the Dominant Provider setting out in detail the rules, policies, methods, allocations, calculations, assumptions, procedures and Processes used by the Dominant Provider for the purpose of preparing Regulatory Financial Statements in accordance with the Regulatory Accounting Guidelines and the Regulatory Accounting Principles;

b) "Accounting Policies" means the manner in which the Dominant Provider applies the requirements of Regulatory Accounting Guidelines and the Regulatory Accounting Principles in each of the Regulatory Financial Statements;

c) "Alternative Regulatory Auditor" means any auditor not for the time being appointed as the Dominant Provider's Regulatory Auditor;

d) "Agreed Upon Procedures" means an engagement carried out in accordance with international standard (ISRS 4400) under which the Regulatory Auditor or another independent third party performs a set of audit procedures agreed by Ofcom and based on Ofcom's specific requirements in relation to the Regulatory Financial Statements, and reports the findings of that work to Ofcom;

e) "Attribution Methods" means the practices used by the Dominant Provider to attribute revenue (including appropriate Transfer Charges), costs (including appropriate Transfer Charges), assets and liabilities to activities or, insofar as those activities have been aggregated into Wholesale Segments or Retail Segments in a given Market or Technical Area (as applicable), to each Wholesale Segment or Retail Segment;

f) "Current Year Figures" means, in relation to any set of Regulatory Financial Statements, the amounts relating to the Financial Year to which the statements relate;

g) "External Wholesale Services" means services supplied or offered to any Communications Provider other than the Dominant Provider;

h) "Financial Year" means a financial year of the Dominant Provider in respect of which the Statutory Financial Statements are required to be (or to have been) prepared and audited in accordance with the requirements of the Companies Act 2006;

i) "ICAEW Guidance" means the technical release titled "Reporting to Regulators of Regulated Entities: Audit 05/03" issued by the Audit and Assurance Faculty of the Institute of Chartered Accountants in England & Wales in October 2003;

j) "Internal Wholesale Services" means services supplied within the Dominant Provider;

k) "Long Run Incremental Cost Methodology" means the long run incremental cost principles, procedures and Processes which form the framework under which long run incremental costs are determined by the Dominant Provider;

l) "Market" means the market to which these conditions apply;

m) "Material Error" means a deviation from accuracy or correctness which meets the materiality threshold as directed by Ofcom from time to time for the purpose of these conditions;

n) "Material Difference" means a difference identified in a systems reconciliation report which meets the materiality threshold as directed by Ofcom from time to time for the purpose of these conditions;

o) "Network Component" means an element of the network that is used to provide Wholesale Services, and, to the extent the network components are used in the Market or Technical Area (as applicable), specified in a direction given by Ofcom from time to time for the purposes of these conditions;

p) "Network Services" means those groups of Network Components used directly (or which in the absence of horizontal or vertical integration would be used directly) in the course of supplying Wholesale Services;

q) "Prior Year Comparatives" means, in relation to any set of Regulatory Financial Statements, the amounts relating to the Financial Year immediately preceding the Financial Year to which the Regulatory Financial Statements relate, re-evaluated if necessary to ensure that such figures are comparable to the Current Year Figures;

r) "Process" means the series of inter-related activities or actions to obtain, record or hold data or information or to carry out any operation or set of operations on the data or information, including:

i. organisation, storage, adaptation, or alteration of the data or information;

ii. retrieval, consultation, computation or use of the data or information;

iii. disclosure of the data or information by transmission, dissemination, or otherwise making available; or

iv. alignment, combination, blocking, erasing or destruction of the data or information;

s) "Product" means any product or service comprised in a Market or Technical Area to which these conditions apply;

t) "Regulatory Accounting Guidelines" means documentation setting out the policies, methodologies, systems, Processes and procedures for deriving or

calculating costs, revenues, assets and liabilities as directed by Ofcom from time to time for the purpose of these conditions;

u) "Regulatory Accounting Methodology" means the rules, policies, methods, allocations, calculations, assumptions and procedures used by the Dominant Provider for the purpose of preparing Regulatory Financial Statements;

v) "Regulatory Accounting Principles" means the principles as directed by Ofcom from time to time for the purpose of these conditions;

w) "Regulatory Accounting System" means the set of computerised and manual accounting methods, procedures, Processes and controls established to determine and attribute the costs, revenues, assets and liabilities and summarise, interpret, and present the resultant financial data in an accurate and timely manner;

x) "Regulatory Auditor" means the auditor for the time being appointed by the Dominant Provider in accordance with these conditions;

y) "Regulatory Financial Statement" means any financial statement in respect of a Financial Year prepared or required to be prepared by the Dominant Provider in accordance with these conditions;

z) "Retail Segments" means groups of Retail Products;

aa) "Statutory Accounting Standards" means the accounting standards, including the requirements of the Companies Act 2006, by reference to which the Dominant Provider is required to prepare the Statutory Financial Statements;

bb) "Statutory Auditor" means the auditor for the time being appointed by the Dominant Provider in accordance with the requirements of the Companies Act 2006;

cc) "Statutory Financial Statements" means any annual account required to be prepared by the Dominant Provider in accordance with the requirements of the Companies Act 2006;

dd) "Technical Area" means the technical area to which these conditions apply;

ee) "Transfer Charge" means the charge or price that is applied, or deemed to be applied, within the Dominant Provider by one division or business unit of the Dominant Provider to another for the use or provision of an activity or group of activities. For the avoidance of doubt, such activities or group of activities include, amongst other things, Products provided from, to or within the Market or Technical Area (as applicable) and the use of Network Components in the Market or Technical Area (as applicable);

ff) "Transfer Charge System Methodology" means the methodology of the system employed by the Dominant Provider which enables an activity to use a service or good from another activity and to account for it as though it had purchased that service or good from an unrelated party (including accounting for it at an appropriate amount);

gg) “Wholesale Catalogue” means the documentation required to be produced by the Dominant Provider under condition 11.33;

hh) “Wholesale Segments” means groups of Wholesale Services; and

ii) “Wholesale Services” means services related to network access on the Dominant Provider’s network used by or offered to any Communications Provider (including the Dominant Provider).

Schedule 7: SMP conditions (KCOM)

Part 1: Application

1. The SMP conditions in Part 3 of this Schedule 7 shall, except where specified otherwise, apply to the Dominant Provider in each of the relevant markets listed in Column 1 of **Table 1** to the extent specified in Column 2 of **Table 1**.

Table 1: Relevant markets for the purposes of this Schedule

Column 1: Relevant market	***Column 2: Applicable SMP conditions as set out in Part 3 of this Schedule 7***
Wholesale market for low bandwidth traditional interface symmetric broadband origination in the Hull Area, at bandwidths up to and including 8Mbit/s	Conditions 1 to 6 inclusive
Wholesale market for contemporary interface symmetric broadband origination in the Hull Area	Conditions 1 to 6 inclusive
Retail market for low bandwidth traditional interface leased lines in the Hull Area, at bandwidths up to and including 8Mbit/s	Conditions 7 to 10 inclusive
Retail market for contemporary interface symmetric broadband origination in the Hull Area	Conditions 7 to 10 inclusive

The Conditions referred to in Column 2 of **Table 1** are entitled as follows—

Condition 1	Network access on reasonable request
Condition 2	No undue discrimination (wholesale)
Condition 3	Publication of a Reference Offer (wholesale)
Condition 4	Notification of charges and terms and conditions
Condition 5	Notification of technical information
Condition 6	Provision of a Wholesale Pricing Transparency Report
Condition 7	Provision of retail leased lines
Condition 8	No undue discrimination (retail)
Condition 9	Publication of a Retail Reference Offer
Condition 10	Provision of a Retail Pricing Transparency Report

Part 2: Definitions and interpretation

1. In this Schedule 7—

(a) "Access Charge Change" means any amendment to the charges, terms and conditions on which the Dominant Provider provides network access or in relation to any charges for new network access;

(b) "Access Charge Change Notice" means a notice given by the Dominant Provider of an Access Charge Change;

(c) "Access Agreement" means an agreement entered into between the Dominant Provider and a Third Party for the provision of network access in accordance with Condition 1;

(d) "Act" means the Communications Act 2003 (c. 21);

(e) "Dominant Provider" means KCOM Group plc, whose registered company number is 2150618, and any of its subsidiaries or holding companies, or any subsidiary of such holding companies, all as defined in section 1159 of the Companies Act 2006;

(f) "First Relevant Year" means a period beginning on the date on which this Schedule enters into force and ending on 31 March 2017;

(g) "Hull Area" means the area defined as the 'Licensed Area' in the licence granted on

November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and KCOM Group plc;

(h) "Network Termination Point" means the physical point at which a customer is provided with access to an electronic communications network;

(i) "Reference Offer" means the terms and conditions on which the Dominant Provider is willing to enter into an Access Agreement;

(j) "Relevant Year" means each of the following three periods:

(i) the First Relevant Year;

(ii) the Second Relevant Year; and

(iii) the Third Relevant Year.

(k) "Retail Pricing Transparency Report" means a report required under Condition 10 to be provided by the Dominant Provider to Ofcom;

(l) "Retail Reference Offer" means the terms and conditions on which the Dominant Provider is willing to enter an agreement for the provision of a retail leased line;

(m) "Second Relevant Year" means a period beginning on 1 April 2017 and ending on 31 March 2018;

(n) "Third Party" means a person providing a public electronic communications service or a person providing a public electronic communications network;

(o) "Third Relevant Year" means a period beginning on 1 April 2018 and ending on 31 March 2019; and

(p) "Wholesale Pricing Transparency Report" means a report required under Condition 6 to be provided to Ofcom.

2. For the purpose of interpreting this Schedule—

(a) except in so far as the context otherwise requires, words or expressions shall have the meaning assigned to them in paragraph 1 of this Part 2, and otherwise any word or expression shall have the same meaning as it has in the Act;

(b) headings and titles shall be disregarded;

(c) expressions cognate with those referred to in this Schedule shall be construed accordingly; and

(d) the Interpretation Act 1978 (c. 30) shall apply as if this Schedule were an Act of Parliament.

Part 3: SMP conditions

Condition 1 – Network access on reasonable request

1.1 The Dominant Provider must provide network access to a Third Party where that Third Party, in writing, reasonably requests it.

1.2 The provision of network access by the Dominant Provider in accordance with this Condition must:

(a) take place as soon as reasonably practicable after receiving the request from a Third Party;

(b) be on fair and reasonable terms, conditions and charges; and

(c) be on such terms, conditions and charges as Ofcom may from time to time direct.

1.3 The provision of network access by the Dominant Provider in accordance with this Condition shall also include such associated facilities as are reasonably necessary for the provision of network access and such other entitlements as Ofcom may from time to time direct.

1.4 The Dominant Provider must comply with any direction Ofcom may make from time to time under this Condition.

Condition 2 – No undue discrimination (wholesale)

2.1 The Dominant Provider must not unduly discriminate against particular persons or against a particular description of persons, in relation to the provision of network access in accordance with Condition 1.

2.2 In this Condition, the Dominant Provider may be deemed to have shown undue discrimination if it unfairly favours to a material extent an activity carried on by it so as to place one or more Third Parties at a competitive disadvantage in relation to activities carried on by the Dominant Provider.

Condition 3 – Publication of a Reference Offer (wholesale)

3.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall publish a Reference Offer.

3.2 Subject to Condition 3.8 below, the Dominant Provider shall ensure that a Reference Offer in relation to the provision of network access includes, where applicable, at least the following:

(a) a description of the network access to be provided, including technical characteristics (which shall include information on network configuration where necessary to make effective use of network access);

(b) the locations at which network access will be provided;

(c) any relevant technical standards for network access (including any usage restrictions and other security issues);

(d) the conditions for access to ancillary, supplementary and advanced services (including operational support systems, information systems or databases for pre-ordering, provisioning, ordering, maintenance and repair requests and billing);

(e) any ordering and provisioning procedures;

(f) relevant charges, terms of payment and billing procedures;

(g) details of interoperability tests;

(h) details of maintenance and quality as follows:

(i) specific time scales for the acceptance or refusal of a request for supply and for completion, testing and hand-over or delivery of services and facilities, for provision of support services (such as fault handling and repair);

(ii) service level commitments, namely the quality standards that each party must meet when performing its contractual obligations;

(iii) the amount of compensation payable by one party to another for failure to perform contractual commitments;

(iv) a definition and limitation of liability and indemnity; and

(v) procedures in the event of alterations being proposed to the service offerings, for example, launch of new services, changes to existing services or change to prices;

(i) details of any relevant intellectual property rights;

(j) a dispute resolution procedure to be used between the parties;

(k) details of duration and renegotiation of agreements;

(l) provisions regarding confidentiality of the agreements;

(m) rules of allocation between the parties when supply is limited (for example, for the purpose of co-location or location of masts);

(n) the standard terms and conditions for the provision of network access.

3.3 To the extent that the Dominant Provider provides to itself network access that—

(a) is the same, similar or equivalent to that provided to any other person; or

(b) may be used for a purpose that is the same, similar or equivalent to that provided to any other person;

in a manner that differs from that detailed in a Reference Offer in relation to network access provided to any other person, the Dominant Provider shall ensure that it publishes a Reference Offer in relation to the network access that it provides to itself which includes, where relevant, at least those matters detailed in Condition 3.2(a)-(n).

3.4 The Dominant Provider shall, within one month of the date that this Condition enters into force, publish a Reference Offer in relation to any network access that it is providing as at the date that this Condition enters into force.

3.5 The Dominant Provider shall update and publish the Reference Offer in relation to any amendments or in relation to any further network access provided after the date that this Condition enters into force.

3.6 Publication referred to above shall be effected by the Dominant Provider —

(a) placing a copy of the Reference Offer on any relevant publically available website operated or controlled by the Dominant Provider; and

(b) sending a copy of the Reference Offer to Ofcom.

3.7 The Dominant Provider shall send a copy of the current version of the Reference Offer to any person at that person's written request (or such parts as have been

requested).

3.8 The Dominant Provider shall make such modifications to the Reference Offer as Ofcom may direct from time to time.

3.9 The Dominant Provider shall provide network access at the charges, terms and conditions in the relevant Reference Offer and shall not depart therefrom either directly or indirectly.

3.10 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 4 – Notification of charges and terms and conditions

4.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall publish charges, terms and conditions and act in the manner set out in this Condition.

4.2 Where it proposes an Access Charge Change, the Dominant Provider shall send to Ofcom, and to every person with which it has entered into an Access Agreement pursuant to Condition 1, an Access Charge Change Notice.

4.3 The obligation in Condition 4.2 shall not apply where the Access Charge Change is directed or determined by Ofcom or required by a notification or enforcement notification issued by Ofcom under sections 96A or 96C of the Act.

4.4 An Access Charge Change Notice must:

(a) in the case of an Access Charge Change involving existing network access, be sent not less than 90 days before any such amendment comes into effect (except where the Access Charge Change relates solely to a reduction in the price of network access in which case it must be sent not less than 28 days before any such amendment comes into effect);

(b) in the case of an Access Charge Change involving new network access, be sent not less than 28 days before any such amendment comes into effect.

4.5 The Dominant Provider shall ensure that an Access Charge Change Notice includes:

(a) a description of the network access in question;

(b) a reference to the location in the Dominant Provider's current Reference Offer of the terms and conditions associated with the provision of that network access; and

(c) the date on which, or the period for which, the Access Charge Change will take effect (the "effective date").

4.6 The Dominant Provider shall not apply any Access Charge Change identified in an Access Charge Change Notice before the effective date.

4.7 To the extent that the Dominant Provider provides to itself network access that:

(a) is the same, similar or equivalent to that provided to any other person; or

(b) may be used for a purpose that is the same, similar or equivalent to that provided to any other person, in a manner that differs from that detailed in an Access Charge Change Notice in relation to network access provided to any other person,

the Dominant Provider shall ensure that it sends to Ofcom a notice in relation to the network access that it provides to itself which includes, where relevant, at least those matters detailed in Conditions 4.5 (a) to (c) and, where the Dominant Provider amends the charges, terms and conditions on which it provides itself with provides network access, it shall ensure it sends to Ofcom a notice equivalent to an Access Charge Change Notice.

Condition 5 – Notification of technical information

5.1 Except in so far as Ofcom may from time to time otherwise consent in writing, where the Dominant Provider provides network access pursuant to Condition 1 and proposes new or amended terms and conditions relating to the following:

(a) technical characteristics (including information on network configuration, where necessary, to make effective use of the network access provided);

(b) the locations at which network access will be provided; or

(c) technical standards (including any usage restrictions and other security issues),

the Dominant Provider shall publish a written notice (the "Notice") of the new or amended terms and conditions within a reasonable time period but not less than 90 days before either the Dominant Provider enters into an Access Agreement to provide the new network access or the amended terms and conditions of the existing Access Agreement come into effect.

5.2 The obligation in Condition 5.1 shall not apply:

(a) where the new or amended charges or terms and conditions are directed or determined by Ofcom or are required by a notification or enforcement notification issued by Ofcom under sections 96A or 96C of the Act; or

(b) in relation to new or amended technical specifications determined by NICC Standards Limited, whose registered company number is 6613589.

5.3 The Dominant Provider shall ensure that the Notice includes—

(a) a description of the network access in question;

(b) a reference to the location in the Dominant Provider's Reference Offer of the relevant terms and conditions;

(c) the date on which or the period for which the Dominant Provider may enter into an Access Agreement to provide the new network access or any amendments to the relevant terms and conditions will take effect (the "effective date").

5.4 The Dominant Provider shall not enter into an Access Agreement containing the terms and conditions identified in the Notice or apply any new relevant terms and conditions identified in the Notice before the effective date.

5.5 Publication referred to in Condition 5.1 shall be effected by the Dominant Provider:

(a) placing a copy of the Notice on any relevant publically available website operated or controlled by the Dominant Provider;; and

(b) sending a copy of the Notice to any person at that person's written request, and where the Notice identifies a modification to existing relevant terms and conditions, to every person with which the Dominant Provider has entered into an Access Agreement pursuant to Condition 1. The provision of such a copy of the Notice by the Dominant Provider may be subject to a reasonable charge.

Condition 6 – Provision of a Wholesale Pricing Transparency Report

6.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall prepare and provide to Ofcom for each Relevant Year a Wholesale Pricing Transparency Report in relation to the provision of network access under Condition 1.

6.2 Subject to Condition 6.4 below, the Dominant Provider must, in each Wholesale Pricing Transparency Report, set out the following:

(a) each service being provided to a Third Party by the Dominant Provider under Condition 1 on the last day of the Relevant Year;

(b) in relation to each service referred to in Condition 6.2(a) above:

(i) a specification of each of the service type, interface, bandwidth and circuit orientation;

(ii) the amount of the connection charge;

(iii) the date on which the rental charge was agreed;

(iv) the amount and the frequency of the rental charge.

6.3 Provision referred to in Condition 6.1 shall be effected by sending the Wholesale Pricing Transparency Report in Excel spreadsheet format by email to the designated person in the form notified by Ofcom from time to time within one month after the end of each Relevant Year to which the Wholesale Pricing Transparency Report relates.

6.4 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 7 - Provision of retail leased lines

7.1 Subject to Conditions 7.3 and 7.4, the Dominant Provider shall supply a retail leased line where the Dominant Provider was supplying that retail leased line on the date that this Condition enters into force or where a new retail leased line is reasonably requested in writing.

7.2 The provision of retail leased lines under Condition 7.1 shall be provided on fair and reasonable terms, conditions and charges, and on such terms, conditions and charges as Ofcom may from time to time direct.

7.3 The obligation in Condition 7.1 to supply a retail leased line shall not apply to the supply of new retail leased line services with bandwidths below 2Mbit/s.

7.4 Where on the date that this Condition enters into force the Dominant Provider is supplying to end users retail leased lines with bandwidths below 2Mbit/s, the Dominant Provider may withdraw the supply of those services provided that the Dominant Provider has given notice in writing to all of those end users and to Ofcom at the same time. The notice period referred to in this Condition 7.4 must be:

(a) no shorter than two years in duration; and

(b) of the same duration for each end user and Ofcom.

7.5 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 8 – No undue discrimination (retail)

8.1 The Dominant Provider shall not unduly discriminate against particular persons or against a particular description of persons, in relation to matters connected with the supply of a retail leased line.

8.2 In this Condition, the Dominant Provider may be deemed to have shown undue discrimination if it unfairly favours to a material extent an activity carried on by it so as to place at a competitive disadvantage persons competing with the Dominant Provider.

Condition 9 – Publication of a Retail Reference Offer

9.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall publish a Retail Reference Offer in relation to the supply of retail leased lines.

9.2 Subject to Condition 9.7, the Dominant Provider shall ensure that a Retail Reference Offer under Condition 9.1 includes at least the following:

(a) the technical characteristics, including the physical and electrical characteristics as well as the detailed technical and performance specifications which apply at the Network Termination Point;

(b) charges, including the discounts offered to end users, the initial connection charges, the periodic rental charges and other charges;

(c) information concerning the ordering procedure;

(d) the contractual period, which includes the period which is in general laid down in the contract and the minimum contractual period which the end user is obliged to accept; and

(e) any refund procedure.

9.3 The Dominant Provider shall, within one month of the date that this Condition enters into force, publish a Retail Reference Offer in relation to retail leased lines that it is supplying as at the date that this Condition enters into force.

9.4 The Dominant Provider shall update and publish the Retail Reference Offer, in relation to any amendments, or in relation to any further retail leased lines supplied after the date that this Condition enters into force, on the same day as such amendments take effect or further retail leased lines are offered.

9.5 Publication referred to above shall be effected by the Dominant Provider:

(a) placing a copy of the Retail Reference Offer on any relevant publically available website operated or controlled by the Dominant Provider; and

(b) sending a copy of the Retail Reference Offer to Ofcom.

9.6 The Dominant Provider shall send a copy of the current version of the Retail Reference Offer to any person at that person's written request (or such parts which

have been requested).

9.7 The Dominant Provider shall make such modifications to the Retail Reference Offer as Ofcom may direct from time to time.

9.8 The Dominant Provider shall supply retail leased lines at the charges, terms and conditions in the relevant Retail Reference Offer and shall not depart therefrom either directly or indirectly, unless Ofcom otherwise directs.

9.9 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Condition 10 – Provision of a Retail Pricing Transparency Report

10.1 Except in so far as Ofcom may from time to time otherwise consent in writing, the Dominant Provider shall prepare and provide to Ofcom for each Relevant Year a Retail Pricing Transparency Report in relation to the supply of retail leased lines under Condition 7.

10.2 Subject to Condition 10.4 below, the Dominant Provider must, in each Retail Pricing Transparency Report, set out the following:

(a) each retail leased line being provided by the Dominant Provider to an end user under Condition 7 on the last day of the Relevant Year;

(b) in relation to each retail leased line referred to in Condition 10.2(a) above:

(i) a specification of each of the service type, interface, bandwidth and circuit orientation;

(ii) the amount of the connection charge;

(iii) the date on which the rental charge was agreed;

(iv) the amount and the frequency of the rental charge.

10.3 Provision referred to in Condition 10.1 shall be effected by sending the Retail Pricing Transparency Report in Excel spreadsheet format by email to the designated person in the form notified by Ofcom from time to time within one month after the end of each Relevant Year to which the Retail Pricing Transparency Report relates.

10.4 The Dominant Provider shall comply with any direction Ofcom may make from time to time under this Condition.

Annex 7

Draft legal instruments

Part 1 Proposed directions for BT

NOTIFICATION OF PROPOSALS UNDER SECTIONS 49 AND 49A OF THE COMMUNICATIONS ACT 2003 AND CONDITIONS 1 AND 8 RELATING TO REQUIREMENTS CONCERNING QUALITY OF SERVICE PROPOSED TO BE IMPOSED ON BT IN RESPECT OF CERTAIN ETHERNET SERVICES AND DARK FIBRE SERVICES AND REQUIREMENTS CONCERNING SERVICE LEVEL GUARANTEES PROPOSED TO BE IMPOSED ON BT IN RESPECT OF ETHERNET SERVICES

Background

1. Ofcom is publishing, on 15 May 2015, a consultation document entitled "*Business Connectivity Market Review: Review of competition in the provision of leased lines*" ("**May 2015 BCMR Consultation**"). In this document, Ofcom is consulting on new proposals identifying markets, making certain market power determinations and setting SMP services conditions on BT and KCOM respectively.

2. Under proposed SMP services condition 8 set out at Annex 6 to the May 2015 BCMR Consultation, BT must comply with all such quality of service requirements as Ofcom may from time to time direct in relation to network access provided by BT pursuant to proposed SMP services conditions 1 and 2 (as applicable).

3. Under proposed SMP services condition 1 set out at Annex 6 to the May 2015 BCMR Consultation, BT must comply with any direction Ofcom may make from time to time.

4. This Notification relates to proposals pursuant to proposed SMP services condition 8 to specify the following minimum quality of service requirements:
    a. in the provision of the Relevant Ethernet Services:
        i. compliance with minimum performance standards; and
        ii. provision and publication of Key Performance Indicators ("**KPIs**");
    b. in the provision of the Dark Fibre Services:
        i. provision of KPIs.

5. This Notification also relates to a proposal pursuant to proposed SMP services condition 1 to specify the requirements relating to the provisions of Service Level Guarantees.

Proposal to give directions

6. Ofcom is proposing to make the directions set out in Schedules 1, 2, 3 and 4 to this Notification.

7. The effect of, and the reasons for giving, the proposed directions are set out in the accompanying consultation document.

Ofcom's duties and legal tests

8. Ofcom considers that the proposed directions referred to in paragraph 6 comply with the requirements of section 49(2) of the Communications Act 2003 ("**Act**").

9. In making the proposals referred to in paragraph 6, Ofcom has considered and acted in accordance with its general duties set out in section 3 of the Act, the six community requirements in section 4 of the Act and the duty to take account of European Commission recommendations for harmonisation in section 4A of the Act.

Making representations

10. Representations may be made to Ofcom about the proposals set out in this Notification and the accompanying consultation by no later than 31 July 2015.

11. In accordance with section 49C(1)(a) of the Act, a copy of the Notification, together with the Schedules, has been sent to the Secretary of State.

Interpretation

12. For the purposes of interpreting Schedules 1 to 3 the following definitions shall apply:

"**Contractual Delivery Dates**" means the first, each subsequent and the last dates provided by the Dominant Provider to a Third Party Customer on which an Order is planned to become a Completed Order;

"Customer Caused Delay" means a delay which the Dominant Provider may reasonably attribute to being caused by a Third Party Customer or a customer of that Third Party Customer including an end user;

"**Fault**" means a degradation or problem with network access that is identified by the Dominant Provider or a Third Party Customer and which is registered on the Dominant Provider's operational support system;

"**Final Contractual Delivery Date**" means the last date provided by the Dominant Provider to a Third Party Customer on which an Order is planned to become a Completed Order;

"**First Relevant Year**" means a period beginning on the date on which Schedules 1 to 3 enter into force and ending on 31 March 2017;

"KPI" means a key performance indicator;

"Initial Contractual Delivery Period" means the period, excluding only Working Days reasonably attributable to Customer Caused Delay which occurred before the Initial Contractual Delivery Date was issued, beginning on the date on which an Order becomes an Accepted Order and ending on the Initial Contractual Delivery Date;

"**Provision Category**" means such categories, as may be specified from time to time in the Dominant Provider's Reference Offer in relation to its ordering and provisioning procedures, which identify an Order by reference to one or more of the following:
(i) a specified level of provisioning work; and

(ii) a specified lead time;

"**Relevant Customers**" means:

i. the nine Third Party Customers who purchased the largest total volumes of the Relevant Ethernet Services during the period beginning on 1 April 2013 and ending on 31 March 2016; and
ii. a notional customer representing the remainder of the Third Party Customers, whose purchased total volumes of the Relevant Ethernet Services during the period beginning on 1 April 2013 and ending on 31 March 2016, have been aggregated;

"**Relevant Regions**" means the following eight regions:

i. Northern Ireland;
ii. North East and Scotland;
iii. Midlands and North West;
iv. Wales, Marches and Northern Home Counties;
v. East of England;
vi. London;
vii. South East; and
viii. South West

or other such regions as Ofcom may agree with the Dominant Provider or direct from time to time;

"**Restored Service**" means the point at which a Relevant Ethernet Service subject to a Fault or a Dark Fibre Service subject to a Fault (as applicable) is available for use by the Third Party without each applicable Fault;

"**Second Relevant Year**" means a period beginning on 1 April 2017 and ending on 31 March 2018;

"**Third Party**" means a person providing a public electronic communications network or a person providing a public electronic communications service;

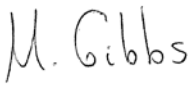
"Third Party Customer" means a Third Party purchasing a Relevant Ethernet Service or a Dark Fibre Service (as applicable) from the Dominant Provider;

"Third Relevant Year" means a period beginning on 1 April 2018 and ending on 31 March 2019; and

"Time To Provide" means the total number of Working Days, excluding only Working Days reasonably attributable to Customer Caused Delay, from the date on which an Order becomes an Accepted Order to the date when that Accepted Order becomes a Completed Order.

13. For the purposes of interpreting this Notification and each of Schedules 1, 2, 3 and 4 to this Notification, except as otherwise defined, words or expressions used shall have the same meaning as they have been ascribed in the proposed SMP services conditions set out in Annex 6 of the May 2015 BCMR Consultation and otherwise any word or expression shall have the same meaning as it has in the Act.

Signed



Marina Gibbs

Competition Policy Director, Ofcom

A person duly authorised in accordance with paragraph 18 of the Schedule to the Office of Communications Act 2002

15 May 2015

Schedule 1

1. The Dominant Provider shall comply with the following minimum quality of service requirements in the provision of the Relevant Ethernet Services:

   1.1. The Dominant Provider shall deliver Completed Orders in a Time To Provide that is less than or equal to the applicable Initial Contractual Delivery Period:

      a. in at least 80% of such instances in the First Relevant Year;

      b. in at least 85% of such instances in the Second Relevant Year; and

      c. in at least 90% of such instances in the Third Relevant Year.

   1.2. The Dominant Provider shall ensure that the average Time To Provide of Completed Orders is no more than:

      a. 46 Working Days in the First Relevant Year;

      b. 40 Working Days in the Second Relevant Year;

      c. 40 Working Days in the Third Relevant Year.

   1.3. The Dominant Provider shall ensure that the average Initial Contractual Delivery Period of Completed Orders is no more than:

      a. 46 Working Days in the First Relevant Year;

      b. 40 Working Days in the Second Relevant Year;

      c. 40 Working Days in the Third Relevant Year.

   1.4. The Dominant Provider shall ensure that in at least 40% of Completed Orders, the Time To Provide is:

      a. 30 Working Days or less in the First Relevant Year;

      b. 29 Working Days or less in the Second Relevant Year;

      c. 29 Working Days or less in the Third Relevant Year.

   1.5. The Dominant Provider shall ensure that in at least 40% of Completed Orders, the Initial Contractual Delivery Period is:

      a. 30 Working Days or less in the First Relevant Year;

      b. 29 Working Days or less in the Second Relevant Year;

      c. 29 Working Days or less in the Third Relevant Year.

   1.6. The Dominant Provider shall ensure that in no more than 3% of Completed Orders, the Time To Provide is:

      a. 159 Working Days or more in the First Relevant Year;

      b. 118 Working Days or more in the Second Relevant Year;

      c. 118 Working Days or more in the Third Relevant Year.

1.7. The Dominant Provider shall ensure that in no more than 3% of Completed Orders, the Initial Contractual Delivery Period is:

a. 159 Working Days or more in the First Relevant Year;

b. 118 Working Days or more in the Second Relevant Year;

c. 118 Working Days or more in the Third Relevant Year.

2. The Dominant Provider shall comply with the following minimum quality of service requirements in the repair of all Faults in respect of Relevant Ethernet Services:

2.1. The Dominant Provider shall ensure that 94% of Faults achieve a Restored Service within 5 hours of being registered on the Dominant Provider's operational support system.

General

3. This Schedule shall take effect on the day it is published and shall be implemented by the Dominant Provider on that date.

Schedule 2

1. The Dominant Provider must publish for each month the information relating to the provision of the Relevant Ethernet Services required in KPIs (i) to (v) below:

    a. for the United Kingdom as a whole; and

    b. split by reference to each of the Relevant Regions.

2. Publication referred to in paragraph 1 above shall be effected by the Dominant Provider placing the information on any publically available website operated or controlled by the Dominant Provider within 15 calendar days after the end of the relevant month to which the information referred to in paragraph 1 relates.

3. The Dominant Provider must provide to Ofcom each month:

    a. the information relating to the Relevant Ethernet Services required in KPIs (i) to (xix) below:

        (i) KPIs (i) to (xix) for the United Kingdom as a whole;

        (ii) KPIs (i) to (x), (xvii) and (xviii) split by reference to each of the Relevant Regions;

        (iii) KPIs (i) to (xix) split by reference to each of the Relevant Customers;

        (iv) KPIs (ix), (x) and (xvii) split by reference to each of the Provision Categories;

    b. in relation to each of the requirements concerning each of KPIs (i) to (ix), (xi) to (xv) and (xix) set out in paragraph 3(a) above:

        (i) the denominator representing the volume of the applicable Relevant Ethernet Services over which the average or the percentage (as applicable) is calculated; and

        (ii) the numerator representing the value corresponding to the denominator from which the average or the percentage (as applicable) is calculated.

4. Provision referred to in paragraph 3 above shall be effected by sending email to the designated person in the form notified by Ofcom from time to time within 15 calendar days after the end of the relevant month to which the information referred to in paragraph 3 relates.

5. The Dominant Provider must make available, on a confidential basis, to each Third Party Customer each month within 15 calendar days after the end of the relevant month to which the information relates, the information required in KPIs (i) to (xix) below applicable to that Third Party Customer.

KPI (i) – Mean Time to Provide

In relation to all Orders that became Completed Orders in the relevant month, the average Time To Provide;

KPI (ii) – Fault Repair Performance

The percentage of Faults during the relevant month that achieved a Restored Service within 5 hours of being registered on the Dominant Provider's operational support system;

KPI (iii) Delivery Date Certainty

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders which were completed within their Initial Contractual Delivery Period;

KPI (iv) - Time To Provide Lower Percentile Limit

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Time To Provide was:

(i) 30 Working Days or less in the First Relevant Year;

(ii) 29 Working Days or less in the Second Relevant Year and in the Third Relevant Year;

KPI (v) – Time To Provide Upper Percentile Limit

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Time To Provide was:

(i) 159 Working Days or more in the First Relevant Year;

(ii) 118 Working Days or more in the Second Relevant Year and in the Third Relevant Year;

KPI (vi) - Initial Contractual Delivery Period

In relation to all Orders that became Completed Orders in the relevant month, the average Initial Contractual Delivery Period;

KPI (vii) - Initial Contractual Delivery Period Lower Percentile

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Initial Contractual Delivery Period was:

(i) 30 Working Days or less in the First Relevant Year ;

(ii) 29 Working Days or less in the Second Relevant Year and in the Third Relevant Year;

KPI (viii) - Initial Contractual Delivery Date Upper Percentile

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Initial Contractual Delivery Period was:

(i) 159 Working Days or more in the First Relevant Year;

(ii) 118 Working Days or more in the Second Relevant Year and in the Third Relevant Year;

KPI (ix) - Monitoring The Tail

In relation to all Orders that became Completed Orders in the relevant month, the average Time To Provide where the Time To Provide was:

(i) 159 Working Days or more in the First Relevant Year;

(ii) 118 Working Days or more in the Second Relevant Year and in the Third Relevant Year;

KPI (x) - Monitoring The Tail Extremities

In relation to all Orders that became Completed Orders in the relevant month, the longest Time To Provide.

KPI (xi) - Order Validation

In relation to all Orders that became Completed Orders in the relevant month, the percentage that became Accepted Orders within the timescales set out in the applicable service level agreement set out in the Dominant Provider's Reference Offer;

KPI (xii) - Performance in issuing Initial Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the percentage for which the Initial Contractual Delivery Date was issued within the timescales set out in the applicable service level agreement set out in the Dominant Provider's Reference Offer;

KPI (xiii) - Performance against the Final Contractual Delivery Date

In relation to all Orders that became Completed Orders in the relevant month, the percentage that were completed on or before the Final Contractual Delivery Date;

KPI (xiv) - Changes to Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the percentage in respect of which a Contractual Delivery Date was changed, excluding changes to Contractual Delivery Dates which were due to Customer Caused Delay;

KPI (xv) - Average Number of Changes to Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the average number of changes to the Contractual Delivery Dates per Completed Order, excluding changes to the Contractual Delivery Dates which were due to Customer Caused Delay;

KPI (xvi) - New Orders

The total number of Accepted Orders during the relevant month;

KPI (xvii) - Orders Completed

The total number of Completed Orders during the relevant month;

KPI (xviii) - Volume of Faults

The total number of Faults during the relevant month;

KPI (xix) - Cablelink Mean Time To Provide

In relation to all Orders for Cablelink that became Completed Orders in the relevant month, the average Time To Provide.

General

6. The Dominant Provider shall implement this Schedule within 10 working days of its publication.

7. This Schedule shall take effect on the day it is published.

Schedule 3

1. The Dominant Provider must provide to Ofcom each month:

    a. the information relating to the Dark Fibre Services required in KPIs (i) to (xviii) below:

        (i) KPIs (i) to (xviii) for the United Kingdom as a whole;

        (ii) KPIs (ix), (x) and (xvii) split by reference to each of the Provision Categories;

    a. in relation to each of the requirements concerning each of KPIs (i) to (ix) and (xi) to (xv) set out in paragraph 1(a) above:

        (i) the denominator representing the volume of the applicable Dark Fibre Services over which the average or the percentage (as applicable) is calculated; and

        (ii) the numerator representing the value corresponding to the denominator from which the average or the percentage (as applicable) is calculated.

2. Provision referred to in paragraph 1 above shall be effected by sending email to the designated person in the form notified by Ofcom from time to time within 15 calendar days after the end of the relevant month to which the information referred to in paragraph 1 relates.

3. The Dominant Provider must make available, on a confidential basis, to each Third Party Customer each month, within 15 calendar days after the end of the relevant month to which the information relates, the information required in KPIs (i) to (xviii) below applicable to that Third Party Customer.

KPI (i) – Mean Time to Provide

In relation to all Orders that became Completed Orders in the relevant month, the average Time To Provide;

KPI (ii) – Fault Repair Performance

The percentage of Faults during the relevant month that achieved a Restored Service within the timescales set out in the applicable service level agreement set out in the Dominant Provider's Reference Offer;

KPI (iii) Delivery Date Certainty

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders which were completed within their Initial Contractual Delivery Period;

KPI (iv) - Time To Provide Lower Percentile Limit

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Time To Provide was 29 Working Days or less;

KPI (v) – Time To Provide Upper Percentile Limit

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Time To Provide was 118 Working Days or more;

KPI (vi) - Initial Contractual Delivery Period

In relation to all Orders that became Completed Orders in the relevant month, the average Initial Contractual Delivery Period;

KPI (vii) - Initial Contractual Delivery Period Lower Percentile

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Initial Contractual Delivery Period was 29 Working Days or less;

KPI (viii) - Initial Contractual Delivery Date Upper Percentile

In relation to all Orders that became Completed Orders in the relevant month, the percentage of Completed Orders in respect of which the Initial Contractual Delivery Period was 118 Working Days or more;

KPI (ix) - Monitoring The Tail

In relation to all Orders that became Completed Orders in the relevant month, the average Time To Provide where the Time To Provide was 118 Working Days or more;

KPI (x) - Monitoring The Tail Extremities

In relation to all Orders that became Completed Orders in the relevant month, the longest Time To Provide.

KPI (xi) - Order Validation

In relation to all Orders that became Completed Orders in the relevant month, the percentage that became Accepted Orders within the timescales set out in the applicable service level agreement set out in the Dominant Provider's Reference Offer;

KPI (xii) - Performance in issuing Initial Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the percentage for which the Initial Contractual Delivery Date was issued within the timescales set out in the applicable service level agreement set out in the Dominant Provider's Reference Offer;

KPI (xiii) - Performance against the Final Contractual Delivery Date

In relation to all Orders that became Completed Orders in the relevant month, the percentage that were completed on or before the Final Contractual Delivery Date;

KPI (xiv) - Changes to Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the percentage in respect of which a Contractual Delivery Date was changed, excluding changes to Contractual Delivery Dates which were due to Customer Caused Delay;

KPI (xv) - Average Number of Changes to Contractual Delivery Dates

In relation to all Orders that became Completed Orders in the relevant month, the average number of changes to the Contractual Delivery Dates per Completed Order, excluding changes to the Contractual Delivery Dates which were due to Customer Caused Delay;

KPI (xvi) - New Orders

The total number of Accepted Orders during the relevant month;

KPI (xvii) - Orders Completed

The total number of Completed Orders during the relevant month;

KPI (xviii) - Volume of Faults

The total number of Faults during the relevant month;

General

4. This Schedule shall enter into force 18 months from the date of its publication.

Schedule 4

The Dominant Provider shall provide Ethernet Services and shall do so in accordance with this Schedule.

Service level guarantees (SLGs)

1. The Dominant Provider shall ensure the terms and conditions which govern the supply of Ethernet Services in the wholesale markets for (i) contemporary interface symmetric broadband origination in the Rest of the UK excluding the Hull Area and (ii) contemporary interface symmetric broadband origination in the London Periphery, provide the following[14]:

Compensation per event and value of compensation

a) The definition of "Contractual Delivery Date" as set out in the Dominant Provider's terms and conditions has been amended to require BT to provide reasons to justify a Contractual Delivery Date which is set beyond the 57th day and that any extension of the Contractual Delivery Date beyond the 57th shall be made subject to the consent of the Third Party concerned whose consent shall not be unreasonably withheld;

b) BT shall pay the Third Party compensation for each day or part day of delay in delivery of service beyond the Contractual Delivery Date or the "CP Requirement Date" (as set out in the Dominant Provider's terms and conditions), whichever is later;

c) BT shall pay the Third Party compensation for each and every fault which has not been restored in the first five hours on a per hour basis thereafter;

d) The compensation payable in event of the each late provision of the required Backhaul Extension Services, Wholesale Extension Services or Wholesale End-to- End Segments shall be set at 100% of one month's line rental for every day or part day of delay beyond the Contractual Delivery Date or CP Requirement Date (whichever is later), up to a maximum of 60 days;

e) The compensation payable in the event of each late fault repair in relation to Backhaul Extension Services, Wholesale Extension Services or Wholesale End-to- End Segments shall be 15% of one month's line rental for every fault which has not been restored in the first five hours for every hour thereafter until service is restored, up to a maximum of 200 hours;

Limitations on compensation- removal of caps

f) Any limits on compensation payable as a result of a failure to satisfy the service guarantees shall be removed other than those set out in d) and e); and

Additional losses

[14] In particular, the following contracts will require modification to reflect the requirements set out in the direction:

(i) the Conditions for Backhaul Extensions Services; and (ii) the Conditions for Wholesale Extension Services.

g) Any compensation payable under the contract shall be without prejudice to any right of either party to claim for additional loss.

Proactive payments

h) BT shall monitor its performance against the service guarantees for fault repair and compensate Third Parties proactively should it fail to satisfy the service guarantees. Compensation payments shall be made on a monthly basis. For the avoidance of doubt, compensation shall be payable without the need for a Third Party to make a claim.

General

2. The Dominant Provider shall implement this Schedule within 10 working days of its publication.

3. This Schedule shall take effect on the day it is published.

Direction under sections 49 and 49A of the Communications Act 2003 and SMP services Condition 1, proposed as a result of the analysis of the wholesale market for low bandwidth traditional interface symmetric broadband origination in the UK excluding the Hull Area, at bandwidths up to and including 8Mbit/s

Background

1. Ofcom is publishing, on 15 May 2015, a consultation document entitled "*Business Connectivity Market Review: Review of competition in the provision of leased lines*" ("**May 2015 BCMR Consultation**"). In this document, Ofcom is consulting on new proposals identifying markets, making certain market power determinations and setting SMP services conditions on BT and KCOM respectively.

2. Ofcom is proposing to determine that BT, as a Dominant Provider, has significant market power in, amongst others, the wholesale market for low bandwidth traditional interface symmetric broadband origination in the UK excluding the Hull area, at bandwidths up to and including 8Mbit/s.

3. SMP services Condition 1 is proposed to be set in relation to, amongst others, the market referred to in paragraph 2.

4. This Notification relates to matters to which SMP services Condition 1 is proposed to apply.

Proposal to give directions

5. Ofcom is proposing to make the direction set out in Schedule 1 to this Notification.

6. The effect of, and the reasons for giving, the proposed direction are set out in the accompanying consultation document.

Ofcom's duties and legal tests

7. Ofcom considers that the proposed direction referred to in paragraph 5 complies with the requirements of section 49(2) of the Communications Act 2003 ("**Act**").

8. In making the proposal referred to in paragraph 5, Ofcom has considered and acted in accordance with its general duties set out in section 3 of the Act, the six community requirements in section 4 of the Act and the duty to take account of European Commission recommendations for harmonisation in section 4A of the Act.

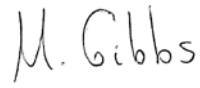
Making representations

9. Representations may be made to Ofcom about the proposals set out in this Notification and the accompanying consultation by no later than 31 July 2015.

10. In accordance with section 49C(1)(a) of the Act, a copy of the Notification, together with Schedule 1, has been sent to the Secretary of State.

Interpretation

11. Except as otherwise defined, words or expressions used shall have the same meaning as they have been ascribed in the proposed SMP services conditions set out in Annex 6 of the May 2015 BCMR Consultation and otherwise any word or expression shall have the same meaning as it has in the Act.



Marina Gibbs

Competition Policy Director, Ofcom

A person duly authorised in accordance with paragraph 18 of the Schedule to the Office of Communications Act 2002

15 May 2015

Schedule 1

Definitions

For the purpose of interpreting this Direction the following definitions shall apply:

"**Act**" means the Communications Act 2003;

"Dominant Provider" means British Telecommunications plc, whose registered company number is 1800000 and any British Telecommunications plc subsidiary or holding company, or any subsidiary of that holding company, all as defined in section 1159 of the Companies Act 2006;

"**Hull Area**" means the area defined as the 'Licensed Area' in the licence granted on 30 November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and KCOM Group plc;

"**Point of Connection**" means a point at which the Dominant Provider's electronic communications network and another person's electronic communications network are connected;

"**Third Party**" means a person providing a public electronic communications service or a person providing a public electronic communications network.

For the purpose of this Direction the following terms shall have the meaning as set out in the Dominant Provider's Standard PPC Handover Agreement, as at the date of publication of this Direction, but with the necessary changes in order to ensure compliance with the Direction:

- Advance Capacity Order
- Advance Order Commitment
- BT Retail Private Circuit
- BT Serving Node
- Capacity Order
- Capacity Profile

- Customer Sited Handover (“CSH”)
- Forecast Profile
- In-Span Handover (“ISH”)
- Re-Designation
- Qualifying BT Retail Private Circuit

The following definitions shall also apply for the purpose of this Direction:

Term	**Definition**
Acceptance of Terms	Date on which a Third Party confirms acceptance of delivery conditions and is committed to the order.
Civil Works	Works that necessitate the digging up of a street for the installation of ducts.
Committed Delivery Date	The date confirmed by the Dominant Provider as the delivery date.
Firm Offer Confirmation (“FOC”)	Confirmation by the Dominant Provider in writing (by fax or e-mail) to a Third Party of the delivery conditions including price and Committed Delivery Date, after acknowledging receipt of an order for a Partial Private Circuit or Network Infrastructure from a Third Party.
FOC Acceptance Interval	The number of working days from the FOC Date until the Acceptance of Terms.
FOC Date	The date on which the Dominant Provider makes a Firm Offer Confirmation.
FOC Receipt Interval	The number of working days from the Order

	Request Date until the FOC Date.
Installation Date	Date of installation of a Partial Private Circuit or Network Infrastructure.
Network Infrastructure	The categories of products listed in the table contained in paragraph 51 of this Direction.
Order Request Date	Date on which a Third Party dispatches a valid Partial Private Circuit order, or Network Infrastructure order, to the Dominant Provider.
Partial Private Circuit (“PPC”)	A circuit provided pursuant to the PPC Contract and in accordance with the Directions.
PPC Contract	The Dominant Provider's Standard PPC Handover Agreement as at the date of publication of this Direction.
Provisioning Interval	The number of working days from the Order Request Date until the Installation Date.
Requisite Period	The period commencing on the Order Request Date and ending on the applicable working day as set out in the tables in paragraphs 41 and 51 of this Direction.
Reduced Requisite Period	The period commencing on the Order Request Date and ending on the applicable working day as set out in the tables in paragraphs 44 and 54 of this Direction.
Subsequent Partial Private Circuit	A Partial Private Circuit which can be delivered on dedicated pre-provided Network Infrastructure where spare capacity exists.

Except as otherwise defined and/or as the context otherwise requires, words or expressions shall have the same meaning as in the Act.

The Interpretation Act 1978 shall apply as if this Direction was an Act of Parliament.

Headings and titles shall be disregarded.

A. Subject to paragraphs B and C below, the Dominant Provider shall provide Partial Private Circuits and shall do so in accordance with this Direction.

B. Where on the date that this Direction enters into force the Dominant Provider is providing to Third Parties Partial Private Circuits at bandwidth below 2Mbit/s, the Dominant Provider may withdraw the provision of new Partial Private Circuits and cease to provide existing Partial Private Circuits provided that:
   (i) the Dominant Provider has given all of the Third Parties at the same time notice in writing;
   (ii) the notice period referred to in paragraph B(i) is:
      a. no shorter than one year in duration; and
      b. of the same duration for each of the Third Parties.

C. Up to and including the date on which the notice period referred to in paragraph B expires, the Dominant Provider must comply with the requirements set out in paragraphs 1 to 77 of this Direction

D. After the expiry of the notice period referred to in paragraph B, this Direction shall be construed as no longer applying to the provision of Partial Private Circuits at bandwidth below 2Mbit/s.

Migration

1. The 12 month contractual minimum term placed upon a Third Party, for the provision of a Partial Private Circuit which has been migrated pursuant to the PPC Contract, shall be measured from the date that the original BT Retail Private Circuit was brought into service.

2. The Dominant Provider shall not impose any deadline before which a Third Party must inform the Dominant Provider that it requires a BT Retail Private Circuit to be migrated to an equivalent Partial Private Circuit status under the PPC Contract.

3. The Dominant Provider shall allow a BT Retail Private Circuit, which fell within paragraph 1.3 of the Phase 1 PPC Direction published on 14 June 2002, to be considered under the PPC Contract as a Qualifying BT Retail Private Circuit.

4. A circuit deemed to be a Qualifying BT Retail Private Circuit under paragraphs 20 or 21 of the Phase 2 PPC Direction published on 23 December 2002 shall continue to be a Qualifying BT Retail Private Circuit.

5. Where a Third Party was not previously eligible to migrate a BT Retail Private Circuit to a Qualifying BT Retail Private Circuit, but subsequently becomes eligible to do so, the Dominant Provider shall, for 60 working days following the date on which the Third Party's circuits become eligible for migration, allow migration without the Third Party incurring any penalty (including any default or early termination charge) under its agreement with the Dominant Provider for the provision of BT Retail Private Circuits.

6. Where, at the date of publication of this Direction, the Dominant Provider offers a BT Retail Private Circuit product and does not offer an equivalent Partial Private Circuit product, but subsequently offers to provide an equivalent Partial Private Circuit product, it shall allow a Third Party to migrate to the equivalent Partial Private Circuit product without it incurring any penalty (including any default or early termination charge) under its agreement with the Dominant Provider for the provision of BT Retail Private Circuits, for a period of 60 working days following the date on which the equivalent Partial Private Circuit product is first offered by the Dominant Provider.

7. Where the Dominant Provider has taken, or will take, longer than five working days from receiving a request from a Third Party to migrate a Qualifying BT Retail Private Circuit to a Partial Private Circuit, it shall give to the Third Party a refund as set out in paragraphs 8 and 9 of this Direction.

8. Where paragraph 7 of this Direction applies, the Dominant Provider shall refund to the Third Party a sum of money equal to the difference between:

- the charge levied by the Dominant Provider for the BT Retail Private Circuit to which the request for migration relates; and
- the charge levied by the Dominant Provider for the Partial Private Circuit to which the request for migration relates.

9. The refund set out in paragraph 8 of this Direction shall cover the period from the date the Dominant Provider receives the request to migrate until the date the Dominant Provider completes the migration.

10. The Dominant Provider shall, upon a Third Party's written request, provide to the Third Party a map of its network within the United Kingdom which clearly illustrates and labels the geographic location of each Dominant Provider tier 1, tier 1.5, tier 2, and tier 3 nodes.

Forecasts

11. The Dominant Provider shall only require a Third Party to provide a profile of future Partial Private Circuit capacity ordering intentions over a 12 month period, on a national aggregate basis for groupings of bandwidths no narrower than the following:

- less than 1Mbit/s; and
- 1Mbit/s through to 2Mbit/s.

12. The Dominant Provider shall allow a Third Party to set its Advance Capacity Order and Advance Order Commitment without any penalty by up to, 10% (by volume) below, or 20% (by volume) above, the amount stated in the Third Party's previous Capacity Profile or Forecast Profile for the period covered by the Advance Capacity Order or Advance Order Commitment.

13. The Dominant Provider shall allow a Third Party to revise periods covered by its previously stated Capacity Profile and Forecast Profile without any penalty by up to, 30% (by volume) below, or 30% (by volume) above, the amount stated in the Third Party's previous Capacity Profile or Forecast Profile, provided that paragraph 12 of this Direction does not apply.

14. In calculating any increase to an Advance Capacity Order, Advance Order Commitment, Capacity Profile or Forecast Profile pursuant to paragraphs 12 and 13 of this Direction, the outcome of the revision shall, if not an integer, be rounded up to the nearest integer.

15. In calculating any decrease to an Advance Capacity Order, Advance Order Commitment, Capacity Profile or Forecast Profile pursuant to paragraphs 12 and 13 of this Direction, the outcome of the revision shall, if not an integer, be rounded down to the nearest integer.

16. Where a Third Party places a Capacity Order at a Point of Connection for the period corresponding to that of the Advance Capacity Order, which total less than its Advance Capacity Order for the Point of Connection, the Dominant Provider may levy a charge no more than a sum equal to:

[(80% of B) – C] x £2,490

Where B is the total capacity provision by number of VC4-equivalent units specified in the relevant Advance Capacity Order in respect of each Point of Connection; and

Where C is the number of VC4-equivalents ordered during the period to which the relevant Advance Capacity Order relates in respect of each Point of Connection, but does not include cancellations of Capacity Orders made during or after the relevant Advanced Capacity Order period, but does include any Capacity Order cancelled as a result of the inability of the Dominant Provider to secure consents for CSH links.

17. Where a Third Party places orders for Partial Private Circuits below 1 Mbit for the period corresponding to that of the Advanced Order Commitment, which total less than its Advance Order Commitment for the Partial Private Circuits below 1 Mbit, the Dominant Provider may levy a charge no more than a sum equal to:

[(80% of B) – C] x £52

Where B is the total Advance Order Commitment for Private Partial Circuits below 1 Mbit; and

Where C is the number of Partial Private Circuits below 1 Mbit ordered during the period to which the Advance Order Commitment relates, but does not include cancellations of orders for Partial Private Circuits made during or after the relevant Advanced Order Commitment period, but does include any order for a Partial Private Circuit cancelled as a result of the inability of the Dominant Provider to secure consents for Partial Private Circuits.

18. Where a Third Party places orders for Partial Private Circuits from 1 Mbit through to 2 Mbit/s for the period corresponding to that of the Advanced Order Commitment, which total less than its Advance Order Commitment for Partial Private Circuits from 1 Mbit through to 2 Mbit/s, the Dominant Provider may levy a charge no more than a sum equal to:

[(80% of B) – C] x £143

Where B is the total Advance Order Commitment for Private Partial Circuits from 1 Mbit through to 2 Mbit/s; and

Where C is the number of Partial Private Circuits from 1 Mbit through to 2 Mbit/s ordered during the period to which the Advance Order Commitment relates, but does not include cancellations of orders for Partial Private Circuits made during or after the relevant Advanced Order Commitment period, but does include any order for a Partial Private Circuit cancelled as a result of the inability of Dominant Provider to secure consents for Partial Private Circuits.

19. [Paragraph not used].

20. In calculating (80% of B) in paragraphs 16 to 18 inclusive of this Direction the outcome shall, if not an integer, be rounded down to the nearest integer.

Service level agreements (SLAs)

General

21. The Dominant Provider shall set a Committed Delivery Date for each Partial Private Circuit or Network Infrastructure ordered from it by a Third Party and shall be required to provide reasons to justify a Committed Delivery Date which is set beyond the relevant Requisite Period (RP) and that any extension of the Committed Delivery Date beyond the relevant Requisite Period (RP) shall be made subject to the consent of the Third Party concerned whose consent shall not be unreasonably withheld.

22. For each Partial Private Circuit or Network Infrastructure ordered from the Dominant Provider by a Third Party, the Dominant Provider shall provide to a Third Party Firm Offer Confirmation in the manner set out in the definition section of this Direction.

23. The time scales and levels of fixed individual compensation payments to be payable under the service level agreement shall be those set out in paragraph 34 of this Direction, unless otherwise agreed between the Dominant Provider and a Third Party, or except to the extent that Ofcom otherwise consents.

24. Unless otherwise agreed between the Dominant Provider and a Third Party, any fixed individual compensation payment, or reimbursement pursuant to paragraph 28 of this Direction, payable by the Dominant Provider to a Third Party pursuant to the Directions shall be offset by the Dominant Provider against the money owed to it by the Third Party, on a quarterly basis. The Dominant Provider shall keep complete and accurate records of the amounts it has offset in accordance with this paragraph. Such records shall be made available by the Dominant Provider following a request by a Third Party.

25. The Dominant Provider shall not be liable to pay fixed individual compensation payments pursuant to the Directions for periods of delay which arise due to circumstances beyond its reasonable control. The Dominant Provider shall notify a Third Party as soon as reasonably practicable when such circumstances arise. All contractors or sub-contractors of whatever level, and their respective employees, servants and agents, shall for the purpose of this paragraph be treated as employees of the Dominant Provider. Major construction works shall not be considered circumstances beyond the Dominant Provider's reasonable control.

26. The Dominant Provider shall ensure that any time limits set out in this Direction shall not apply to a Third Party to the extent that periods of delay arise due to circumstances beyond its reasonable control. The Third Party shall notify the Dominant Provider as soon as reasonably practicable when such circumstances arise. All contractors or sub-contractors of whatever level, and their respective employees, servants and agents, shall for the purpose of this paragraph be treated as employees of the relevant Third Party.

27. The Dominant Provider shall, at the reasonable request of a Third Party, postpone the Committed Delivery Date of a Partial Private Circuit or Network Infrastructure if such postponement is technically and organisationally reasonable. In agreeing to such a postponement the Dominant Provider shall only charge for reasonable additional expenses it has directly incurred as a result of the postponement.

28. The Dominant Provider shall only postpone the Committed Delivery Date of a Partial Private Circuit or Network Infrastructure with the written agreement of the Third Party. The Dominant Provider shall inform the Third Party as soon as reasonably possible of any proposed postponement of the Committed Delivery Date. Where such a postponement takes place the Dominant Provider shall reimburse the Third Party for any reasonable additional cost incurred by the Third Party as a direct result of the postponement.

29. The FOC Receipt Interval shall be a maximum of:

– five working days for Partial Private Circuits of less than 2 Mbit/s; and

– eight working days for Partial Private Circuits of 2 Mbit/s and Network Infrastructure;

regardless of how many Partial Private Circuits are, or the amount of Network Infrastructure is, ordered at a particular site.

30. The Dominant Provider shall ensure that the FOC Acceptance Interval is a maximum of one working day for Partial Private Circuits of 2 Mbit/s or below and two working days for Network Infrastructure. Where a Third Party has not informed the Dominant Provider of its Acceptance of Terms or rejection of the order within five working days of the FOC Date, the Dominant Provider may cancel the Third Party's order.

31. The Dominant Provider shall keep complete and accurate records of the ordering, provision and repair of Partial Private Circuits and Network Infrastructure it provides to a Third Party.

32. Where any Partial Private Circuit or Network Infrastructure which is ordered by a Third Party is in excess of 110% (by volume), rounded up to the nearest integer where necessary, of its Advance Order Commitment or Advance Capacity Order, the applicable Requisite Period set out in the tables in paragraphs 41 and 51 of this Direction shall be extended by 50% and rounded up to the nearest working day, where necessary, for the purposes of calculating fixed individual compensation payments.

Unliquidated damages

33. Nothing in the PPC Contract, as amended by the Direction, shall prevent a Third Party from bringing a claim against the Dominant Provider for unliquidated damages over and above the fixed individual compensation payments set out in the Direction.

Service level guarantees (SLGs)

34. The Dominant Provider shall ensure the terms and conditions which govern the supply of Partial Private Circuits set out in the PPC Contract continue to provide the following:

Compensation per event and value of compensation

a) The Dominant Provider shall pay the Third Party compensation for each day or part day of delay in delivery of service beyond the Committed Delivery Date or the Third Party's Requirement Date (whichever is later).

b) The Dominant Provider shall pay the Third Party compensation for each and every fault which has not been restored:

- for Regular Care customers, in the first two days on a per day basis thereafter; and

- for Enhanced Care customers, in the first five hours on a per hour basis thereafter.

c) The compensation payable in event of the each late provision of the required Partial Private Circuit or Network Infrastructure service shall be set at 100% of one month's line rental (or Network Infrastructure rental) for every day or part day of delay beyond the Committed Delivery Date or Requirement Date (whichever is later), up to a maximum of 60 days.

d) The compensation payable in the event of each late fault repair in relation to a Partial Private Circuit or Network Infrastructure shall be:

- for Regular Care customers, 100% of one month's line rental for every fault which has not been restored in the first two days for every day thereafter until service is restored, up to a maximum of 30 days; and

- for Enhanced Care customers, 15% of one month's line rental for every fault which has not been restored in the first five hours for every hour thereafter until service is restored, up to a maximum of 200 hours.

e) Any limits on compensation payable as a result of a failure to satisfy the service guarantees shall be removed other than those set out in (c) and (d) above.

Additional losses

f) Any compensation payable under the contract shall be without prejudice to any right of either party to claim for additional loss.

Proactive payments

g) The Dominant Provider shall monitor its performance against the service guarantees for fault repair and provision and compensate Third Parties proactively should it fail to satisfy the service guarantees. Compensation payments shall be made as soon as possible after the event and not later than the billing cycle following the billing cycle after the event unless not practicable. For the avoidance of doubt, compensation shall be payable without the need for a Third Party to make a claim.

35. The terms and conditions amended as set out in paragraph 34 above shall take effect from the 90th day after publication of the Final Statement.

Partial Private Circuits

Quick quote and very high bandwidth quote on line

36. The Dominant Provider shall provide to a Third Party, upon written request, the necessary wholesale network and pricing information to enable the Third Party to obtain the same information for Partial Private Circuits that is available to the Dominant Provider's retail arm, for its “Quick Quote” quote facilities.

Concurrency of Partial Private Circuit and ISH link and CSH link delivery times

37. Where a Third Party has ordered a Partial Private Circuit, and the operation of the circuit requires the provision of an ISH link or CSH link, the Dominant Provider shall ensure that the delivery dates of the Partial Private Circuit and the CSH link or ISH link are the same.

Expedited orders

38. Upon a Third Party’s written request, the Dominant Provider shall make reasonable endeavours to set a Committed Delivery Date for Partial Private Circuits within 50% of the relevant Requisite Period set out in the table in paragraph 41 of this Direction, rounded up to the nearest working day where necessary, for at least 15% (by volume) of a Third Party’s previous month’s order. The Third Party shall inform the Dominant Provider which particular Partial Private Circuits it shall endeavour to be expedited pursuant to this paragraph. This paragraph shall only apply to the delivery of Partial Private Circuits of 2 Mbit/s or less. This paragraph shall not apply to Partial Private Circuits which exceed 110% (by volume), rounded up to the nearest integer where necessary, of a Third Party’s Advance Order Commitment.

39. Paragraph 48 of this Direction does not apply to orders of Partial Private Circuits made pursuant to paragraph 38 of this Direction.

Time scales for fixed individual compensation

40. Where the Committed Delivery Date for Partial Private Circuits is set by the Dominant Provider later than the relevant Requisite Period (as set out in the table in paragraph 41 of this Direction) without the agreement of a Third Party, the Dominant Provider shall be liable

to pay the Third Party a fixed individual compensation payment in accordance with paragraph 34 of this Direction.

41. Where the Committed Delivery Date for Partial Private Circuits is set by the Dominant Provider either, later than the relevant Requisite Period (as set out in the table below) but with the agreement of a Third Party, or within the Requisite Period, the Dominant Provider shall be liable to pay the Third Party a fixed individual compensation payment in accordance with paragraph 34 of this Direction.

Bandwidth of Partial Private Circuit	**Requisite Period**
64 kbit/s	10 working days
128 kbit/s to 256 kbit/s delivered over copper	10 working days
128 kbit/s to 256 kbit/s delivered over fibre	30 working days
320 kbit/s to 960 kbit/s	30 working days
1 Mbit/s	30 working days
2 Mbit/s	30 working days
Subsequent Partial Private Circuit of 2 Mbit/s	10 working days

Third Party's ability to cancel order

42. Where the Provisioning Interval exceeds the relevant Requisite Period set out in the table in paragraph 41 of this Direction, a Third Party shall be allowed to cancel its order for a Partial Private Circuit after the Cancellation Threshold (as set out in the table below) has expired. The Cancellation Threshold shall commence upon the expiry of the relevant Requisite Period set out in the table in paragraph 41 of this Direction. The Requisite Periods in the table in paragraph 41 shall apply, for the purposes of this paragraph, regardless of whether there is a delay in delivery of a Partial Private Circuit which is due to circumstances beyond the Dominant Provider's reasonable control but not including delay by a Third Party.

Requisite Period set out in the table in paragraph 41 of this Direction	**Cancellation Threshold**
10 working days	10 working days

30 working days	20 working days

43. Where a Third Party cancels a Partial Private Circuit pursuant to paragraph 42 of this Direction, the Dominant Provider shall not charge the Third Party for the circuit and shall not charge for cancelling the circuit. The Dominant Provider shall also be liable to pay the Third Party any fixed individual compensation payments accumulated pursuant to the PPC Contract as amended by the Directions.

Reduced Requisite Periods for Partial Private Circuits

44. The Dominant Provider shall ensure that for at least 70% (by volume) of Partial Private Circuits of a particular bandwidth delivered by the Dominant Party to a Third Party within a three month period (such period not to be calculated on a rolling basis) the Committed Delivery Date is set within the relevant Reduced Requisite Period (as set out in the table below).

Bandwidth of Partial Private Circuit	**Reduced Requisite Period**
128 kbit/s to 256 kbit/s delivered over fibre	20 working days
320 kbit/s to 960 kbit/s	20 working days
1 Mbit/s	20 working days
2 Mbit/s	20 working days

45. In calculating the 70% (by volume) of Partial Private Circuits to which paragraph 44 of this Direction applies the following shall not be included:

- Partial Private Circuits of 64 kbit/s;

- Partial Private Circuits of 128 kbit/s to 256 kbit/s delivered over copper;

- Subsequent Private Partial Circuits of 2Mbit/s;

- Partial Private Circuit orders to which paragraph 38 of this Direction applies; and

- Partial Private Circuits which exceed 110% (by volume), rounded up to the nearest integer where necessary, of a Third Party's Advance Order Commitment.

46. The Reduced Requisite Periods set out in the table in paragraph 44 of this Direction apply only if, in the previous three month reporting period (such period not to be calculated on a rolling basis), a Third Party has ordered from the Dominant Provider at least ten Partial Private Circuits of the same bandwidth where such Partial Private Circuits are 2 Mbit/s or less.

47. For the purposes of this Direction, in determining whether 110% (by volume), rounded up to the nearest integer where necessary, of a Third Party's Advance Order Commitment has been exceeded, the calculation shall be at a national level for each individual Partial Private Circuit bandwidth category and applied in the order in which the Partial Private Circuits were ordered by the Third Party.

Multiple orders

48. Where the Dominant Provider receives an order for more than 10 Partial Private Circuits at one site from a Third Party, the relevant Requisite Period applicable to determine whether the Dominant Provider shall pay fixed individual compensation as set out in paragraphs 40 and 41 of this Direction, shall be the relevant Requisite Period set out in the table in paragraph 41 of this Direction increased by a maximum of 50%. The Dominant Provider shall inform the Third Party of the revised time scales as soon as reasonably practicable.

Availability of service

49. When total loss of service (i.e. total loss of service for one minute or longer) occurs three or more times, within a 12 month period, to a Partial Private Circuit, the Third Party shall not be liable to the Dominant Provider for the monthly rental in any subsequent month where total loss of failure occurs to the Partial Private Circuit, until such time as 12 months have passed and the Partial Private Circuit has not suffered total loss of service. Occurrences of total loss of service which result in the Dominant Provider being liable to pay fixed individual compensation pursuant to paragraphs 62, 63 and 64 of this Direction, shall not be considered as an occurrence of a total loss of service for the purposes of this paragraph.

Network Infrastructure

Time scales for fixed individual compensation

50. Where the Committed Delivery Date for Network Infrastructure is set by the Dominant Provider later than the relevant Requisite Period (as set out in the table in paragraph 51 of this Direction) without the agreement of a Third Party, the Dominant Provider shall be liable

to pay the Third Party a fixed individual compensation payment in accordance with paragraph 34 of this Direction.

51. Where the Committed Delivery Date for Network Infrastructure is set by the Dominant Provider either, later than the relevant Requisite Period (as set out in the table below) but with the agreement of a Third Party, or within the Requisite Period, the Dominant Provider shall be liable to pay the Third Party a fixed individual compensation payment in accordance with paragraph 34 of this Direction.

Network Infrastructure	**Requisite Period (where the Dominant Provider needs to carry out Civil Works)**	**Requisite Period (where the Dominant Provider does not need to carry out Civil Works)**
ISH links	110 working days	85 working days
CSH links	110 working days	85 working days
ISH links – provision of new multiplexor on an existing Point of Connection	Not applicable	60 working days
ISH links - provision of extra STM-1 interface on existing STM-1 ISH SMA4 multiplexor	Not applicable	60 working Days
CSH links - provision of new multiplexor on existing Point of Connection	Not applicable	60 working Days
CSH links requiring only provision of new tributary card on existing multiplexor		

	Not applicable	25 working Days

Third Party's ability to cancel order

52. Where the Provisioning Interval exceeds the relevant Requisite Period set out in the table in paragraph 51 of this Direction, a Third Party shall be allowed to cancel its order for Network Infrastructure after the Cancellation Threshold (as set out in the table below) has expired. The Cancellation Threshold shall commence upon the expiry of the relevant Requisite Period set out in the table in paragraph 51 of this Direction. The Requisite Periods in the table in paragraph 51 shall apply, for the purposes of this paragraph, regardless of whether there is a delay in delivery of Network Infrastructure which is due to circumstances beyond the Dominant Provider's reasonable control but not including delay by a Third Party.

Requisite Period set out in the table in paragraph 51 of this Direction	**Cancellation Threshold**
21 to 40 working days	20 working days
41 to 60 working days	25 working days
61 to 90 working days	30 working days
Over 90 working days	40 working days

53. Where a Third Party cancels Network Infrastructure pursuant to paragraph 52 of this Direction, the Dominant Provider shall not charge the Third Party for the Network Infrastructure and shall not charge for cancelling the Network Infrastructure. The Dominant Provider shall also be liable to pay the Third Party any fixed compensation payments accumulated pursuant to the PPC Contract as amended by the Directions.

Reduced Requisite periods for Network Infrastructure

54. The Dominant Provider shall ensure that for at least 70% (by volume) of the total VC4-equivalents of Network Infrastructure delivered by it to a Third Party during a three month period (such period not to be calculated on a rolling basis) the Committed Delivery Date is set within the relevant Reduced Requisite Period (as set out in the table below).

Network Infrastructure	**Reduced Requisite Period (where the Dominant Provider needs to carry out Civil Works)**	**Reduced Requisite Period where the Dominant Provider does not need to carry out Civil Works)**
ISH links	75 working days	60 working days

CSH links	75 working days	60 working days
ISH links - provision of new multiplexor on an existing Point of Connection	Not applicable	40 working days
ISH links - provision of extra STM-1 interface on existing STM-1 ISH SMA4 multiplexor	Not applicable	40 working days
CSH links - provision of new multiplexor on existing Point of Connection	Not applicable	40 working days
CSH links requiring only provision of new tributary card on existing multiplexor	Not applicable	20 working days

55. In calculating the 70% (by volume) of the total VC4-equivalents of Network Infrastructure to which paragraph 54 of this Direction applies the following shall not be included:

- Network Infrastructure which exceeds 110% (by volume), rounded up to the nearest integer where necessary, of a Third Party's Advance Capacity Order.

56. The Reduced Requisite Periods set out in the table in paragraph 54 of this Direction only apply if, in the previous three month reporting period (such period not to be calculated on a rolling basis) a Third Party has ordered from the Dominant Provider at least 2 VC4-equivalents of Network Infrastructure. For the purposes of this paragraph the first reporting period of three months shall be the first such reporting period falling after 30 working days following the date of publication of this Direction.

57. For the purposes of this Direction, in determining whether 110% (by volume), rounded up to the nearest integer where necessary, of a Third Party's Advance Capacity Order has been exceeded, the calculation shall be made using VC4-equivalents at each Point of Connection applied in the order in which the Network Infrastructure was ordered by the Third Party.

Repair of Partial Private Circuits and Network Infrastructure

58. Where the Dominant Provider offers to a Third Party Regular Care and Enhanced Care for Partial Private Circuits and Network Infrastructure it shall do so at a cost orientated price and as set out in the table below:

	Operational hours	**Repair/response time**	**Extras**
Regular Care	Normal working hours	Response within one working day of receipt of a fault report by a Third Party. Repair within two working days of receipt of a fault report by a Third Party.	If a fault is not remedied within two working days of receipt of a fault report by a Third Party, the Dominant Provider shall call the Third Party to report progress being made to remedy the fault.
Enhanced Care	24 hours per day, 7 days per week (including public and bank holidays).	Response within four hours of receipt of a fault report from a Third Party. Repair within five hours of receipt of a fault report by a Third Party.	If a fault is not remedied within five hours of receipt of a fault report by a Third Party, the Dominant Provider shall contact the Third Party to report progress being made to remedy the fault.

59. Receipt by the Dominant Provider from a Third Party of a report of a fault concerning a Partial Private Circuit or Network Infrastructure, shall be acknowledged by the Dominant Provider to the Third Party within one hour.

60. Where the Dominant Provider fails to repair a Partial Private Circuit within the time limits set out in the table in paragraph 58 of this Direction it shall pay to the Third Party a fixed individual compensation payment as set out in paragraphs 61 to 65 inclusive of this Direction in respect of the period commencing on the expiry of the applicable repair time set out in the table in paragraph 58 and expiring at the time the Partial Private Circuit or Network Infrastructure is repaired.

61. Where the Third Party has ordered the Dominant Provider's Regular Care for Partial Private Circuits, the Dominant Provider shall pay the Third Party an amount set in accordance with paragraph 34 of this Direction.

62. Where the Third Party has ordered the Dominant Provider's Regular Care for Network Infrastructure, the Dominant Provider shall pay the Third Party an amount set in accordance with paragraph 34 of this Direction.

63. Where the Third Party has ordered the Dominant Provider's Enhanced Care for Partial Private Circuits, the Dominant Provider shall pay the Third Party an amount set in accordance with paragraph 34 of this Direction.

64. Where the Third Party has ordered the Dominant Provider's Enhanced Care for Network Infrastructure, the Dominant Provider shall pay the Third Party an amount set in accordance with paragraph 34 of this Direction.

65. The Dominant Provider shall not be liable to pay fixed individual compensation pursuant to paragraphs 62 and 64 of this Direction where it is also liable for fixed individual compensation pursuant to paragraphs 61 and 63 of this Direction where the Partial Private Circuit is being provided using the Network Infrastructure which is being repaired.

66. The Dominant Provider shall attend, and invite Third Parties to regular meetings to review the level of service provided by it in relation to Partial Private Circuits and related Network Infrastructure.

Change of speed or interface

67. The Dominant Provider shall offer to provide within a reasonable period of a Third Party's written request, the ability to alter the speed or interface of a Partial Private Circuit.

68. The Dominant Provider shall ensure that it provides to a Third Party a Partial Private Circuit variant for the services to which paragraph 67 of this Direction applies, which are equivalent to the services it currently provides on a retail basis for retail leased lines.

STM-1, ISH and CSH handover

69. The Dominant Provider shall offer to provide within a reasonable period of a Third Party's written request for a Synchronous Transfer Mode–1 ("STM-1"), an interface using an ISH link or CSH link; and handover pursuant to paragraph 70 of this Direction. Such link or handover shall be provided by way of network connecting apparatus capable of providing no more than the STM-1 capacity ordered by the Third Party.

70. The Dominant Provider shall within a reasonable period of a Third Party's written request, handover in a footway jointing chamber for Partial Private Circuits at a reasonable point nominated by the Third Party. The footway jointing chamber shall be located in the same Dominant Provider local serving exchange area as the Dominant Provider Serving Node to which the Partial Private Circuits being handed over are connected.

Equipment re-use

71. Paragraph 72 of this Direction shall only apply to the re-use of Plesiochronous Digital Hierarchy ("PDH") and Synchronous Digital Hierarchy **("SDH")** equipment situated at a third party site ("Equipment").

72. The Dominant Provider may reject a request by a Third Party for re-use of PDH Equipment **if such re-use would be incompatible with its network. Any such rejection by the** Dominant Provider **shall be made within 10 working days of a request by the Third Party and fully justified in writing to the requesting Third Party at the same time as the request is rejected.**

Other Circuits

73. Unless Ofcom otherwise agrees, the Dominant Provider shall offer to provide Partial Private Circuit with no single point of failure, within a reasonable period of a Third Party's request.

74. The Dominant Provider shall offer to provide, within a reasonable period of a Third Party's written request, a Partial Private Circuit which is dual pathed and diversely routed from a third party customer's premises to a Third Party's single Point of Connection.

RBS Backhaul

75. The Dominant Provider shall offer to provide to a Third Party, within a reasonable period of the Third Party's written request, transparent transmission capacity at all bandwidths up to and including a bandwidth capacity of two megabits per second between a radio base station and a Point of Connection with a Third Party's electronic communications network connected to the nearest appropriate digital cross connection node.

General

76. The Dominant Provider shall implement this Direction within 10 working days of its publication.

77. This Direction shall take effect on the day it is published.

Part 2 Proposed modifications of directions for KCOM

Proposal for direction modifying requirements set out in Direction 1 and Direction 3

Notification of proposal under sections 49 and 49A of the Communications Act 2003 and SMP Services Condition OB2 modifying the requirements in relation to network components and preparation, audit, delivery and publication of the Regulatory Financial Statements

Background

1. On 22 July 2004, Ofcom published a statement entitled "*The regulatory financial reporting obligations on BT and Kingston Communications Final statement and notification – Accounting separation and cost accounting: Final Statement and notification*" ("**July 2004 Statement**"). At Annex 3 of this statement, Ofcom imposed SMP services conditions with respect to regulatory accounting on KCOM in markets in which KCOM had been found to have significant market power in previously concluded market reviews.

2. At Annex 5 of the July 2004 Statement, Ofcom published various directions for KCOM given under the SMP services conditions. These included:
    a. a direction specifying network components ("**Direction 1**"); and
    b. a direction relating to the preparation, audit, delivery and publication of the Regulatory Financial Statements ("**Direction 3**").

3. Direction 3 was subsequently modified by:
    a. the Direction published at Annex 6 of the regulatory statement "*Changes to BT and KCOM's regulatory financial reporting – 2008/09 update*" of 15 June 2009;
    b. the Direction published at Annex 5 of the regulatory statement "*Changes to BT and KCOM's regulatory and financial reporting 2009/10 update*" of 4 June 2010; and
    c. the Direction published at Annex 4 of the regulatory statement "*Changes to BT and KCOM's regulatory and financial reporting 2013/14 update*" of 3 April 2014.

4. Ofcom is publishing, on 15 May 2015, a consultation document entitled "*Business Connectivity Market Review: Review of competition in the provision of leased lines*" ("**May 2015 BCMR Consultation**"). In this document, Ofcom is consulting on new proposals identifying markets, making certain market power determinations and setting SMP services conditions on BT and KCOM respectively.

5. Under conditions OB2 set out at Annex 2 of the July 2004 Statement which Ofcom proposes to impose on KCOM in the May 2015 BCMR Consultation, Ofcom may from time to time make such directions as they consider appropriate in relation to KCOM's obligations under proposed condition OB5.

6. This Notification sets out proposals for further requirements in relation to the network components and the preparation, delivery and publication of the Regulatory Financial Statements.

Proposal to give direction

7. Ofcom is proposing to make the directions set out in Schedule 1 and Schedule 2 to this Notification.

8. The effect of and reasons for giving the proposed directions are set out in the accompanying consultation.

Ofcom's duties and legal tests

9. Ofcom considers that the proposed directions referred to in paragraph 7 comply with the requirements of section 49(2) of the Communications Act 2003 ("**Act**").

10. In making the proposals referred to in paragraph 7, Ofcom has considered and acted in accordance with its general duties set out in section 3 of the Act, the six community requirements in section 4 of the Act and the duty to take account of European Commission recommendations for harmonisation in section 4A of the Act.

Making representations

11. Representations may be made to Ofcom about the proposals set out in this Notification and the accompanying consultation document by no later 31 July 2015.

12. In accordance with section 49C(1)(a) of the Act, a copy of the Notification, together with the Schedules, has been sent to the Secretary of State.

Interpretation

13. Except as otherwise defined, words or expressions used shall have the same meaning as they have been ascribed in the conditions set out in Annex 2 of the July 2004 Statement and otherwise any word or expression shall have the same meaning as it has in the Act.

M. Gibbs

Marina Gibbs

Competition Policy Director, Ofcom

A person duly authorised in accordance with paragraph 18 of the Schedule to the Office of Communications Act 2002

15 May 2015

Schedule 1 – Proposed modifications of Direction 3

The information set out in Annex A to Direction 3 is modified by adding a statement entitled "Wholesale Pricing Transparency Report" which must be produced and provided to Ofcom.

The information set out in Annex C to Direction 3 is modified by adding a statement entitled "Retail Pricing Transparency Report" which must be produced and provided to Ofcom.

Schedule 2 – Proposed modification of Direction 1

The information set out in Annex A to Direction 1 is modified by adding the following network components:

1.2 Local loop infrastructure;

1.3 Exchange to exchange infrastructure;

1.4 Electronics;

1.5 Field provision;

1.6 Field maintenance;

1.7 Back-office provision;

1.8 Back-office maintenance;

1.9 Sales and product management;

1.10 Net current assets; and

1.11 Other.

Annex 8

Wholesale product market definition: overview

A8.1 This Annex describes our approach to wholesale product market definition for this review. We apply this approach to our assessment of product markets in Annexes 9 to 12. Our product and geographic market assessments for CI core conveyance and TI trunk are set out in Annexes 19 and 20.

Approach to product market definition for this review

A8.2 The purpose of market definition in this review is to structure and inform our forward looking assessment of whether SMP exists in any market(s) for the supply of relevant business connectivity services. Market definition is not an end in itself, but is carried out with the aim of understanding whether, during the course of the review period, the users of business connectivity services will be protected by effective competition, or whether *ex ante* regulation is required.

A8.3 In formulating our approach, we have taken account of the 2014 Recommendation on Markets[15], the accompanying explanatory memorandum (the "Explanatory Memorandum")[16] and the Commission's SMP Guidelines.[17]

A8.4 As in previous reviews, we inform our assessment of the market boundaries by considering the likely strength of competitive constraints from demand- and supply-side substitution. The hypothetical monopolist test is a useful tool we use to assess such substitution possibilities. This approach considers whether a hypothetical monopolist could profitably impose a small but significant, non-transitory increase in price (a SSNIP) in a candidate market. If demand- or supply-side substitution to alternative services is sufficient to render the price increase unprofitable, then the market should be widened to include the closest substitute services.

A8.5 In order to define the relevant markets on a forward looking basis we have considered existing market conditions, taking into account past data, and expected or foreseeable market developments over the review period.

A8.6 We apply the Modified Greenfield Approach when carrying out the market definition exercise. This means that the market definition exercise is conducted in relation to a hypothetical scenario in which there are no *ex ante* SMP remedies in the reference market(s), but *ex-ante* SMP remedies in other markets continue to apply. For example, we assume that remedies imposed in the Wholesale Local Access

[15] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014H0710&from=EN

[16] http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=7056

[17] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52002XC0711(02)&qid=1399986405910&from=EN

(WLA) market apply[18] and that therefore BT is required to provide LLU, VULA, SLU and PIA.[19]

Relationship between wholesale and retail markets

A8.7 The Explanatory Memorandum notes that in general for electronic communications sectors[20] there are at least two market levels to consider:

- *Retail markets:* for services or facilities provided to end-users, and
- *Wholesale markets:* for upstream access to facilities and networks which are necessary for operators to provide competitive access services to end-users.

A8.8 This is a review of wholesale services, but the relationship between wholesale and retail markets is also an important factor in this market assessment. Demand for wholesale products derives from demand for retail services, and we therefore identify wholesale product markets by first analysing substitutability between products at the retail level. Where we find that two products are close substitutes at the retail level, this suggests that the wholesale market should include both products. Where we find products are not close substitutes at the retail level, then this finding is likely to follow at the wholesale level because the scope for direct substitution at the wholesale level is limited.[21]

A8.9 It then follows that, insofar as demand-side substitution is relevant to our wholesale product definition, it arises primarily from indirect constraints from retail markets. Indirect constraints arise because some proportion of the wholesale price increase is likely to be passed on to the retail level, which may result in retail customers switching to goods which do not require the wholesale input. If such retail substitution would be sufficient to limit the ability of a wholesale operator to profitably raise wholesale prices by any significant amount then an indirect constraint exists. Such indirect constraints might lead to wholesale products being included in the same relevant market even if those products do not constrain each other directly at the wholesale level.

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[18] WLA refers to the fixed connection from the local exchange or access node to the end-user. We currently require BT to provide various WLA services such as Local Loop Unbundling ('LLU') or Sub-Loop Unbundling ('SLU') (for copper-based current generation access ('CGA') services) and VULA (for fibre-based next generation access ('NGA') services) on regulated terms. Physical Infrastructure Access ('PIA') is a passive remedy for WLA that provides access to BT's access ducts. The set of WLA remedies allows other CPs to use BT's access network to provide competing voice and broadband services in the downstream markets. http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/statement-june-2014/volume1.pdf

[19] One practical implication of this approach is that EFM can be included in our market, even though CPs require access to BT's regulated WLA products in order to be able to supply EFM.

[20] Page 7 of the Explanatory Memorandum, http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=7056

[21] If a retail service A can only be provided by a matching wholesale service A, and another retail service B can only be provided by a matching wholesale service B, then direct substitution at the wholesale level is not possible. Any substitution between services A and B must therefore occur at the retail level. If retail services A and B are also not good substitutes at the retail level, and are therefore in separate retail markets, the corresponding wholesale services will then also be in separate markets.

Product market definition approach adapted to business connectivity markets

Consideration of services other than leased lines in our product market definition

A8.10 The main focus in this business connectivity review is the assessment of competition in the provision of wholesale leased lines terminating segments. In the EC Recommendation, terminating segments of leased lines are included in the market for "Wholesale high-quality access provided at a fixed location." According to the Explanatory Memorandum, this market may also include other products and services, such as wholesale asymmetric business broadband access which is used to provide retail services that some users might view as substitutes for leased lines. Therefore, we have discussed alternative products and services that might widen the scope of the relevant markets beyond leased lines services.

A8.11 In particular, we have considered whether asymmetric broadband services might impose a sufficient constraint on leased lines prices to be included in the same market.

A8.12 For this market review, we are interested in the constraint asymmetric services exert on leased lines and not in the other direction. This is because we recently conducted a review of wholesale broadband access (WBA) markets and found that asymmetric services were not constrained by higher quality symmetric leased lines services. We determined that asymmetric broadband services sold to businesses were part of the WBA markets and that leased lines were outside of the WBA market. [22] We then went on to determine regulation appropriate to WBA markets.

We consider a range of evidence when assessing demand and supply-side substitution

A8.13 We rely on a number of sources of evidence to inform our views about retail product markets, in particular the extent to which customers view different products as substitutes, including:

- *Technical or qualitative assessment:* we consider whether different types of service are good substitutes for each other, given any differences in product characteristics between services;
- *Pricing information:* in general, if two products perform a similar function and have similar prices it is more likely that they are substitutes than if prices are very different. If one has a higher price, both might still be sufficiently close substitutes to be included in the same market, if the higher price reflects a higher quality;
- *Consumer survey evidence:* in order to assess whether consumers view services as good substitutes, we commissioned BDRC to conduct a consumer survey. We

[22] Ofcom's 2014 Wholesale Broadband Access (WBA) market review concluded broadband access services are not constrained by symmetric services such as leased lines. See Ofcom's "Review of the wholesale broadband access markets", draft statement, 19 May 2014, p. 69-72, at http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-statement.pdf

asked a number of questions to determine likely consumer preferences for different retail services and future intentions regarding purchases of Business Connectivity Services (BCS) that determine demand for leased lines. We asked end-users about the key service characteristics they value (availability, reliability, bandwidth etc) and how these vary depending on services they currently consume. We also asked consumers for views on likely switching intentions in future and whether they have particular concerns about switching to particular services;

- *CPs' approaches to marketing different business connectivity services and their views on market definition:* we also assessed how suppliers market different services. We also asked stakeholders about market definition in the CFI and more directly in our market questionnaires; and

- *Barriers to switching:* even if there are general reasons why consumers might find products to be substitutes, there may be barriers to switching between the products either at the wholesale or retail level.

A8.14 We therefore rely on a range of evidence to inform our substitution analysis.

Chain of substitution analysis

A8.15 As set out in Section 3, the products and services under review cover a wide range of users (mobile, enterprises of varying size) and applications (data connections, telemetry, voice, storage/backup etc). As a result, products are differentiated to meet the needs of specific uses and users, even though all are delivered over the same physical network (duct and fibre) and use the same network technologies (e.g. Ethernet).

A8.16 The Explanatory Memorandum observes that superficially distinct high quality access services could fall within a single market if they are linked by a *chain of substitution* via an intermediate product(s). The Explanatory Memorandum explains that, if so, *"both ends of the chain belong to the same market as they are both constrained by the same product(s)".* [23] However, the Explanatory Memorandum also recognises that: *"the business retail market is characterised by considerable divergent national conditions. It is therefore for the NRAs to ascertain whether any breaks in the chain of substitution can be observed."*

A8.17 If the evidence suggests clear breaks in the chain of substitution then this could justify the definition of separate relevant product markets. Alternatively, there may be reasons to include the various differentiated products in the same market. In particular, definition of a single market may be appropriate if there are interactions between the various links of the chain, clear boundaries are difficult to determine, prices are conditioned by the choices of the firm that may have SMP, or if the boundaries are otherwise unstable as demand patterns evolve over time.

A8.18 Some general issues arising in analysis of chains of substitution are discussed below.

- As discussed in our market context section, leased lines prices are not always easily observed at the retail level. One reason is that leased lines may form part

[23] Page 50, Explanatory note to the EC Recommendation.

of a wider package of connectivity services purchased as a bundle, and prices for individual services may not be transparent. Retail prices may also vary significantly from customer to customer and may depend on which other services are also taken, even though the underlying business connectivity products used are similar.

- In the absence of retail price data we could (as in 2013) use BT's wholesale input prices as a proxy for the competitive price benchmark, on the assumption that the competitive level of retail prices will be close to costs for which the wholesale charges are a proxy. Wholesale input prices for lower bandwidths are subject to charge controls and so in aggregate prices for these lines should reflect costs over time. However, even within the context of a charge control set to bring average prices for a basket of services into line with a forecast of average costs, there is still scope for average charges to be above cost where revenues are higher or costs lower than expected when the control was set. In other cases, where it does not face cost based charge controls, BT may be able to set prices reflecting a degree of market power.

- Therefore, there is a risk that prices are above levels that would arise in competitive markets. This can result in incorrect inferences being drawn about product market boundaries, for example:

    - If current prices are above competitive benchmarks, applying the SSNIP test to current prices may result in an excessively broad market definition.[24]

    - market power may cause distortions in relative prices which reduce the extent of customer switching between services, creating apparent breaks in a chain of substitution when such breaks would not exist in a competitive market.

A8.19 In the case of leased lines, services with different bandwidths or technologies are often delivered over the same underlying physical infrastructure that accounts for a significant proportion of the overall costs. The costs of this shared infrastructure are common to circuits of different bandwidths and other services. Whilst, in a competitive market, costs which are caused by an individual service (its incremental costs) will generally be recovered through the price of that service, common costs of this kind are by definition not caused by any single service and this can make it difficult to identify the competitive price level of a single service. This is because it might not be possible to say what amount of common costs would be recovered from any individual service, and hence what the competitive price of it would be.

A8.20 However as we would expect prices in a competitive market to reflect incremental costs (with mark-ups to allow recovery of common costs), we have looked at incremental cost differences between services of different bandwidths or technologies. This provides an alternative reference point for comparisons of relative prices, as it allows us to understand the extent to which incremental cost

[24] The error described here is known as the 'cellophane fallacy' and is named after the US case US v EI Du Pont Nemours & Co, 1956. This effect occurs because if prevailing prices are already above the competitive level, even a monopolist reaches a point where further price increases become unprofitable and where competitive constraints come into action that would not have applied at competitive price levels. If this is not taken into account, the erroneous conclusion could be reached that a monopolist who has successfully exercised market power by raising price is subject to competitive constraints since, starting from monopoly price levels, it would be constrained from implementing further price increases.

differences drive observable differences in the relative prices of services, and how far price differences reflect differences in the extent of common cost recovery and possibly also exploitation of market power.

Homogeneity of competitive conditions

A8.21 Even if services are not demand or supply-side substitutes, it can sometimes be appropriate to analyse them as constituting part of the same market if competitive conditions in the supply of the two services are sufficiently homogeneous.[25] This approach can help streamline the subsequent market power analysis by avoiding the need to review multiple highly-similar markets. The homogeneous competitive conditions criterion is relevant for our product market definition analysis because, in leased lines markets, there are a number of closely related services which are supplied under homogeneous competitive conditions. We explain in Section 4 that, in general, we expect competitive conditions to be fundamentally homogeneous across wholesale leased lines of different bandwidths and interfaces where they are provided over the same infrastructure.

[25] This approach was adopted in the BCMR 2013. We noted that, although homogeneity of competitive conditions is usually used in the context of geographic market definition as a reason for aggregating different areas not linked by demand or supply side substitution, it might also be used in the product market context. See paragraph 3.243 and footnote 187 of the BCMR 2013 statement.

Annex 9

Wholesale product market definition: broadband and EFM

Introduction

A9.1 In this Annex, we review whether asymmetric broadband and EFM (Ethernet in the First Mile) services are sufficiently close substitutes for either Ethernet or TI retail leased lines for them to be placed in the same product market.[26]

A9.2 We focus on the constraint that asymmetric broadband and Ethernet First Mile (EFM)[27] may provide on the prices of retail leased lines. As discussed in Annex 8, we do not consider the possibility of constraints in the other direction (on broadband prices), as this was assessed in the WBA Review. We also do not include an analysis of SDSL services as they are no longer material given the volumes now sold.[28]

A9.3 In our 2013 Statement, we excluded asymmetric broadband services from the leased line markets, and included EFM in the market for AI services. Our updated analysis in this section includes a consideration of the changes in technology since the 2013 Review and expected future developments during this review period. In particular our analysis covers:

- a qualitative assessment of different technologies;
- marketing, service features and pricing of each service;
- price comparisons and migration trends between services;
- evidence from consumers based on our consumer survey;

[26] As well as NGA and EFM, there are various connectivity products used in niche applications (some circuits used for CCTV, broadcast and street access) that have some similarity to leased lines. These products are not alternatives for most leased line customers, due to their specialist technical characteristics. Moreover, they are small in volumes and in some cases have various non-leased line alternatives. As in the 2013 BCMR we do not propose to include these products in our leased line product markets.

[27] For a description see the relevant sub-sections below.

[28] SDSL services were previously included within the TI market and subject to network access obligations. Although they were relatively low quality relative to a TI service, they were a low cost way to achieve symmetric services at low speeds and contention rates, so were sufficient for those that did not have a strong need for TI features. There is not expected to be a material volume of active subscribers throughout this review period. SDSL users are actively being encouraged by CPs to migrate to other services, notably EFM and Ethernet. According to BT, EFM or Ethernet will not cost more than SDSL, and will provide additional service features:

https://www.btwholesale.com/pages/static/Products/Broadband/BT_IPstream/featuresandbenefits.htm

BT has also retired SDSL from its portfolio: http://www.managedcomms.co.uk/2013/bt-retiring-sdsl-services-by-spring-2014/

- views of stakeholders based on our market questionnaire and responses to our CFI;
- supply-side substitution; and
- barriers to switching.

A9.4 In light of the available evidence, we consider that (asymmetric) broadband services do not fall in the same market as any leased line services. We consider that EFM services are part of the same market as other Ethernet leased lines.

A9.5 We begin the detailed analysis below by considering demand-side substitutability between asymmetric broadband services and leased lines. We then consider demand-side substitutability between EFM-based services and leased lines. We then consider barriers to switching which apply to both EFM and NGA services, before finally considering supply-side substitution.

Asymmetric broadband services

Qualitative assessment

A9.6 In this section, we compare the technical and service characteristics of leased lines to those of the following fixed asymmetric broadband technologies which are available in the UK, namely:

- Asymmetric Digital Subscriber Line (ADSL);
- fibre to the cabinet or premises (referred to collectively as FTTx or next generation access (NGA)); and
- cable broadband.

A9.7 As discussed in Section 3, current Generation Access (CGA) based on ADSL or ADSL2+ technology uses a standard copper telephone line to provide asymmetric broadband data communications. It is asymmetric as it provides higher download than upload bandwidths. This asymmetry is more suited to residential users that, on average, are more interested in downloading or streaming content at home. By contrast, business users tend to value two-way communication, such that their upload and download requirements will be closer (i.e. more symmetric).

A9.8 NGA technologies offer an upgraded access connection either through (i) FTTC which involves deploying fibre to the cabinet and then using copper to connect the end user; or (ii) FTTP which involves the deployment of fibre all the way from the exchange to the end-user. Virgin's network provides NGA over its cable access network, which uses a hybrid coaxial/fibre network utilising Data Over Cable Service Interface Specification (DOCSIS) technology to connect to equipment in the Virgin serving exchange.

A9.9 In Table A9.1 below, we show the different service characteristics of asymmetric broadband services and leased lines.[29] In the consumer survey we asked

[29] Note, here when we use the term leased line we are referring to both TI and Ethernet services. We make this simplification because although some performance differences between leased lines

respondents to rank these by importance. According to the results of our consumer survey, availability – a measure of reliability – was ranked almost twice as high in importance as the next most important service attribute.[30] Resilience and speed – both download and upload – were among the next highest ranked characteristics. This was followed by having a dedicated (uncontended) connection and latency. End-users also ranked speed and availability as the factors most important going forward.[31] End-users ranked jitter among the service features with lower importance. We did not ask end-users to rank the relative importance of security in the consumer survey, although other evidence in the survey suggests it is important to some users.[32]

services remain, the differences between an NGA service on the one hand, and either an Ethernet or a TI service on the other, are likely to be much more marked. We ignore WDM-based services in our assessment, as NGA is only likely to be a relevant constraint at lower bandwidths.

[30] In the consumer survey, we asked respondents to rank services in terms of relative importance to each other based on Max Difference technique. See Figure 7.1, page 35, BDRC Business Connectivity Services Review, March 2014. http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[31] Figure 7.2, page 37 of BDRC Business Connectivity Services Review. http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[32] For example, around 8% of users with leased lines that had concerns about switching to asymmetric broadband mentioned uncertainty about the security as a factor.

Table A9.1: Service characteristics of asymmetric broadband and leased line services

	ADSL	FTTC	FTTP/Cable Modem	Leased Lines
Geographic availability	BT has nationwide coverage for ADSL (99.8%) and covers 92% of UK premises with ADSL 2+;[33] TalkTalk covers 95%.[34]	NGA to 68% of UK premises. BDUK target for NGA of 95% by 2017. Numerous smaller deployments by other companies across the UK. Virgin Media's cable network covers 44% of UK premises[35]		Nationwide (subject to ECCs)
Headline bandwidths	Download 24Mbit/s/, upload 1.4Mbit/s	Download 80Mbit/s/ upload 20Mbit/s. [36]	FTTP: Download 300Mbit/s, upload 20Mbit/s. Virgin Media supports download 152Mbit/s and upload 12Mbit/s distance dependent.[37]	64kbit/s up to 100Gbit/s + symmetric capacity available
Bandwidth limitations	Bandwidth decreases based on distance of customer site to the exchange. Practical limit ≈ 3km (ADSL2+) to 5km (ADSL). For FTTC, the effect is much less than ADSL due to shorter local loops.			Not distance limited
Contention	The amount of contention can be varied by provision of backhaul capacity, depending on end-user requirements, Contention typically varies between 20:1 to 50:1	The amount of contention can be varied by provision of backhaul capacity depending on end-user requirements.		Uncontended
Latency / Jitter	Variable - dependent on the bandwidth capacity of the network and traffic at any given point in time, specified levels cannot be guaranteed			Low
Resilience	Not deployed to support resilience options			Resilience available
Security	Perceived as less secure as carried over a shared infrastructure			Medium to High
Synchronisation	Not supported		Supported on FTTP, unsupported on Cable	Supported

Source: Ofcom 2015

[33] BT Group annual report 2014, p. 42, at http://btplc.com/Sharesandperformance/Annualreportandreview/pdf/2014_BT_Annual_Report.pdf

[34] TalkTalk Group annual report 2014, p. 5, at http://www.talktalkgroup.com/~/media/Files/T/TalkTalk-Group/2014/AGM%202014/TalkTalk_Telecom_Group_PLC_Annual_Report_2014.pdf

[35] Ofcom's "Infrastructure Report 2014 Update", p.19, at http://stakeholders.ofcom.org.uk/binaries/research/infrastructure/2014/infrastructure-14.pdf

[36] BT is testing vectoring ASIC technology that may increase the maximum download speeds to up to 100Mbit/s.

[37] Virgin is currently testing ways to further increase the headline bandwidth to 10Gbit/s download and 1Gbit/s upload with the DOCSIS3.1 specification, but it is yet to deploy this technology. The final specification of DOCSIS 3.1 has not yet been determined and is expected to become available in 2015/16. We however do not identify any other notable improvements with DOCSIS 3.1, except bandwidth, that would make cable broadband features more similar to leased lines. See: http://www.ispreview.co.uk/index.php/2014/07/virgin-media-uk-lab-testing-10gbps-docsis-3-1-broadband-upgrade.html

A9.10 The nature of inter-site traffic for a business is such that sufficient capacity to cope with high volumes of traffic is often needed in both directions. But for many users exact bandwidth 'symmetry' per se is not required. They simply need the necessary upload and download bandwidths to meet their needs.

A9.11 In contrast to leased lines, the highest current generation bandwidths are only available to ADSL end-users close to the exchange. However, even with ADSL2+ technology, the maximum a user might expect is an upload bandwidth of up to 1.4Mbit/s. [38] We therefore focus below on NGA technologies as closer substitutes to leased lines.

A9.12 For some users, NGA could be considered to provide an acceptable alternative to a symmetric service with a maximum bandwidth rate equal to the upload bandwidth of the broadband service. Table A9.1 shows that a leased line user with bandwidth requirements of 20Mbit/s could potentially buy a FTTC (or FTTP) service running a download speed of up to 80Mbit/s (300Mbit/s FTTP) and an upload bandwidth of up to 20Mbit/s (20Mbit/s FTTP). These FTTx services could be considered as broadly 'equivalent' in bandwidth terms to a lower bandwidth symmetric leased line service.

A9.13 However, while FTTx services can provide higher download and upload bandwidths than ADSL services, there are still a number of differences in service features compared to leased lines. These include differences in terms of contention, latency and jitter, the level of security, resilience options, SLAs/SLGs and synchronisation support (for FTTC). Because NGA services are currently being deployed they also do not have the same geographic availability as leased line services, although they are expected to be widely available by the end of the three year period covered by this review. Similar quality issues also apply to cable products.[39]

A9.14 The analysis above suggests that, at least in terms of headline speeds, NGA services can be seen as a potential substitute to leased lines services. Indeed, some users of low bandwidth TI leased lines (2Mbit/s and below) in principle could in fact experience an increase in speed by moving to NGA. However, some leased line service features are not fully matched by NGA services. Where these features are required, it is unlikely that the latter will be a close substitute to a leased line. For TI, NGA can easily match the speed, but specific quality issues may be important. For AI, the entry level is now typically at 100Mbit/s (see Section 3, Figure 3.9), which is much higher than the speeds that NGA can offer. While a user may not need 100Mbit/s all of the time, EFM is still potentially a better substitute than NGA where lower prices are important (as discussed in the next section).

[38]Upload bandwidth is also distance dependent but, because upload bandwidths are lower, they are not necessarily impacted by distance from the exchange to the same extent as download bandwidths.

[39] Virgin delivers, on average, relatively high actual speeds of between 94 and 100 per cent of the headline download speeds it advertises. Although a cable modem can offer the same download and upload bandwidths as many leased lines, there are still a number of differences in the service features, as is the case with other asymmetric broadband technologies. These include differences in terms of contention, latency, jitter, the level of security, resilience options, SLAs/SLGs and synchronisation support. For details of Virgin Media's speeds, see Ofcom's "UK fixed-line broadband performance, November 2013", p. 20, at http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/november2013/Fixed_bb_speeds_Nov_2013.pdf

A9.15 Cable broadband can match (or even exceed) lower bandwidth AI and TI leased line services in terms of download speed, but upload speeds are not always very high and there are still key differences in other service features. Where these features are required, cable broadband is unlikely to be a close substitute for a leased line. Indeed Virgin Media's business website positions Ethernet leased lines and business broadband as suitable for different business applications.[40] There are significant price differences between Virgin Media's business broadband over cable (from £25 per month)[41] and its managed internet access over dedicated Ethernet connections (from £325 per month) reflecting this product differentiation (prices as of May 2015).[42]

Marketing and pricing

A9.16 In this section we discuss our research [43] of CPs' marketing and pricing of asymmetric broadband packages, including their positioning of these services relative to leased lines.

A9.17 The marketing of business broadband packages helps provide an understanding of how CPs position broadband services relative to leased lines and hence whether they may be serving different markets/customer segments.

A9.18 According to our research, providers do not usually position business broadband as a close substitute for leased lines. CPs that provide both broadband and leased lines typically position leased lines as a premium service. For instance, Easynet describes its leased lines proposition as *"a service for those organisations that regard their Internet connectivity as absolutely mission critical"*, whereas it does not attach the same description to its broadband proposition.[44] TalkTalk describes an Ethernet leased line as *"Simply the best there is"* across all of its propositions.[45] BT mentions that while fibre broadband can be used for a dependable internet connection *"… some businesses just need something more"*.[46]

A9.19 We observe that a common marketing approach is to match the typical end-user types to different services such as asymmetric broadband or leased lines. Examples of types of businesses are often distinguished by the number of employees they have, by the level of usage the overall business normally makes, ranging from light to heavy, or by how critical reliable data is to the business. In general, smaller firms with less business critical services are matched to

[40] http://www.virginmediabusiness.co.uk/Products-and-solutions/Broadband-and-Internet-Services/business-broadband-ppc/?gclid=CjwKEAjwp7WgBRCRxMCLx8mMnDMSJADncxS2BKBzXtmo_0jhCvmKuI6dYywM7JQ4RBtcDWZ2WtpUkxoCsoHw_wcB

[41] http://www.virginmediabusiness.co.uk/Products-and-solutions/Broadband-and-Internet-Services/Business-Broadband/

[42] http://www.virginmediabusiness.co.uk/Products-and-solutions/Broadband-and-Internet-Services/Managed-Internet-Access/

[43] Based on available information on CPs' websites

[44] See http://www.easynetconnect.net/products-and-services/internet/fibre-leased-lines/

[45] See http://www.talktalkbusiness.co.uk/products-and-services/connectivity-networking/ethernet/

[46] See http://business.bt.com/broadband-and-internet/leased-lines/why-leased-lines/

asymmetric broadband and larger businesses with business critical services are matched to leased lines.[47]

A9.20 Overall, the marketing suggests that broadband services are not simply characterised as a cheap substitute for leased lines but are aimed at end-users who demand different service characteristics.

A9.21 In addition to looking at the marketing of leased lines and broadband, we also researched retail prices of business broadband offers on CPs' websites. As we explain in Annex 8, we consider that the prices of two services performing broadly similar functions should themselves be similar if they are close substitutes. On the other hand, if there are large differences in price between them, it is less likely that users regard them as close substitutes.

A9.22 Our research covered 39 CPs' broadband packages with advertised download speeds of between 512kbit/s up to 100Mbit/s.[48] Figure A9.1 plots the annualised price of the package against the headline download bandwidths in Mbit/s of each surveyed package. [49] We have identified separately offers with unlimited and capped data allowances.

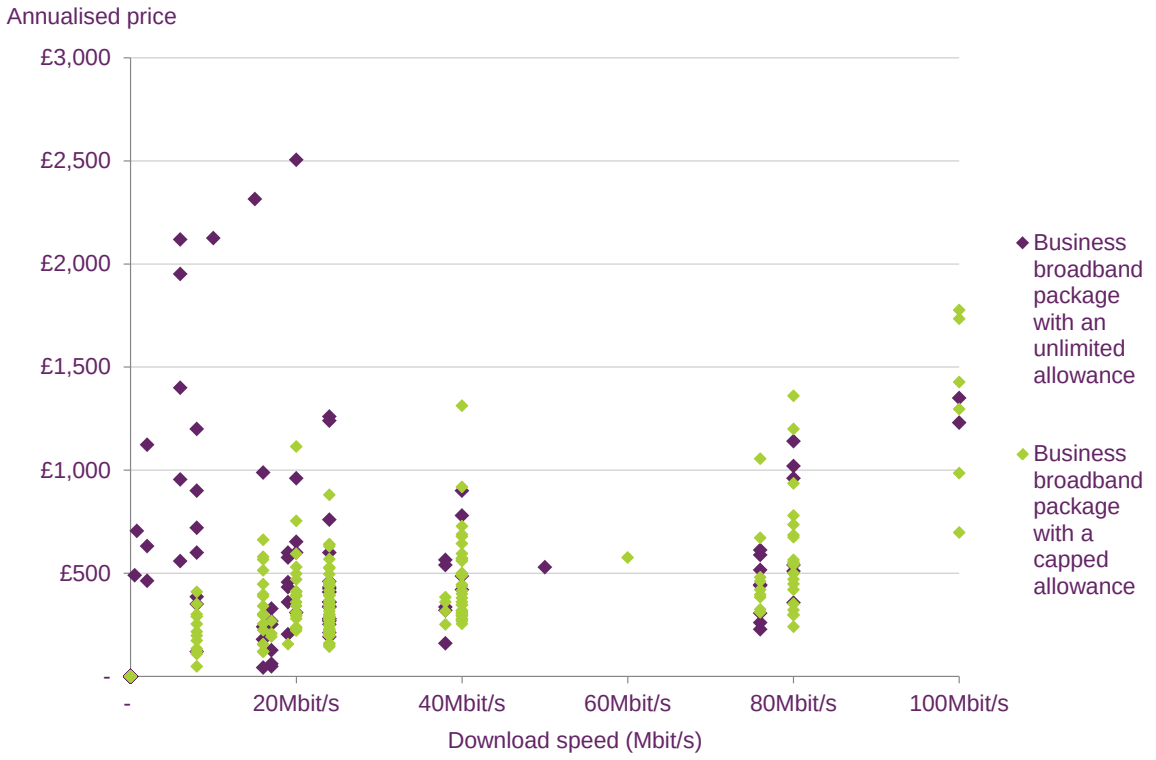
[47] For example, Virgin's business website has different product offerings and distinguishes between 'business' customers up to 99 employees and 'enterprise' customers with 100+ employees.

http://www.virginmediabusiness.co.uk/business-types/

[48] Note that although Virgin offers higher speeds than 100 Mbit/s packages, it does not offer them to business users.

[49] Data was retrieved in June to July 2014. It includes ADSL, FFTC, FTTH and Cable broadband. The annualised price includes charges such as connection fees and line rental, where applicable, and excludes VAT. When possible, we considered the shortest period contract.

Figure A9.1: Business broadband offers by download bandwidth



Source: Ofcom analysis, based on publicly available prices on CPs' websites

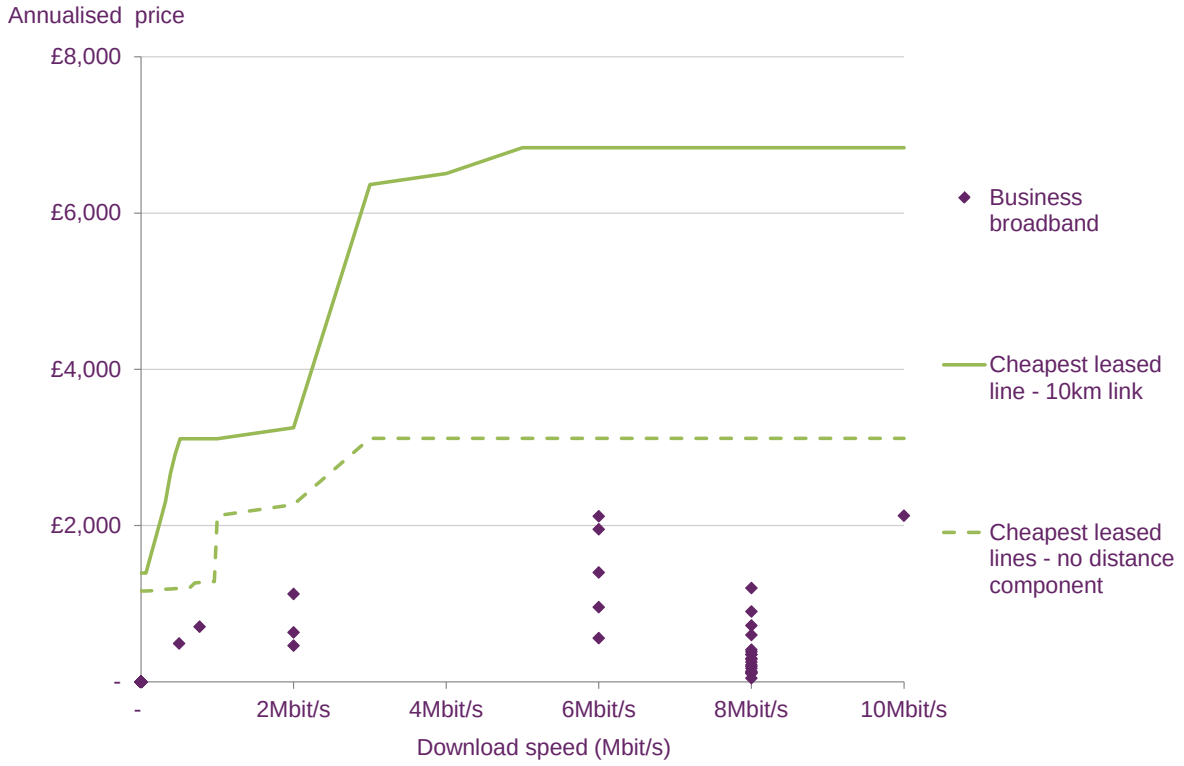
A9.23 In general, we observe that higher bandwidths are associated with higher prices, for a given CP. However, the data in Figure A9.1 suggests quite a wide range of prices available at each bandwidth. This is reflective of the wide range of available service characteristics. At the bottom-end of the price range, entry-level business packages are often priced at equivalent levels to residential broadband with very little difference in the service levels compared to residential deals. Additional service features are included in more expensive packages such as: security software; IP addresses; queue-free 24x7 UK-based helpdesk support; larger download allowances; through to better SLA/SLGs for repair and lower contention.

A9.24 The above analysis suggests that the annualised price of asymmetric broadband rarely exceeds £1,500 and is generally less than £1,000 on average.[50] We therefore focus on the lower bandwidth leased lines services more likely to be considered as alternatives to asymmetric broadband. Figure A9.2 below shows that NGA/CGA services are significantly cheaper than an illustrative price for a leased line of the same (but symmetric) headline speed. The comparison below is only illustrative because the upload speed of the broadband package will be significantly lower than the headline download speed. In addition, the leased line price used is a wholesale input price excluding retail margins. The comparison below includes two

[50] The only examples of retail services above this level are for low contention asymmetric broadband services. However, contention per se is not the reason for significantly higher prices (i.e. greater than £1,500), in general as, for example, Total Web Solutions offerred an uncontended headline 20Mbit/s downstream speed connection for as low as £21.99 a month.

examples of leased line prices, one for a 10km link and one with no distance component.[51]

Figure A9.2: Comparison of asymmetric broadband services with cheapest alternative leased lines services



A9.25 Our analysis highlights the range and variety of business broadband packages available, even allowing for the difficulties of comparing prices. But in general there is a marked gap between broadband prices and the prices of even the cheapest leased lines (based on wholesale input costs). Moreover, in retail markets, we would expect an equivalent leased lines access circuit to be priced higher than suggested in Figure A9.2 because it will include a retail margin over and above the wholesale input price. The price evidence does not therefore suggest that there is a 'chain of substitution' linking the higher quality asymmetric broadband services sold to businesses to low bandwidth leased lines.

A9.26 We also note that most CPs marketing asymmetric broadband do not typically characterise it as a cheap substitute for leased lines. In general, it seems to be positioned as appealing to end-users with different requirements.

Consumer survey analysis

A9.27 In this section, we consider evidence from the consumer survey conducted by BDRC on behalf of Ofcom. [52]

[51] In practice, an asymmetric broadband service consists of access to the internet, which entails a CP providing any access and backhaul necessary to get to its internet access points on its core. For leased lines the equivalent depends on network configuration, so we have shown prices for leased lines services within a typical range of distances.

A9.28 Consumer surveys can be an important tool for market definition to help understand consumers' preferences for different services or characteristics. However, it is important to bear in mind a number of caveats when it comes to interpretation of the survey results. In particular, some of the information Ofcom has collected from customer surveys relates to claimed behaviour of consumers who are asked questions about their future intentions. In general, experience shows that when asked hypothetical questions, consumers tend to overestimate the extent to which they will take actions (i.e. switching away from a supplier in response to a price rise). Therefore, consumer survey evidence based on hypothetical questions may tend to be most useful in indicating the maximum extent to which consumers may take particular actions.

A9.29 When interpreting survey results, care is also needed in particular for the following reasons:

- For some service groupings and questions there are small sample sizes that mean that in some cases analysis of the results can only be indicative rather than statistically robust;
- The underlying network connectivity may be sold as part of an underlying package of services e.g. the leased line service may also include value-added managed IT solutions as part of the contract. As such it may be that end-users find it difficult to think only about the leased line service that is of interest when formulating their responses;
- End-users may also overstate their willingness to switch to other services without considering the practicalities of changing other parts of the bundle; and
- There may be other factors that influence consumer choice, such as whether they have an affinity to a particular service provider's brand. Users may be unwilling to switch to a service that their preferred CP does not supply and may be willing to pay a significant price premium to use their preferred supplier's service.

A9.30 In the consumer survey, we asked users of leased lines:

- For those who had switched in the past, what alternatives they considered;
- What were the main motives for selecting leased lines over other services and what factors might become more important in future;
- Whether, when they switched services, they had considered NGA and whether they would have any specific concerns about switching to this service in future; and
- which services they might consider switching to in future.

A9.31 Overall, we think that the results of the consumer survey (discussed below) are consistent with asymmetric broadband falling outside of the market. Nevertheless, the overall findings of the consumer survey suggest that NGA may be attractive to customers that attach more importance to cost savings than performance.

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[52] http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

However, the results do not suggest leased lines and NGA services are sufficiently close substitutes for them to be regarded as part of the leased lines markets.

Detailed summary of results

Relatively small numbers of leased lines users that recently changed service had considered asymmetric broadband.

A9.32 We asked all those that changed service technology or supplier in the last three years what alternative service types they had considered. Among those users with leased lines[53] that said they had considered alternatives, other types of leased lines were most commonly mentioned (17%) with only 6% mentioning ADSL. One third of current users who selected leased lines had not considered any alternatives when they last changed services. Among the key factors driving end-users with leased lines to eventually select the service they did were price and changing business requirements (40% of respondents mentioned each of these factors) with perceived quality as the next most important (25%).

A9.33 We asked a number of users more directly about whether they had considered asymmetric broadband when they last reviewed their contracts. A large proportion of users asked had not actively considered asymmetric broadband as an alternative to their current service (82%) or had actively rejected it (8%). Very few respondents (6%) said that they had actively considered it and would plan to switch to NGA at the end of their contract.[54] This suggests that a significant number of respondents did not consider broadband as a close substitute (or had not considered it at all).

Concerns about asymmetric broadband services

A9.34 We asked users directly about their perceived challenges or concerns about switching from leased lines to broadband. [55] 42% had no particular concerns; whereas 17% listed upload speeds; 15% had concerns about reliability; 10% were concerned about download speeds and 9% were concerned about available SLA/SLGs. A further 10% considered that the prices offered for asymmetric broadband relative to leased lines were not that attractive/worth switching for.

A9.35 In addition, speed and reliability were listed as important factors behind the choice of current service. As NGA only addresses symmetric demand at very low bandwidths, reflecting its limited upload capabilities, and as it also has lower levels of reliability than a leased line, this suggests that NGA is not likely to be viewed as a good alternative for many users .[56] At higher speeds, and certainly above 10Mbit/s, EFM or Ethernet services are likely to be the most attractive in terms of providing reliable bandwidth.

[53] Leased lines or VPNs mainly underpinned by leased lines. Table 230 of consumer survey results.

[54] These results are for users with any type of leased lines as sample sizes are too small to look at sub-categories within.

[55] In terms of general switching behaviour in the past three years, 36% of respondents currently with a BCS had made no changes to their service; 38% changed the speed; over a quarter (26%) said that they had changed the service or technology; a significant number changed other factors, such as supplier (32%); contract terms (32%); change in SLAs (21%).

[56] The maximum symmetric bandwidth is equal to the lower of the upload and download speeds.

Some users when asked directly about switching to NGA would be likely to consider switching in future.

A9.36 We asked all of the users who had *not* actively considered NGA as an alternative; how likely they would be to *consider* switching to NGA in the future. Relatively few (8%) said they were very likely to consider switching; 23% said they were quite likely; 17% were neutral; 25% said they were quite unlikely to consider switching; and 23% were very unlikely to do so.

A9.37 Taking the first two categories together, some 31% of those that had not actively considered NGA in the past appear likely to consider switching to NGA. This is a smaller proportion than the share that were either quite or very unlikely to switch (48%). In addition:

- these answers do not tell us how users would respond to changes in the relative prices of NGA and leased lines, which is the relevant question for market definition purposes;[57]
- In general, users tend to overstate their likely or intended actions. In addition, answers to other survey questions suggest that rates of switching might be lower:
  - As noted in paragraphs A9.33, only 6% actively plan to switch to NGA
  - The 31% who said they would consider switching to an NGA service, were presented with NGA as the only service option. The results do not tell us the other services that would also be considered and possibly switched to in preference to NGA.
- Within the pool of potential switchers, we note that a number of users asked would be more likely to switch to leased lines or other services that are functionally closer to their requirements. For example, we can combine the results of our survey on respondents likely to consider switching *and* those that have no concerns about switching to asymmetric broadband. This might suggest that only 13% of current users of leased lines would be likely to consider switching to asymmetric broadband and also would have no concerns about doing so.[58]

When asked more generally about switching intentions in the next 3-5 years, the results also do not suggest the inclusion of broadband in the market.

A9.38 We asked a more general set of questions to all users of leased lines on how likely it was, in the next 3-5 years, that their organisation would replace current leased lines with a different service. 16% stated they were very likely to do so; 24% said

[57] Whilst it is possible that some users would switch to NGA faster if leased line prices increase, we have no evidence that the effect would be large and indeed customers may not always be able to switch, due for example to minimum contract terms or the need to change IT systems, which might constitute barriers to bringing forward their decision to switch away any faster. For a formal discussion of this see 'autonomous migration' Section 14.2 of Ecorys' report to the Commission: http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3148

[58] Based on 31% of users who said they were likely to consider switching to asymmetric broadband and, separately, the 42% of leased lines users that have no concerns about switching from leased lines to asymmetric broadband (ie 31% x 42% = 13%).

they were quite likely; 12% were neutral; 25% were quite unlikely; and 21% were very unlikely to do so.

A9.39 For the 40% of all leased lines users who said they were likely or very likely to change, the main drivers mentioned were speed 61%; cost 40%; reliability 22%; security 17%. When asked about the service they were likely to replace their current leased lines with, 46% mentioned asymmetric broadband; 24% Ethernet; and 4% WDM, although the apparently high number mentioning asymmetric broadband needs to be set against the overall proportion who considered it very likely they would switch (16%) and the large number that mentioned speed as an important driver of change (61%).

A9.40 Overall, the consumer survey results do not suggest leased lines and NGA services are sufficiently close substitutes for them to be regarded as part of the same market.[59] The overall findings of the consumer survey suggest that NGA services may be attractive to customers that attach more importance to cost savings than performance, but we consider that a high degree of sensitivity to relative prices is unlikely. This finding is consistent with NGA providing some (weak) competitive influence on lower bandwidth leased line services, which we can take into account in our SMP analysis as an "external constraint".

Market questionnaire and April 2014 call for inputs

A9.41 We asked stakeholders specific questions about NGA in business connectivity markets in the April 2014 CFI and our market questionnaire. In the April 2014 CFI we asked three specific questions on NGA substitution:

8) Can broadband, particularly NGA-based services be used effectively for the delivery of business connectivity? Has this changed over the last three years? How do you think this might change over the coming three years?

9) Are new business customers that would traditionally have taken leased line products now opting for a broadband service? If yes, what type of broadband service are these business customers taking.

10) Are existing business customers actively migrating from leased lines to broadband products? If yes:

- ***which types of business customer are migrating?***
- ***which types of leased line product (interface and bandwidth) are they migrating from?***
- ***which types of broadband service are they migrating to?***
- ***does switching vary between different areas of the country (e.g. depending on NGA availability, the number of broadband providers present or other factors)?***
- ***What are the barriers (if any) to switching from leased lines to broadband products?***

[59] Below we only consider results for substitution between leased lines and asymmetric broadband. In the case of EFM, due to survey length limitations, and the small base of EFM users we were not able to test this part of the market.

A9.42 In addition to the CFI, we asked further questions in our market questionnaire. This included some general questions about CPs' views of the target markets or customer types for particular business connectivity services and specific questions about NGA and EFM substitution:

16. For each of the services underpinned by any of the technologies listed above, in your experience, when end-users come to change their business connectivity requirements are there any obvious trends in terms of technologies customers are switching to or choosing? In particular:

a. Are low bandwidth TI users migrating to Ethernet and/or services based on NGA technologies?
b. Are users with Ethernet leased lines-based services sticking with technology, upgrading bandwidths, or switching to services based on NGA technologies?
c. Are there particular customers adopting wave division multiplexed (WDM) services (e.g. customer has WDM equipment installed at its premises).Do you sell or make use of ADSL/NGA products to compete in business markets?

17-18. Do you sell or make use of ADSL/NGA products to compete in business markets? If so, please describe how you market ADSL/NGA services relative to leased lines and whether this varies by the types of leased lines/bandwidth, e.g.:

a. ADSL and/or NGA is marketed as a close substitute for a leased line e.g. do you encourage switching from leased lines,
b. If not, do you market ADSL and/or NGA to particular customer niches? If so, please explain the main customer segments you target.
c. Do your rivals market ADSL and/or NGA services to businesses as an alternative to leased lines? How effective is competition from this source?

CFI responses

A9.43 Six CFI respondents (BT, CoLT, KCOM, Sky, Verizon, Virgin and Vodafone) commented on questions regarding use of asymmetric broadband services for business connectivity. It was generally accepted that some customers with low bandwidth needs and without a need for high quality have switched from leased lines to broadband services. However, there was also generally widespread agreement that, for most users, leased lines and broadband are not good substitutes and should remain separate markets, although there was less agreement about the reasons for this.

A9.44 BT, CoLT, Easynet, [✂ ✂], KCOM, Verizon and Vodafone mentioned two types of constraint that limit the take-up of broadband as a substitute to leased lines: technological (such as limited latency, reliability and capacity) and service quality-based (such as poor SLAs). BT, CoLT, KCOM, Verizon and Vodafone noted a third constraint, which is the limited roll-out of NGA in business areas.

- KCOM observed that its customers were unwilling to forgo the dedicated capacity and SLAs associated with leased lines.
- COLT did not consider that NGA-based products offered genuine business-class connectivity as carrier-grade leased lines had intrinsic security and resilience characteristics that are not substitutable by NGA.
- BT considered it too early to judge how significant NGA will prove to be by the end of the review period. BT observed migration from leased lines at or below 10Mbits/s (both legacy and Ethernet) to services based on ADSL and NGA, but

not where the user requires dedicated capacity, low latency, resilience and high reliability. BT saw no major barriers to switching, but some technology constraints, including coverage issues (superfast roll-out and service quality in areas where older technologies (IPStream) were still used). BT also mentioned SLAs (an issue for utilities that require faster repair times), latency (important for traffic control and transport) and encryption and specialised requirements (defence and police).

- Verizon had not seen a significant swing away from leased line products to broadband services. It referred to a lack of availability of NGA as a barrier to take up, [✂ ✂] and repair SLAs are poor.

- Virgin Media considered that SFBB has an important role to play in providing connectivity to some small businesses, but it considered NGA and leased lines remain different products.

- Vodafone considered that the vast majority of customers who could switch to ADSL (current generation broadband) have already done so but recognised that slower ongoing substitution to NGA will continue to occur. However. Vodafone noted that as bandwidth demand increases it is likely that many customers will need to move service to have their bandwidth requirements fulfilled.

- Vodafone submitted that substitution had previously been limited by BT's approach to rolling out NGA (although Vodafone also mentioned QoS). Vodafone noted that for multi-site customers, rather than adopting NGA alongside traditional connections, many customers are choosing to wait until availability of NGA is more widespread.

- The City Corporation was of the view that NGA based services could be used effectively for the delivery of business connectivity for start-ups and SMEs who cannot afford Leased Lines.

- [✂ ✂], a small provider, argued that it saw a growing trend of leased line customers opting for broadband solutions with a range of different services with QoS levels to meet their needs. It noted that the types of customer were mostly SOHO and SMEs migrating from leased lines to broadband based products, but even some large customers are opting for NGA services instead of EAD circuits. It also noted that migration from ISDN and 2Mbit/s TI voice services to NGA was popular.

Market questionnaire responses with respect to NGA substitution

A9.45 There were sixteen responses to the market questionnaire, with seven providing specific views on NGA substitution (BT, Easynet, Surf Telecoms, EU Networks, Zen, [✂] and IFNL). Consistent with responses to the April 2014 CFI, most respondents said that they did not market ADSL/NGA as a replacement to leased lines.

- [✂ ✂] noted that it marketed ADSL/NGA as a much cheaper option than leased lines and with a much greater availability. But in general [✂ ✂] used it for IPVPN access to 'in-fill' the network where on-net connections were not possible or higher quality connections were not needed. Customers requiring these types of services are mostly multi sited SME and corporate customers owning a large site in the London and comparatively

smaller/less important sites outside London. [✂ ✂] believed that while some of its rivals were effective at marketing ADSL and/or NGA services as an alternative to leased lines the range of applications for which they are substitutes was extremely limited at the low end of the market.[60]

- [✂ ✂] noted strong interest in NGA from the high street sector, but given gaps in NGA coverage, it has relied on alternative services such as ADSL, EFM and leased lines to fill the gap. NGA is also used as a win-back option for potential customers currently using leased lines on a rival network. [✂ ✂] also noted that it had lost a number of contracts where rivals have actively used mixed network solutions including leased lines and NGA to win business.

- [✂ ✂] was an exception in that it exclusively uses NGA derived wholesale services, so customers were encouraged to "move away from leased lines and utilise Ethernet." It considered that, "to date we have not found any resistance to this strategy."

A9.46 Most users that responded thought that migration was more likely to be to Ethernet (from SDH) or by Ethernet customers looking to increase bandwidth and remaining on leased lines:

- [✂ ✂] thought most SDH users were switching to Ethernet and Ethernet users were upgrading their bandwidths.

- [✂ ✂] saw that most of the shift of low bandwidth leased lines users was towards Ethernet (rather than asymmetric broadband).

- [✂ ✂] also considered that when customers are upgrading their capacity from a 2Mbit/s SDH/PDH service they definitely are looking at Ethernet as their preferred alternative. [✂ ✂] noted that transparency might not be so important for some enterprise customers with basic data needs, in which case a packet-based service might suffice

A9.47 On the whole, responses to our April 2014 CFI and market questionnaire suggest that asymmetric broadband is not generally considered as a close substitute to leased lines. With the advent of NGA, users at the low end that previously only had the choice of a leased line to meet their bandwidth requirements reliably have another option. Nevertheless, it appears that a number of leased lines users at the low-end still value the quality and service characteristics of a leased line.

Conclusions on demand-side substitutability for asymmetric broadband

A9.48 Our comparison of asymmetric broadband services and leased lines shows that:

[60] [✂ ✂] observed that business customers are quite specific about bandwidth and would prefer to pay a lower price for the same guaranteed bandwidth rather than upgrading their speed at a higher cost. To these consumers, more is not necessarily better. The key factors in this market are the technology, product characteristics, SLA, service and service surround. Some CPs have suggested that the lower quality of business broadband is a function of BT SLAs/SLGs. However we note that BT's upstream inputs are available to support repair times comparable to those offered for leased lines.

- There are significant differences between their service characteristics, which are important to users
- There are large price differences between them
- They seem to be marketed to different groups of customers with different needs
- Users do not appear to regard them as close substitutes and neither do CPs

A9.49 Therefore we consider that asymmetric broadband services and leased lines are not sufficiently close demand-side substitutes to be considered part of the same market.

Ethernet First Mile

Qualitative assessment

A9.50 As discussed in Section 3, EFM is a set of specifications that allow CPs to run Ethernet over multiple bonded copper pairs in the access segment to connect the "first mile" from the customer to the nearest node. In the UK, CPs most commonly lease BT's copper exchange lines to connect customer premises to the nearest local serving exchange.[61] From exchange locations, connectivity can then be provided in a similar manner to leased lines, using the CPs' backhaul and core transmission networks.

A9.51 EFM is presented to the customer with an Ethernet interface and provides dedicated symmetric capacity to the end-user and in that respect it is identical to an Ethernet leased line. The key difference between EFM and leased lines is the use of copper unbundled loops in the access segment and resulting impacts on the services offered.

A9.52 There are two main benefits from the use of copper loops, lower potential connection cost and faster connection times, both achieved by avoiding the need to dig or install a dedicated fibre link to the customer's premises (although this benefit may not always be realised where multiple bonded copper lines are required).

A9.53 However, the use of copper in the access segment means that the connection faces similar distance limitations to ADSL broadband. The signal diminishes the further the distance of the customer from the exchange, which in turn impacts on the speed of a connection that can reliably be offered. As with ADSL, one solution to increase bandwidth is to bond together a number of copper lines to serve a single site.

A9.54 The results of our qualitative assessment of the key features of EFM and leased line services are shown below in Table A9.2.

[61] BT is required to provide unbundled local loops as a remedy for its SMP in the wholesale local access market.

Table A9.2: Key features of EFM and leased line services

	EFM	Leased Lines
Geographic availability	BT plans to cover 90% of business premises by spring 2015[62]	Nationwide
Bandwidth	2Mbit/s up to 35Mbit/s symmetric capacity offered by CPs, distance dependent	64kbit/s up to 100Gbit/s symmetric capacity available
Bandwidth limitations	Bandwidth decreases according to local loop length e.g. distance from the customer premise to the exchange. Higher bandwidth available up to 1.2km[63], after which lower bandwidth is available up to 4.5km[64] from the exchange. Customers can purchase more copper pairs to reduce the distance effect.[65]	Not limited
Contention	Uncontended	Uncontended
Latency / Jitter	Low	Low
Resilience	Resilience options available[66]	Resilience options available
Security	Medium to High[67]	Medium to High
Synchronisation	Not supported, although technically feasible	Supported

Source: Ofcom 2015

[62] BT Wholesale data sheet, see https://www.btwholesale.com/shared/document/Promotions/EFM/BTW_Wholesale_Ethernet_EFM_Datasheet.pdf

[63] See http://www.btlnet.co.uk/media/1357550/btl-btwholesale.pdf

[64] See https://www.btwholesale.com/shared/document/Promotions/EFM_Proactivemonitoring/EFM_DATASHEET_V14.pdf

[65] For instance, TalkTalk guarantees minimum symmetrical speeds of 2Mbit/s, going up to 10Mbit/s over two copper pairs and up to 20Mbit/s bandwidth on four copper pairs. See http://www.talktalkbusiness.co.uk/Resources/CON161%20EFM%20Datasheet%20WH.pdf

[66] EFM is more resilient than other copper based solutions, as the service can continue to operate if there is a fault on a single copper pair. See http://www.talktalkbusiness.co.uk/Resources/CON161%20EFM%20Datasheet%20WH.pdf

[67] EFM offers comparable security to leased lines, in that the connection is private, though in other respects it may be somewhat less secure. For instance, it may be easier to gain access to the EFM network nodes at the exchange as well as at the street cabinet, which could be considered a risk.

A9.55 The qualitative assessment suggests that a customer who requires the lower bandwidths offered by EFM would find the characteristics comparable to those of an Ethernet leased line.

A9.56 EFM services use multiple access network cable pairs (generally between 2 and 8) and are capable of supporting bandwidths of up to about 35Mbit/s using 8 cable pairs, 20Mbit/s using 4 cable pairs and 10Mbit/s using 2 cable pairs. However, like other DSL services bandwidth is dependent on the distance of the customer premise from the exchange and the maximum bandwidths for a given number of cable pairs would only be achievable for premises close to the exchange.

A9.57 Table A9.3 shows the straight-line distance of businesses to BT exchanges and it appears that most businesses should be within 2 to 3km of an exchange.

Table A9.3: Distribution of business distances to BT local exchanges

Distance (km)	Count of businesses within distance	Proportion
1	99,638	61%
2	140,498	86%
3	156,486	96%
4	160,341	98%
Total	163,021	100%

Source: Ofcom 2015

A9.58 The above data shows that 86% of businesses are within two km of an exchange and 96% within three km. Most operators quote a practical limit for EFM of about 4km. At this distance, bandwidth using 8 cable pairs is likely to be limited to around 8Mbit/s.

A9.59 In addition, we have been told by one CP [✂ ✂] that the final speed available to the customer cannot always be determined until the line is installed. It suggested that this unpredictability means that CPs are cautious in terms of the headline speeds they advertise, and would be reluctant to offer EFM at higher bandwidths with associated SLA/SLGs.

A9.60 Furthermore, as discussed below, the cost of multiple bonded lines limits the suitability of EFM for higher bandwidth requirements. This appears to be supported by evidence on CPs' marketing of EFM relative to Ethernet leased lines (discussed in the next sub-section).

Marketing and pricing of EFM

A9.61 The way EFM is marketed suggests it is likely to be seen as a low cost leased line service. For instance, TalkTalk mentions that *"EFM is an ideal upgrade for SDSL or Leased Lines making [customers'] access more resilient and compatible with future technologies"*.[68] BT defines EFM as the *"lower-cost version of BT's leased line*

[68] See http://www.talktalkbusiness.co.uk/Resources/CON161%20EFM%20Datasheet%20WH.pdf

service."[69] Smaller CPs re-iterate this marketing message. For example, Spitfire markets EFM as the *"ideal leased line replacement"*.[70]

A9.62 Broadly speaking, much of the marketing we reviewed seems to position EFM as a low cost type of leased line service, and we did not find any marketing that suggested the contrary. In particular, we do not see EFM positioned as a substitute for ADSL. Often it is described as well suited for SMEs that need the technological characteristics of leased lines (such as latency and reliability) and service quality characteristics (SLAs) but can compromise on bandwidth requirements due to their smaller size.

A9.63 For example, Updata notes the following 'use cases' for EFM:

"There are two primary scenarios where customers choose EFM:

- *As access for a national network - use of 2 & 4 pair EFM to backhaul data onto our MPLS network. Updata offers symmetrical bandwidths up to 16mb with a maximum distance of 4km between serving exchange and customer site. Our network enhancement roadmap includes up to 8 pairs, which will increase both the distance and support symmetrical bandwidths up to 30mb.*

- *As an access for a closed regional network deployment - Updata currently supports up to 8 pair EFM, however this will soon be extended to 12 pairs, allowing us both to support distances beyond 7km and speeds in excess of 40mb"*[71]

A9.64 We note that, as above, EFM is typically marketed as serving speeds up to 30 to 40Mbit/s, but in the near future it may address some higher bandwidths.

Pricing of EFM

A9.65 Pricing of EFM is consistent with CPs' marketing, which positions the service as a low cost alternative to leased lines. In Figure A9.3 we plot annualised prices of EFM against the advertised bandwidth in Mbit/s.[72] This is based on publicly available data we collected from six CPs' websites across 12 individual EFM packages. We have also included BT Wholesale's price of EFM at the equivalent bandwidth.[73] Clearly, the wholesale EFM price is not directly comparable to the retail price, as

[69] See http://business.bt.com/broadband-and-internet/leased-lines/efm/

[70] See http://www.spitfire.co.uk/EFM-Ethernet/?gclid=CNW4irbrycACFVNutAodlgkArw

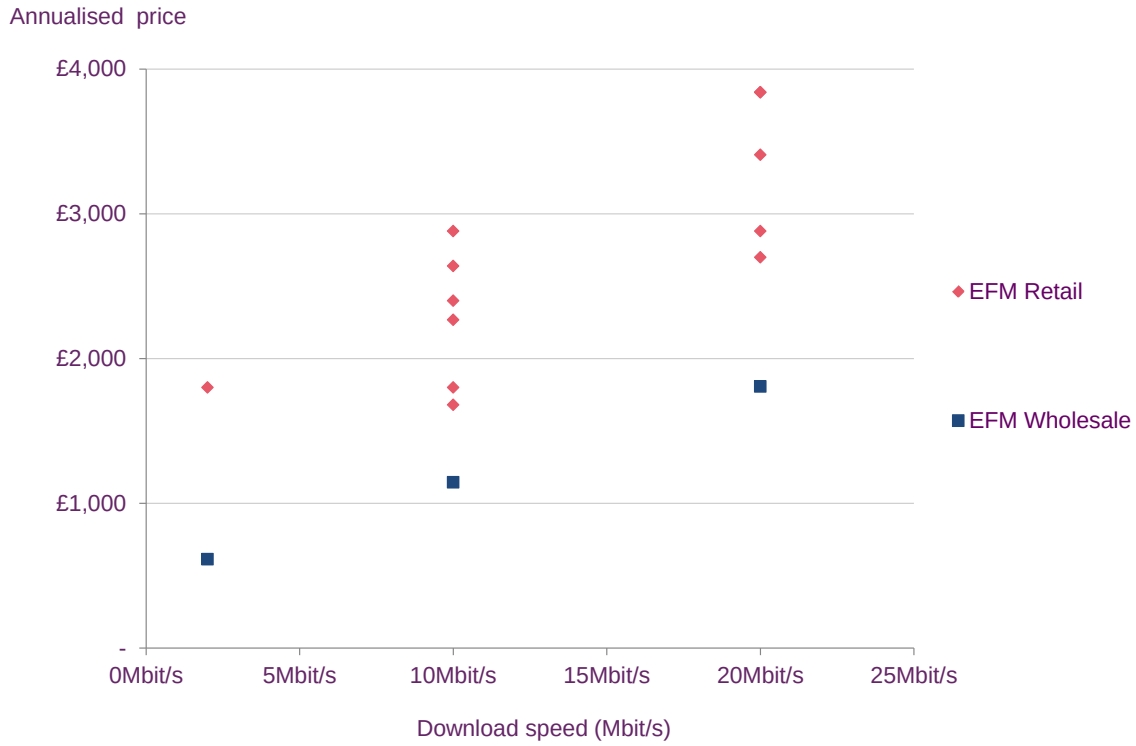
[71] http://www.updata.net/products/updata-efm

[72] Data retrieved in August 2014. The annualised price includes charges such as connection fees and line rental, where applicable. When unspecified, we assumed a 36 month contract is required. Our sample of EFM prices is limited because the majority of CPs do not provide pricing information publicly and instead price on application. Although unpublished prices could be significantly higher or lower than the ones collected in our research, we have no reason to believe there is in fact a systematic bias in the data we have.

[73] Data was retrieved in August 2014 using BT Wholesale's EFM pricing tool, available at https://bt.pricingtool.net/Modules/Pricing/WholesaleEthernet/WholesaleEthernetInput.aspx. We have gathered evidence for various postcodes and their distance to the local exchange, although there is no variation by distance within BT's EFM Access charge.

the retail EFM package would need to include other network and management costs and any retail margins.

Figure A9.3: EFM offers by download bandwidth



Source: Ofcom analysis, based on prices on CPs' websites (retail) and BT price lists (wholesale)

A9.66 On average, across the packages surveyed, a 2Mbit/s EFM retail service costs £1,800 per year, a 10Mbit/s service costs £2,278 per year and a 20Mbit/s service costs £3,333 per year. We note that across the packages surveyed there is also some variation in EFM prices, which seems to reflect different service wraps. For example, at a given bandwidth, higher priced offers include enhanced features such as higher level service guarantees and priority customer support relative to lower priced alternatives.

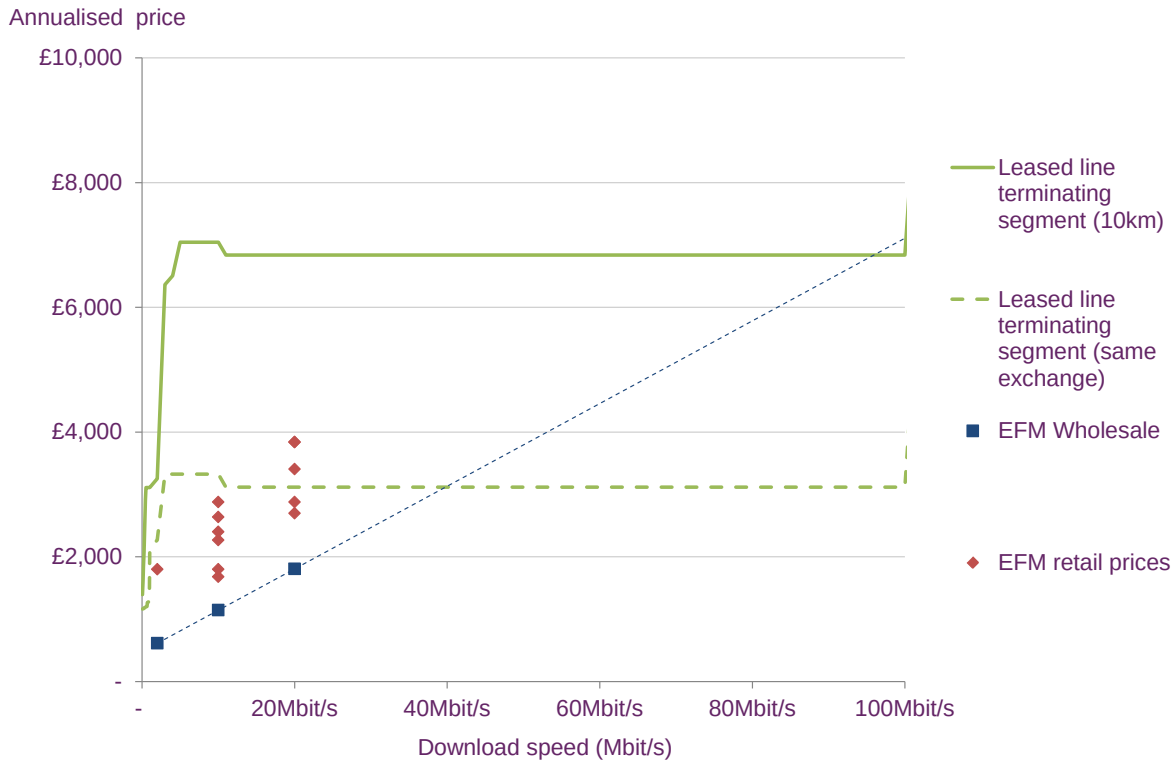
A9.67 In Figure A9.4 below, we present a comparison between EFM prices and the most affordable leased lines alternative at the given bandwidth,[74] and also project the price of EFM for various bandwidths based on the observed data points we identified.[75] As with business broadband and leased lines, for comparison purposes, we need to identify leased lines and EFM services that are as far as possible equivalent. According to CPs' websites most retail EFM services are sold

[74] BT's EAD 10Mbit/s service is priced higher than its 100Mbit/s EAD service. We have shown this in the Figure, but in principle for a new connection a CP would always purchase a 100Mbit/s service given the lower price.

[75] We make the simplifying assumption that EFM charges would increase linearly with bandwidth reflecting the underlying cost of renting additional copper pairs to deliver higher speeds.

to provide access to the Internet or as part of site to site connectivity, but there is no evidence on operators' website that they vary the price of EFM for different usage scenarios. We have taken the EFM prices as indicative of a connection to one customer site. For 'equivalent leased lines' we present two different price scenarios. We show the cost of a leased line at the 'same exchange' and also for a 10km circuit. [76]

Figure A9.4: EFM and leased lines price comparison



Source: Ofcom analysis, based on publicly available prices on CPs' websites and BT price lists

A9.68 The results in Figure A9.4 suggest that at lower bandwidths wholesale EFM is significantly cheaper than comparable wholesale leased line circuits. This is true across all bandwidths and service characteristics up to the 30/40 Mbit/s range where the differences are smaller.

A9.69 The analysis presented in Figure A9.4 shows price increasing with bandwidth at a more-or-less uniform rate for EFM, whereas, except at the very lowest bandwidths,

[76] Here we compare the wholesale price of the lowest priced PPC or Ethernet circuit combination with retail asymmetric broadband package prices. Each purple dot represents a discrete package price. Each section on the green trend represents the lowest priced end-to-end leased line service, assuming a 3 years contract and a 10km main link provision. We use wholesale leased lines prices to represent a lower bound for leased lines prices, as they do not include the costs of the retail service wrap. Thus the finding that leased lines prices are significantly above asymmetric broadband prices would be stronger if we had used retail leased line prices. We assume a 3 year contract is taken for the leased lines and annualise the price.

the cheapest leased line equivalent is a 100MBit/s circuit giving much greater capacity. Competition from Ethernet leased lines may explain why EFM services are only offered commercially over a limited bandwidth range. Although we cannot rely on this analysis to definitely predict where EFM would be most attractive, it broadly agrees with the analysis of EFM marketing (discussed above) where the cut-off point is typically around the 30-40Mbit/s mark. At higher bandwidths above 40Mbit/s most users would find a 100Mbit/s Ethernet leased line more attractive. However, at lower bandwidths below 40Mbit/s, savings may be available by switching to EFM from an Ethernet leased line.

A9.70 The lower annualised price, compared to an equivalent leased line, may partly reflect the lower costs of installing EFM. Connecting a new EFM customer would usually cost CPs less, as many premises are already connected to a copper network, while fibre may require additional ducting. This is especially the case when the nearest fibre network node is further away from the customer premises. In such cases, Excess Construction Charges (ECC) might be imposed on new customers for leased lines requiring substantial ducting. Because EFM uses existing copper infrastructure, and no additional ducting is usually required, typical lead times can be as low as half those for leased lines.[77]

A9.71 However, even with EFM, the level of upfront costs and speed of installation may depend on the bandwidth required. For instance, a customer asking for higher speed EFM services would require multiple bonded copper lines . The cost of leasing many copper lines might erode or even eliminate the potential saving relative to Ethernet over fibre. Furthermore, higher speed EFM services would require additional copper lines to be installed and in some cases additional duct. Nevertheless, over the bandwidths at which EFM is typically supplied, these two features, i.e. lower connection price and shorter lead times, are used in the marketing of EFM to emphasise its benefits over leased lines to certain types of customers.

A9.72 Overall, our analysis suggests a smaller price gap between leased lines and EFM on average than between asymmetric broadband services and leased lines offering similar headline bandwidth rates. Prices of EFM services appear to overlap somewhat with those of leased lines. As EFM also offers similar service characteristics to an Ethernet leased line (though with some possible quality differences), we consider that the evidence is consistent with the existence of a chain of substitution including EFM-based services and other Ethernet leased lines. It is likely that demand for an Ethernet service would be met using EFM at bandwidths of up to about 30Mbit/s – 40Mbit/s, at which point customers are likely to consider a 100Mbit/s Ethernet circuit if they want additional bandwidth.

A9.73 We consider that some past pricing behaviour might suggest greater competitive interaction between EFM and Ethernet than seen for asymmetric broadband. For example, in 2013, BT introduced price reductions for its main 100Mbit/s Ethernet services (EAD) while wholesale charges for its 10Mbit/s EAD services were left unchanged. The reduction in BT's Ethernet services at 100Mbit/s may have been in response to competition from EFM at the low end of the market. With competition in

[77] For instance, Zen states that while their "EFM service is typically installed in less than 30 working days, Ethernet leased lines have a standard lead time target of 65 working days but this can increase if civil engineering works are required to install the physical fibre into the building". See http://www.zen.co.uk/business/leased-lines-and-ipvpn/leased-lines/leased-line-faqs.aspx

the low bandwidth segment, it may be that BT has encouraged existing Ethernet leased lines to upgrade to 100Mbit/s. Indeed, from our discussions with some stakeholders, they view 10Mbit/s Ethernet leased lines as largely redundant, which may, in part, reflect the emergence of EFM as an alternative. The pricing evidence is open to some interpretation, however, and we therefore rely on a range of evidence to inform our views.

Market questionnaire[78]

A9.74 In its response to the market questionnaire, [✂ ✂] noted that it positioned EFM more towards 10Mbit/s connections to larger SMEs and corporates, but as an 'Ethernet lite' service reflecting inferior service levels and lack of bandwidth upgrade capability. [✂ ✂] noted that it adopts a similar approach when marketing access into VPNs.

A9.75 [✂ ✂] noted, in terms of SDH leased lines customers, that most of its users had moved to EFM a few years ago, but those remaining typically move onto Ethernet leased lines.[79] [✂ ✂] saw a similar migration picture for Ethernet users with some going to EFM and some upgrading bandwidth.

A9.76 [✂ ✂] made a similar comment to Easynet.[80] [✂ ✂] further mentioned that they use EFM as an access option alongside Ethernet leased lines in their [✂ ✂]product targeted at the larger SME and corporate market.

A9.77 BT referred to some migration analysis it had conducted where a customer ceased a circuit and BT was able to detect a new service.[81] This suggested that a relatively large proportion of Ethernet users were migrating from legacy WES to newer EAD, but with few moving to EFM. For TI, it noted the vast majority apparently migrating to Ethernet and then EFM. For its wholesale Ethernet customers, [✂%✂] apparently migrated from one Ethernet product to another EAD product often at higher bandwidths. It noted that a small proportion ([✂%✂] of all EAD ceases) moved to EFM with a small but increasing proportion apparently moving to other access options such as NGA and ADSL (equivalent to [✂%✂] of EAD ceases by summer 2014). In a similar internal exercise carried out in 2012 for a sample of ceased PPCs, where BT could determine a follow on activity, the majority of circuits migrated to EAD with [✂%✂] going to EFM, and a proportion (approx. [✂%✂]) moving to NGA.[82] The BT migration evidence is therefore generally consistent with EFM being a closer substitute for leased lines than NGA.

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[78] We do not report consumer survey results for EFM. In the case of EFM, due to survey length limitations, and the small base of EFM users we were not able to test this part of the market.

[79] [✂ ✂]noted that the willingness to switch was driven by customer's needs with those looking for reliable service moving to Ethernet over fibre and those looking for more bandwidth at lower cost moving to NGA or EFM services.

[80] [✂ ✂]stated that in their experience, *"enterprises that have connections based on low speed 10Mbps Ethernet may often replace it with EFM when their contract is renewed, or otherwise upgrade the Ethernet bandwidth dependent on whether the requirements to reduce expenditure or cater for growing bandwidth needs".*

[81] Annex 3 of BT letter to Ofcom, "BCMR – some further evidence relevant to Ofcom's market analysis", 30 January 2015

[82] Source: BT response to Ofcom's market questionnaire.

A9.78 In summary, those respondents that provided a view generally saw EFM as a product closer to leased lines than NGA.

Conclusions on demand-side substitutability for EFM

A9.79 Our comparison of EFM and Ethernet leased lines shows that:

- Their service characteristics are largely similar
- The price differences between them depend on the bandwidth required, with EFM cheaper up to around 30/40Mbit/s
- EFM seems to be marketed as a low-cost, low-bandwidth Ethernet service
- CPs appear to regard them as close substitutes

A9.80 Therefore we consider that EFM services and leased lines are likely to be linked by a chain of substitution on the demand-side.

Barriers to switching

A9.81 End-users switching from leased lines to broadband or EFM face some of the same considerations as end-users considering moving from TI to CI leased lines. We identified these as:

- the potential for service disruption;
- parallel operation whilst the new service is tested; and
- changes required to Customer Premises equipment: end-users with SDH/PDH interfaces switching to Ethernet may have to change their CPE. Examples include changes to PBX equipment used to provide private circuit switched voice services.

A9.82 Alongside these, there may be particular issues which arise when migrating leased lines to asymmetric broadband. These include:

- technological challenges, which may include adjusting existing systems in anticipation of different levels of contention, latency and lack of synchronisation;
- security considerations of using a shared medium rather than the dedicated medium of leased lines;
- service level agreements for asymmetric broadband, which can vary by package, but largely are still considerably different to those of leased lines.

A9.83 As in the case of migration from TI to CI services discussed above, the impact of switching costs will vary by type of end-user. For end-users with large legacy networks or who use specialised applications, significant switching costs may be involved because of the need to upgrade customer premises equipment and applications.

A9.84 In the case of asymmetric broadband, barriers to switching add weight to our finding that it is not a close demand-side substitute for a leased line. Barriers to switching between an EFM service and an CI leased line seem likely to be less significant

(the factors listed in paragraph A9.82 will not apply) and we do not consider that they outweigh the evidence of demand-side substitutability set out above.

Supply-side substitution

A9.85 Finally we consider whether to broaden the market to include asymmetric broadband in the CISBO market on supply-side substitution grounds. Supply-side substitution appears technically possible, in that an LLU operator which is not currently providing EFM-based Ethernet services (which, as set out above, we include in the CISBO market on demand-side substitution grounds) could begin to do so relatively quickly and easily. However, we would only broaden the market in this way if supply-side substitution represented a genuine additional constraint on leased line prices that we had not already taken account of. In other words, a CP that is already active in the supply of leased lines cannot also be a supply-side substituter.

A9.86 Sky, TalkTalk and Vodafone are among the main players in broadband markets with extensive presence at BT exchanges.

A9.87 However, we note that supply-side substitution from Vodafone would not be relevant as it is already 'present' in the market by virtue of the fact that it already supplies leased lines and EFM services. Similarly, TalkTalk is among the main suppliers of EFM-based services and, as we include EFM within the same market as Ethernet leased lines, then we already take into account the competitive constraint from TalkTalk. As Vodafone and TalkTalk have already entered the market for leased lines they are not potential supply-side substituters.

A9.88 [✂

✂] Therefore, we exclude supply-side substitution by LLU-players as a relevant constraint. We consider that the SMP analysis is the most appropriate place to reflect any scope for greater competition in the EFM segment to emerge in future.

Ofcom's proposed conclusion about broadband and EFM substitution

Broadband

A9.89 On the basis of our analysis we propose that asymmetric broadband is outside relevant leased lines markets, as:

- our assessment of the qualitative differences between broadband services and leased lines highlights that there remain a number of key differences in technological and service features;
- the growing availability of NGA has increased the speeds available with asymmetric broadband, but the available migration data suggests that there has not been an obvious change in leased lines growth overall and BT reports very few cases where customers ceased BT's Ethernet or TI services due to NGA migration;

- evidence from the consumer survey suggests that a minority of users might consider switching to NGA as an alternative to a leased line, but does not suggest that NGA and leased lines are close enough substitutes to be placed in a single market;

- evidence also suggests that most CPs do not market asymmetric broadband as a substitute for leased lines, because of the key differences indicated above. This evidence includes CPs' marketing of broadband to consumers on their websites, as well as the vast majority of CPs' responses to our questionnaire and CFI about substitutability between the two; and

- consideration of barriers to switching highlights that end-users with large legacy networks and/or those who use specialised applications in particular are likely to face higher switching costs moving to broadband in the short term.

A9.90 In addition to the above factors, we note that price comparisons show that there is a considerable difference between the prices of broadband and leased lines services. The size of the price differentials, together with evidence on volume trends and migration appears consistent with the broadband and leased line markets being separate.

A9.91 Overall our analysis suggests that substitutability is insufficiently strong to include leased lines and asymmetric broadband in the same market, and this will remain so over the course of the three year review period. Nevertheless, we do take into account the 'external constraint' that might arise from leased lines users switching to broadband in our SMP assessments.

EFM

A9.92 On the basis of our analysis we propose to include EFM in the CI market for the following reasons:

- the qualitative assessment generally shows there are not significant qualitative differences between EFM and other Ethernet leased lines. The main differences between the two relate to distances of EFM from the exchange and the bandwidths and SLAs that can be supported. However, customers with requirements up to 30-40Mbit/s, where EFM is feasible, are likely to consider EFM as a substitute for an Ethernet service;

- evidence also suggests that CPs position EFM as a lower cost type of leased line service, suitable for those customers that do not require high bandwidths. This is evidenced by the way CPs market EFM to consumers on their websites, along with responses to our questionnaire that supported the information we have on marketing;

- consideration of barriers to switching highlights that end-users with Ethernet-ready infrastructure in place might not face significant barriers to switching;

- relative price comparisons are consistent with a chain of substitution including EFM-based services and Ethernet leased lines. We further note that reductions in the price of BT's Ethernet services at 100Mbit/s may have been in response to competition from EFM at the low end of the market. The view that 10Mbit/s is a 'largely redundant' speed for standard Ethernet, may in part reflect the emergence of EFM as an alternative; and

- there has been significant increases in EFM volumes since our 2013 Review. We do not hold enough data to determine whether this significant increase might be a migration from leased lines, SDSL or asymmetric broadband. However, when considered in light of broader evidence, the increase in EFM take-up may seem like a reasonable consequence of the identified incentives for consumers to migrate to EFM as a lower cost substitute for low bandwidth CISBO services.

A9.93 Our analysis suggests that EFM would be a good substitute for some leased lines customers, especially those currently on or considering migration to low bandwidth Ethernet services.

Annex 10

Wholesale product market definition: legacy leased lines

Introduction

A10.1 This Annex sets out the main analysis and evidence used to support our product market definition proposals for wholesale legacy leased lines set out in Section 5. We apply the approach to market definition set out in Annex 8, and so definition of these wholesale markets is informed by retail market analysis.

A10.2 In the 2013 BCMR, we identified a TISBO services market including legacy SDH and PDH digital leased lines and analogue leased lines. We found these legacy services to be in a separate market to AISBO and asymmetric broadband services. We identified separate markets for wholesale TISBO services of different bandwidths as follows:

- Low bandwidth TISBO (up to and including 8Mbit/s);
- Medium bandwidth TISBO (above 8Mbit/s up to and including 45Mbit/s);
- High bandwidth TISBO (above 45Mbit/s up to and including 155Mbit/s); and
- Very high bandwidth TISBO (at 622 Mbit/s).[83]

A10.3 We included analogue circuits and also SDSL services, which support similar upload and download speeds, in the low bandwidth TISBO market.

A10.4 In this Annex, we assess product market definition for legacy services. We consider:

- whether to identify all legacy technologies such as PDH, SDH and analogue leased lines in the same (TI) product market.
- whether the market should be defined more widely to include other products such as Ethernet.
- whether a relevant market or markets should be defined for medium and high bandwidth TI services, given significant declines in demand for these services and the possibility of substitution to other services.

Product market definition for legacy services

A10.5 In this section, we consider the evidence for placing legacy analogue and digital services in the same market and then go on to assess the strength of possible

[83] As we found the very high bandwidth TISBO market in the UK (as a whole) to be effectively competitive in the 2013 BCMR, we propose not to review it again, consistent with section 84(2) and 84A(3)(a) of the Act.

constraints from substitution to Ethernet or NGA services on services within the low bandwidth TI segment. Finally, we assess medium and high bandwidth TI services.

Low bandwidth TI services (up to and including 8Mbit/s)

A10.6 We propose that analogue and low bandwidth SDH/PDH leased lines are in the same market.[84] In support of this proposal we note that:

- analogue leased lines offer broadly equivalent functionality to low bandwidth digital SDH/PDH leased lines. It would be straightforward to adapt an analogue leased line to transmit digital information and to adapt a digital leased line to transmit analogue signals;
- the services in question are based on legacy technologies which are no longer being developed and therefore the functional capabilities of the technologies are unlikely to have changed significantly since the last review; and
- many analogue and low bandwidth SDH/PDH leased lines run on the same network using the same technology – this suggests that any significant changes in costs are likely to have affected both services and hence be reflected in the competitive price levels of both.[85]

A10.7 One development in the very low bandwidth segment is the expected closure of the platform used to support sub-2Mbit/s services. BT expects to withdraw all existing sub-2Mbit/s services in 2020. One of the reasons that BT has given for this closure is that manufacturers no longer supply equipment needed to support current sub-2Mbit/s services.[86] We note that a number of users faced with closure of BT's sub-2Mbit/s platform intend to upgrade to 2Mbit/s. This suggests that these users view the two services as technical substitutes.[87]

A10.8 From a technical perspective, we consider that SDH/PDH services at different low bandwidth increments of 64kbit/s (or multiples thereof) and at 2Mbit/s should be within the same market. Common to both is TDM technology that has the capability to support reliable, low latency connections. The fact that sub-2Mbit/s and 2Mbit/s services share these characteristics suggests that service quality would not be an obstacle to substitution between them for end-users whose demand can be met either by multiple 64kbit/s circuits or a single 2Mbit/s circuit.

A10.9 We also note that in the 2013 BCMR, we presented analysis of the relative prices of 64Kbit/s and 2Mbit/s circuits. This analysis suggested there could be a chain of

[84] In previous BCMR reviews, we also identified services based on symmetric digital subscriber line (SDSL) technology in the TI markets. SDSL services have largely been replaced with EFM as the main symmetric broadband service over copper for users of lower bandwidth services that found SDSL services sufficient. There are now very few installed SDSL circuits and BT no longer supports this service.

[85] In the 2013 BCMR Statement, we also noted previous research has found that end-users would be likely to switch between these services in response to changes in relative prices.

[86] With limited equipment spares available this increases the risk to users of increased downtime and failures given the difficulties in sourcing equipment, refurbishing existing suppliers and having enough stock situated across the network to guarantee fast repair times.

[87] We confirm below that the price analysis conducted in 2013 BCMR still holds.

substitution linking the services and hence that definition as a single market was appropriate.[88] We have updated this price analysis to take account of BT's latest prices. Whilst we do not put great weight on BT prices as they may not be a good indicator of prices in a competitive market, we note that there have not been any significant changes in the relative prices of 2Mbit/s and 64Kbit/s connections which would invalidate the 2013 finding that there could be a chain of substitution.

A10.10 On this basis, we think there is evidence to support the inclusion of analogue, SDH and PDH in the same low bandwidth segment up to and including 8Mbit/s.[89] In response to the CFI no stakeholder challenged this view.

Should we define a wider market than low bandwidth TI?

Introduction

A10.11 Some stakeholders have argued that there is potential for including Ethernet leased lines in the same market as TI services. In this section, we discuss whether, given the background of a decline in TI services and a gradual move to alternative services, there still remains a case for a separate TI market (or markets), or whether we should include other services, such as Ethernet. The focus of this analysis is on lower bandwidth TI, as these account for 98% of TI demand. We consider higher TI bandwidths (i.e. medium and high TI at 34/45Mbit/s and 155Mbit/s) in paragraphs A10.44 to A10.66.

A10.12 In summary, our view is that the qualitative differences are less significant than previously, but the remaining TI-specific characteristics matter for at least some users, and more generally for all existing TI users our analysis of prices and barriers to switching still supports the definition of a separate TI market.

A10.13 As noted in our market context section, the TI market is viewed as a legacy market in overall decline. With a few exceptions most new data connections are based around Ethernet or business broadband connections. Overall the trend for migration is related to three main drivers:

- BT has signalled to end-users that it is ending support for the PDH platform that supports sub-2Mbit/s services due to obsolescence of the equipment.
- Some TI users are increasing their bandwidths to 10 Mbit/s or higher (where Ethernet is the cheaper technology).
- NGA broadband and Ethernet First Mile services are widely available to support higher upload and download speeds using Wholesale Local Access remedies (i.e. LLU and VULA).

A10.14 Despite these general trends, significant numbers of customers are expected to remain on low bandwidth TI circuits over the review period, with some new

[88] Paragraphs 3.203 to 3.210, BCMR 2012 April Consultation. See also the further discussion in the BCMR 2013 final Statement, particularly paragraph 3.394.

[89] Consistent with the 2013 BCMR Statement we define the low bandwidth market up to and including 8Mbit/s. In the 2013 BCMR Statement, we defined the bandwidth break at this point as the price evidence suggested retail customers would find it economic to use multiple 2Mbit/s up to this point and 8Mbit/s was a previously supported bandwidth.

connections still occurring.[90] Below, we consider in the context of an overall declining market, whether there is a case to include some or all of the main alternatives within the same relevant market. We consider substitution towards Ethernet (as the closest candidate substitute service based on product characteristics) and alternative technologies.[91]

Qualitative assessment - TI and Ethernet

A10.15 We consider that the qualitative differences between legacy TI services and Ethernet have eroded to such a degree that for many end-user requirements they are no longer important. However, below, we note that there will remain a class of customers still likely to remain on TI. We discuss differences between asymmetric broadband and leased lines in more detail in Annex 9.

A10.16 Carrier class Ethernet equipment based on IEEE, ITU-T and MEF standards is the ubiquitous standard for new business data applications.[92] As noted in the 2013 BCMR Statement carrier class Ethernet services have narrowed the differences between Ethernet and SDH/PDH services, as shown in Table A10.1 which compares the key features of SDH/PDH and carrier class point-to-point Ethernet leased lines.

[90] See Section 3, Figure 3.8. From our discussions with [✂ ✂] we note that non-trivial numbers of circuits are still ordered at 2Mbit/s for example for voice applications.

[91] See Section 5 and Annex 9 for more detailed discussion of NGA and EFM substitution.

[92] The Institute of Electrical and Electronic Engineers (IEEE) modified the Ethernet standards to improve management and scalability. Further work by the IEEE and the International Telecommunications Union Telecommunications Standardisation Sector (ITU-T) added operations, administration and maintenance functionality. Alongside this, work by the Metro Ethernet Forum (MEF) defined the characteristics of Ethernet-based services to facilitate interworking between equipment and networks.

Table A10.1: Comparison of key features of SDH/PDH and carrier class point-to-point Ethernet leased line services

	Point-to-point Ethernet (carrier class)	SDH/PDH
Contention	Dedicated	Dedicated
Distance limitations	Not limited	Not limited
Jitter	Low (load dependent[93])	Low
Latency	Low (load dependent)	Low
Resilience	High	High
Symmetry	Symmetrical	Symmetrical
Synchronisation	Networks supporting resilient synchronisation deployed, but not supported by some older carrier Ethernet services	Networks support resilient synchronisation of end-user equipment natively.

Source: Ofcom BCMR 2012 consultation

A10.17 Ethernet services cannot exactly match all of the characteristics of SDH/PDH services such as latency and jitter to the very high specification across all network load scenarios. But as discussed above, these differences are becoming progressively less important as mainstream enterprise applications migrate to Ethernet/IP technologies and are therefore able to use Ethernet leased lines.

A10.18 Thus while legacy applications and some specialist applications will continue to require SDH/PDH leased lines, many businesses have now adopted (lower cost) Ethernet services over TI services.

A10.19 This is also consistent with the EC Recommendation, where it is stated that *"terminating segments of traditional interface leased lines, […] have been found substitutable to "carrier-grade" Ethernet services for all but the most demanding business applications."*[94]

A10.20 This is consistent with our survey evidence where most (79%) of those with analogue or SDH/PDH leased lines stated that they had no particular concerns about replacing them with Ethernet. For those that do have concerns, inadequate service level agreements (7%) and concerns around reliability (6%) are the main ones mentioned.

A10.21 However, even if most survey respondents do not identify particular concerns with Ethernet as a replacement for TI services, this does not mean that they would necessarily switch in response to a SSNIP. One reason why they might not is that migration of enterprise applications can be disruptive as it typically requires investment in new or upgraded equipment. Therefore, we might expect migration to

[93] As discussed in A12.17 below.

[94] Page 50 of Explanatory note to EC Recommendation

proceed gradually. With this in mind, there could still be significant demand for TI leased lines during the timescale of this review and beyond.

A10.22 There remain a small number of customers that use TI circuits for telemetry purposes. For many of these end-users, the time synchronisation and low latency of TI circuits is important and their equipment is configured for TI interfaces.

A10.23 For example, end-users such as electricity distribution operators have traditionally relied on sub-2Mbit/s PDH circuits to monitor their networks. With BT announcing plans to shut the platform that supports sub-2Mbit/s services, some of these users are planning to migrate to alternative TI technologies (i.e. SDH circuits (at 2Mbit/s)). This suggests that some users still value TDM characteristics. In this particular case, the shut-down of the sub-2Mbit/s platform will tend to increase the demand for 2Mbit/s SDH services for whom TI characteristics are important.

A10.24 However, in the context of product market definition, the relevant question is whether a sufficient proportion of existing users (and with no immediate plans to move to alternative technologies)[95] would switch in response to a SSNIP to make that SSNIP unprofitable.

A10.25 We do not know how many users place a high value on TI services. However, we note that around 40 percent of BT's customers for very low bandwidth TI circuits could be designated as operators of Critical National Infrastructure (CNI), some of which rely on features of TI circuits for telemetry applications. We cannot determine exactly how many of these could only use TI circuits or would face significant barriers to switching to an alternative technology.[96] We know it will not be 100 percent, however, as some users of low bandwidth circuits within the CNI category, such as Transport for London, are migrating sub-2Mbit/s TI circuits to broadband. But as the base of TI customers migrates (perhaps as bandwidth needs increase), it is increasingly likely the consumers that remain on TI services are those with specialised requirements that are less likely to move away.

Price analysis

A10.26 Below we compare the relative prices of Ethernet and TI services and, in the light of this, consider consumers' likely switching behaviour if TI prices were to increase. Our price analysis suggests that consumers with low bandwidth requirements have limited incentives to switch to Ethernet. TI users are unlikely to be sensitive to small changes in prices, which is supportive of separate markets.

A10.27 In Table A10.2, we compare Ethernet leased lines to TI services for a 10km circuit end. We also show available EFM wholesale prices from BT. The wholesale charges are based on the lowest priced theoretical combination of circuits needed

[95] If existing TI users are already intending to switch to an alternative technology (e.g. as they need to upgrade bandwidth) at the end of the contract term then they will be insensitive to an increase in the TI price. Further, due to minimum contractual periods users intending to switch could not typically react any faster to a price increase.

[96] With the closure of BT's sub-2Mbit/s platform, some users will have to migrate to alternative services, so in the case of those users any general barriers to switching should not be an issue. However, they may still be relevant to the extent that changing technologies (i.e. moving from TI to an alternative interface or broadband) might incur significant one-off costs relative to a simple upgrade in bandwidth for a 2Mbit/s TI circuit.

to deliver a particular end-user's bandwidth requirement at a particular distance for a particular leased lines service.[97]

A10.28 In the absence of retail price data we have used BT's wholesale input prices as a proxy for the competitive retail price benchmark. We do so because the competitive level of retail prices will be approximately equal to costs, and we then use BT's wholesale charges as a proxy for costs since they are subject to an RPI-X charge control which is intended to bring wholesale prices and (expected) costs into line over the charge control period. However, some care is needed in the use of BT wholesale prices since (as discussed previously in Annex 8), even charges which are subject to an RPI-X charge control may sometimes differ significantly from underlying costs and competitive market prices.[98]

Table A10.2: Comparison of Ethernet and TI prices

	Wholesale service		
Bandwidth	TI	Ethernet*	EFM**
2	3,253	6,838	614
10	16,265	6,838	1,145
20	21,851	6,838	1,807
34/45	21,851	6,838	
100	42,514	6,838	
140/155	42,514	8,693	

Source: Ofcom 2015, based on BT price lists / price quotation tool

A10.29 The above analysis suggests that BT's TI services (PPCs) are at a significant premium relative to the main Ethernet services (EAD) apart from at the lowest bandwidths.

A10.30 At the lowest bandwidths, BT's TI services are significantly cheaper than equivalent EAD services. Indeed EAD services are almost twice the price of TI services at 2Mbit/s, making switching in response to a small price change unlikely. A price comparison between TI services and Ethernet leased lines such as EAD does not support a combined low bandwidth market therefore.

A10.31 Whilst a comparison between TI and EFM-based variants of Ethernet services shows that EFM-based services are cheaper and so are potentially a better alternative to TI than an EAD circuit, Figure A10.1 below shows that demand for TI

[97] All prices exclude VAT; for all of BT Openreach and BT Wholesale products, including EFM, we have assumed 3 years contract and a 10km main link provision; for broadband products, we have sampled the shortest contract available and included line rental; headline speeds for broadband and EFM are, by nature of the technology they use, maximal and are expected to decrease the more the end-user is distant from the exchange.

[98] In addition, as noted in Annex 8, where common costs are significant, it may be not be possible to determine a unique competitive price and there is no necessity for the price of a service in a competitive market to equal a measure of accounting cost such as BT's fully allocated cost (FAC). Where BT is free to determine the relative prices of different services within a single charge control basket, it may not choose the same structure of relative prices as would emerge in a competitive market for various reasons including strategic considerations and exploitation of market power.

services remains significant at 2Mbit/s despite these price differentials. The relative robustness of demand for 2Mbit/s circuits is in contrast to the demand for TI circuits at 34/45 Mbit/s and 155 Mbit/s which now account for only 2% of all TI circuits (based on end counts). This suggests that substitution of higher bandwidth TI circuits by Ethernet has been much more complete than at 2Mbit/s. In the light of this, the continuing demand for 2Mbit/s TI circuits without apparent price convergence suggests that EFM may not be an effective constraint on 2Mbit/s TI prices in practice. In any case, the number of EFM circuits is relatively small and the inclusion of EFM within the low bandwidth TI market would not significantly alter BT's share of this market.[99]

A10.32 We have looked at the overall migration trend away from 2Mbit/s TI services given changes in relative prices. This is shown in Figure A10.1. The expectation is that if 2Mbit/s TI users are price sensitive we might expect to see the rate of migration responding to changes in the differential between TI and CI prices. This analysis suggests that the rate of migration has been fairly steady and insensitive to changes in relative prices.

Figure A10.1: Volumes and price analysis [✂

✂]

Source: Ofcom 2015, based on published BT wholesale prices

A10.33 As shown in Figure A10.1, the gap between Ethernet rental charges and 2Mbit/s TI rentals initially widened and then narrowed as Ethernet prices initially rose then fell, then were stable for a while before falling again. Despite these changes in relative prices the trend in TI volumes has been consistently and steadily downwards and there is no clear sign that the rate of migration away from TI has responded to the changes in relative charges that have occurred. Given the magnitude of these changes, we consider that this suggests that the rate of migration is unlikely to be responsive to small movements in relative prices.

[99] There are approximately 250,000 low bandwidth (64kbit/s up to 8Mbit/s) TISBO connections (customer ends) in the UK outside the Hull area, of which BT supplies 89%, compared to around 37,500 EFM connections only. Of these, BT is the largest user of EFM to provide leased lines.

A10.34 In the light of this, it may be that a user's decision to migrate, and hence the overall amount of migration, reflects underlying changes in users' requirements such as the need for greater bandwidth. We know from our price analysis above that Ethernet leased lines are far cheaper where users need greater bandwidth and that higher bandwidth TI circuits have tended to be used for data traffic for which specific TI characteristics are less necessary. A requirement for a higher bandwidth circuit may therefore be accompanied by a switch to Ethernet. But for those with limited bandwidth needs, incentives to move to Ethernet services are less strong. Although EFM does offer a lower-priced alternative at lower bandwidths, we expect that, if anything, responsiveness to price differences might in fact decline in the future as those TI customers that do view Ethernet as an alternative will tend to migrate, leaving the base of TI customers remaining on legacy technologies as those most likely to value the characteristics of the TI interface.

Barriers to switching

A10.35 Responsiveness to a SSNIP might also be limited by barriers to switching from TDM to other technologies even if users regard these other technologies as acceptable substitutes.

A10.36 End-users switching from TI leased lines to Ethernet (and to alternative technologies such as broadband) could face barriers such as:

- the potential for service disruption;
- the costs of parallel operation whilst the new service is tested; and
- changes required to Customer Premises equipment: end-users with SDH/PDH interfaces switching to Ethernet or broadband may have to change CPE. Examples include changes to PBX equipment used to provide private circuit switched voice services.

A10.37 The impact of switching costs will vary by type of end-user. For end-users with large legacy networks or who use specialised applications, there are likely to be significant switching costs involved. This is because of the need to upgrade all the customer premises equipment and applications to support Ethernet or broadband connections, as well as the need to test the systems ahead of launch. Examples include utility companies with specialist telemetry equipment or end-users using legacy voice.

A10.38 A number of CPs have highlighted that their customers often place value on connections that are in place with proven performance and limited risks of service disruption. In response to our market questionnaire, [✂ ✂] noted that SDH is still a significant part its business. It thought that this was mainly due to some customers wanting to avoid the cost of replacing their own legacy equipment.

A10.39 As mentioned above, with BT announcing plans to shut the PDH platform, some of these users are still planning to migrate to TI technologies (i.e. SDH circuits (at 2Mbit/s)). Continued demand for TDM-based services could be related to the barriers to switching associated with having to change end-user equipment in order to use alternative technologies.

A10.40 Another use of TDM is to provide circuit switched voice services. These voice circuits rely on customer premises equipment known as PBXs to operate. Switching to alternative technologies such as Ethernet would require a change to VOIP

phones or PBX to IP conversion equipment so that existing handsets could be used. There could be some conversion technologies (IP-PBXs) that enable the end-user to retain legacy voice but use packet-based networks. IP PBX solutions are widely available but it is likely that the cost of moving from a TI based PBX to an IP based PBX could only be justified if such costs were recovered through lower charges for the AI service. However, as noted above switching to AI would not lead to savings except at higher bandwidths that are typically used for voice services.

A10.41 Users might be more likely to move from legacy TDM networks as part of an overall IT refresh, including use of VoIP telephony or bandwidth upgrades. Therefore, in these circumstances, switching in response to a price change is likely to be delayed, perhaps until the end-user equipment comes to the end of its useful life. Indeed, Openreach recognised this pattern of migration from legacy to Ethernet in its sales literature, where it stated "customers may consider Ethernet adoption as a viable alternative to legacy services like Time Division Multiplexing as part of a premises move, contract renewal or PBX change-out. "[100]

A10.42 Therefore, we consider that barriers to switching may be important in low bandwidth TI segments.

Preliminary views

A10.43 In light of the above, we propose that we continue to identify a market for retail low bandwidth TI services including analogue and SDH/PDH services at 8Mbit/s and below.

TI services at higher bandwidths

Introduction

A10.44 In the 2013 BCMR, we identified separate markets for medium and high TI services at 34/45Mbit/s and at 155Mbit/s. We based this on price evidence and on our assessment of differences in competitive conditions. We also identified a very high market at 622Mbit/s, but this was found to be effectively competitive and this remains the case, so we do not review it further here.[101]

A10.45 We identified separate geographic markets for the two TISBO markets at bandwidth increments above 2Mbit/s for the WECLA and the rest of the UK (excluding Hull). BT was found not to have SMP in the WECLA for higher bandwidths, but we found BT to have SMP in the rest of the UK.

A10.46 Based on our circuit volume data, across the UK, we estimate that BT sells a maximum of [✂ ✂] TI services with bandwidth increments above 2Mbit/s with over three quarters of these outside the CLA and LP. For these services BT has a large share above 60%, but within the CLA and LP BT's share is below 30%. In our charge control assessment, we forecast significant declines in

100 http://www.openreach.co.uk/orpg/home/products/ethernetservices/downloads/ethernet_portfolio_training_pack.pdf

101 In any case, the number of circuits within that segment is very low and BT's national service share remains significantly below 40%.

these circuit volumes with fewer than [✂ ✂] circuits remaining by 2018.

A10.47 Below we assess the case for continued identification of separate high bandwidth TI product markets.

Qualitative assessment

A10.48 In our qualitative assessment for low bandwidth TI in paragraphs A10.15 to A10.25, we noted that carrier class Ethernet was well suited to most data applications. At lower bandwidths we noted the use of TI services for voice and more specialised data applications that make use of PDH/SDH characteristics such as low speed telemetry applications. These considerations together with price factors and barriers to switching may make Ethernet less attractive for low bandwidths.

A10.49 We consider that TI services for bandwidth increments above 2Mbit/s are most likely to be used for general data transmission purposes. The quality requirements of data transmission are more easily satisfied by Ethernet than those of voice transmission or telemetry applications for which a 2Mbit/s TI leased line is more likely to be used.[102] Service quality differences are therefore much less important for higher bandwidth TI leased lines than for those of 2Mbit/s and below. In the case of TI services above 2Mbit/s, we consider that such services would be likely to have been used for more general data requirements where quality requirements are more easily satisfied by Ethernet. For this kind of use, the view reflected in the EC Recommendation, that *"terminating segments of traditional interface leased lines, […] have been found substitutable to "carrier-grade" Ethernet services"* is more likely to apply.

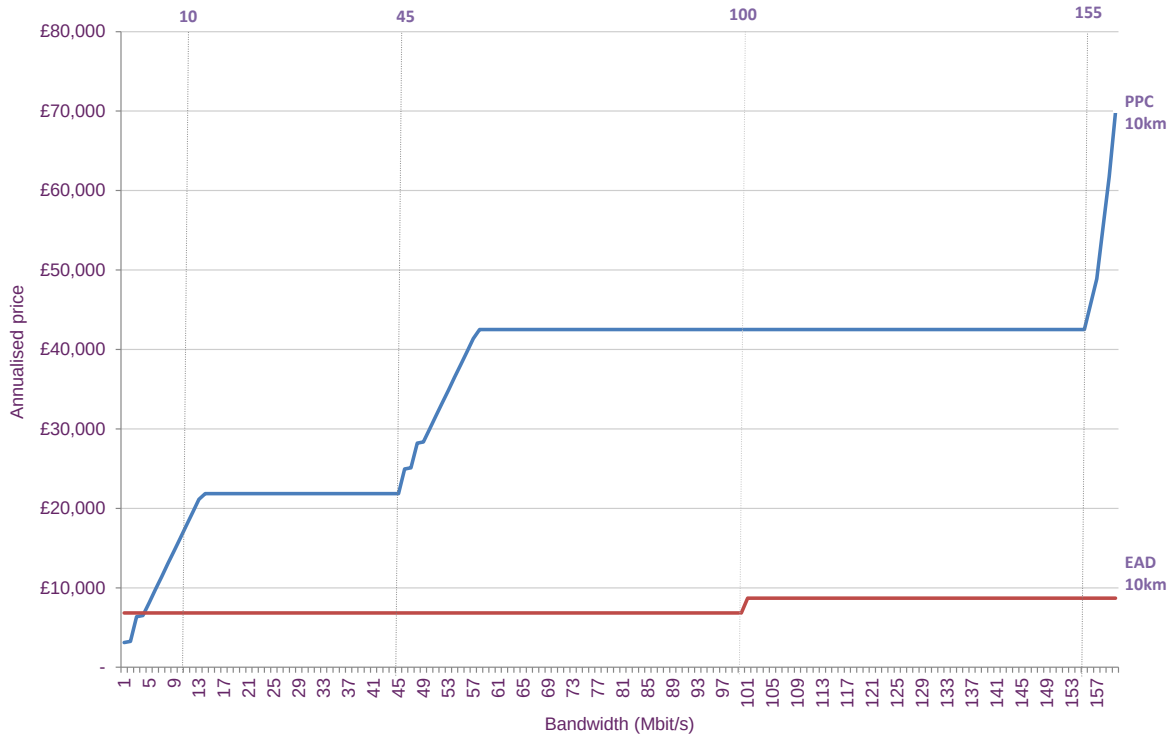
A10.50 Indeed, we know from the 2013 BCMR that quite a few TI circuits above 2Mbit/s were used for mobile backhaul applications which have now largely migrated to Ethernet interfaces. Furthermore, the large majority of other high bandwidth TI customers have migrated to Ethernet services.

Price analysis

A10.51 Our price analysis in Figure A10.2 shows that TI services at higher bandwidths are significantly more expensive than Ethernet services of equivalent bandwidth and also more expensive than low bandwidth TI. There are significant price differences between 2Mbit/s TI and higher bandwidth increments (i.e. 34/45Mbit/s and 140/155Mbit/s). There are also significant price savings associated with Ethernet relative to higher bandwidth TI services.

[102] For this kind of use, the view reflected in the EC Recommendation, where CI and TI are generally viewed as substitutes, is likely to apply. Indeed, we know from the 2013 BCMR that quite a few TI circuits above 2Mbit/s were used for mobile backhaul applications which have now largely migrated to Ethernet interfaces.

Figure A10.2: Ethernet and TI wholesale charges at higher bandwidths



A10.52 The pricing of higher bandwidth TI services suggests two things:

- there are strong incentives for higher bandwidth TI users to migrate to Ethernet, provided that higher bandwidth users do not have the same type of 'quality' concerns that users of lower bandwidth TI might have; and
- customers at lower bandwidths wishing to upgrade bandwidth would be more likely to switch to Ethernet than upgrade to higher bandwidth TI services.

A10.53 These migration trends can be observed within market volume trends, as the base of high bandwidth TI services is very low relative to other leased lines segments. It also appears that those leased lines users upgrading bandwidths are switching to Ethernet, as there are virtually no new connections of TI high bandwidths. We observe that 100Mbit/s Ethernet (and increasingly 1Gbit/s) account for the majority of new supply.

A10.54 This is further supported by evidence from our market questionnaires and consumer survey evidence. Respondents to our market questionnaires have observed that once low bandwidth TI users decide to switch, for example for higher bandwidths, they are moving to Ethernet segments. For example, [✂ ✂] considered that when customers are upgrading their capacity from a 2Mbit/s SDH/PDH service they definitely are looking at Ethernet as their preferred alternative. In addition, we recognise that some TI users looking to upgrade speed by a limited amount might find EFM or NGA as a possible alternative depending on the use.

A10.55 Therefore, the above analysis suggests that TI users with bandwidth requirements above 2Mbit/s have incentives to migrate to Ethernet, as a cheaper way of

obtaining the service they require at acceptable quality. This is supported by the volume and migration trends we observe in the market.

Barriers to switching

A10.56 Some barriers to switching would remain where a user is switching technologies (i.e. between TI and Ethernet). However, given the significant savings associated with moving to Ethernet, there is a greater incentive for the end-user to overcome these barriers than there is at low bandwidths.

Proposed product market definition

A10.57 Our view is that we should not include the high bandwidth TI market for services with bandwidth increments above 2Mbit/s (i.e. 34/45 and 155Mbit/s) within the low bandwidth TI market (up to and including 8Mbit/s).

A10.58 As discussed above, the higher bandwidth TI services continue to display significant differences to low bandwidth TI. In addition we anticipate very low circuit installed volumes by the end of the period covered by this review, noting that for high bandwidth TI services, there is evidence of economic incentives and better scope for substitution to Ethernet services than at low bandwidths.

A10.59 We also consider it would not be appropriate to include higher bandwidth TI services within the product market that includes Ethernet services[103]. Importantly, as mentioned above, the existing demand for TI services above 2Mbit/s is very low and forecast to continue to reduce significantly over the review period. This is in contrast to demand for Ethernet which now accounts for a significant proportion of leased lines demand and is forecast to continue to grow significantly. Therefore, whilst the inclusion of higher bandwidth TI services in the same product market as Ethernet would have no material bearing on our subsequent assessment of market power, in the event of a finding of significant market power, higher bandwidth TI services would then fall within the scope of *ex ante* regulation as this would extend over all services within that market. We consider such an outcome would be disproportionate because the imposition of *ex ante* regulation on higher bandwidth TI services is unnecessary and, consequently, it would be inconsistent with our duty to apply objective, transparent, non-discriminatory and proportionate regulatory principles in pursuit of the policy objectives set out in Article 8 of the Framework Directive.

A10.60 Instead, in our regulatory judgment, we consider the appropriate approach is to regard the TI medium and high bandwidth markets as markets which are no longer susceptible to *ex ante* regulation.

Three criteria test for TI high bandwidth markets

A10.61 We consider that the conditions in the TI mid and high bandwidth markets point to markets that are no longer susceptible to *ex ante* regulation.

[103]We also note that medium and high bandwidth TI prices will not constrain Ethernet prices as Ethernet customers are unlikely to move back to legacy services, particularly at higher bandwidths where there is a significant price premium associated with TI services. In this sense, any price constraint which does exist is likely to be asymmetric.

A10.62 When considering if a market listed in the EC Recommendation is not susceptible to *ex ante* regulation in the specific national circumstances, NRAs should demonstrate that at least one of the following three criteria is no longer met:

- the presence of high and non-transitory structural, legal or regulatory barriers to entry;
- a market structure which does not tend towards effective competition within the relevant time horizon, having regard to the state of infrastructure-based and other competition behind the barriers to entry; and
- competition law alone is insufficient to adequately address the identified market failure(s).

A10.63 For both the medium and high TI markets, we do not think it is likely that there will be additional market entry or that BT's competitors will gain significant share of the supply of TI services within the timeframe of this review given that these markets are in significant decline. BT still has advantages with its greater network coverage and existing supply to many customers. Competitive supply requires significant sunk costs to be incurred upfront, particularly related to network extension. Outside of London, BT has maintained a significant share of 34/45 Mbit/s and 155Mbit/s segments and we do not expect this to change.

A10.64 However, behind the barriers to entry, and taking into account observed behaviour of users of mid and high TI services, we consider that the structures of both the mid and high TI segments are such that they tend towards effective competition in the absence of *ex ante* regulation.

A10.65 In this respect we note the EC Recommendation which states that "[a] *tendency towards effective competition implies that the market will either reach the status of effective competition absent ex ante regulation within the period of review, or will do so after that period provided clear evidence of positive dynamics in the market is available within the period of review. Market dynamics may for instance be caused by technological developments, or by the convergence of products and markets which may give rise to competitive constraints being exercised between operators active in distinct product markets. This may also be the case in markets with a limited – but sufficient – number of undertakings having diverging cost structures and facing price-elastic demand*"[104]. As set out above, the reason that the current installed base of TI high bandwidth circuits is low and predicted to fall further going forward is that customers are increasingly switching to Ethernet services. This reflects the fact that Ethernet services are now a cheaper and acceptable substitute, and we believe that the availability of Ethernet services will provide a sufficient constraint on the prices of higher bandwidth TI circuits above 2Mbit/s.

A10.66 Our analysis leads us to consider that the market failures identified in the medium and high TI markets in the 2013 BCMR, which arose from a finding of SMP and for which extensive or frequent and timely intervention was previously considered indispensable, are no longer present. In this respect we note the Explanatory Note to the EC Recommendation which states that *"[o]nly in markets where national and EU competition law is not considered sufficient by itself to redress market failures and to ensure effective and sustainable competition over a foreseeable time*

[104] See Recital 15.

horizon, should be identified for potential ex ante regulation"[105]. We also note the EC Recommendation which states that *"[t[he third criterion serves to assess the adequacy of corrective measures that can be imposed under competition law to tackle persistent market failures"*[106]. In light of our analysis, we no longer consider there are any persistent market failures in either the mid or high TI markets that would warrant, for example, access obligations under certain circumstances or extensive intervention that should be maintained over time (e.g. monitoring of terms and conditions) or frequent and/or timely intervention.

[105] See Section 2.2.(iii).

[106] Emphasis added. See Recital 16.

Annex 11

Wholesale product market definition: mobile backhaul

Introduction

A11.1 In Section 4 we summarise our proposals to include mobile backhaul services within the markets for other wholesale leased lines (used for business connectivity purposes). Our analysis is set out in more detail in this Annex.

A11.2 Mobile network operators connect most of their radio base stations to their switching centres using leased lines from other CPs.

A11.3 We consider below whether there are:

- particular demand-side or supply-side issues for mobile backhaul that would justify identifying separate wholesale product markets for these services; and
- significant differences in competitive conditions for the supply of mobile backhaul services that warrant identifying a separate market (or at least considering competition for these segments separately).

A11.4 Our proposal is not to identify a separate mobile backhaul market, but we note that there is a case for considering carefully competition in these segments when included as part of a wider assessment of SMP in leased lines.

Background

A11.5 In the last review, we did not identify a separate mobile backhaul market. We included mobile backhaul services within the relevant AISBO and TISBO markets.[107] This section considers our approach to market definition for mobile backhaul for the period until 2018.

A11.6 Since the last review mobile operators have been rolling-out their 4G networks, which are forecast to cover 98% of the population by 2015. [108] The take-up of 4G services has been high with EE, the first network to launch 4G services in 2012, reporting that 29% of its contract base is on a 4G contract. This is equivalent to over 4 million subscribers.[109]

A11.7 Even prior to the launch of 4G services, data usage was growing rapidly with the take-up of smartphones. This growth is expected to increase further. The four national MNOs have suggested that consumers with 4G subscriptions tend to use more data than 3G users (in its financial results for January to March 2014, Telefonica said that, on average, its UK 4G subscriptions consumed twice as much

[107] We also noted that to the extent that mobile operators used MISBO circuits then any circuits sold to mobiles would fall within this market.

[108] European mobile in Q4 2014: "The recovery continues", Enders Analysis, 13 April 2015, p.24.

[109] http://ee.co.uk/our-company/financials/2015/04/27/ee-results-for-the-first-quarter-to-31-march-2015

data as its 3G subscriptions). In response to this growth in data demand, MNOs have been in the process of installing higher capacity fibre-based links.

A11.8 With the increase in bandwidth requirements for mobile backhaul (1Gbit/s or more) and packet-based networks, [110] Ethernet has become the more attractive technology, not least due to the lower cost per Mbit/s. According to our meetings with stakeholders (EE, MBNL, Three) currently major urban sites are being served with [✂ ✂] connections which are likely to be upgraded to [✂ ✂] within [✂ ✂]. MBNL indicated that it expected to move remaining [✂ ✂] mobile sites currently on [✂ ✂] to [✂ ✂] speeds over [✂ ✂].

A11.9 Some operators have indicated their plans to retire TI services fully by the end of the review period. For example, [✂ ✂], indicated that most of its TI circuits will be decommissioned by the end of 2017 in the core, and by the end of 2018 in the backhaul.[111] [✂ ✂], and EE/MBNL's roll-out of fibre [✂ ✂], also means that it has [✂] TI circuits remaining.]

Technical assessment

A11.10 In the 2013 BCMR, we noted that a key technical requirement for mobile networks was very accurate time synchronisation to set their operating frequency[112] and to provide seamless handover as mobile users move between cells. TI services have historically provided synchronisation as standard, so MNOs have always been able to use an RBS service for mobile backhaul that was technically equivalent to a standard TISBO service. The same was not true of Ethernet services however, as standard Ethernet services did not feature synchronisation, and an MNO would not have been able to use a standard Ethernet service without adding a timing source. But, as we discuss below, developments in Ethernet technology mean that these differences are now less important than in the past.

A11.11 While the requirement for timing synchronisation is not necessarily unique to mobile networks,[113,114] it remains a key technical requirement for MNOs. For TI services, these rely on Time Division Multiplexing ('TDM') and accurate timing synchronisation is an inherent feature of the service. BT's TI services sold to mobile

[110] Unlike previous generation networks such as 2G (or 3G), 4G networks are packet switched only. Therefore, in addition to the lower cost per Mbit of Ethernet, it is also suitable for 4G applications due to its packet-based nature.

[111] [✂ ✂] response to market questionnaire.

[112] Accurate operating frequencies allow narrower guard bands between cell frequencies and thus more efficient use of the radio spectrum.

[113] http://www.spectracomcorp.com/Support/HowCanWeHelpYou/Library/tabid/59/Default.aspx?EntryId=343&Command=Core_Download&Method=attachment

[114] Other applications are also emerging such as synchronisation of servers as data centres, interworking of Ethernet technologies with TDM (this could be relevant for operators in the process of moving from a circuit switched voice network to NGN).

operators (known as RBS Backhaul) use the same SDH technologies and are technically identical to PPCs used to serve enterprise customers.

A11.12 The lower cost of Ethernet per Mbit/s and the move to 4G networks means that it has become the more attractive technology for mobile backhaul going forward. However, accurate timing information is not an inherent feature of Ethernet technologies, as Ethernet packet-based networks do not need synchronised timing information to transport data unlike SDH. Ethernet solutions have now been developed to support synchronisation.

A11.13 In some cases, where MNOs have rolled out Ethernet links, they initially retained a TI circuit to the base station as an interim solution to continue to provide timing or relied on 'circuit emulation'. However, this was seen as a short term solution pending the deployment of the more efficient synchronisation standards. The two main Ethernet synchronisation solutions deployed in the UK are known as IEEE1588v2 and Synchronous Ethernet (SyncE). Virgin Media has successfully deployed SyncE in its provision of mobile backhaul to MBNL and Openreach offers SyncE as an option in its EAD product range.

A11.14 Therefore, as TISBO services support synchronisation as an inherent feature of the technology, the service sold to MNOs known as RBS backhaul is technically identical to other TISBO services (such as BT's PPCs) and there is therefore no technical barrier to substitutability between TISBO and RBS services. For Ethernet leased line services, mobile backhaul will require an enhanced type of Ethernet that supports synchronisation (although timing synchronisation is not uniquely a mobile requirement). On this basis, there are in principle technical differences between standard Ethernet services and those that support synchronisation, with only the latter readily suitable for MNO use. However, as technological developments mean that standard Ethernet services also increasingly support synchronisation, any technical barrier to switching between standard Ethernet and "MNO" versions will become less important over time.

Demand-side substitution

A11.15 In the light of the technical assessment set out above, we now consider the potential for demand and supply-side substitution

- between TISBO and RBS backhaul; and
- between CISBO and Ethernet mobile backhaul.

A11.16 Finally, we consider whether distinctions between Ethernet and WDM-based services are relevant to mobile backhaul.

RBS backhaul and TISBO services

A11.17 As noted above, RBS backhaul and TISBO rely on the same underlying inputs and therefore the cost of providing these services should be the same. As there is no technological distinction between SDH/PDH mobile backhaul and other forms of TISBO services, it should be possible, technically, to use a TISBO service to deliver RBS backhaul (or vice versa). Therefore, an MNO would find an RBS service and a TISBO service of the same bandwidth and delivered to the same locations to be

good substitutes (or vice versa). In practice however it may be possible for a supplier to set prices which discriminate between MNOs and other users.[115]

Standard Ethernet versus Ethernet mobile backhaul

Demand-side arguments

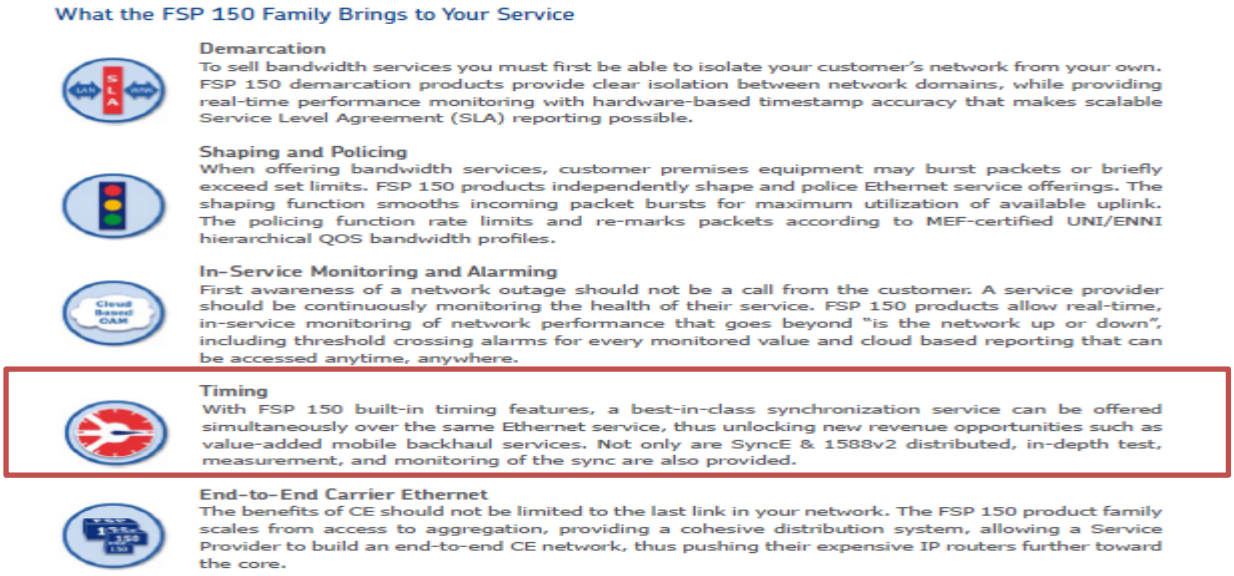
A11.18 On the demand-side, the nature of mobile backhaul provision suggested a strong requirement for synchronised Ethernet. To provide mobile backhaul, BT essentially relies on the same wholesale inputs (e.g. EAD services) used to provide Ethernet leased lines and LLU backhaul. However, technically, a standard Ethernet service would not be in itself a direct substitute for a synchronous Ethernet service as it would need:

- equipment capable of supporting synchronisation, which is not necessarily provided with some pre-existing Ethernet services using older technologies; and
- to deliver the synchronisation capability, for which the service would need to be enabled and a necessary clock source supplied.

A11.19 In relation to the first point, we note that modern equipment supports synchronisation features as standard. Indeed, in the last review equipment vendors (such as ADVA and Cisco) told us that there were no significant technical barriers to an MNO or CP seeking to purchase equipment that supports synchronous Ethernet (based on the 'state of the art' equipment). This is supported by recent ADVA sales literature, which suggests that its Ethernet equipment (FSP products) support synchronisation as a built-in feature of that equipment.

[115] The CP may know the identity and location of the customer, including whether it is an MNO. Given the technical similarity of RBS backhaul and TISBO, if BT offered TISBO and RBS to MNOs at different prices, the MNO would always take the cheaper one. However, there are two (equivalent) ways in which (unregulated) BT might be able to price-discriminate. The two practices are only offering MNOs "RBS" (at a different price to TISBO, which is only offered to non-MNOs) or selling TISBO to MNOs but at a different price to that charged to other customers.

Figure A11.1: Ethernet equipment with synchronisation



Source: ADVA Optical website, August 2014[116]

A11.20 The above ADVA literature does not suggest that CPs or mobile operators wishing to deploy Ethernet solutions for mobile backhaul would need specific Ethernet equipment different to that deployed to enterprise customers.

A11.21 That being the case, as new Ethernet equipment is deployed, these synchronisation features would become part of the standard Ethernet product. It would therefore, in principle, be difficult to draw a distinction between synchronous Ethernet and ordinary carrier Ethernet just because the equipment is different (i.e. a similar situation to TI where there is essentially no difference between PPCs and RBS circuits). This would tend to undermine the distinction between mobile Ethernet and standard Ethernet services.

Supply-side substitution

A11.22 Supply-side substitution could be a relevant factor if a CP could take a standard TI or Ethernet circuit and add the necessary equipment or services to supply mobile operators with synchronous Ethernet services.[117]

A11.23 As explained above there are no particular issues for a CP to use a TISBO circuit to deliver mobile backhaul. In the case of Ethernet, we argued that Ethernet equipment should be capable of supporting synchronisation. However, a supplier of Ethernet services entering to provide mobile backhaul would need to access a clock-source.

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116 http://www.advaoptical.com/~/media/Resources/Fact%20Sheets/Carrier%20Ethernet%20Access.ashx

117 However, we would normally only broaden a market on the basis of supply-side substitution if there were additional suppliers that would enter the market rapidly and at low cost in response to a small price change, and which were not already operating in the (narrowly-defined) market.

A11.24 This clock source needs to be delivered to each cell site over the Ethernet link in order to deliver the necessary synchronisation. This requirement could be an obstacle to the supply of synchronous mobile Ethernet backhaul (for a supplier with Ethernet equipment capable of supporting synchronous Ethernet).

A11.25 However, we note that a CP currently providing TDM-based circuits would have its own access to a clock source, so there would be no specific technological barrier to providing synchronised Ethernet circuits. Providers such as Virgin Media are also successfully supplying a synchronous Ethernet product, suggesting that there are no major technical hurdles to providing synchronous services.

A11.26 The requirements for synchronous Ethernet can therefore be achieved using available Ethernet equipment. While synchronisation functions may add an additional cost to Ethernet services (so that the equipment has access to a clock source), this is unlikely to be a significant proportion of the cost of deployment (relative to the costs of installing fibre and Ethernet equipment). [118]

Ethernet versus WDM-based solutions

A11.27 In Section 4, we considered whether there is likely to be a chain of substitution linking Ethernet and WDM-based services, in general. Here we consider this in the specific case of MNO backhaul. As discussed above, MNO's backhaul capacity requirements are at a point where 1Gbit/s and 10Gbit/s circuits have been deployed and MNOs are looking to upgrade many circuits from 100Mbit/s to 1Gbit/s or 1Gbit/s to 10Gbit/s.

A11.28 For fibre-based cell sites supporting 4G technologies, MNOs will typically require an Ethernet interface. However, there is no technological reason for MNOs to require a particular service to be provided over a standard Ethernet connection rather than over WDM-based equipment presented with an Ethernet interface, or vice versa.

A11.29 The main driver of technology choice is the likely total cost of ownership of the alternative services given current and foreseen bandwidth requirements. In this respect, we note that both WDM-based services and Ethernet have been used to deliver mobile backhaul with a given bandwidth. In particular, the detailed circuit information on MNOs' purchases from different operators shows that MNOs needing 1Gbit/s have used a range of solutions, including Ethernet on BT Wholesale's 21C network; direct inputs from Openreach; and Virgin Media's mobile backhaul solution (a variant of its WDM-based High Capacity Services to deliver mobile backhaul requirements).

A11.30 Therefore, consistent with the proposed finding that Ethernet and WDM services (used by enterprise customers) are part of the same CISBO market, we see no specific evidence of a need to segment mobile backhaul services on the basis of whether an Ethernet service or one using WDM-based technologies is supplied.

[118] If there were a significant premium associated with synchronous Ethernet then it may be that CPs would seek to avoid the equipment costs of this feature for end-users that do not generally need it. We do not have detailed information on the likely costs, but from informal discussions with vendors, we do not consider that the costs of SyncE would be sufficiently large.

Summary of demand and supply-side assessment

A11.31 We consider that the potential for demand- and supply-side substitution suggests that BT's standard regulated CISBO and TISBO products used by enterprise customers could also be used to supply mobile backhaul requirements. However, there may still be some non-technical features of mobile backhaul demand which would enable a provider to discriminate between MNOs and enterprise users of leased lines to exploit any differences in competitive conditions. In particular, as discussed below, mobile backhaul customers are a large and identifiable group of customers. In addition, in the absence of regulation, there may be an incentive to discriminate where competitive conditions vary. Therefore, below, we consider whether there are any differences in competitive conditions for mobile backhaul such as would justify a separate market definition.[119]

Differences in competitive conditions

A11.32 Mobile backhaul circuits differ from the general supply of leased lines to enterprise customers due to the geographic scale and scope of mobile backhaul purchases. This may reduce OCPs' ability to compete for mobile backhaul services compared to enterprise connectivity. BT has also previously argued that competitive differences could also work the other way. BT has suggested that mobile backhaul markets are more competitive (citing competitive entry by OCPs and MNOs' ability to self-supply or make use of microwave links). We discuss these points in turn below.

A11.33 We note that within the timeframe of the market review period there is the potential for BT to acquire EE. This may have the potential to change the competitive picture within the mobile backhaul segment and potentially more widely.

Why mobile backhaul demand might face limited competition

A11.34 We discuss below why mobile backhaul may face less intensive competition in some geographic locations than leased lines more generally. Mobile operators need to purchase access circuits across a very wide geographic footprint in order to provide national coverage. This geographic footprint is wider than for enterprise customers and incorporates areas where OCPs have little rival infrastructure. This makes it difficult for operators with a limited geographic reach to compete.

A11.35 The geographically distributed nature of mobile base stations, including in remote rural locations, compared to other premises served by BT's CISBO and TISBO products, means that over the years the mobile industry have purchased access circuits from BT outside the geographic footprint required by the majority of other enterprise customers. In a number of cases, mobile operators had to bear the costs of BT's excess construction charges associated with extending its network to cell sites.

A11.36 MNOs have previously argued that this offers BT a first mover advantage as it is often already present at relevant locations (for example having previously supplied RBS backhaul). This means that BT has already incurred the main costs of provision (digging and ducting), which are largely sunk, giving it an advantage over

[119] As discussed above, we do not consider that a meaningful distinction can be applied to services deliver with Ethernet interfaces based on whether this is over single service Ethernet or WDM.

CPs without an existing connection. BT would also not face costs associated with obtaining way-leaves and land-owner permissions to connect to those sites. This may explain why competitive provision by BT's rivals has been the exception rather than the rule.

A11.37 Figure A11.2 shows, for example, data on fibre connected cell sites associated with one of MBNL's core switches in South Wales.

Figure A11.2: Geographical distribution of fibre connected cell sites[✂

✂]

Source: Ofcom 2015

A11.38 Figure A11.2 shows how the fibre connected cell sites can be in fairly remote locations, which clearly advantages BT because of the greater reach of its network.

A11.39 MNOs have also argued that the hierarchical structure of mobile networks creates important differences in terms of possibilities to exploit economies of scale and scope in mobile backhaul.

A11.40 Mobile networks are typically configured in a hierarchy with a relatively small number of core network switches each serving a number of main fibre connected cell sites. The fibre connected sites also act as hubs for small sites which may be connected by fibre or microwave links. For example, according to MBNL, the network consists of around [✂ ✂] core nodes, which serve approximately [✂ ✂] mobile base stations made up of [✂ ✂] served by fibre and the remaining [✂ ✂] served by microwave. Those microwave links are often (but not always) from cell sites back to fibre connected sites [✂

✂].

A11.41 Mobile network operators do not seek to purchase alternative mobile services on an individual site-by-site or route-by-route basis. It is more likely that they will contract with a single supplier for backhaul connectivity for a "branch" of their network whereby a large number of base station sites are connected into the core network node or switch. In these circumstances, if a CP is required to have coverage to each of the base station sites associated with a core node then the ubiquity of BT's network clearly provides a competitive advantage. For a rival CP to BT to be able to competitively serve all of the base stations in a particular region would require the rival CP to have network in sufficient proximity to all of the base stations. But this is unlikely and still may not be sufficient to overcome BT's incumbency advantages.

A11.42 Another source of advantage is that there are economies of scale from aggregating traffic from multiple cell sites and backhauling it to the core network over a single backhaul link. With a more extensive network, BT has the potential to aggregate traffic lower down in its network hierarchy onto high capacity backhaul links. In addition, with a larger overall share of wholesale circuits used to support other retail markets (LLU/broadband, enterprise etc.) this potentially provides it with greater economies of scope in backhaul. OCPs may not be able to replicate these as easily (particularly outside of urban areas).

BT's view that backhaul is competitive

A11.43 In response to the 2013 BCMR, BT argued that mobile backhaul is a very competitive market. It repeated many of these points in response to the April 2014 CFI (in support of its submission that there was no need for passive remedies in respect of mobile backhaul): *"mobile network operators have a number of competing options available to them including use of microwave backhaul infrastructure. BT provided detailed views as part of the last BCMR on the extent to which this was a viable option in many scenarios.* [..]*In the relevant UK markets, the existing wide range of wholesale products, competing provision from existing networks and the self-build options (including microwave access) provide sufficient competing options. We do not consider there is evidence that mobile operators have not been able to use existing products to acquire sufficient, competitively priced, backhaul capacity to meet their expanding needs, given the current and projected state of 4G roll out and usage in the UK."* [120]

A11.44 In relation to competition from (self-supplied) microwave, we deal with these points below, but we do not consider that it would act as a significant constraint on BT's prices. In many situations where BT circuits are used, for example for backhaul of traffic from MNOs main hub sites to their core networks, microwave would not be a viable alternative.

A11.45 In relation to competition from existing networks, as set out in our discussion above, the limited geographic coverage of many OCPs' networks is a barrier to competition in mobile backhaul since MNOs' demand backhaul in areas outside of the geographic footprint of many OCPs' networks. These barriers to competition are reflected in our service share data below, which does not suggest that operators such as Virgin Media have gained a significant share of the circuits sold to MNOs.

[120] BT response to Ofcom CFI, paragraph 69.

Evidence of differences in competitive conditions

A11.46 Our analysis suggests that BT has a very high share of Ethernet and TI circuits sold to MNOs ([✂% and %✂] in 2014). On a forward looking basis CPs may make larger inroads into BT's share. For example, Virgin Media accounts for approximately [✂%✂] of EE/Three/MBNL's mobile backhaul purchases (excluding microwave and legacy TI links). Telefónica has also estimated that on a forward-looking basis it expected to purchase around [✂%✂] of its mobile backhaul requirements from [✂ ✂] within the three year timeframe of this review. But for both of these MNOs, BT's shares will remain very high.

A11.47 BT's service shares are higher than seen in most other leased lines markets. In addition there is limited variation in BT's service share in the CLA or LP relative to the Rest of the UK.[121] Nevertheless, our network reach analysis suggests that the many competing infrastructures in the CLA could be used to supply MNO backhaul as well as leased lines for enterprise users. For example, if we compare OCPs with network proximity to fibre or copper connected mobile cell sites we find nearly identical network reach for mobile sites as large business sites.[122]

A11.48 As with CISBO generally, we consider that the main determinant of competitive conditions is the number of competing networks present. In the CLA, there is considerable potential for competitors to supply MNO backhaul just as there is for other CISBO services. The fact that this has not been translated into service shares does not necessarily indicate a difference in competitive conditions at the CISBO market level therefore.

A11.49 However, MNOs have put forward an argument that one potential difference to CISBO is that many mobile backhaul leased lines are sold as part of a managed service, which is downstream of the Openreach CISBO services. We assess this in paragraphs A11.59 to A11.70 below.

Microwave links

A11.50 In this part, we explain our reasons for excluding microwave links from the market based on:

- Technical features: we discuss the technical capabilities and some issues associated with the use of microwave links; and
- Demand-side substitution: we consider whether a hypothetical monopolist would be constrained in its ability to increase the price of mobile backhaul by the threat of MNOs switching to microwave links.

[121] We estimate BT's service share in the CLA at [✂%✂] (excluding TI and microwave), [✂%✂] in the London Periphery and [✂%✂] in the Rest of the UK.

[122] Average network reach of 8 for the CLA (200m buffer distance assumption). In addition, 35% of MNO sites located in CLA are within 200m of 9 OCPs and 27% of sites are located within 200 metres of 8 OCPs. The network reach for the CLA contrasts with the Rest of the UK where on average network reach to mobile cell sites is 0.9.

Technical assessment

A11.51 In the 2013 BCMR, we asked MNOs to provide details of the technologies they used in different parts of their networks. The information submitted by MNOs in response to our information request showed that microwave was used at various levels within the network including between cell sites and for links back to operators' core networks. However, we found that microwave was most typically used at the edge of the network or to 'daisy chain' RBS sites back to another RBS site that acts as collector hub. From this location, traffic from other RBS sites (provided over microwave) might then be backhauled to the core network (using fibre). In some cases, these RBS to RBS links were self-provided and predominantly carried 2Mbit/s SDH transmission. Some microwave links also carried Ethernet transmission.

A11.52 In current network deployments, some MNOs make use of microwave to a significant extent while others had only very limited deployments. Operators such as Telefonica (formerly BT Cellnet) have historically relied far less on microwave.

A11.53 In most cases, microwave links are self-supplied by mobile operators as shown in Annex 15, Table A15.11.

A11.54 Although microwave links are used for mobile backhaul needs, they cannot meet MNOs' backhaul requirements in all cases and therefore, technically, microwave could not act as substitutes for mobile backhaul products under all scenarios. We have previously identified a number of issues with microwave backhaul:

- ability to support only lower capacity links compared to fibre-based backhaul;[123]
- requirement for line of sight connectivity;
- significantly lower transmission range than fibre-based backhaul links;
- deployed microwave antennas are exposed and have higher risk of failure.

A11.55 In response to the CFI, Vodafone has submitted a detailed report by Analysys Mason.[124] This report suggests that microwave faces significant challenges both in terms of available spectrum needs and its ability to meet capacity requirements going forward. Analysys Mason also indicated issues related to available spectrum suited to microwave backhaul uses.

A11.56 Given 4G / LTE network deployments and continuing growth in data demand are driving significant increases in required backhaul capacity, the limitations to microwave technology (as discussed in paragraph A11.54) make fibre the preferred and potentially the only viable technology choice for many backhaul applications. MNOs have told us that, in response to this, they planned to reduce the extent of fixed wireless usage for backhaul applications and to rely increasingly

[123] Although next generation microwave might support high bandwidths, it is not clear whether cost effective microwave backhaul supporting more than 1Gbit/s would become available during the period covered by this review. In addition, the same technical considerations are still likely to apply, such as overall performance guarantees and length of transmission ranges of microwave backhaul links.

[124] http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone_Annex_3.pdf

on fibre deployments which can be more easily scaled to meet increasing bandwidth requirements. In other circumstances, however, fibre might not be feasible and therefore fixed wireless links might be the only option. However, the use of wireless is often limited to the edge of the network rather than the major backhaul links to MNOs core switches. On a forward-looking basis, increasing backhaul capacity would be needed. This suggests that fibre is increasingly preferred in most circumstances, as verified in our discussions with MNOs.

Demand-side substitution

A11.57 Overall, within mobile networks both fibre and microwave are used depending on the conditions. As noted above fibre might be preferred for most use cases and may be the only viable solution in others. There may be instances however, at the margin, where some, albeit limited substitution could be possible. The question in these circumstances would be whether switching to microwave links would impose a sufficient competitive constraint on a hypothetical monopolist to make a SSNIP on fibre-based backhaul solutions unprofitable.

A11.58 An MNO that already had in place a fibre-based link would also incur various costs in switching from fibre to microwave. Microwave links would only provide an effective alternative to fibre/copper-based solutions where it was technically feasible. Most of the roll-out of fibre to mobile sites is now complete however. Hence it is unlikely that an MNO would switch to microwave provision in response to a SSNIP applied to Ethernet mobile backhaul. The costs of doing so are likely to be prohibitive (and it might not be a technically feasible solution).[125] It is therefore unlikely that a SSNIP would prompt sufficient switching from fibre/copper links to wireless to impose a competitive constraint. On this basis, we propose to exclude microwave links from both the CISBO and TISBO product market definitions.

Managed backhaul services for MNOs

A11.59 As noted above, each MNO must connect the thousands of radio aerial sites of its cellular network with its core switches, which are located in a small number of sites. Mobile networks are also arranged in a hierarchy of sites. Core switch sites are connected by fibre to a primary sub-set of aerial sites. Each of the latter acts as a collector node for a number of smaller cell sites, which may be connected either by fibre or by microwave links.

A11.60 MNOs have typically purchased backhaul in the form of integrated managed service solutions which aggregate connections to large numbers of aerial sites, rather than making discrete purchases of large numbers of links to connect each aerial site individually. BT Wholesale provides a high proportion of these managed services for MNOs' backhaul, in the form of its Managed Ethernet Access Service (MEAS) product.

A11.61 The primary focus of our work in this review is to examine the state of competition in the upstream provision of terminating segments of leased lines. This reflects our

[125]For example, we estimate that the price of a 1Gbit/s CISBO is around £9,000 per annum (see Section 4, Figure 4.1). We would anticipate that, in a competitive market, an Ethernet mobile backhaul service (that uses the same underlying inputs) should be priced in a similar manner. Therefore, it is unlikely that an MNO would seek to incur significant sunk costs of installing self-supplied microwave links in response to a SSNIP on a CISBO service (assuming that this was technically feasible).

general approach across regulated markets of, where appropriate, focussing regulatory intervention on any upstream bottlenecks. We consider that promoting competition at the upstream level should have the effect of safeguarding users' interests in the markets for downstream services.

A11.62 However, MNOs have raised concerns about lack of competition in the managed services they purchase in the context of our work in this review. In response to the CFI, MBNL expressed concerns over its reliance on MEAS for around [✂ ✂]. Our circuit information from Vodafone also suggests that MEAS represents more than [✂ ✂] of its purchases of Ethernet circuits from BT.

A11.63 We also note that BT's proposed acquisition of EE may give a combined BT/EE an incentive to discriminate in the provision of MEAS in favour of EE over other MNOs.

A11.64 We have therefore considered whether there may be enduring competition issues at the managed services level in light of the remedies we are proposing to impose at the upstream level.

A11.65 We note that BT Wholesale assembles the infrastructure for MEAS using a combination of Openreach's regulated Ethernet leased line services, together with standard electronic equipment (e.g. service routers and cell-site gateways) and unregulated transmission links in BT's national core network. We currently require Openreach to provide a variety of fibre Ethernet leased line terminating segments on regulated terms. We are considering in this review (Section 10 – specific CI remedies) whether there are issues in the relative pricing of certain Openreach Ethernet leased lines services, and whether these are sufficiently substantive to require addressing as part of the remedies package we are proposing. We are also proposing to require Openreach to provide passive access (in the form of a dark fibre product).

A11.66 Notwithstanding BT Wholesale's high shares of managed services, we consider that in principle, a rival would be able to use Openreach's regulated Ethernet leased line services (or dark fibre), together with standard electronic equipment and unregulated transmission links available from BT or its competitors, to supply managed services to MNOs in competition with BT Wholesale (or indeed for the MNOs to self-supply managed services using the same inputs).

A11.67 We recognise that BT Wholesale might have some advantages over other potential providers of managed services. Specifically:

- BT Wholesale has established presence in more of BT's 1,100 or so fibre Access Service Node (ASN) exchanges than any other CP. This may put it in a better position that its rivals to use Openreach's regulated Ethernet leased line terminating segments to connect cost-effectively to MNOs' cell sites across the country;

- BT Wholesale is a major supplier of other managed services, such as fixed wholesale broadband access, and hence may be in a better position than its rivals to exploit economies of scale and scope in providing managed services to MNOs, by aggregating MNOs' traffic with other traffic;

A11.68 We also understand that the MNOs are typically tied into long-term managed services contracts (including circuit-volume commitments) with BT Wholesale, and

so may have limited ability to switch to alternative suppliers (and/or self-supply) in the short term.

A11.69 Notwithstanding these factors, we would expect BT Wholesale's supply of MEAS to be constrained by the prospect of alternative supply using the regulated inputs, and we would therefore not expect it to have SMP at the level of managed services. This also reflects the focus of CPs' complaints, which have largely been focused on the Openreach products and pricing (not MEAS).[126]

A11.70 Notwithstanding the above, we recognise that the assessment of the BT/EE merger may include more detailed consideration of these managed services contracts. We do not currently expect that any work done in the context of the merger will give us cause to revise the position set out above for the purpose of this BCMR. However, we will keep this under review.

Conclusions

A11.71 We propose to keep mobile backhaul within the markets as per the 2013 Statement based on the following:

- **Technical assessment:** MNO backhaul is technically equivalent to standard leased lines. Whilst mobile operators have a need to synchronise timing at cell sites, this technical requirement can be supported natively by TI services, and Ethernet now includes synchronisation as a service feature (the main standard is referred to as SyncE). We find that SyncE is now a standard feature of available Ethernet equipment and operators such as Virgin Media have successfully deployed these Ethernet solutions for mobile backhaul applications in the UK.

- **Demand and supply-side substitution:** in the light of specific technical requirements for MNO backhaul, we consider whether any demand or supply-side substitution opportunities exist between, on the one hand CISBO and TISBO services, and on the other, mobile backhaul services. In our view RBS backhaul services are identical to standard TI services and synchronisation is a standard feature of Ethernet and so in principle MNO backhaul and standard services are substitutable; and

- **Competitive conditions:** It might be appropriate to define mobile backhaul separately if the competitive conditions vary significantly from other leased lines services. However, and notwithstanding some differences in service share, we do not consider it to be materially more or less competitive than other forms of connectivity.

A11.72 We note that a significant proportion of mobile purchases from BT make use of 'downstream' MEAS solutions. However, this does not suggest a fundamental difference in competitive conditions at the upstream level or a need to define a separate MNO backhaul market.

[126] http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Combined_response.pdf

Annex 12

Wholesale product market definition: LLU backhaul

Introduction

A12.1 Local Loop Unbundling ("LLU") operators rely on leased lines to backhaul broadband traffic from BT's exchanges (where they have co-location equipment to aggregate unbundled local loops) to their core networks. We consider in this annex whether there are:

- particular demand-side or supply-side issues for these LLU backhaul services that would justify identifying a separate wholesale product market for these services; and
- significant differences in competitive conditions for the supply of LLU backhaul services relative to CISBO.[127]

A12.2 Our proposal is not to identify a separate LLU backhaul market, but we note that there is a case for considering carefully competition in these segments when included as part of our wider assessment of SMP in leased lines.

Background

A12.3 In the last review, we included LLU backhaul services within the relevant AISBO and MISBO markets. This section considers our approach to market definition for LLU backhaul for the period until 2019.

A12.4 LLU backhaul circuits provide a link between OCPs' LLU co-location facility and their core network nodes.[128] Currently, LLU backhaul providers mainly rely on Ethernet circuits.

A12.5 We proceed by first reviewing the substitutability between products used for LLU backhaul and those used for enterprise customers. We go on to discuss whether competitive conditions in the supply of LLU backhaul services and CISBO services are broadly homogenous.

Direct demand-side substitution

A12.6 LLU backhaul circuits by definition start at an LLU operator's co-location point at the (unbundled) BT local exchange. In this they differ from leased lines circuits provided to enterprise customers, which always need an access circuit starting at the

[127] We do not consider LLU backhaul relative to TISBO markets, as the primary technology used is Ethernet backhaul.

[128] LLU backhaul connects a CP's co-location facility to its relevant point of handover. Presently most CPs have their co-location equipment at BT local exchanges. However, our LLU backhaul definition would include co-location at a point closer to the end-user, including at the street cabinet level. Similarly, the definition could include co-location at a point more distant from the end-user.

customer's premises. However, within the backhaul segment, Ethernet terminating segments supplying enterprise customers and LLU backhaul services both use identical fixed point-to-point Ethernet connectivity. Indeed, BT's EAD services (which are wholesale Ethernet point-to-point services typically used to provide leased lines) are not limited to particular uses (i.e. EAD is not restricted only to enterprise applications).[129] BT's networked Ethernet backhaul services (such as BT's Ethernet Backhaul Direct service) also enable CPs to deliver converged backhaul solutions (where they have invested in necessary equipment). [130] This would give the option to backhaul traffic both from enterprise and LLU customers over a common Ethernet link. Therefore, a CP could purchase either an EAD or EBD product from BT and use it provide LLU backhaul and leased lines backhaul.

A12.7 We note that there is no attempt by BT to distinguish between services offered to LLU backhaul providers and other services. There appears to be flexibility for these products to be used to provide backhaul for both asymmetric (e.g. residential and business broadband) and symmetric broadband services (e.g. leased lines). More formally, in the context of demand-side substitution from a technical perspective and based on current service offerings, an Ethernet leased lines service sold for general enterprise applications could be used for LLU backhaul (and vice versa).

A12.8 However, although LLU backhaul can use the same inputs as other Ethernet leased lines users, it may be that absent regulation (i.e. such as network access on non-discriminatory terms) there could be scope for price discrimination. LLU backhaul might be at risk because some of the main LLU backhaul operators such as Sky and TalkTalk are typically large and easily identifiable customers. Indeed, Sky and TalkTalk have expressed concern that the nature of LLU backhaul purchases puts them at a relative disadvantage when seeking competitive supply. We therefore consider below whether there are differences in competitive conditions between LLU backhaul and other leased lines services.

Variations in competitive conditions

A12.9 The geographic spread of LLU backhaul demand is potentially wider than seen for enterprise segments (i.e. some unbundled exchanges are outside the main urban areas where most of the leased lines demand from business customers is located).-[131] In its response to our market questionnaire, Sky described this as offering BT a significant advantage in the supply of LLU backhaul as:

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[129] http://www.openreach.co.uk/orpg/home/products/ethernetservices/ethernetaccessdirect/ead/downloads/eadfactsheet.pdf

[130] For BT's main Ethernet product portfolio, EADLA is the only service variation that could not be used for LLU backhaul applications. This is because EADLA is a specific access product from customer sites to BT access serving nodes. Therefore, it does not include a backhaul component. In this respect, EADLA would also not be suitable for an Ethernet leased line serving an enterprise customer that needed a backhaul element. Therefore, the existence of specific 'access only' products is not relevant to our assessment of LLU backhaul versus CISBO.

[131] We identified in the WBAMR three geographic areas: Market A – where no more than two significant operators known as Principal Operators are present or forecast to be present, which accounting for 9.5% of UK premises; Market B – in which there is effective competition, accounting for 89.8% of premises; and the Hull area – 0.7% of UK premises, where KCOM is the only significant provider. Market A tends to be in the most rural and remote parts of the country. http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-draft-statement.pdf

- BT is the only provider that can offer nationwide products from its wholly owned network. Sky argued it is often more efficient for Sky to purchase products from a single provider at a national scale as purchasing from multiple providers introduces additional overheads; and

- demand for LLU backhaul is likely to be concentrated away from areas of high business density (where demand has mostly been concentrated to date) and even away from those areas that currently have some limited competitive supply of LLU backhaul. The scope for entry in these areas is lower due to the lower density of potential customers and lower scope to supply a range of customers (i.e. there are fewer businesses and LLU operators in the market).

A12.10 TalkTalk made similar comments in its Market Questionnaire response:

[✂"

"✂]

A12.11 We note that, similar to mobile backhaul, BT has a strong position in the provision of LLU backhaul. According to data provided in response to our S135 information request, for [✂ ✂] the evidence suggested that they relied on BT for [✂%✂] of their total LLU backhaul requirements (i.e. they only self-supplied or procured backhaul from third parties for less than [✂%✂] of their circuits). This compares to BT's share of the CISBO market of around 56% outside of the main urban areas.

A12.12 The figures show that BT's shares for LLU backhaul (to Sky and TalkTalk) and for other CISBO services are both well in excess of the threshold for assumed dominance of 50%. This suggests that if we assess market power for LLU backhaul and other CISBO services separately, we would be likely to conclude that BT was dominant or had SMP in the supply of both services in most parts of the UK.

A12.13 We have considered whether there are differences in competitive conditions by geography. To assess whether competitive conditions were similar for CISBO services and LLU backhaul, we have looked specifically at the CLA and the London Periphery.

A12.14 For the CLA, our analysis suggests that BT's share of LLU backhaul is much lower [✂%✂] ([✂% and % ✂]). These lower shares reflect the scope for competitive provision of backhaul from the local exchanges in the CLA. In particular, we observe an average network reach of nearly seven OCPs at BT local exchanges within the CLA. All CLA exchanges have at least two operators with network within 100 metres and 96% of CLA exchanges have at least four alternative operators within 100 metres. For the London Periphery, BT's share is higher ([✂ %✂]) and more similar to its nationwide share of LLU backhaul. This is likely to be because the number of OCPs with network within reach of exchanges in the London Periphery is lower than in the CLA (e.g. in the LP there is average network reach of 3 CPs). BT's very high share of LLU backhaul outside of London is also consistent with the relative lack of competing

infrastructure in the rest of the UK, which itself is reflected in BT's dominant position there in the CISBO market generally.

A12.15 Both TalkTalk and Sky told us that they have a general preference for purchasing services from a single provider, [✂

✂]. However, we note that both Sky and TalkTalk do in fact use alternative providers to BT, despite their stated preference, and what is particularly apparent in the CLA is the scope for competitive supply – the many competing networks in the CLA are, in principle able to supply LLU backhaul as well as other leased line services. Hence, we consider that Sky's and TalkTalk's preference for purchase from a single supplier ought not to be a significant barrier to competition, and that competitive conditions for LLU backhaul within a given geographic area should therefore be broadly similar to the rest of the CISBO market. In other words, as with CISBO generally, we regard the main determinant of competitive conditions as the number of competing networks present.

A12.16 Therefore, we consider that competitive conditions are not sufficiently distinct for LLU backhaul relative to CISBO services more generally to identify a separate product market for LLU backhaul. Even if we were to identify a separate market for LLU backhaul, it would not likely impact our SMP findings.

Conclusion

A12.17 In light of our analysis, we have concluded it is appropriate to define LLU backhaul as part of the CISBO product market. This is for the following reasons:

- First, LLU backhaul and other leased lines services make use of the same products from BT. BT's Ethernet services do not differentiate between circuits used for LLU or leased lines backhaul which reflects the technical similarities in the requirements for Ethernet connectivity used to support LLU backhaul and other leased lines services.

- Second, in a given geographic area, competitive conditions in the provision of LLU backhaul and leased lines services are similar. We note that in the CLA, BT has only a slightly higher share of LLU backhaul than the rest of the CISBO market reflecting, at a fundamental level, these are technically equivalent services provided using a common infrastructure and we consider competitive conditions to be broadly homogeneous. We note that there are rival networks present at CLA exchanges able to supply LLU backhaul in competition with BT, in line with the presence of competing networks in the CLA generally.

- Third, although Sky and TalkTalk have expressed a preference to use a limited number of suppliers, we note that they do use alternative suppliers to BT.

A12.18 Our proposal is to define LLU backhaul as part of the CISBO product markets.

Annex 13

Approach to SMP Assessment

Introduction

A13.1 This Annex presents the approach to SMP assessment that we follow in our market power determinations in the relevant markets for wholesale and retail leased lines defined in Sections 4, 5 and 6 of this consultation. In addition, this Annex summarises evidence that informs our assessment of a number of SMP criteria: economies of scale, countervailing buyer power, and prospects for competition.

A13.2 Significant market power (SMP) is defined in the Act as being equivalent to the competition law concept of dominance. A CP shall be deemed to have SMP if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers.[132]

A13.3 We have taken particular account of the SMP Guidelines[133] and, where relevant, of the ERG Revised SMP Paper.[134] The SMP Guidelines set out a non-exhaustive list of criteria to be considered in a SMP assessment, and state that a dominant position may derive from a combination of these criteria, which taken separately may not necessarily be determinative.[135] We acknowledge that evidence on the most relevant SMP criteria should be considered in the round, and that findings should not be based on assessment of a single criterion.

A13.4 Whilst we considered all the criteria listed in the SMP Guidelines, we regard the following criteria as particularly relevant to assessment of SMP in wholesale leased lines markets:

- market shares and market share trends;
- control of infrastructure not being easily duplicated;
- economies of scale and scope;

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[132] See section 78 of the Act and Article 14 of the Framework Directive.

[133] Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services, 2002/C 165/03. In accordance with section 4A of the Act we have taken due account of all applicable guidelines and recommendations which have been issued by the European Commission under Article 19(1) of the Framework Directive, and which relate to analysis or the determination of what constitutes significant market power. In doing so, pursuant to Article 3(3) of Regulation (EC) No 1211/2009, we have also taken utmost of any relevant opinion, recommendation, guidelines, advice or regulatory practice adopted by BEREC.

[134] Revised ERG Working Paper on the SMP concept for the new regulatory framework, September 2005. http://berec.europa.eu/doc/publications/public_hearing_concept_smp/erg_03_09rev3_smp_common_concept.pdf

[135] Paragraph 79 of the SMP Guidelines.

- barriers to entry and expansion;
- external constraints;
- countervailing buyer power;
- profitability, and;
- prospects for competition.

A13.5 Given that we are required to determine whether a CP will enjoy a dominant position in any of the relevant markets over the course of the review period, it is important to bear in mind that a degree of uncertainty may be present in the SMP assessment as a whole. This is expressly recognised, and provided for, in the SMP Guidelines from which we note:

> "In the exercise of their regulatory tasks under Article 15 and 16 of the framework Directive, NRAs enjoy discretionary powers which reflect the complexity of all the relevant factors that must be assessed (economic, factual and legal) when identifying the relevant market and determining the existence of undertakings with SMP. These discretionary powers remain subject, however, to the procedures provided for in Article 6 and 7 of the framework Directive."[136]

A13.6 Specifically in relation to assessing SMP, the SMP Guidelines state:

> "In particular, when assessing *ex ante* whether one or more [CPs] are in a dominant position in the relevant market, NRAs are, in principle, relying on different sets of assumptions and expectations than those relied upon by a competition authority applying [Article 102 TFEU[137]], *ex post*, within a context of an alleged committed abuse. Often, the lack of evidence or of records of past behaviour or conduct will mean that the market analysis will have to be based mainly on a prospective assessment. The accuracy of the market analysis carried out by NRAs will thus be conditioned by information and data existing at the time of the adoption of the relevant decision."
>
> "The fact that an NRA's initial market predictions do not finally materialise in a given case does not necessarily mean that its decision at the time of its adoption was inconsistent with the Directive. In applying ex ante the concept of dominance, NRAs must be accorded discretionary powers correlative to the complex character of the economic, factual and legal situations that will need to be assessed. In accordance with the framework Directive, market assessments by NRAs will have to be undertaken on a regular basis. In this context, therefore, NRAs will have the possibility to react at

[136] See paragraph 22 of the SMP Guidelines.

[137] Article 102 of the Treaty on the functioning of the European Union, formerly Article 82 of the Treaty Establishing the European Community.

> regular intervals to any market developments and to take any measure deemed necessary."[138]

A13.7 We recognise that *ex ante* regulatory reviews should be forward-looking. Our aim is to assess whether markets can be prospectively competitive and thus whether any lack of competition is durable by taking expected or foreseeable market developments over the review period into account.[139]

A13.8 Whilst the focus of this Annex lies on assessing market power in wholesale markets, most of the approach applies similarly to the assessment of market power in retail markets. We assess competition in two retail markets – low bandwidth TI and CI services in the Hull area.

A13.9 We adopt the *modified Greenfield* approach when assessing competition in wholesale and retail markets.

- In wholesale markets we assume that no *ex ante* regulation arising from a finding of SMP applies to any CP within the relevant market in question.[140]

- In retail markets we take the presence of *ex ante* regulation in wholesale markets into account (where relevant). That is, we assume that while no *ex ante* SMP regulation applies to any CP in the retail market in question, CPs have access to regulated wholesale leased line products.

A13.10 As noted at paragraphs 2.46-2.48, the EU Civil Infrastructure Directive (CID) is due to come into effect in UK law by summer 2016. We consider that, under the *modified Greenfield* approach, it is appropriate to consider the effect of the relevant implementing legislation in our forward looking assessment of market power, to the extent possible.

A13.11 Unlike any remedy imposed under the BCMR, the availability of access under the CID will not be limited to operators with significant market power in specifically defined product and geographic markets. However, in principle it will allow reasonable requests for access on a nationwide basis to public communications infrastructure, and will therefore provide a means through which CPs can seek access to physical infrastructure, which may (in theory at least) affect an assessment of whether the operators of that physical infrastructure have SMP in any relevant markets.

A13.12 At this stage, we consider that there is significant uncertainty about the practical effects of the future legislation implementing the CID. In particular, we note that it will not come into effect until after we conclude the 2016 BCMR, and consider that it may take some time after its implementation to resolve issues about, in particular, the scope and pricing of access. Only once these issues have been resolved will we be able to ascertain with a degree of certainty whether the CID provides a viable alternative access solution for telecoms infrastructure.

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[138] See paragraphs 70 and 71 of the SMP Guidelines.

[139] See Recital 27 of the Framework Directive and paragraph 20 of the SMP Guidelines, The forward-looking period of this review is three years.

[140] We note that *ex ante* regulation in adjacent markets (which can be relevant when assessing external constraints) is taken into account as part of our assessment.

A13.13 Consequently, although we do take it into account, we do not place significant weight on the existence of the CID for the purpose of this review, and do not consider that its existence materially changes our assessment of market power in any relevant markets.

A13.14 The rest of this Annex explains our general assessment of the SMP criteria referred to above, and how these criteria are relevant to market power in the wholesale markets for leased lines we identify in this review.

General assessment of SMP criteria in the relevant wholesale markets

A13.15 It is instructive to explain in general terms how each of the SMP criteria identified as relevant in paragraph A13.4 above apply to the wholesale markets for leased lines identified in this review.

Market shares and market share developments

A13.16 The SMP Guidelines note that "market shares are often used as a proxy of market power".[141] Market shares – and trends in market shares – are a measure of the outcome of competition, and as such, can provide an indication of how competitive a market has been in the past, and is now. Where an undertaking has a persistently large market share this usually points to impediments to effective competition being present, and where impediments, as in many cases, do not change over time, market shares can be a good indicator of competitive conditions in the future.

A13.17 In this respect, we continue to regard the following from the SMP Guidelines of particular relevance:

- single dominance concerns normally arise where market shares exceed 40%;
- concerns can also arise at lower shares depending on the difference between the market shares of the undertaking in question and that of its competitors;
- very large market shares in excess of 50% are in themselves evidence of a dominant position, save in exceptional circumstances; and
- undertakings with market shares of no more than 25% are not likely to enjoy a (single) dominant position on the market concerned.[142]

A13.18 Market shares do not always provide a reliable indicator of future competitive conditions. Underlying competitive conditions can and often do change over time. For example, an undertaking may have a high share in an emerging market as a result of innovation, successfully gaining a temporary yet significant competitive advantage. In a competitive market with no material impediments to competition, we would not expect this undertaking to sustain its initial high share. In other conditions, for example, where contracts to supply an individual customer or a small set of customers account for a sizeable part of the market, shares may be a less reliable indicator of competitive conditions.

[141] See paragraph 75 of SMP Guidelines.

[142] See the SMP Guidelines.

A13.19 While market share is an important criterion, we recognise that a large market share alone is not sufficient to find SMP. The SMP Guidelines note in this regard that "the existence of a dominant position cannot be established on the sole basis of large market shares". Barriers to entry are particularly important in this respect. An undertaking with a high market share may not have market power when entry barriers are low as the threat of other undertakings entering the market within a reasonable amount of time and at low costs, could be enough to prevent an undertaking raising prices above the competitive level.

A13.20 Changes in market shares can be informative about an undertaking's position in markets. More particularly, a decrease in the share of an undertaking may point to that undertaking having limited or declining market power. We note in this regard that:

- Where an undertaking maintains a high share over time, this provides further support for impediments to effective competition being present.
- While the gradual erosion of an undertaking's very high share may indicate that a market is becoming more competitive over time, such a development does, in itself, not preclude a finding of SMP.[143]

Practical issues

A13.21 As the SMP Guidelines make clear, the choice of metric for measuring market shares will depend on the characteristics of relevant markets, and it is for the National Regulatory Authority to decide which metric is the most appropriate.

A13.22 Annex 15 explains our approach to measuring service shares in wholesale leased lines markets. We have established service shares based on volumes (by counting the number of leased lines termination points), and consider that our estimates of shares allow us to analyse the positions of CPs in the wholesale markets identified, as well as in segments of these markets.

A13.23 Our service shares are estimates, and subject to uncertainty. As such, it may be useful to check the sensitivity of estimated service shares to changes in relevant assumptions. Annex 15 presents the sensitivity analysis undertaken.

A13.24 It is often also useful to consider value-based shares (reflecting estimated revenues instead of volumes), especially where products are differentiated.[144] Within a broad market (such as the markets for CISBO services identified in Section 4), we have estimated value-based shares (for each relevant geographic market) by weighting CP volumes in each bandwidth segment by the standard prices for BT wholesale products in these segments.[145]

A13.25 The market shares we observe reflect the effects of regulation to prevent BT exploiting any market power it has. For example, if large users with multi-site demand (e.g. MNOs) prefer their connectivity requirements to be met by one

[143] See paragraph 75 of the SMP Guidelines.

[144] See for example the CMA guide to the Assessment of Market Power, OFT 415, paragraph 4.7 at: https://www.gov.uk/government/publications/assessment-of-market-power

[145] See Annex 15, paragraph A15.188 and further.

supplier, BT might be able to exploit this in an unregulated but not fully competitive market. BT could then be better placed to compete for contracts involving multi-site demand as its more extensive network would allow it to provide bundles at lower incremental costs than OCPs. As a result, where multi-site demand is important and where competition is limited, BT might be able to gain a greater share of the market benefitting from its ubiquitous network.

Limitations of service share analysis at very high CISBO

A13.26 We recognise that estimation and interpretation of service shares in very high CISBO (the segment of the CISBO markets identified in Section 4 involving services capable of supporting bandwidths greater than 1Gbit/s), in particular, are subject to a number of limitations raising uncertainty surrounding estimates, and reducing reliability of service share evidence as a good indicator of competitive conditions. These limitations include:

- **Missing information on on-net provision –** Some operators, including [✂ ✂] could not provide information on the mode of provision (on-net, off-net) for a large proportion of very high CISBO services. We classified very high CISBO services as supplied on-net where the operator has a flexibility point within 200m of the site to which the service is supplied. While we consider this an appropriate way of dealing with the missing information, we recognise that this raises the uncertainty surrounding our estimates. [146]

- **Limited volumes –** The limited very high CISBO volumes, particularly so within narrow geographic areas, imply that estimates likely provide less reliable indication of current and future competitive conditions. This problem is further exacerbated by the presence of large contracts and by the high growth in volumes.

- **Migration –** The material migration from medium/high to very high CISBO can have a material impact on service shares in very high CISBO going forward. We note that medium/high CISBO volumes are significantly greater than those of very high CISBO. If CPs manage to retain customers upgrading bandwidth, migration would likely increase the shares of CPs with significant sales in mid/very high CISBO (BT, most prominently).

- **Pricing and positioning** – Current service shares are affected to a material degree by CPs' pricing and positioning of their CISBO products over the past years.

  - BT's prices increase with bandwidth whilst costs vary with bandwidth to a much lesser degree, encouraging greater entry by OCPs in the higher bandwidth CISBO segments, with the result that, as far as we are able to observe, BT's share of the supply of higher bandwidth services tends to be relatively low;

  - BT and another supplier of higher bandwidth CISBO services [✂ ✂] position their products differently. We have noted that

[146] See Annex 15, paragraph A15.109.

the other supplier uses WDM-based services to meet connectivity requirements for which BT offers its standard Ethernet 1Gbit/s services.

A13.27 Recognising the limitations identified and discussed above, we place less weight on service shares for very high CISBO on a stand-alone basis, and take due note of service shares in CISBO at bandwidths up to and including 1Gbit/s (and the adjacent high CISBO segment in particular) and of developments with a particular relevance to very high CISBO (including growth, migration, CP pricing and product positioning).

Control of infrastructure not easily duplicated

A13.28 In order to provide leased lines to a site, a CP requires a physical connection to that site. Where a CP does not have an existing connection to a site, it needs to extend its network to establish a connection in order to provide leased lines to that site. The costs of network extension represent a significant proportion of the total costs of providing leased lines, are largely sunk, are common to fixed telecommunications services, and increase in the distance of network extension required.

A13.29 BT, as the former monopolist, has a very extensive trench and duct network extending to most (business) sites in the UK outside the Hull area. Its infrastructure enables BT, as only limited network extension may be required, to supply leased lines to almost any site in the UK outside the Hull area at low incremental costs and within a relatively short period of time.

A13.30 As shown in Section 4 and Annex 15, rival infrastructure is considerably more limited in amount and coverage. Commonly, OCPs will not have an existing connection to a site, in which case they will require network extension to establish the connection. The greater is the distance between a site and their infrastructure, the greater will be the costs of network extension.

A13.31 The extent of the advantage BT derives from its network depends on whether an OCP has network infrastructure in the proximity of (or possibly even an existing connection to) a site, or not. Whilst we consider that BT has, on average, an advantage in both instances, BT's advantage will be materially greater where an OCP does not have network in the proximity of a site.

- With no network in the proximity of a site, an OCP would require a significant investment in network extension. Given the significant costs of network extension, OCPs can typically not justify such investments as expected revenues in (or even beyond) the contract period will not be sufficient to recover investment costs.

- With network in the proximity of a site, an OCP may still require a network extension to reach a site.

    - Where an OCP has an existing connection, it can supply leased lines quickly and at low incremental costs, and it would not have a disadvantage vis-à-vis BT.

    - Where an OCP does not have an existing connection (which will frequently be the case), it will require some network extension, the extent and costs of which will depend on the distance between the site and the OCP's infrastructure. The more significant the amount and costs of network extension required, the more

likely it is that an OCP incurs considerably greater costs than BT to connect and provide services to new customer sites.

A13.32 The analysis of CP digging data, presented in Annex 18, provides evidence corroborating our view that BT derives an advantage from its network. The analysis shows that:

- BT requires network extension for a lower proportion of new customers (indicating that BT's network extends to a greater number of sites); and
- BT, on average, digs shorter distances in cases where network extension is needed (indicating that BT's existing network, on average, tends to be closer to sites).

A13.33 We consider there are a number of other reasons why BT benefits from its more extensive network:

- BT, because of its ubiquitous network, does not need to rely on third party CPs for connectivity. This reduces the possibility of interoperability issues occurring, contributes to a greater level of control over network equipment, can improve network security, and removes the need to negotiate wholesale supply arrangements with third party suppliers which may be complex and potentially influenced by whether the third party supplier is also a downstream competitor;
- BT's extensive network infrastructure may create technical advantages in terms of its ability to offer and build diverse physical routes. Physically separate routes are required to provide a service which is resilient to faults in network infrastructure. Some users seeking high availability may value such routes. We consider it easier for BT to connect a customer site to two separate access points and to find diverse routes from access points to destination; and
- BT may have advantages in serving multi-site contracts if customers place value on knowing that a single provider supplies the physical infrastructure for the whole contract or a large part of it.

A13.34 Depending on the proximity of its network to a site, an OCP may be able to overcome the network disadvantage it has. However, as we do not consider it practicable or proportionate to undertake a site-by-site assessment, we instead examine the degree to which BT faces rival infrastructure across wider geographic areas.

Barriers to entry and expansion

A13.35 If an undertaking present in a market raises prices in an effort to increase profits, this will create an incentive for new undertakings to enter the market. If entry then occurs, any excess profits are likely to be competed away, even where the undertaking that raised its prices started with a high market share. But if there are entry barriers, the threat of entry may be removed, and the undertaking with the high market share may be able to sustain high prices and profitability above the competitive level over the longer term.

A13.36 We consider that *sunk costs* and *switching costs* are likely to give rise to barriers to entry and expansion in wholesale leased lines markets. Where present, barriers to entry and expansion can raise significant impediments to competition, protecting the position of incumbent CPs – KCOM in the Hull area and BT in the rest of the UK

– and making it more difficult for OCPs to compete for the supply of wholesale leased lines.

Sunk costs

A13.37 An extension of network infrastructure commonly requires a significant investment, and the costs associated with such investment are, to a large degree, sunk. We define a sunk cost as one which has been paid in the past, is not recoverable on market exit, and does not need to be paid again in order to remain in the market over the period under consideration.

A13.38 The OFT's guidelines on the assessment of market power (OFT 415) explain that:

> "sunk costs might give an incumbent a strategic advantage over potential entrants. Suppose an incumbent has already made sunk investments necessary to produce in a market while an otherwise identical new entrant has not. In this case, even if the incumbent charges a price at which entry would be profitable (if the price remained the same following entry), entry may not occur. This would be the case if the entrant does not expect the post-entry price to be high enough to justify incurring the sunk costs of entry".[147]

A13.39 The costs of extending network infrastructure to connect to sites are largely sunk as the physical network built cannot be transferred to another location if it is no longer required at the original site.

A13.40 While the costs of network extension are not the only costs incurred in supplying wholesale leased lines, they represent, in our understanding, a significant proportion of total costs. Annex 18 presents evidence on the costs of network extension.

A13.41 Over time, BT and KCOM have developed extensive network infrastructure in their respective areas, largely sinking the costs incurred in developing their infrastructure. This implies that BT and KCOM are able to supply wholesale leased lines to most sites, in their respective areas, at low incremental costs, likely significantly lower than the costs that would be incurred by OCPs.

A13.42 OCPs have much less extensive infrastructure, and they will commonly need to extend their networks in order to supply services to new customer sites. As investment costs associated with network extension are significant, and are sunk following investment, OCPs will commonly be at a competitive disadvantage vis-à-vis incumbent CPs.

A13.43 The asymmetry between incumbent CPs and OCPs in terms of the need to extend network infrastructure to provide leased lines to new customer sites, in our view, gives rise to barriers to entry. Having been the first CPs to develop network infrastructure and having largely sunk the costs of building their network, incumbent CPs have a first-mover advantage. The ability of incumbent CPs to supply leased lines at lower incremental costs may discourage OCPs to compete for supply of leased lines to sites where material network extension is required for providing services, as they, in such cases, will not be able to recover investment costs.

[147] Paragraph 5.10 of the OFT Guidelines.

Switching costs

A13.44 Existing customers may incur – or anticipate incurring – costs when switching to another supplier which they would not incur when continuing to purchase from their current supplier. Such costs, known as switching costs, can be of a financial or non-financial nature – cost of replacing equipment an example of the former, and risk of temporary service disruption and being tied to existing contracts examples of the latter.[148] Customers are considerably less likely to switch when tied to a contract with a current supplier.

A13.45 The direct effect of switching costs is that customers will be reluctant to switch to another supplier even if that supplier offers terms and quality that are at least as good as those offered by the current supplier. Switching costs make it more difficult for suppliers to attract customers currently served by another supplier. While this affects all suppliers, in practice, we consider the impact will be greater for suppliers with no, or only a small existing, customer base. Such suppliers, OCPs, need to increase their customer base in order to compete more successfully and gain greater foothold in leased lines markets.

A13.46 The BDRC end-user survey shows that businesses indicated the hassle of switching, the potential for service disruption, the risk of the new service not working well, and internal costs of switching are barriers to switching supplier of business connectivity services.[149] We consider that the survey evidence confirms that switching costs are present to a material degree, and to the extent of raising barriers to entry and expansion in markets for wholesale leased lines services.

A13.47 In addition, we note that a number of OCPs expressed the difficulty they face to win customers where they cannot provide leased lines on-net and where customers have an existing contract with another supplier.[150]

A13.48 Where switching costs are present, OCPs anticipate that attracting new customers may require prices significantly below those offered by the current supplier and potentially below the level required for recovery of investment costs. This makes OCPs less likely to invest in network extension and customer acquisition.

A13.49 Switching costs, for example, may be of less significance if new CPs entering the market do not need to rely only on winning existing customers from an incumbent CP. The presence of longer-term contracts – 77% of businesses have a contract lasting more than one year, 40% of more than two years. means that only a proportion of customers may be contestable at any given time, making it more difficult for OCPs to attract new customers.

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[148] See Section 8 of the BDRC end-user survey, http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[149] See Section 8 of the BDRC end-user survey, http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[150] Meeting with a CP. [✂ ✂]

A13.50 Incompatibility of technology, most likely to arise in relation to IT systems and customer equipment, can be a significant barrier to switching supplier.

- Wholesale customers may develop IT systems to help automate and manage transactions with their supplier. Customers will typically have a system in place for dealing with BT, and might have to develop a second set of systems when purchasing from another CP

- Compatibility relating to customer equipment is not guaranteed, and is likely to make customers more reluctant to switch supplier.

A13.51 OCPs considering entry or expansion are likely to take account of the incumbent CP's (anticipated) response as the two main drivers of revenues – volumes and prices – depend on the incumbent CP's response. Where the incumbent CP is able to respond aggressively to entry or expansion, for example, by offering discounts to customers identified as likely to switch, this can materially reduce the incentives of OCPs to make the required investments in network extension and customer acquisition.

A13.52 BT has been regulated in the past in respect of most wholesale products, with regulation placing limits on BT's ability and incentives to respond in a targeted way to offers made by OCPs. In practice BT has generally adopted broadly uniform pricing, with little variation by area.[151] In the absence of regulation, BT would have greater flexibility to respond to instances where it did face competition. This would raise the riskiness of OCPs' investments in network extension, as BT, provided it could identify the customers most willing and able to switch to its rivals, could compete aggressively for customers of OCPs. It may also translate into BT winning a larger share of sales, though we note that the absence of regulation would also allow BT to set higher prices on average, which may give OCPs some increased ability to win business if BT was not able to target these price increases effectively.

A13.53 CPs, other things equal, will be more willing to invest in a growing market. As a result, we consider that barriers to entry and expansion tend to be less of an impediment to competition in markets with rapidly growing volumes.

Economies of scale and scope

A13.54 Markets for wholesale leased lines products – or fixed telecommunications services more broadly – are characterised by economies of scale and scope, with economies of scope typically being more material. It is instructive, as part of the SMP assessments we undertake, to distinguish between economies of scale and scope in order to assess their independent influence.

A13.55 We define *economies of scale* (or increasing returns to scale) as circumstances in which the unit cost falls as volumes of the same service increase, and *economies of scope* as circumstances where the unit cost falls as volumes of a different service increase.

[151] We note that BT offered discounted connection charges on EAD 1Gbit/s product in the WECLA in the period March 2013 to May 2014, and tends to price its MISBO services in the WECLA more flexibly. [✂

✂]

A13.56 The presence of fixed costs can give rise to economies of scale because average fixed costs necessarily fall as volumes of a service increase. The presence of common costs – costs that need to be incurred in order to provide any of a group of services, but which then do not need to be incurred again in order to supply any other service in the group – can give rise to economies of scope with the average fixed cost decreasing in the total volumes of services in the group supplied (so not only of the service itself).

A13.57 The costs of developing network infrastructure – which form a major proportion of total costs of providing leased lines – are both fixed in the short-term and to a large extent common. The materiality of economies of scale and scope in any particular case depends on the extent to which network infrastructure can be used to supply additional volumes in the same market (*economies of scale*) or in different markets (*economies of scope*).

A13.58 We note that common costs relating to development of physical infrastructure are particularly significant in fixed telecommunications markets as CPs can use the same infrastructure to supply a range of fixed telecommunications services, including leased lines. In relation to the supply of leased lines, we consider that the more significant reductions in unit costs that can be achieved are driven by the ability of a CP to spread the common costs of network infrastructure over a wider range of fixed telecommunications services. This explains why in our view, economies of scope are more likely to be material in wholesale leased lines markets.

A13.59 The incumbent CPs – BT (in the UK outside the Hull area) and KCOM (in the Hull area) – because of the scope and scale of their fixed telecommunications operations, are likely to benefit to a greater extent from economies of scale and scope than OCPs.

Economies of scale

A13.60 A large proportion of costs associated with providing leased lines are incurred in developing (and maintaining) the part of the infrastructure that connects to sites, i.e. the dedicated access links. This part of physical infrastructure is, to a large degree, incremental to sites, and the cost of developing these links depends greatly on the length of links. We consider that the costs of access links only give rise to economies of scale insofar as the number of services provided to a site increases and do not depend on the total number of leased lines supplied or customers served by a CP.

A13.61 We recognise that there may be economies of scale arising from costs that are not related to access links.

- CPs providing greater volumes of wholesale leased lines purchase more equipment, and they may be able to negotiate a lower equipment price per unit than CPs supplying lower volumes.

- The way BT charges for backhaul products (such as EBD) can give rise to economies of scale which BT can exploit more effectively than smaller CPs. The lowest unit costs are obtainable by purchasing the highest capacity circuit and then filling it, but only BT may have sufficient traffic to do this on some routes. As one circuit can be used to backhaul the traffic of multiple services and/or of multiple customers, the greater the number of services using a backhaul circuit, the lower is the unit cost of that circuit. While this holds true for any CP (and EBD

is provided on an EoI basis), we note that the ability of a CP to use the highest capacity backhaul products will depend on that CP's sales of downstream products. Thus BT may be better able to utilise the capacity of its backhaul product (as it will more commonly be able to increase the number of customers that make use of the same backhaul product), allowing it to achieve greater economies of scale overall, with respect to these services than OCPs offering similar products.

A13.62 As part of the financial modelling undertaken to inform the charge control remedy we propose to impose, we use cost volume elasticities (CVEs) and asset volume elasticities (AVEs) for the cost components relevant to provision of leased line services. CVEs and AVEs reflect how operating costs and capital costs, respectively, vary with changes in volumes of cost components. CVE and AVE values below one provide an indication of the unit operating and the unit capital cost, respectively, decreasing in volumes. We interpret such values as an indicator of economies of scale.

A13.63 BT has provided us with their internal estimates of AVEs and CVEs, which shows that most of the values are below one, some significantly so. We interpret this as evidence of BT achieving economies of scale in its provision of leased lines. We expect OCPs, while they are able to achieve economies of scale as well, to be constrained in the economies they can achieve due to the smaller scale of their operations.

Economies of scope

A13.64 As explained above, it is the presence of common costs in the provision of leased lines that gives rise to economies of scope, and given the significance of common costs in provision of leased lines, we consider that economies of scope are likely to be material.

A13.65 It can be instructive to distinguish between costs common to the provision of fixed telecommunications services, to the provision of leased lines, and to leased lines provided using a particular technology:

- A large proportion of costs incurred in supplying leased lines are common to the provision of fixed telecommunications services. Thus, CPs selling a wider range of fixed telecommunications services have greater opportunities to benefit from economies of scope.

- There are also costs that are incremental to supplying leased lines, yet common to all types of leased lines. If such costs are significant, this allows CPs providing a range of leased lines to reduce unit costs.

- There can be costs which are common to leased lines provided using a particular technology. CPs selling a greater number of lines using a given technology may benefit from lower unit costs in providing services using this technology.

View on economies of scale and scope

A13.66 The scope of BT's operations in the UK outside the Hull area is greater than that of OCPs – across markets for fixed telecommunications and leased lines services.

Virgin Media, BT's closest competitor in terms of scale and scope of its telecoms services, has a significantly less extensive network and a considerably smaller installed customer base across these markets.[152] Therefore, we consider that BT benefits from a greater ability to spread the costs of its network infrastructure across a wider range and greater number of fixed telecommunication services than OCPs. We recognise that the materiality of the advantage BT derives from its scale and scope will be smaller in areas with a greater amount of rival infrastructure, but there is little such infrastructure in most areas outside Central London. In the Hull area, KCOM is the CP with by far the greatest scale and scope of fixed telecommunications operations, and as such is likely able to benefit to a greater extent from economies of scale and scope.

Countervailing buyer power

A13.67 A market in which one supplier appears to have a strong position – it has a high share and barriers to entry are present – may not lead to harmful outcomes for consumers if buyers have sufficient countervailing buyer power to curtail this supplier in exercising any market power it may have.

A13.68 In general, purchasers in wholesale leased lines markets may have a degree of buyer power where they purchase large volumes and have a credible threat to switch supplier or to meet requirements through self-supply. In order for the threat to be effective, the volumes that are or can credibly be met from another source of supply need to have a material impact on the supplier's profitability. Practically, this requires volumes to be significant and to represent a material proportion of a supplier's total volumes.

A13.69 In practice, our assessment of countervailing buyer power considers the availability of another source of supply (another supplier or self-supply), and the materiality of purchasers' volumes as the two requirements that need to be cumulatively met for purchasers to have material countervailing buyer power.

A13.70 The first requirement concerns the availability of another source of supply. In leased lines markets, the availability of another source of supply depends on the presence of rival infrastructure in the proximity of a site. Only where one or more OCPs have network near its site can a purchaser make a credible threat to switch volumes from the incumbent CP to an OCP. Where a purchaser knows that more than one CP has network in the proximity of his site, and can thus provide leased lines at not too great incremental costs, he can try to play CPs off against each other asking for better terms.

A13.71 As a general rule, the greater is the presence of rival infrastructure in an area, then the more likely it is that one or more OCPs have some infrastructure in the proximity of a site and thus some ability to supply leased lines to that site. The network reach analysis, that we carried out (presented in Section 4) estimates the presence of rival infrastructure in geographic areas. In areas where the presence of rival

[152] The difference between BT and Virgin Media in terms of coverage of network infrastructure and scale remains significant. The total number of leased lines supplied by BT is more than four times the number supplied by Virgin Media, and BT supplies twice as many CISBO services. Moreover, the coverage of BT's network is considerably greater than that of Virgin Media. BT has network infrastructure in the proximity of most businesses. [✂

✂].

infrastructure is low (as evidenced by their low network reach), most businesses will have no or limited choice when it comes to suppliers as few OCPs have infrastructure in the proximity of their site.

A13.72 The second requirement concerns purchasers' volumes. As stated in the ERG SMP Paper, "the higher the amount of purchase of services by customers or the higher the proportion of the producer's total output that is bought by a certain customer, the stronger the countervailing power might be".[153]

A13.73 In principle, countervailing power could be exercised at the wholesale level and at the retail level. However, retail users are likely to purchase too small volumes to have any material countervailing power. If we turn to wholesale markets, we can observe that in each of the relevant wholesale markets identified in the 2013 BCMR, BT/Openreach's largest customer is its downstream retail division.[154] Table A13.1 below presents internal and external volumes (as reported in BT's Regulatory Financial Statements 2014), and the ratio of internal/total volumes for the markets identified in the previous market review. The ratio of internal/total volumes exceeds 57% for each of the markets in which BT was found to have SMP in the previous market review.

[153] See paragraph 11 of the 'Revised ERG Working Paper on the SMP Concept for the New Regulatory Framework', 2005. http://berec.europa.eu/doc/publications/public_hearing_concept_smp/erg_03_09rev3_smp_common_concept.pdf

[154] The same is true for KCOM in relation to wholesale business connectivity services markets in the Hull area.

Table A13.1 BT sales of wholesale leased lines: internal vs external

Product market	Internal volumes (circuits)	External volumes (circuits)	Ratio of internal to total volumes
Low bandwidth TISBO (<=8Mbit/s)	37,006	20,352	65%
Higher bandwidth TISBO (>8Mbit/s)	905	292	76%
Low bandwidth AISBO (<=10Mbit/s)	24,786	13,905	64%
Medium bandwidth AISBO (>10Mbit/s, <1Gbit/s)	43,982	24,602	64%
High bandwidth AISBO (1Gbit/s)	16,797	9,527	64%
MISBO* (WDM at all bandwidths and AI services >1Gbit/s)	1,890	1,438	57%

* *Includes only non-WECLA MISBO volumes*

Source: Ofcom analysis based on BT's Regulatory Financial Statements 2014

A13.74 Apart from BT's downstream retail divisions – and possibly MNOs and LLUOs, discussed hereafter – we do not consider there are customers whose volumes are large enough for them to potentially exert buyer power.[155]

A13.75 BT's involvement upstream and downstream, if anything, reduces its incentives to offer (selective) discounts to competitors of its downstream divisions. Offering discounts would only intensify downstream competition, possibly reducing margins earned and volumes sold by BT's downstream division.

A13.76 Even if some purchasers were able to exercise buyer power effectively, this is unlikely to benefit customers without buyer power. Where BT is able to offer

[155] We note that even where a customer purchases significant volumes, this does not necessarily imply that this customer has material countervailing buyer power. For example, if a significant proportion of a customer's volumes can only be purchased from one supplier (as only that supplier has network in that area) this would weaken the customer's, and strengthen the supplier's bargaining position.

selective discounts to purchasers with buyer power, those without buyer power would not benefit, and in fact, would likely face higher prices. Where BT is not able to offer lower prices only to purchasers with (potential) buyer power, it will be less inclined to decrease prices in response to the threat of a single purchaser.

A13.77 We discuss specific issues relating to competition for mobile and LLU backhaul, including countervailing buyer power, in Annexes 11 and 12, respectively.

A13.78 Overall, we consider that buyer power in relevant wholesale markets would not materially constrain the incumbent CPs – BT and KCOM – in potentially exercising market power in these markets.

External constraints

A13.79 Our market power determinations aim to take all relevant competitive constraints, whether inside or outside markets defined, into account. We consider external constraints – out-of-market products which some customers might regard as substitutes to in-the-market product – and their individual and joint impact on competition for in-the-market products as part of our SMP assessment. External constraints by their nature tend to be relatively weak, but they can, in combination with competition within the market, constrain a CP's ability to exercise market power, as some customers may switch to out-of-market products in response to a relative price increase of the in-the-market product.

A13.80 Customer requirements offer a natural starting point for identifying external constraints. Out-of-market products can only potentially constrain CP market power if some (potential) users regard these products as substitutes to in-the-market products. Practically, this requires out-of-market products to be able to meet broadly similar needs and to be of acceptable quality for at least some users.[156]

A13.81 Relevant out-of-market products typically concern fixed telecommunications services that can be provided over the same network as the in-the-market products. As BT supplies most fixed telecommunications services, the directional impact of out-of-market products can be ambiguous. They can constrain BT's market power when BT faces intense competition in the markets for out-of-market products, but they can, on the other hand, strengthen BT's market power when BT maintains a strong position in these markets.

A13.82 We identify other leased lines products and asymmetric broadband (NGA) as potentially relevant external constraints. Generally, we do not consider the external constraints arising from these out-of-market products to materially constrain market power of CPs for in-the-market products.

Profitability

A13.83 The SMP Guidelines refer to the importance, when assessing market power, of considering the ability of a CP to raise prices without incurring a significant loss of sales or revenue as part of a market power assessment.[157]

[156] Secondly, price differences between in-the-market and out-of-market products matter too.

[157] See paragraph 73 of SMP Guidelines.

A13.84 An unregulated CP with SMP has, by definition, the ability and incentives to increase profits by raising prices above the competitive level. CPs that do not have market power will, constrained by competition, not be able to raise prices above the competitive level, and thus cannot sustain profitability that materially exceed the cost of capital (the competitive benchmark).

A13.85 We note that profitability temporarily exceeding the cost of capital, for example because of successful innovation, can be consistent with competitive markets, and in fact ensure that markets remain competitive by providing incentives for entry and expansion. It is the ability of a CP to sustain high profitability (i.e. substantially above the cost of capital) over a longer period of time that points to market power.

A13.86 We do not consider the reverse to be true, particularly where a CP is already subject to a charge control. That is, we do not regard profitability at or below the cost of capital as evidence of a CP not having market power since the objective of a charge control is normally to reduce prices to the competitive level, eliminating excess profits. In addition, firms with SMP are often able to operate inefficiently, in the absence of competitive pressure to reduce costs and this can then be reflected in low reported profits. Low profitability can therefore be the result of CP inefficiencies and/or price regulation, both of which factors arise where a CP has SMP.

A13.87 We assessed the profitability of the two incumbent CPs (BT and KCOM) by benchmarking the return on capital employed (ROCE) against the weighted average cost of capital (WACC).[158] Both BT and KCOM are obliged to publish the financial data required for carrying out profitability analysis (returns, operating costs, mean capital employed) in their regulatory financial statements for each of the markets in which they were found to have SMP in the previous review.

A13.88 We note that analysis of BT's and KCOM's leased lines operations is subject to measurement and interpretation limitations.

- First, the treatment of holding gains/losses as costs in BT's accounts has an impact on ROCEs observed, and in particular, introduces a volatility reflecting changes in asset values.

- Second, the high proportion of common costs in leased lines markets has an important consequence for accounting measures of profitability which necessarily reflect a particular common cost allocation which may not be uniquely correct. We note that BT has some discretion in the way it recovers common costs (it is subject to fair and reasonable pricing rules), and is also affected by the design of the regulatory regime.

- Third, financial data might apply to groups of services which do not correspond to our proposed market definitions.

- Finally, the economic lives of some assets may exceed their accounting lives. This means that the assets used to provide some services (more likely for low bandwidth TISBO than for CISBO services) may be heavily depreciated, tending to reduce the accounting value of capital employed and raise measured ROCEs without necessarily indicating the exploitation of market power.

[158] The WACC is the minimum expected return required by investors given the level of risk they bear.

A13.89 Taking the above into account, we interpret profitability as follows:

- We do not make inferences about competitive conditions in markets where we find low levels of profitability and price regulation applies; and
- We do place weight on a high level of profitability as an indicator of market power.

A13.90 As discussed above, our proposals regarding market power determinations never rely on one indicator alone. Although the existence of profitability persistently and significantly above the competitive level often indicates that a CP has SMP, we note that this is not a necessary condition for finding SMP.[159] Neither is it a sufficient condition. For example, where we have strong evidence on rival infrastructure being significant enough to sustain effective competition, this can overcome evidence on high profitability as a potential indicator of SMP.

A13.91 Annex 22 presents the profitability analysis of BT's and KCOM's operations in leased lines markets we have carried out.

Prospects for competition

A13.92 In applying cumulatively all the relevant SMP criteria, we also reflect the requirement under the terms of Article 16 of the Framework Directive for our market analysis to involve a forward-looking, structural evaluation of the relevant market, based on existing market conditions. We need to determine whether, in the absence of *ex ante* regulation, the market is prospectively competitive, and thus whether any lack of effective competition is durable, by taking into account expected or foreseeable market developments over the course of a reasonable period[160].

A13.93 We assess the prospects for competition by reviewing evidence on expected and foreseeable market developments that may lead to effective and sustainable competition in a market. Competition is more likely to increase in intensity where prospects for profitable entry exist or will improve. Relevant factors include the value of services, the level of and trends in demand and any expected technological changes which could affect costs or entry conditions.

A13.94 We note that costs of providing services do not vary greatly over the bandwidth range, whereas prices (as shown in Section 4 and Annex 10) do. BT's prices for its CISBO products increase with the bandwidth of the circuit, whilst the incremental costs of network extension – which forms the majority of costs of providing services – generally do not vary with the bandwidth of the circuit. This combination of prices which rise with bandwidth and costs which vary to a much lesser degree is encouraging greater entry by OCPs in higher bandwidth CISBO segments.

A13.95 As explained in Section 4, we interpret service shares in the supply of very high CISBO services in light of this pricing structure. OCPs, in particular Virgin, have been successful in winning a materially greater share of supply due to BT setting

[159] This is consistent with the ERG Revised SMP Paper (see section 3, paragraph 20).

[160] See Recital 27 of the Framework Directive and paragraph 20 of the SMP Guidelines. The forward-looking period of this review is three years.

higher prices for these services and hence making it more attractive and feasible for OCPs to gain a foothold.

A13.96 At low bandwidths (up to about 30Mbit/s), entry can also occur using EFM technology and wholesale unbundled local loops purchased from BT on regulated terms. An LLU operator can provide EFM services at low incremental costs to each site located in exchange areas where the LLU operator is co-located at the local BT exchange. While Talk Talk currently offers EFM services in many areas, [✂

✂]

Demand developments

A13.97 Trends in demand are important for a number of reasons. First, economies of scale mean that average costs fall as volume grows and this can make entry more attractive. Second, switching costs may be of less significance in a growing market, also making entry easier.

A13.98 We analysed the development of volumes over time, and going forward. Actual and forecast volumes for TISBO services were obtained from IDC. Volumes for CISBO services, both actual and forecast, were provided by Ovum.[161] Table A13.2 presents the expected annual growth rates for TISBO and CISBO services at various bandwidths for the periods 2012-15 and 2016-18.[162]

[161] These concern total volumes of services at the retail level. We consider this an appropriate approximation of total volumes at the wholesale level as wholesale demand is derived from retail demand.

[162] These forecasts are for the growth of the entire market. In the forthcoming June LLCC Consultation, we will present the forecasts we consider appropriate for BTW and Openreach's sales.

Table A13.2 Development of volumes across interface types and bandwidth segments

		Expected compound annual growth rate	
Interface	**Bandwidth**	**2012-15**	**2016-18**
TISBO	Low bandwidth (<=2Mbit/s)	-20%	-26%
	Higher bandwidth (>2Mbit/s)	-21%	-28%
CISBO	<=10Mbit/s	4%	-9%
	100Mbit/s	15%	15%
	1Gbit/s	23%	24%
	10Gbit/s	45%	35%
	>=10Gbit/s	15%	15%

Source: Ofcom analysis based on Ovum and IDC data.

A13.99 The development of volumes varies considerably across service types, with TISBO volumes declining and volumes of CISBO services of 1Gbit/s and above on the rise. This development is forecast to continue over the review period. That is, TISBO volumes are forecast to decline significantly, and volumes of 1Gbit/s and above CISBO services are forecast to grow strongly over the next years reflecting greater demand from existing users, users of lower bandwidth CISBO services upgrading, users of TISBO services migrating, and emerging demand from new users of leased lines.

Prospects for competition - overall

A13.100 Having considered two drivers of revenue opportunities – value per service and demand prospects – we find that, in the absence of *ex ante* regulation, the prospects for competition are potentially more favourable for CISBO services. These services have greater values (they are currently sold at significantly higher prices), and have better demand prospects. Prospects for competition are poor for low bandwidth TISBO services. The combination of low value per service supplied and unfavourable demand prospects mean that OCPs are unlikely to be willing to invest in network extension for providing these services.

A13.101 Our analysis of rival infrastructure indicates that OCP investment in network infrastructure has been limited.[163] The limited investment in network infrastructure by OCPs suggests that caution is warranted when placing weight on the prospects for competition in market power determinations.

A13.102 Overall, we expect barriers to entry arising from the presence of sunk costs and asymmetries between BT and KCOM on the one hand and OCPs on the other hand, to remain significant. We do not expect any fundamental changes to technology or costs which would undermine these. In addition, BT will retain the only ubiquitous UK network capable of supplying leased lines (at the wholesale level) nationwide. We therefore consider that, in most of the UK, there is unlikely to be any material change in competitive conditions over the review period. Moreover, any prospects for greater competition (in the absence of regulation) are likely to be confined to those areas where conditions are already relatively favourable.

[163] CP approaches to, and plans for, network expansion are described in Annex 21

Annex 14

Regulatory framework

Introduction

A14.1 This annex provides an overview of the market review process to give some additional context and understanding of the matters discussed in this Consultation, including the draft legal instruments published at Annexes 6 and 7.

A14.2 Market review regulation is technical and complex, including the legislation and the recommendations and guidelines that we need to consider as part of the process. There may be many relevant documents depending on the market and/or issues in question. This overview does not purport to give a full and exhaustive account of all such materials that we have considered in reaching our preliminary views on this market. Some of the key aspects of materials relevant to this market review are, however, discussed in this annex.

Market review concept

A14.3 The concept of a market review refers to procedures under which, at regular intervals, we identify relevant markets appropriate to national circumstances and carry out analyses of these markets to determine whether they are effectively competitive before then deciding on appropriate remedies, known as SMP obligations or conditions (we explain the concept of SMP below).

A14.4 In carrying out this work, we act in our capacity as the sector-specific regulator for the UK communications industries, including telecommunications. Our functions in this regard are to be found in Part 2 of the CA03.[164] We exercise those functions within the framework harmonised across the European Union for the regulation of electronic communications by the Member States (known as the CRF), as transposed by the CA03. The applicable rules[165] are contained in a package of five EC Directives, of which two Directives are particularly relevant for present purposes, namely:

- Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services ('the Framework Directive'); and
- Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities ('the Access Directive').

A14.5 The Directives require that NRAs (such as Ofcom) carry out reviews of competition in communications markets to ensure that SMP regulation remains appropriate and proportionate in the light of changing market conditions.

A14.6 Each market review normally involves three analytical stages, namely:

[164] http://www.legislation.gov.uk/ukpga/2003/21/contents

[165] The Directives were subsequently amended on 19 December 2009. The amendments have been transposed into the national legislation and applied with effect from 26 May 2011 and any references in this document to the CA03 should be read accordingly.

- the procedure for the identification and definition of the relevant markets ('the market definition procedure');
- the procedure for the assessment of competition in each market, in particular whether the relevant market is effectively competitive ('the market analysis procedure'); and
- the procedure for the assessment of appropriate regulatory obligations ('the remedies procedure').

A14.7 These stages are normally carried out together.

Market definition procedure

A14.8 The CA03 provides that, before making a market power determination[166], we must identify "the markets which in [our] opinion, are the ones which in the circumstances of the United Kingdom are the markets in relation to which it is appropriate to consider whether to make such a determination" and to analyse those markets.

A14.9 The Framework Directive requires that NRAs shall, taking the utmost account of the Relevant Markets Recommendation[167] and EC SMP Guidelines[168] published by the EC, define the relevant markets appropriate to national circumstances, in particular relevant geographic markets within their territory, in accordance with the principles of competition law.

A14.10 The Relevant Markets Recommendation identifies a set of product and service markets within the electronic communications sector in which ex ante regulation may be warranted. Its purpose is twofold. First, it seeks to achieve harmonisation across the single market by ensuring that the same markets will be subject to a market analysis in all Member States. Second, the Relevant Markets Recommendation seeks to provide legal certainty by making market players aware in advance of the markets to be analysed.

A14.11 However, NRAs are able to regulate markets that differ from those identified in the Relevant Markets Recommendation where this is justified by national circumstances, taking account of the three cumulative criteria referred to in the Relevant Markets Recommendation ('the three-criteria test') and where the EC does not raise any objections.

A14.12 The three criteria, which are cumulative, are:

[166] The market power determination concept is used in the CA03 to refer to a determination that a person has SMP in an identified services market.

[167] EC, *Commission Recommendation of 9 October 2014 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, (2007/879/EC),*

[168] EC, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

- the presence of high and non-transitory structural, legal or regulatory barriers to entry;

- a market structure which does not tend towards effective competition within the relevant time horizon, having regard to the state of infrastructure-based and other competition behind the barriers to entry; and

- competition law alone is insufficient to adequately address the identified market failure(s).

A14.13 The fact that an NRA identifies the product and service markets listed in the Relevant Markets Recommendation or identifies other product and service markets that meet the three-criteria test does not automatically mean that regulation is warranted. Market definition is not an end in itself but rather a means of assessing effective competition. The three-criteria test is also different from the SMP assessment because it focuses on the general market structure and market characteristics.

A14.14 The relationship between the market definitions identified in this review and those listed in the Relevant Markets Recommendation is discussed in relevant parts of this Statement.[169]

A14.15 The EC SMP Guidelines make clear that market definition is not a mechanical or abstract process. It requires an analysis of any available evidence of past market behaviour and an overall understanding of the mechanics of a given market sector. As market analysis has to be forward-looking, the EC SMP Guidelines state that NRAs should determine whether the market is prospectively competitive, and thus whether any lack of effective competition is durable, by taking into account expected or foreseeable market developments over the course of a reasonable period. The EC SMP Guidelines clarify that NRAs enjoy discretionary powers which reflect the complexity of all the relevant factors that must be assessed (economic, factual and legal) when identifying the relevant market and assessing whether an undertaking has SMP.

A14.16 The EC SMP Guidelines also describe how competition law methodologies may be used by NRAs in their analysis. In particular, there are two dimensions to the definition of a relevant market: the relevant products to be included in the same market and the geographic extent of the market. Ofcom's approach to market definition follows that used by the UK competition authorities, which is in line with the approach adopted by the EC.

A14.17 While competition law methodologies are used in identifying the *ex ante* markets, the markets identified will not necessarily be identical to markets defined in individual competition law cases, especially as the *ex ante* markets are based on an overall forward-looking assessment of the structure and the functioning of the market under examination. Accordingly, the economic analysis carried out for the purpose of this review, including the markets we have identified, is without prejudice to any analysis that may be carried out in relation to any investigation pursuant to

[169] See, in particular, where we set out how we consider the three criteria test is cumulatively satisfied for each of the relevant markets which are not included in the Relevant Markets Recommendation, but for which we have concluded are markets in which *ex ante* regulation is warranted.

the Competition Act 1998[170] (relating to the application of the Chapter I or II prohibitions or Article 101 or 102 of the Treaty on the Functioning of the European Union[171]) or the Enterprise Act 2002.[172]

Market analysis procedure

Effective competition

A14.18 The CA03 requires that we carry out market analyses of identified markets for the purpose of making or reviewing market power determinations. Such analyses are normally to be carried out within 2 years from the adoption of a revised recommendation on markets, where that recommendation identifies a market not previously notified to the EC, or within 3 years from the publication of a previous market power determination relating to that market.

A14.19 In carrying out a market analysis, the key issue for an NRA is to determine whether the market in question is effectively competitive. The 27th recital to the Framework Directive clarifies the meaning of that concept. Namely, *"[it] is essential that ex ante regulatory obligations should only be imposed where there is not effective competition, i.e. in markets where there are one or more undertakings with significant market power, and where national and Community competition law remedies are not sufficient to address the problem*".

A14.20 The definition of SMP is equivalent to the concept of dominance as defined in competition law. In essence, it means that Ofcom needs to determine whether any undertaking in the relevant market is in a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers, and ultimately consumers. The Framework Directive requires that NRAs must carry out their market analysis taking the utmost account of the EC SMP Guidelines, which emphasise that NRAs should undertake a thorough and overall analysis of the economic characteristics of the relevant market before coming to a conclusion as to the existence of SMP.

A14.21 In that regard, the EC SMP Guidelines set out, additionally to market shares, a number of criteria that can be used by NRAs to measure the power of an undertaking to behave to an appreciable extent independently of its competitors, customers and consumers, including:

- the overall size of the undertaking;
- control of infrastructure not easily duplicated;
- technological advantages or superiority;
- absence of or low countervailing buying power;
- easy or privileged access to capital markets/financial;

[170] http://www.legislation.gov.uk/ukpga/1998/41/contents

[171] Previously Article 81 and Article 82 of the EC Treaty, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:FULL:EN:PDF.

[172] http://www.legislation.gov.uk/ukpga/2002/40/contents

- resources;
- product/services diversification (e.g. bundled products or services);
- economies of scale;
- economies of scope;
- vertical integration;
- highly developed distribution and sales network;
- absence of potential competition; and
- barriers to expansion.

A14.22 A dominant position can derive from a combination of these criteria, which when taken separately may not necessarily be determinative.

Sufficiency of competition law

A14.23 As part of our overall forward-looking analysis, we also assess whether competition law by itself (without *ex ante* regulation) is sufficient, within the relevant markets we have defined, to address the competition problems we have identified. Aside from the need to address this issue as part of the three-criteria test, we also consider this matter in our assessment of the appropriate remedies which, as explained below, are based on the nature of the specific competition problems we identify within the relevant markets as defined. We also note that the EC SMP Guidelines clarify that, if NRAs designate undertakings as having SMP, they must impose on them one or more regulatory obligations.

A14.24 In considering this matter, we bear in mind the specific characteristics of the relevant markets we have defined. Generally, the case for *ex ante* regulation is based on the existence of market failures which, by themselves or in combination, mean that the establishment of competition might not be possible if the regulator relied solely on *ex post* competition law powers which are not specifically tailored to the sector. Therefore, it is appropriate for *ex ante* regulation to be used to address these market failures along with any entry barriers that might otherwise prevent effective competition from becoming established within the relevant markets we have defined. By imposing *ex ante* regulation that promotes competition, it may be possible to reduce such regulation over time as markets become more competitive, allowing greater reliance on *ex post* competition law.

A14.25 *Ex post* competition law is also unlikely in itself to bring about (or promote) effective competition, as it prohibits the abuse of dominance rather than the holding of a dominant position itself. In contrast, *ex ante* regulation is normally aimed at actively promoting the development of competition through attempting to reduce the level of market power (or dominance) in the identified relevant markets, thereby encouraging the establishment of effective competition. This is particularly the case when addressing the effects of network externalities, which generally reinforce a dominant position. As noted above, under *ex post* competition law there is no prohibition on the holding of a position of dominance in itself and it is, therefore, normally more appropriate to address the impact of network externalities through *ex ante* obligations.

A14.26 We generally take the view that *ex ante* regulation provides additional legal certainty for the market under review and may also better enable us to intervene in a timely manner. We may also consider that certain obligations are needed as competition law would not remedy the particular market failure, or that the specific clarity and detail of the obligation is required to achieve a particular result.

Remedies procedure

Powers and legal tests

A14.27 The Framework Directive prescribes what regulatory action NRAs must take depending upon whether or not an identified relevant market has been found effectively competitive. Where a market has been found effectively competitive, NRAs are not allowed to impose SMP obligations and must withdraw such obligations where they already exist. On the other hand, where the market is found not effectively competitive, the NRAs must identify the undertakings with SMP in that market and then impose appropriate obligations.

A14.28 NRAs have a suite of regulatory tools at their disposal, as reflected in the CA03. Specifically, the Access Directive specifies a number of SMP obligations, including transparency, non-discrimination, accounting separation, access to and use of specific network elements and facilities, price control and cost accounting. When imposing a specific obligation, the NRA will need to demonstrate that the obligation in question is based on the nature of the problem identified, proportionate and justified in the light of the policy objectives as set out in Article 8 of the Framework Directive.

A14.29 Specifically, for each and every SMP obligation, we explain why it satisfies the requirement in section 47(2) CA03 that the obligation is:

- objectively justifiable in relation to the networks, services, facilities, apparatus or directories to which it relates;
- not such so as to discriminate unduly against particular persons or against a particular description of persons;
- proportionate to what the condition or modification is intended to achieve; and
- transparent in relation to what is intended to be achieved.

A14.30 Additional legal requirements may also need to be satisfied depending on the SMP obligation in question. For example, in the case of price controls, the NRA's market analysis must indicate that the lack of effective competition means that the CP concerned may sustain prices at an excessively high level or may apply a price squeeze to the detriment of end-users. In that instance, NRAs must take into account the investment made by the CP and allow it a reasonable rate of return on adequate capital employed, taking into account any risks specific to a particular new investment, as well as ensure that any cost recovery mechanism or pricing methodology that is mandated serves to promote efficiency and sustainable competition and maximise consumer benefits. Where an obligation to provide third parties with network access is considered appropriate, NRAs must take into account factors including the feasibility of the network access, the technical and

economic viability of creating networks[173] that would make the network access unnecessary, the investment of the network operator who is required to provide access[174], and the need to secure effective competition[175] in the long term.

A14.31 To the extent relevant to this review, we demonstrate the application of these requirements to the SMP obligations in question in the relevant parts of this document. In doing so, we also set our assessment of how, in our opinion, the performance of our general duties under section 3 of the CA03 is secured or furthered by our regulatory intervention, and that it is in accordance with the six Community requirements in section 4 of the CA03. This is also relevant to our assessment of the likely impact of implementing our conclusions.

Ofcom's general duties - section 3 of the CA03

A14.32 Under the CA03, our principal duty in carrying out functions is to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition.

A14.33 In doing so, we are required to secure a number of specific objectives and to have regard to a number of matters set out in section 3 of the CA03.

A14.34 In performing our duties, we are also required to have regard to a range of other considerations, as appear to us to be relevant in the circumstances. For the purpose of the FAMR, we consider that a number of such considerations are relevant, in particular:

- the desirability of promoting competition in relevant markets;
- the desirability of encouraging investment and innovation in relevant markets; and
- the desirability of encouraging the availability and use of high speed data transfer services throughout the UK.

A14.35 We have also had regard to the principles under which regulatory activities should be transparent, accountable, proportionate, consistent, and targeted only at cases in which action is needed, as well as the interest of consumers in respect of choice, price, quality of service and value for money.

A14.36 Ofcom has, however, a wide measure of discretion in balancing its statutory duties and objectives. In doing so, we have taken account of all relevant considerations, including responses received during our consultation process, in reaching our conclusions.

[173] Including the viability of other network access products, whether provided by the dominant provider or another person.

[174] Taking account of any public investment made.

[175] Including, where it appears to us to be appropriate, economically efficient infrastructure-based competition.

European Community requirements for regulation - sections 4 and 4A of the CA03 and Article 3 of the BEREC Regulation

A14.37 As noted above, our functions exercised in this review fall under the CRF. As such, section 4 of the CA03 requires us to act in accordance with the six European Community requirements for regulation. In summary, these six requirements are:

- to promote competition in the provision of electronic communications networks and services, associated facilities and the supply of directories;
- to contribute to the development of the European internal market;
- to promote the interests of all persons who are citizens of the EU;
- to take account of the desirability of Ofcom's carrying out of its functions in a manner which, so far as practicable, does not favour one form of or means of providing electronic communications networks, services or associated facilities over another (i.e. to be technologically neutral);
- to encourage, to such extent as Ofcom considers appropriate for certain prescribed purposes, the provision of network access and service interoperability, namely securing efficient and sustainable competition, efficient investment and innovation, and the maximum benefit for customers of CPs; and
- to encourage compliance with certain standards in order to facilitate service interoperability and secure freedom of choice for the customers of CPs.

A14.38 We considere that the first, third, fourth and fifth of those requirements are of particular relevance to the matters under review and that no conflict arises in this regard with those specific objectives in section 3 of the CA03 that we consider are particularly relevant in this context.

A14.39 Section 4A of the CA03 requires Ofcom, in carrying out certain of its functions (including, among others, Ofcom's functions in relation to market reviews under the CRF) to take due account of applicable recommendations issued by the EC under Article 19(1) of the Framework Directive. Where we decide not to follow such a recommendation, we must notify the EC of that decision and the reasons for it.

A14.40 Similarly, Article 3(3) of the Regulation establishing BEREC[176] requires NRAs to take utmost account of any opinion, recommendation, guidelines, advice or regulatory best practice adopted by BEREC.

A14.41 Accordingly, we have taken due account of the applicable EC recommendations and utmost account of the applicable opinions, recommendations, guidelines, advice and regulatory best practices adopted by BEREC relevant to the matters under consideration in this review.

[176] Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators of Electronic Communications (BEREC) and the Office (the BEREC Regulation) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0001:0010:EN:PDF.

Impact assessment – section 7 of the CA03

A14.42 The analysis presented in the whole of this document represents an impact assessment, as defined in section 7 of the CA03.

A14.43 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the CA03, which means that generally Ofcom has to carry out impact assessments where there is likely to be a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of its policy decisions. For further information about Ofcom's approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on the Ofcom website: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf.

A14.44 Specifically, pursuant to section 7, an impact assessment must set out how, in our opinion, the performance of our general duties (within the meaning of section 3 of the CA03) is secured or furthered by or in relation to the regulation we impose.

A14.45 Ofcom is separately required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality. This assessment is set out in Annex 2.

Regulated entity

A14.46 The power in the CA03 to impose an SMP obligation by means of an SMP services condition provides that it is to be applied only to a 'person' whom we have determined to be a person having SMP in a specific market for electronic communications networks, electronic communications services or associated facilities (i.e. the 'services market').

A14.47 The Framework Directive requires that, where an NRA determines that a relevant market is not effectively competitive, it shall identify 'undertakings' with SMP in that market and impose appropriate specific regulatory obligations. For the purposes of EU competition law, 'undertaking' includes companies within the same corporate group (for example, where a company within that group is not independent in its decision making).[177]

A14.48 We consider it appropriate to prevent a dominant provider to whom an SMP services condition is applied, which is part of a group of companies, exploiting the principle of corporate separation. The dominant provider should not use another member of its group to carry out activities or to fail to comply with a condition, which would otherwise render the dominant provider in breach of its obligations.

A14.49 To secure that aim, we apply the SMP conditions to the person in relation to which we have made the market power determination in question by reference to the so-called 'Dominant Provider', which we define as "*[X plc], whose registered company*

[177] *Viho v Commission,* Case C-73/95 P [1996] ECR I-5447, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:61995CJ0073:EN:PDF.

number is [000] and any [X plc] subsidiary or holding company, or any subsidiary of that holding company, all as defined in section 1159 of the Companies Act 2006".

Annex 15

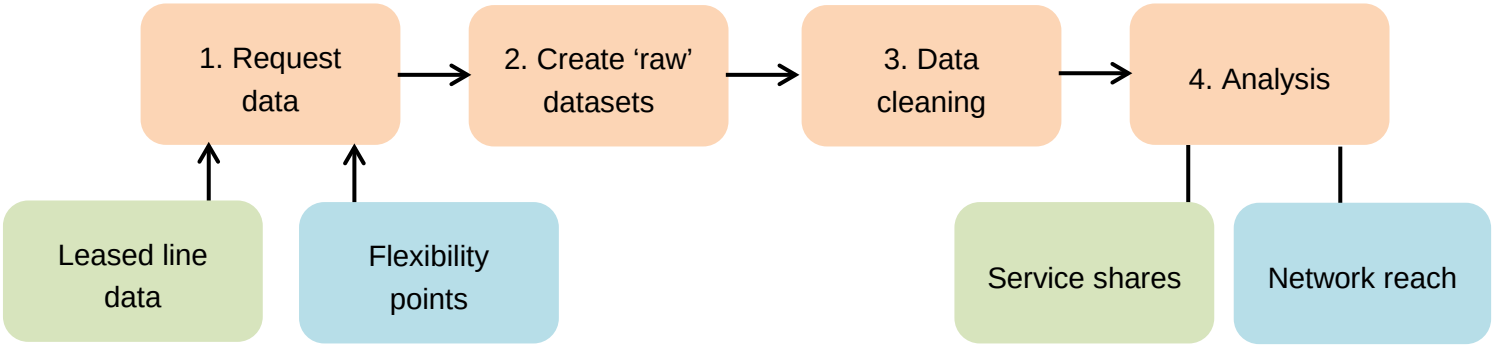
Data Analysis

Introduction

A15.1 As part of our market review process, we have drawn on a wide range of evidence. This annex provides details of the data we have requested from network operators and how we have gone about processing and analysing that information. It is structured as follows. First, we explain our evidence gathering process and summarise the 2014 BCMR Data Analysis Consultation (hereafter referred to as the 'data consultation'). We then explain our data processing methodology, which comprises the four steps outlined in Figure A15.1 below, followed by a set of summary statistics that illustrate the updates we have made since the data consultation. When explaining our methodology, we summarise any substantive consultation responses that we received as well as our comments on these responses. The other responses, and our comments, are summarised in Tables A15.12 and A15.13 at the end of this Annex.

A15.2 In the final section we present a series of analyses that have been used in our assessment of market definition and SMP.

Figure A15.1: Key Steps in Data Analysis



Evidence Gathering and 2014 Data Analysis Consultation

A15.3 The datasets we construct for the BCMR are unavoidably large and complex because we require detailed and granular information from a number of CPs. Stakeholders had divergent views on our approach to processing and analysing the data in the 2013 BCMR, which required a significant investment of resource for both Ofcom and CPs.[178]

A15.4 In light of this, immediately following the conclusion of the last BCMR we had a series of meetings with the CPs that had provided the majority of data.[179] The

[178] A detailed description of the data analysis was provided in Annex 5 of the BCMR 2013 Statement, whilst the network reach and service share analyses are described in Sections 5 and 7 respectively.

[179] This included BT, Virgin Media, Vodafone (following the purchase of Cable & Wireless Worldwide), KCOM, Level 3, COLT and Verizon.

purpose of these discussions was to improve CPs' understanding of the type and quality of data we would require from them for the purpose of conducting this BCMR. It also allowed us to understand in more detail what data each CP holds and how they are recorded, such that we could request information in a manner that did not impose a disproportionate resource burden on CPs. We also sought to minimise the amount of data processing carried out by CPs, with the intention that we would obtain the raw outputs of their information systems and then process and clean the data in a consistent manner.

A15.5 Following these discussions, towards the end of 2013, we sent out a draft information request to the largest CPs in order to ensure that we would be able to obtain the data required for the BCMR 2016. We also requested that CPs provide sample data so that we would be better prepared to process the full datasets when they arrived. A further round of discussions was held with CPs to clarify outstanding questions related to the sample data, followed by another draft information request.

A15.6 In Spring 2014, we issued the final Section 135 (s135) notices to 17 fixed network operators, four local loop unbundler (LLU) operators and four mobile network operators (MNOs).[180] We discuss our choice of CPs later in this Annex.

A15.7 The data we received in response to the s135 notices are not provided in a consistent manner by CPs due to differences in their information systems. Therefore, following receipt of the information, we began cleaning and processing the data, which requires the application of a large number of cleaning rules and some assumptions (particularly with regards to the circuit data) in order to allow us to use the data for economic analysis.

A15.8 In October 2014, we published a consultation on data analysis for the BCMR, which focused on our network reach analysis and service share analysis.[181] The network reach analysis assesses the extent to which BT's competitors have laid their own networks in different parts of the UK, whilst the service share analysis looks at the shares of different types of leased lines that BT and its competitors supply.

A15.9 The consultation explained what data we had requested from operators and it provided details of our methodology for processing and analysing network reach and service share data. It also provided an initial set of outputs so that stakeholders could comment on whether they appeared consistent with their recent experience in the relevant business connectivity markets. We did not provide an economic interpretation of the outputs, rather the objective was to assist in producing two sets of data (one for network reach and one for service shares) that are sufficiently accurate to allow for reliable inferences to be drawn about competitive conditions in the current consultation.

A15.10 At the same time that the consultation was published, we sent each CP a cleaned version of the circuit and flexibility point data that they provided in response to our s135 information request. This allowed operators to review the cleaning rules and assumptions which we applied to their data and it gave them an opportunity to

[180] These notices were requests for information made using our formal information gathering powers under section 135 of the Communications Act 2003.

[181] Ofcom, *Business Connectivity Market Review Consultation on Data Analysis*, 8 October 2014. http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/

identify any errors we may have made. It also enabled them to provide further information to enable us to improve the quality of the datasets.

A15.11 As shown in Annex 5, we received several responses to the 2014 Data Analysis Consultation as well as comments from some CPs on the clean data we provided.[182] Where necessary, we also held further discussions with operators during the consultation to discuss their data. Where appropriate, we have incorporated all the feedback we received into our analysis for the current consultation. Details of how we have done so are explained in Tables A15.12 and A15.13 at the end of this annex.

A15.12 Following the consultation, we also commissioned an external auditor to review the network reach and service share models, as well as the calculations carried out for the market definition and SMP analysis, to ensure that our methodologies have been correctly implemented. We have published the findings of the audit alongside this consultation.[183]

A15.13 In light of the work that has been undertaken since the last BCMR, we believe that we have sufficiently robust sets of data to support the analysis presented in this consultation. Where certain assumptions or judgements are required and where there are limitations within the data, we have ensured that they are fully taken into account when the data is interpreted for economic analysis and that we give appropriate weight to other sources of evidence.

Scope and Coverage of the Data

A15.14 As explained in the data consultation, our information requests were informed by the scope and coverage of the data we used in the BCMR 2013. Specifically, we requested data on 'leased lines' as defined in the BCMR 2013 – i.e. a symmetric service of dedicated (uncontended) capacity between two fixed locations.[184] These are used for a variety of communications (including voice, video and data communications) and they are also used as building blocks for other connectivity services, such as virtual private networks (VPNs)[185] and IP transit.

A15.15 Although we allowed CPs to provide data on other types of connectivity (for example ADSL broadband, Next Generation Access (NGA) and ISDN), this was not a mandatory requirement and the majority of CPs did not provide us with data on other forms of business connectivity. As set out in Annex 9, we do not consider connectivity such as ADSL broadband or NGA to be part of the relevant market for leased lines. We have therefore not obtained additional information from CPs on these services.

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[182] Non-confidential versions of the responses we received can be found on the Ofcom website.

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

[183] Cartesian, 'Business Connectivity Market Review Model Audit' (April 2015)

[184] See also Section 4.2.2.3., 2nd paragraph, of the European Commission's (EC) draft Explanatory Note accompanying the EC's draft Recommendation on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services.

[185] A VPN allows users to connect multiple sites over a public telecommunications network that is software partitioned to emulate the service offered by a physically distinct private network.

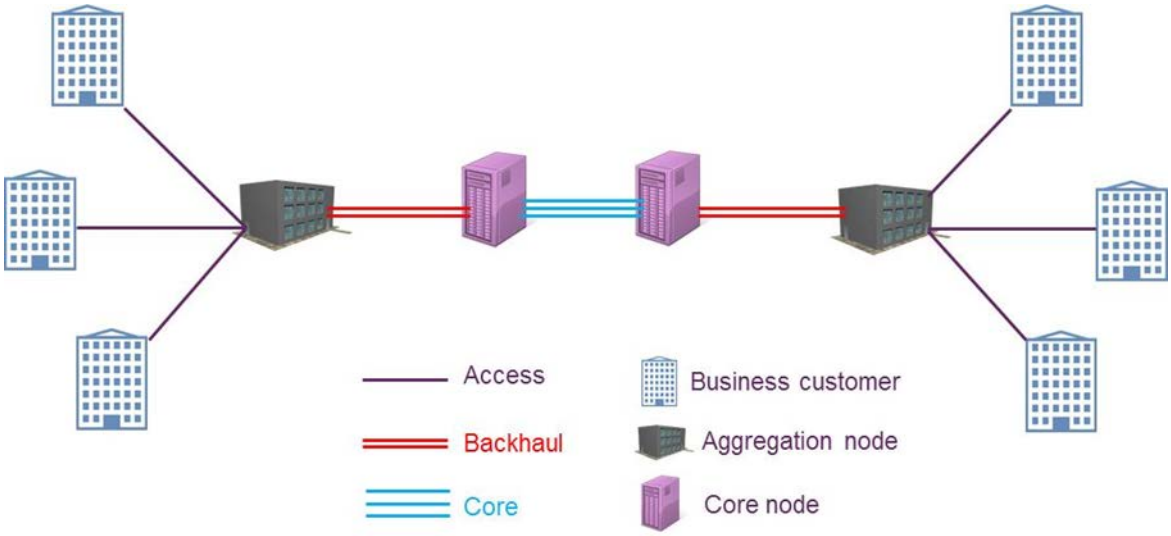
A15.16 In terms of the data we have requested on leased lines, our information requests (and this Annex) often refer to three distinct parts of a telecommunications network: core, backhaul and access. These are illustrated in Figure A15.2 below. By 'core', (also referred to as 'trunk' or 'backbone') we are referring to connections between core network nodes. These are nodes where CPs provide switching or routing of traffic and where voice, data, internet and storage services are accessed.

A15.17 'Backhaul' connections are typically the 'intermediate' links on the network between local network nodes close to the customer and the core network or, in other cases, between local nodes. Backhaul connections may aggregate together different traffic streams by service (e.g. residential broadband traffic from different customers) but economies of scale and scope in backhaul are typically less significant than in the core network.

A15.18 By 'access' we refer to connections between end-users, particularly business customers, and a local node where network equipment to backhaul traffic is located (such as a local exchange). In this market review, our primary focus is on leased line 'terminating segments', which generally refer to leased lines in the access network (though they may also include leased lines in the backhaul part of the network as well).

A15.19 The figure below provides a stylised example of this network topology. Although each CP will construct their network in a specific manner, the majority can be broadly split into the three segments above.

Figure A15.2: Stylised Network example



A15.20 In its response to the data consultation, BT queried the definition of leased lines that was used in our s135 information request and how other CPs might interpret it. BT contended there was a possibility that some CPs did not report services they felt did not fall within the definition of a leased line when actually they did. BT had two specific examples.[186]

[186] BT response to 2014 BCMR Data Analysis Consultation, Annex 1.

A15.21 First, BT felt that our use of the phrase "symmetric services of dedicated (i.e. uncontended) capacity between two locations" when defining leased lines might be misleading because, in BT's view, the terms "dedicated" and "uncontended" are not interchangeable.

A15.22 Second, BT argued that our examples of leased lines (direct connection and use of a VPN) created ambiguities around the relevant number of circuit ends and the appropriate measure of circuit bandwidth. BT proposed an alternative definition and suggested we should consider gathering additional data.

A15.23 With respect to the first concern regarding the terms "dedicated" and "uncontended", we do not believe that Ofcom's terminology has resulted in CPs failing to provide the information we require for the following reasons.

- We spent considerable time with CPs between the end of the last BCMR (April 2013) and before the start of the current BCMR (February 2014) discussing exactly what data we wanted, why we wanted it and how to improve the data collection process.
- All of the ideas from this period (including those from BT) were used to construct our draft information request which we issued to all CPs.
- We again engaged in discussion with CPs to ensure they understood what we wanted and we addressed any uncertainty.
- Feedback from the draft stage was used to modify the final information request that we sent to CPs.
- We specifically asked CPs to provide information in their format, rather than requesting they translate it into a format designed by Ofcom. This removed one layer of potential inaccuracy and where possible we also asked CPs to provide more data rather than less and let us decide what we needed.
- During our data cleaning process, where we were uncertain whether the data provided related to a leased line, we discussed it with the CP concerned. We also checked with CPs where we felt their data was insufficient or incomplete. In several cases this resulted in clarifications and additional data.
- In the data consultation, we set out the scope of our data and analysis, we sent clean data back to CPs and we asked whether there was any missing information or any issues that required further investigation or clarification. The feedback from CPs has been incorporated into our updated analysis, as explained in Table A15.13.

A15.24 With respect to the second concern, regarding our examples of leased lines (dedicated connections and use of a VPN), we again do not believe that relevant data have been omitted or misreported as a result of the way we set out our request for data. Even if CPs were initially not always certain about the data requested, we addressed this during the preparation phase and the draft information request phase. We spent considerable time with CPs explaining what we wanted, why we wanted it and how best the CPs should provide the data. During the formal information request stage, during our data cleaning stage, and during the data consultation we worked closely with CPs to ensure they understood what we wanted and we received the information we required. For these reasons we do not believe there has been a significant misreporting of leased line services.

A15.25 The task of obtaining relevant, accurate and consistent data for the BCMR is not a trivial one and we cannot guarantee that we have obtained data that is completely error-free. However, we spent considerable time working with CPs to ensure they understood what we required and we then spent further time checking submissions to our formal data request to ensure we had the data we expected. We are therefore confident that we have gained a picture of leased line services in UK that is as accurate as it can be, given the complexity of the task and the data gathering difficulties we face. Furthermore, as set out in Sections 4-6, when analysing market definition and SMP we take into account a wide range of evidence, not just service shares and network reach, to ensure that any decisions we take are based on a comprehensive assessment of the market.

Data from fixed network operators

A15.26 We requested leased line and flexibility point data from all the network operators that own or lease access infrastructure and are large enough to have a material effect on our network reach and service share analysis. Ownership of access infrastructure is important because in the BCMR we are mainly concerned with wholesale leased line services that are provided 'on-net' by CPs in the access network. By 'on-net' we mean leased lines where the CP connects its electronic equipment to physical links that it either owns and operates or leases from another company (for example LLU and dark fibre). Owning or leasing access infrastructure is a prerequisite for providing wholesale leased lines because to do so requires a physical link between two or more premises (the physical link can be a copper wire, coaxial cable, optical fibre or a point-to-point microwave radio link). We do not include information from leased line resellers in our wholesale assessment because this would constitute double counting.

A15.27 We have not sought to capture data from every single operator in the UK, but only from those which we consider could have a material impact on our network reach and service share analyses. In the light of Ofcom's industry knowledge, our experience from the BCMR 2013 and following comments received in response to the data consultation, we identified 18 operators which own or lease fixed access infrastructure and which also supply leased lines (and/or infrastructure) in material quantities. We therefore requested data from these 18 fixed network operators as the main suppliers of on-net terminating segments of leased line services in the UK.[187] As an additional cross-check, we also issued four s135 notices to large CPs that we understood not to own or lease any access infrastructure.

A15.28 The following sub-sections set out the five broad requirements of the s135 Notice sent to fixed operators.[188]

[187] In the BCMR 2013, we researched over 100 small CPs that had code powers (and can therefore build fixed network infrastructure) to test whether our analysis could be affected by not requesting data from all UK CPs. We found that the CPs to whom we did not issue an s135 request did not supply a material number of leased line circuits and, as such, it would have been disproportionate to obtain detailed information in terms of the impact on our analysis. See 2013 BCMR and LLCC Statement, Section 7, paragraph 7.62 (footnote 742)

[188] In Annex 6 of the Data Analysis Consultation we presented the s135 that was issued to fixed network operators.

Sales and purchase of leased lines

A15.29 We requested inventories of live leased line sales and purchases.[189] For each leased line, we requested information on:

- the interface used, or a product name to infer the interface;
- whether the service uses WDM technology at the customer's premises;
- the bearer bandwidth;[190]
- the bandwidth sold to the customer;
- the location of each circuit-end (either postcode or Eastings and Northings);
- whether each end is on-net or off-net;
- the annual rental price;
- the connection price; and,
- the name of the wholesale supplier for leased line purchases.

A15.30 We also requested an inventory of sales and purchases of dark fibre and duct, with information on the location of each end and the supplier (for purchases).

A15.31 As discussed above, we also allowed CPs to provide data on other business connectivity services (for example broadband and ISDN) if it was easier for them to extract data for all services from their information systems rather than a subset, though we note that the majority did not do so.

Network flexibility points

A15.32 We requested CPs to provide the Easting and Northing location details of all their flexibility points.[191] These are points where existing physical links can be accessed to connect an end-user premise and from which CPs would consider extending their network in order to provide services to additional end-user premises. Examples of flexibility points include buildings where fibre terminates on an Optical Distribution Frame or underground chambers where fibre can be accessed, such as where ducts meet at a junction. We also requested CPs to provide digital maps of their networks.

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[189] By 'live' we mean circuits that are currently active and in use.

[190] The 'bearer' refers to a transmission link that carries one or more multiplexed smaller-capacity leased line services. For example, if a system using wave-division multiplex technology is used to carry several 1Gbit/s leased line services over a single fibre connection, we would consider the wave-division multiplex system as the bearer. Similarly, if, for example, a 155Mbits/s SDH transmission link is used to carry 60 2Mbit/s leased line services then we would consider the 155Mbits/s transmission link as the bearer.

[191] Eastings and Northings provide the coordinates of any given location in the UK in metres East and North of an origin just to the South West of the Isles of Scilly.

Fibre connected buildings

A15.33 We asked CPs to provide a list of fibre-connected buildings (including both end-user/customer sites and network sites), with information on the full postal address of each building.

A15.34 Furthermore, for the buildings that were newly connected in the 2013 calendar year, we also asked CPs to provide the following information:

- the actual distance dug in order to connect the building (indicating whether this was the radial distance[192] or the route distance[193]);
- the distance between the connected building and the nearest flexibility point;
- the service the CP delivered to the newly connected building (where one was provided);
- the total cost of connecting to the building (including the cost of digging trenches, duct construction, cable installation and installing transmission equipment).

A15.35 Our analysis of dig distances and digging costs is presented in Annex 18.

Network sites

A15.36 We requested from each CP a list of their network sites, which we defined as being locations in the CP's network where they have installed transmission equipment that is used for leased lines and which is capable of serving more than one business customer. Network sites are distinct from flexibility points as the latter are physical locations from which a CP can extend their copper, fibre or coax network. Network sites are buildings where a CP has telecom equipment that allows for the transmission, switching, routing and/or aggregation of traffic. Therefore, although a network site can serve as a flexibility point, the reverse is normally not true.

A15.37 For each network site, we requested address details, a description of the site and whether it is coincident with a customer site. We also requested CPs to provide details of their interconnect points with BT (in our s135 to BT we requested details of their interconnect points with other CPs).

Network architecture

A15.38 Lastly, we requested that each CP provide a description of the architecture of their network, the way in which they provide business connectivity services and whether they have plans for network expansion in the next 5 years.

Mobile network and LLU operators

A15.39 In addition to providing connectivity for business customers, we know that a significant proportion of demand for leased lines comes from MNOs and LLU operators buying access and backhaul circuits to connect radio base stations (and

[192] This is the straight line or 'as the crow flies' distance between two points.

[193] This is the actual length of the physical connection between two points.

BT exchanges for LLU operators) to their core networks. These are illustrated in the figures below. Figure A15.3 shows mobile base stations connected to each other (sometimes via a microwave link) and/or a network or aggregation node. We refer to these access circuits as ‘mobile backhaul’ in this annex. Figure A15.4 shows a group of unbundled BT exchanges (in green) that are connected to an LLU operator’s network node. We refer to these circuits as ‘LLU backhaul’ in this annex.

Figure A15.3: MNO network example

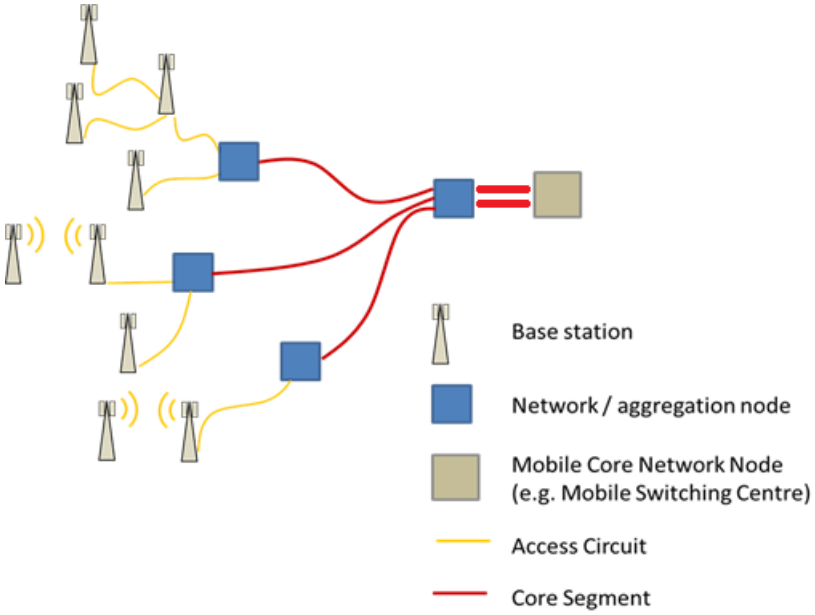
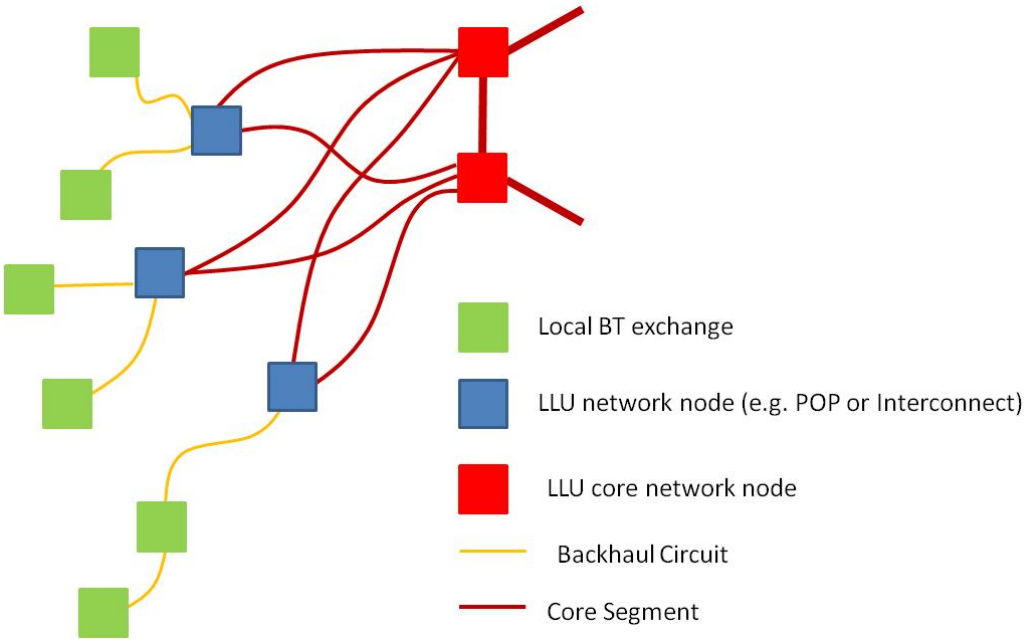


Figure A15.4: LLU network example



A15.40 Although the diagrams above are not representative of how all mobile and LLU operators construct their networks, they illustrate what we mean by mobile and LLU backhaul in the context of leased lines.

A15.41 In order to better understand how competitive conditions for mobile and LLU backhaul compare to those for other leased lines, we requested an inventory of leased line self-supply and purchases from the largest MNOs and LLU operators in the UK. For each leased line, we requested information on:

- the transmission medium (i.e. copper, fibre or microwave) for MNOs;
- the interface used;
- whether the service uses WDM technology;
- the bearer bandwidth;
- the bandwidth that is used;
- the location of each circuit-end (either postcode or Eastings and Northings);
- the name of the supplier;
- the annual rental price; and,
- the connection price.

A15.42 We also requested an inventory of purchases of dark fibre and duct, with information on location of each end and the supplier.

A15.43 In the case of predominantly LLU operators (Updata, Zen, TalkTalk and Sky), we also requested an inventory of Ethernet First Mile (EFM) sales as EFM can be used to provide a leased line.[194] As with our request to fixed operators, we asked that for each EFM sale the CP provides the bandwidth, location of each circuit end and the annual rental and connection price.

Business locations and postcode data

A15.44 In order to carry out our network reach analysis, we require data on UK business locations and postcodes. For the 2013 BCMR and LLCC Statement we used Experian as our source of UK business information. From the full Experian business database of 2011 we extracted the locations of all offices for businesses which employed 250 or more employees. For this BCMR we reviewed business database suppliers and, based on the specific requirements of the BCMR, chose Market Location as our source of UK business information.

A15.45 For the 2013 BCMR and LLCC Statement, geographic market areas were built up by aggregating individual postcode sectors. In 2011 we used Dotted Eyes[195] for an up to date set of postcodes, postcode sectors and their associated polygons.[196] For this BCMR we evaluated a number of options for a postcode database and decided to use Dotted Eyes again.

A15.46 The postcode database is also used to identify locations of businesses and network sites for our network reach analysis. Furthermore, we constructed a database of

[194] The other main providers of EFM that use LLU as a wholesale input were included in our list of fixed network operators (e.g. Vodafone and Virgin Media).

[195] Dotted Eyes is a company specialising in digital mapping and geographic information systems.

[196] For mapping purposes, the polygons for each postcode and postcode sector represent the geographic coverage of the postcode or postcode sector.

old postcodes from the Ordnance Survey such that where CPs have given an out-of-date postcode, we were able to identify the most up to date postcode.

A15.47 As discussed in the data consultation, we checked whether our choice in itself of Market Location rather than Experian as a source of data on UK business locations could materially affect the results of the network reach analysis by, for example, undermining our ability to compare results with those arrived at in the BCMR 2013. We did not find this to be the case.[197]

Physical network and flexibility point data

A15.48 In this sub-section, we explain our methodology for cleaning the flexibility point data.

A15.49 Business customers require a physical network (most commonly using copper wire, optical fibre, radio or coaxial cable) to be able to receive connectivity services. For a business to be competitively served at the wholesale level it must have a choice from among a number of alternative networks.

A15.50 In order to determine how many networks are close enough to businesses to be able to supply them competitively, we need to know the location of businesses and the location of networks. We obtained the former from Market Location whilst network location information was gathered from CPs who own or have access to physical network infrastructure (including dark fibre and LLU). From the business and network location information we were able to build a map showing where independent networks exist that can serve the needs of business consumers.

A15.51 For the 18 CPs we identified as owning fixed network access infrastructure we requested digital maps of their network, the locations of their flexibility points and network nodes.

A15.52 During our discussions with CPs about the BCMR data requirements (in advance of issuing the final s135 notices), two issues were raised about our definition of flexibility points. The first was that certain CPs stated that they are not constrained by flexibility points when looking to extend their network, i.e. they will consider extending from any point on their duct network. In order to take account of this, we requested digital maps of CPs' duct networks to extract a set of points representative of their infrastructure. In areas where concentrations of businesses are relatively high, flexibility points tend to be relatively close to each other and there is little difference between the results of the network reach analysis when based on flexibility points and when based on duct.

A15.53 The other issue some CPs noted is that not all manholes and footway boxes could be considered as flexibility points based on Ofcom's definition, as in some cases the CP would not consider extending their network from certain points (for example a manhole providing the CP with access to a long distance link). Furthermore, it may not be possible to extend the network from some flexibility points for other reasons, for example there may be no space in the duct.

[197] Ofcom, *Business Connectivity Market Review Consultation on Data Analysis*, 8 October 2014, paragraph 2.32.

A15.54 On this point, we note that although access to a physical network can be constrained by lack of capacity, physical obstacles or specific planning rules, no CP was able to consistently identify flexibility points that were unavailable. In addition, capacity constraints and similar obstacles are often likely to be temporary. Given that all CPs may suffer from such limitations to their physical network access, we propose to treat all flexibility points as being equally available.

Processing and cleaning

A15.55 In many cases flexibility point data was provided as Eastings and Northings. Where data was provided as Latitude and Longitude we used MapInfo to convert to Eastings and Northings. Where locations were provided as postcodes we used our postcode database to convert to Eastings and Northings. In some cases CPs provided their network as .kml or .kmz files. Such files can be read to provide a list of coordinates that we can use. Other corrections we made include:

- converting text to numbers;
- removing leading zeros from Eastings and Northings;
- splitting 12 digit references into two 6 digit Eastings and Northings;
- converting two letter based 4 digit references to 6 digit references;
- requesting missing and incomplete references;
- checking the total number of flexibility points against the last BCMR totals; and
- checking the total number of flexibility points against artificial limits e.g. 65k lines for older version of Excel.

A15.56 As a further check we plotted the data received and performed a set of visual checks, which involved:

- checking each dataset against the 2013 results[198] to compare coverage;
- comparing the network coverage plot to any information available from the operators' websites regarding network coverage;
- performing a further sense-check by asking our internal experts to compare the network coverage as arrived at through our analysis with their knowledge of the topology of different operators' networks;
- checking that locations in Northern Ireland had been correctly coded as NI coordinates can be referenced to the Great Britain origin or to the Irish origin; and
- contacting the CP in all cases where the above checks raised concerns so as to discuss the matter until the concern was dealt with.

[198] We note that the results presented in the BCMR 2013 were based mostly on data collected in 2011, meaning there is a three year period between the two datasets.

A15.57 It is important to understand the accuracy of the location data we gather and the physical nature of business sites. In particular:

- The accuracy of CP-supplied flexibility point data varies, with some data given in 1 metre Eastings and Northings and other in 10 metre Eastings and Northings.

- The accuracy of postcode-derived locations (which are relevant to our data on UK businesses) depends on the size of the area covered by the postcode. By using the postcode of a business to identify its location, we assume that the business is positioned at the centroid of the postcode (this is mean grid reference of all addresses in that postcode). The maximum number of delivery points covered by one postcode is 100 and the average is 15.[199] Typically, postcodes are small in densely populated and business regions and large in rural regions. In the table below, we present the cumulative distribution of postcode radii (assuming postcodes are perfect circles[200]) in different areas of the UK.

- Business sites cover an appreciable area and a single point location cannot describe it completely. For example, if we were able to identify the precise Easting and Northing of a business it may be located in the centre of the building, whereas the fibre-entry point may be towards the front of the building. This could be tens of metres away.

Table A15.1 Distribution of postcode radii

Radius (m)	CLA	LP	CBDs	All UK
<=10	62%	12%	8%	8%
<=50	98%	75%	66%	46%
<=100	100%	97%	96%	78%
<=150	100%	98%	98%	82%
<=200	100%	99%	99%	85%

A15.58 Therefore, any interpretations of our network reach analysis should take into account the degree of accuracy we are able to achieve in locating flexibility points and businesses.

[199] http://data.ordnancesurvey.co.uk/ontology/postcode/PostcodeUnit

[200] This assumption is inevitably a simplification but it is done to provide an illustration of the differences in postcode sizes.

Leased line data

A15.59 In this sub-section, we explain our methodology for cleaning the leased line (or circuit) data. In order to understand the data that Ofcom has obtained on leased lines, it is important to understand the context in which leased lines are sold and purchased in the UK.

A15.60 Leased lines provide dedicated transmission capacity between fixed locations. They are part of a complex value chain and both CPs and end-user organisations use them in a variety of ways, for example to access the internet or private voice and data networks, backup and disaster recovery, remote monitoring and telemetry applications. Furthermore, many end-user organisations do not purchase leased lines as distinct services but instead do so as part of a bundle also including other services (for example a business with multiple offices may purchase an ICT package from a systems integrator, which uses leased lines to connect the offices together).[201]

A15.61 In the BCMR, there are two broad categories of leased line use on which we require data:

i) The most straightforward way in which leased lines are used is to provide point-to-point connectivity between two sites. So in Figure A15.2 above a business customer might purchase a leased line to connect two of its sites.

ii) The more complicated scenario is where leased lines are used as inputs into another connectivity service, for example a virtual private network (VPN), or form part of a wider suite of ICT services (which might include, for example, managed IT services, cloud storage or application hosting). In this case, neither the CP nor the customer may refer explicitly to the leased line in their commercial agreement as it is simply one of many inputs into the service being purchased.

A15.62 This has important implications for the collection of data on leased lines because CPs generally have better information on the first category. In the case of the second category, some CPs cannot directly source leased line data from sales databases because these will only record the service provided (for example an IPVPN) with no information on the underlying technical inputs.

A15.63 As a result, our request for leased line data often requires CPs to draw on a number of internal databases and information systems. For example, some might source data from a customer billing database as well as a network or engineering database. A further complication is that circuit data on sales and purchases are often recorded on separate systems and may not always match. For example, if a CP purchased an EAD circuit from BT Openreach and this was used to provide a VPN, this could be identified as a leased line purchase in the CP's billing records but it may not appear as a leased line sale in a sales database if the latter only records the VPN.

A15.64 Another issue affecting the provision of leased line data is that some CPs that have merged with other operators in recent years have not yet finished amalgamating

[201] Section 2, Ofcom, *Business Connectivity Market Review*, 28 March 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/Sections1-4.pdf

records from different sources, meaning that data has to be gathered from different IT systems. These may not always be consistent.

A15.65 The main consequence of these issues is that the majority of CPs are unable to provide all the information we seek for each circuit. In particular, there is often insufficient information to determine the geographic location and bandwidth of a circuit. As discussed below, we deal with this by using uplift allocations.

A15.66 In its response to the data consultation, BT noted that there can be ambiguity in the bandwidth and circuit count when an operator provides connectivity between a business' head office and a number of branch sites; it gave an example of a head office being connected to three branch sites. A direct connection or 'end-to-end' count would report three connections going to the head office site (one from each branch) but if an operator provided the information based on access tails, the head office may just have a single connection of a bearer bandwidth (which must be greater than the aggregation of traffic from each individual branch).[202] BT's solution to this problem was to suggest that we request data on access bearers only (i.e. data on each single end).

A15.67 BT is correct that the count of services might be different in these two scenarios, and there may be some instances where two operators are providing an equivalent service (e.g. connectivity between a head office and three branch offices) but one reports three end-to-end connections (i.e. six customer ends) whilst the other reports four access tails. In this respect, although we asked CPs to provide both the bandwidth of the service sold and the bandwidth of the access bearer, we are restricted in terms of the data that CPs hold, with some reporting end-to-end leased lines and some reporting tails. Furthermore, where data is reported in a single-ended manner it is generally not possible to infer what the other end is. Where data is reported in an end-to-end manner, it is not possible to group multisite connections together.

A15.68 In practice, this issue only relates to a subset of multisite connectons and, notwithstanding that most operators have only reported the bandwidth that is sold, we do not believe it is likely to have a material impact on our analysis.

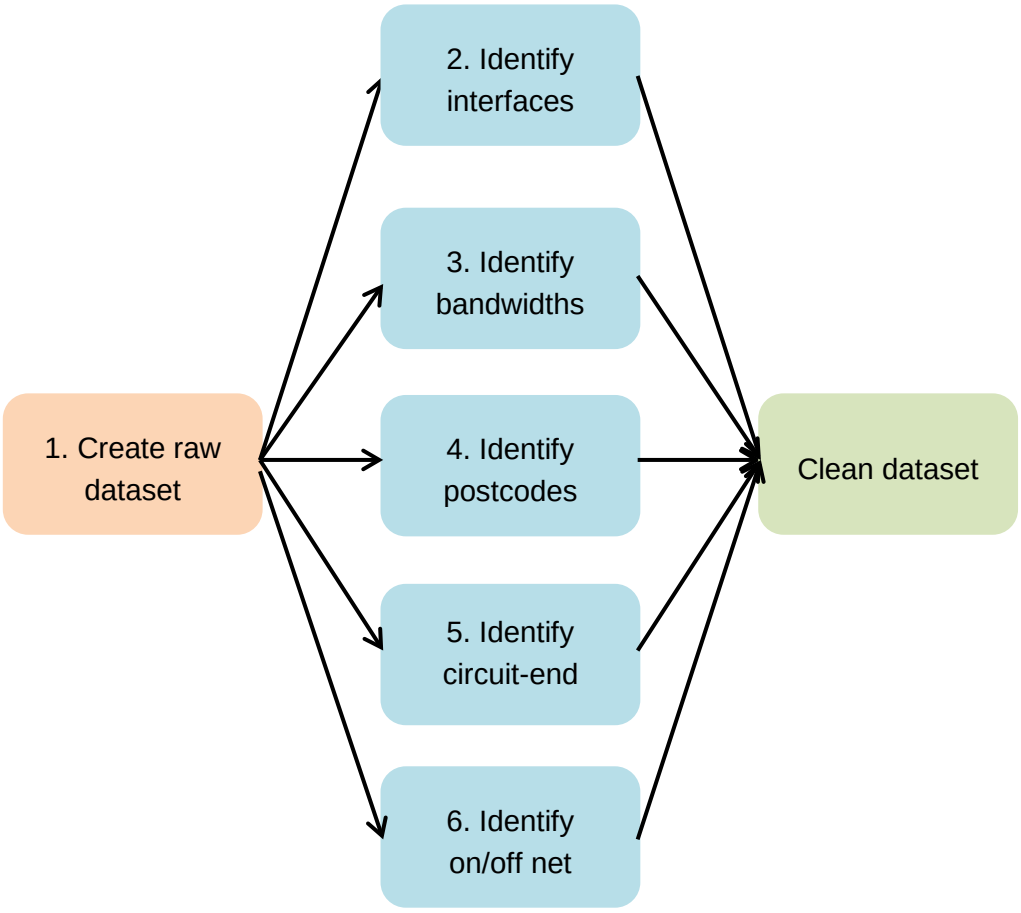
A15.69 We also note that this issue is one of a number of complexities involved in collecting granular data on leased lines, as discussed above. In addition, and although these data are an important source of evidence, service shares are only one of a number of relevant indicators which we take into account when assessing market definition and SMP.

Processing and cleaning

A15.70 There are a number of steps involved in processing the leased line data we receive from CPs. This is illustrated in the figure below.

[202] BT response to 2014 BCMR Data Analysis Consultation, Annex 1.

Figure A15.5: Circuit cleaning process



Create raw dataset

A15.71 Following the 2013 BCMR and LLCC Statement, we decided that all data cleaning and processing should be done by Ofcom rather than by CPs to ensure consistency. We therefore asked CPs to provide unprocessed data from their own databases, where possible, so that we could apply a set of cleaning rules in a consistent manner (rather than sending a template that requires CPs to carry out their own processing). Therefore, the first step in the data cleaning process was to compile a list of leased line circuits (both sales and purchases) into one large dataset called 'RawData'.

A15.72 We did this by creating several fields to manage the data. These are listed in the table below.

Table A15.2: Raw Data Fields

Field	Description
ID	A unique Ofcom generated ID for each circuit
File	Name of the file containing source data (in order to check against raw data provided by CPs)
Worksheet	Worksheet that the source data is contained in
CP	Name of CP providing the data
Category	'W' to indicate a sale and 'P' to indicate a purchase
CircuitID	Any circuit ID information provided by the CP
CircuitType	Information provided by the CP on technology or interface or method of delivery
CircuitType_2	An additional field for CPs that provide further information on technology/interface/delivery
Product	Product name used by CP
Product_2	An additional field for CPs that provide further product information
Bandwidth	Bandwidth that is being sold (or purchased)
Bandwidth_bearer	Information on bearer bandwidth where provided
Customer	Information on customer where provided
Supplier	Information on circuit supplier where provided
A_address	There are three fields for the A-end address (for example some CPs have one column for street address, another for city and another for country)
A_postcode	The postcode of the A-end of the circuit
A_easting	The easting of the A-end where provided
A_northing	The northing of the A-end where provided
B_address	There are three fields for the B-end address (for example some CPs have one column for street address, another for city and another for country)
B_postcode	The postcode of the B-end of the circuit
B_easting	The easting of the B-end where provided
B_northing	The northing of the B-end where provided

WDM	Information on whether the circuit uses WDM equipment at the customer's premise (where provided)
OnnetA	Information on whether the A-end is on-net or off-net
OnnetB	Information on whether the B-end is on-net or off-net
Price_period	The time period for which the rental price is given (monthly, quarterly or annually)
Rental_price	The rental price of the circuit (where provided). Usually given on an annual basis but sometimes it is given by month.
Connection_price	The connection price of the circuit (where provided)
Currency	Currency of the price information (e.g. pounds sterling, euros etc)
Status	Status of the circuit (e.g. live, cancelled)

A15.73 We then created a mapping file that lists all of the source data files provided by CPs. In their submitted files, the CPs include their own field headings to provide information on each circuit. For each field given by the CP, the Ofcom mapping file identifies which field we have used in creating the 'RawData' dataset. For example, two CPs may provide information on interface but in the files they have provided, one will use a field called 'Interface' and another will use a field called 'Technology'. The mapping file shows that for the first CP, we will map data from the 'Interface' column into the 'CircuitType' column in our dataset. For the second CP, we would map data from the 'Technology' column into the 'CircuitType' column.

A15.74 We did not expect to (and did not) find entries for every heading in the data from every CP. The purpose of multiple headings is to gather the most data from each CP and then use our cleaning process to extract the information we require.

A15.75 Having finished this part of the process, we then use the 'RawData' file to start the data cleaning. At this point, we have information on 888,948 circuits (though not all of these are leased lines as some CPs provided information on other types of connectivity and services). This is less than the 918,730 circuits reported in the Data Analysis Consultation due to the removal of duplicate and inactive circuits (see Table A15.13 below for further details).

A15.76 In order to make the data useful for economic analysis (for example to understand whether competitive conditions differ across interface types, bandwidth and geographic areas), we need to produce a set of circuit records which has the following information recorded in a consistent manner:

i) interface;

ii) bandwidth;

iii) postcode for each end;

iv) whether each end is a network site or a customer site; and

v) whether each end is on-net or off-net.

A15.77 We explain how we identify these categories below.

Identify interface

A15.78 A CP that supplies an electronic communications service needs to provide an interface to the customer that complies with a technical standard which the customer requires, for example Ethernet, SDH or PDH.

A15.79 For the purposes of our analysis of circuits by interface type, we classify circuits into the following four categories:

- we identify services that directly fall inside the scope of relevant BCMR markets and which operators often refer to in their responses (for example analogue, EFM, Ethernet, Fibre Channel, FICON, SDH and PDH);
- we identify services that are outside of the scope of the market (for example ADSL, NGA, CCTV and Broadcast Access);
- we identify delivery mechanisms that are relevant to the market review (for example radio/microwave and WDM); and,
- we identify circuits that can be grouped into broader categories (for example ATM, Frame Relay and X.25 can all be considered as services likely to be delivered over TDM-based technologies).

A15.80 Although not all of our categorisations would be considered as ‘interfaces’ from a technical or networking perspective, we use the term ‘interface’ to describe how we categorise the circuit, based on the considerations listed above.

A15.81 In order to identify the interface of each circuit in our database, we follow a sequential approach. First, we use information in the two ‘CircuitType’ and two ‘Product’ fields by creating a set of translation tables that identify the interface of each circuit type and/or product (so, for example, the table would create a rule whereby BT Openreach EAD products would be classified as Ethernet and KCOM’s Kiloline products would be classified as PDH/SDH). Where it is possible to infer two or more different interfaces from these fields (for example if the circuit type is given as SDH but the product name contains the word ‘Ethernet’) we have sought to clarify with CPs the correct interface.

A15.82 Table A15.3 below lists the relevant interfaces in our clean dataset, which are based on our analysis of the different circuit type and product combinations. From this list we can remove circuits that do not fit our definition of leased lines.

Table A15.3: List of circuit interfaces used in cleaning process

ADSL
Analogue
ATM
Broadcast Access
CCTV
Dark fibre
EFM
Ethernet
Fibre Channel
FICON
Frame Relay
NGA
PSTN/ISDN
Radio/Microwave
SDH and PDH
SDSL
WDM (bearer)
WDM (wavelength)
xDSL
X25
Other (not leased line)
Unknown

A15.83 On this basis, we have been able to classify 93% of circuits in the dataset. For the remaining circuits, there was either no information on circuit type or product or the information was not sufficient to infer an interface (for example “Internet Access”). Where direct information on the interface was missing, our next step was to indirectly determine the interface using information on the bandwidth of the circuit as certain bandwidths are typically associated with specific interfaces (for example 155Mbit/s is associated with an STM-1 carrier, which is delivered using SDH). In doing so, we made the following assumptions. This step allowed us to classify the interface of an additional 6% of the circuits in the dataset, or more than 99% overall (just less than 7,000 circuits could not be classified).

Table A15.4: Bandwidth and circuit category assumptions

Bandwidth	Circuit Category Assumption
Up to 9Mbit/s	SDH/PDH
34, 45, 144, 155 and 622 Mbit/s	SDH/PDH
Multiples of 10Mbit/s or 100Mbit/s (up to and including 1Gbit/s)	Ethernet
Above 1Gbit/s	WDM
Different download and upload speeds	ADSL (up to 30Mbit/s download) / NGA (above 30Mbit/s download)

A15.84 During the data consultation, we sent each operator a cleaned version of the data they provided as well as the relevant parts of our interface translation tables. The majority of operators said that our classifications were correct and that no changes were required. Where operators did identify a mistake, we have amended our cleaning rules in order to correctly classify these circuits, as explained in Table A15.13 at the end of this Annex.

A15.85 In our revised dataset, we have information on 605,968 leased line entries (both on-net and off-net).[203] The other circuits are either purchases or not leased lines. We have excluded the 7,000 circuits where we do not have any information from which to infer an interface (and operators have been unable to provide further information). If we were to include them, the most appropriate way to do so would be to allocate them to interface categories in the same proportions as circuits with known interface types but, as discussed below, this would be extremely complicated due to the other allocations required in the model. Furthermore, a proportionate allocation would not have a material impact on our service share analysis given the volume of leased lines in our defined markets and the relatively small number of circuits without an interface. Given that these circuits account for such a small proportion of the total, we do not believe their exclusion will have a significant impact on our results.

A15.86 In its response to the data consultation, BT suggested carrying out four sensitivities whereby the missing circuits would be defined in turn as SDH/PDH, Ethernet, WDM and 'Other'.[204] Having considered BT's proposal, we do not believe that it would be useful to consider extreme scenarios where the unclassified circuits are allocated to

[203] The actual number of leased lines is slightly higher (just over 607,000) because some operators have reported multiple circuits in one entry.

[204] BT response to 2014 BCMR Data Analysis Consultation, paragraphs 22 and 71.

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

one specific interface, especially the high bandwidth segment of leased lines given that the latter only make up just over 1% of our total count of known interfaces. We have no evidence to suggest that a CP's unclassified circuits are disproportionately likely to fall into one interface category.

Identify bandwidth

A15.87 In the s135 notice, we requested information on both the circuit bearer bandwidth and on the bandwidth sold. The reason for doing so is that mixing the two can lead to inconsistent and biased analysis when the data are aggregated. For example, suppose two CPs each provide five 100Mbit/s services in a particular postcode using a 1Gbit/s bearer. One CP could report five sales whereas the other may just report the bearer. In this case, both CPs are providing the same service in the same quantity but the data would suggest that the first CP is selling more connections.

A15.88 We would ideally classify bandwidths using one option (bearer or service sold) but the data we have received consists of a mix of the two (with some CPs only able to provide one type of bandwidth). We have received significantly more information on the bandwidth that is sold/purchased and so we use this measure in the clean bandwidth data.[205] This is also our preferred metric because it reflects the services that customers are receiving and paying for.

A15.89 Our processing of bandwidth information was carried out in two steps. The first step was to consider circuits where the only bandwidth information we had was a single number. The measurement unit was mostly consistent within each CP dataset but not always. We therefore applied the following cleaning rules:

- if the bandwidth number was less than or equal to 10,000 we kept the number on the basis that it was given in Mbit/s; and,
- if the number was greater than 64,000 we divided it by one million on the basis that it was given in bits.

A15.90 In cases where we had some non-numeric information on bandwidth (for example where a unit was given, such as '100M' or when the bandwidth could be inferred from a certain standard, such as STM-1), we used a process similar to the one used for cleaning interfaces. We created translation tables for different combinations of bandwidth, circuit type and product fields (as bandwidth information is sometimes contained in the circuit type or product fields) and identified the appropriate bandwidth for each combination. This allows us to convert bandwidths into a consistent unit (Mbit/s). Where the entry was not a leased line (for example ADSL, colocation services etc.) the bandwidth field was given as null.

A15.91 We also have an additional step where we identify the bandwidth based on other information that has been provided by CPs. For example, where the bandwidth is missing and the interface is EFM, the bandwidth is likely to be less than 30Mbit/s - 40Mbit/s and so we identify it as such. Furthermore, if operators tell us that circuits with missing bandwidth information are likely to be in a particular range (for example below 100Mbit/s, above 1Gbit/s etc) then we can incorporate that information here, before the uplift process.

[205] Though in many cases, the bandwidth that is sold is the total circuit capacity, especially for Ethernet services.

A15.92 Following the data consultation, operators either told us that we had correctly identified the bandwidth of most of their circuits (where it was given) or raised no objections. The main exception was that our clean data did not include the bandwidth of Ethernet (and other AISBO) circuits greater than 1Gbit/s. This has now been corrected.[206]

A15.93 Having cleaned the data using the methodology described above, 93% of leased line circuit-end sales in our dataset have an identifiable bandwidth. Where we do not have bandwidth information, we use the uplift process described below.

Identify postcodes

A15.94 In order to carry out a geographic analysis of leased line circuits, we need to establish the postcode of each circuit end. Using the postcode information that operators provided, we validated each one against a database of old and new postcodes (the old postcodes are sourced from the Ordnance survey and the 2014 postcodes are sourced from Dotted Eyes). This allows us to filter out erroneous postcodes and update postcodes that are no longer in use.

A15.95 During its external review of service share and network reach models, Cartesian noted that our postcode database contained a number of postcodes with multiple locations (i.e. the same postcode would appear more than once with a different Easting and Northing). This is driven by the Ordnance Survey data and is partly due to the fact that postcode boundaries shift over time. In our model, we use the most recent location of a postcode when identifying a circuit's location (this is the same approach used in the 2013 BCMR) as we do not know when each circuit was recorded in a CP's database. Given that our analysis ultimately aggregates circuits at a postcode sector level (and our geographic markets are further aggregated to broad areas) we do not believe that this issue has a material impact on our analysis. In its review, Cartesian also came to this conclusion.[207] However, it does highlight a difficulty that would arise if we carried out our analysis at the postcode level.

A15.96 In addition, when reviewing the Ordnance Survey data we found that it included a large number of Post Office (PO) Boxes, which usually have their own postcode. A circuit end that is reported to terminate in a PO Box is unlikely to be an accurate indicator of the circuit location (e.g. it is more likely to represent a billing address). We found that less than 0.5% of circuit-ends were reported with a PO Box postcode. Given the relatively small proportion, we do not believe this will have a material impact on our analysis. For the purposes of our model, we have removed these PO boxes from our postcode list and so these circuits are allocated as part of our uplift process.

A15.97 Once this geographic cleaning has been carried out, we have 'clean' postcode data for 81% of circuit-ends. A significant proportion of the missing postcodes for leased line sales (around 55%) are relevant to the B-ends provided by two CPs, which both stated that most of their B-ends are network sites. Where the B-end for these CPs

[206] A further issue related to this was that AISBO circuits with bandwidths greater than 1Gbit/s were erroneously excluded from our 2014 service share estimates for the MISBO markets in Table 8 of the Consultation. This was due to an error in the identification of relevant markets in the service share model and it has now been corrected.

[207] Cartesian, 'Business Connectivity Market Review Model Audit' (April 2015)

is a customer site, the information is given in a separate field and a postcode is provided. We sought further information from these CPs where postcodes were not provided for the B-end and obtained some additional postcode data during the data consultation. The additional postcodes we received appeared in the list of network sites provided by the operators, providing us with assurance that the B-ends with missing postcode information for these CPs are network ends. Given that we are primarily interested in customer sites (as discussed below), the fact that these B-ends are missing postcodes should not represent a material issue for our service share analysis of terminating segments. The table below shows the distribution of postcode information for leased line circuit-ends.

Table A15.5: Postcode and circuit-end information

Category	Proportion of circuit-ends
Postcode is known	81.3%
End is not in the UK	0.4%
Classify end based on product information (e.g. EFM and SDSL)	1.7%
Classify end as 'network' based on CP information	10.3%
End is assumed to be a customer (no other information)	6.3%

A15.98 Where we do not have postcode information for non-network sites, any aggregated analysis of the data will need the application of uplifts, which are discussed below.

A15.99 In its response to the data consultation, BT argued that the proportion of circuit data without postcodes will introduce large error margins in the results and that our treatment of around half of them as network sites is not appropriate. This is partly because some of these ends may well be customer sites and also because it will understate the above two CPs' service shares in the scenario where we count circuits as customer ends if they terminate in a joint customer-network site.[208] We accept that the latter point would be valid if some of the excluded network sites were in fact joint customer-network sites and we explain our solution below in the identification of circuit-end types.

A15.100 As to whether it is appropriate to treat all B-ends with missing postcodes as network ends for the above two operators, we believe this is reasonable given the information the two CPs have provided. As noted above, this information has

[208] BT response to 2014 BCMR Data Analysis Consultation, paragraphs 94-100.

provided us with assurance that treatment as network ends is appropriate. We apply similar assumptions when a CP provides us with information about the interface of one of their products, which we use in our data cleaning process. Furthermore, where the two operators have B-ends that terminate at a customer site, the postcode has been provided and we include this in our service share estimates.

Identify on-net and off-net circuits

A15.101 In the BCMR 2013, we noted that CPs do not generally explicitly record whether their sales of leased lines use infrastructure that they own or lease or instead use a wholesale leased line service that they have purchased from another CP.[209] We therefore requested leased line data from CPs split into three categories:

- retail sales (i.e. to end users other than CPs);
- wholesale sales (i.e. sales to other CPs); and
- wholesale purchases (i.e. purchasers from other CPs).

A15.102 Given that retail sales include instances where a CP resells a leased line that it has purchased from another operator, we calculated wholesale service shares by inferring wholesale supply using the following calculation.

$$Wholesale\ Supply = \begin{pmatrix} Wholesale\ circuit\ ends\ sold \\ + \\ Retail\ circuit\ ends\ sold \end{pmatrix} - \begin{pmatrix} Wholesale\ circuit \\ ends\ bought \end{pmatrix}$$

A15.103 In theory, this formula is appropriate. For example, if a CP uses only circuits purchased from another CP to reach customer sites in a certain postcode, its supply volume will net off to zero once we have subtracted its wholesale purchases.

A15.104 In practice, however, there were two main reasons why this approach did not always give an accurate estimate of wholesale supply. The first is that, based on our discussions with CPs following the end of the BCMR 2013, we found that a number of CPs had difficulty distinguishing between what Ofcom defined as 'wholesale' and 'retail' sales of leased lines. This distinction is not generally made by CPs, especially when they source data from engineering databases, and so asking CPs to extract it can lead to errors.[210]

A15.105 The second issue is that, as discussed above, CPs often use different databases to record sales and purchases. These are not always consistent and the sales databases are often missing more address/postcode information than the purchase databases. One consequence of this for the BCMR 2013 was that there were instances where the above equation resulted in negative wholesale supply for some

[209] Paragraph A5.11 in Annex 5, Ofcom, *Business Connectivity Market Review*, 28 March 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes1-7.pdf.

[210] Although such errors should not affect the overall estimate of wholesale supply using the above formula, they could lead to errors in estimating the size of the merchant market (i.e. sales between OCPs).

CPs in certain postcode sectors (i.e. they recorded greater (net) wholesale purchases than their overall retail sales implied they would need).[211]

A15.106 Having discussed this issue with CPs after the BCMR 2013, we found that the majority were able to identify leased line sales that used infrastructure that they own and/or lease. Such sales are generally referred to as 'on-net'. A leased line that is provided using a third-party purchase is referred to as 'off-net'. The benefit of having on-net and off-net information is that it allows us to estimate wholesale supply of leased lines directly (by only counting on-net sales) rather than inferring it from the equation (1) above. It also avoids relying on CP data that might be sourced from two or more inconsistent databases (e.g. sales and billing).

A15.107 In terms of processing the on/off net information, for each circuit sale, operators indicated whether each circuit end was on-net, off-net or unknown (or left blank). As there are only three choices (as opposed to interface and bandwidth where there are many potential responses), we processed the information accordingly.

A15.108 As with our approach to identifying bandwidth, we have a further step of identifying on/off net circuits using additional information. For example, if operators tell us that circuits of a certain interface are generally on- or off-net then we identify those here. Having carried out this processing, the majority of respondents were able to provide information for most of their leased line circuit sales (around 90 per cent in total).[212]

A15.109 For operators where we were missing on-net information for a significant proportion of their circuit sales (we set a threshold of more than 10%), we use the information they provided on postcodes and mapped this against the operator's nearest flexibility point. If the circuit-end is within 200 metres of the flexibility point, we have classified the circuit as on-net, otherwise it is off-net (if the postcode is not known then we leave the on-net classification as unknown).[213] For the remaining ends where we do not have on-net or postcode information, which account for 2% of leased line ends in our database, we have applied a set of uplift allocations (discussed below).

A15.110 In order to ensure that the above methodology is sensible, we have compared the number of off-net sales for the relevant CPs (after we have used postcode information to fill any on-net information gaps) with the number of purchases they report and have not found them to be significantly different.[214] This is supported by our analysis in Table A15.10 below, which shows that our service share results in high volume segments are not significantly different depending on whether we use the 'on-net' approach or the 'sales minus purchases' approach.

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[211] Paragraphs A5.132 and A5.141-A5.145 in Annex 5, Ofcom, *Business Connectivity Market Review*, 28 March 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes1-7.pdf.

[212] The on-net/off-net distinction is not relevant to leased line purchases as these are by definition all off-net.

[213] We note that this assumption is used to classify circuit-ends and is therefore distinct from the buffer assumptions that are used in our geographic market analysis (where we are assessing local supply conditions).

[214] We would not expect the figures to reconcile completely due to the data inconsistencies mentioned above.

Identify circuit-end types

A15.111 In our service share analysis we need to determine whether leased lines terminate at a customer site (by "customer" we mean an end-user that is not a fixed operator[215]) or at a network site. As discussed above, some CPs have sourced their data from sales or billing databases, where circuits are more likely to be recorded on an 'end-to-end' basis (i.e. the two ends will represent customer locations). In cases where CPs have sourced data from network or engineering databases, the circuits are more likely to be recorded from a network perspective, meaning that one end is often a network end. Therefore, any analysis that aggregates the circuits assuming that each entry is a complete 'end-to-end' circuit is likely to result in errors because the units are not consistent. To illustrate this point, consider the following generic example of a circuit between two points, A and B. These could be the location of two business sites (e.g. different branches of a bank).

Figure A15.6: Generic circuit diagram

A15.112 In this diagram, the leased line passes through two network sites at locations N^1 and N^2. Where a CP has recorded sales on an end-to-end basis, it would record one entry for this sale, with the A and B ends represented accordingly. However, if the data are sourced from a network inventory, the CP would record three entries, one for the A end (which it would show as connected to N^1), one for the B end (which it would show as connected to N^2) and one for the link between N^1 and N^2. By not distinguishing between customer and network sites, we would assume that the first CP sold one circuit and the second sold three, even though they are providing the same service.

A15.113 We did not ask CPs to classify whether circuit ends were network or customer sites in their s135 responses because our experience from the BCMR 2013 was that CPs do not usually know when a circuit terminates at another CP's network site (i.e. they only know the locations of their own network buildings).[216] Requesting this information again would therefore have not been appropriate as we would not have considered it reliable.

A15.114 Therefore, in order to identify network ends, we have built a list of postcodes of network sites that is drawn from CP responses to part D1 of the s135 on their network site locations. Based on this data, we have a list of around 9,000 unique postcodes where there is at least one network site located (including BT

[215] We include mobile network operators in our definition of end-users as MNOs purchase leased lines for backhaul.

[216] Paragraph A5.57 in Annex 5, Ofcom, *Business Connectivity Market Review*, 28 March 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes1-7.pdf.

exchanges). We then carry out a matching exercise of these postcodes against the postcodes for each circuit-end in our database. If a match is found, we categorise that circuit end as a network site and if no match is found, we assume it is a customer site. Where there is no postcode, we do one of the following:

- check whether the circuit end is located outside of the UK using the address information that CPs have provided – if this is the case then we define the end as 'Non_UK' and it is not included in our service share calculations (Non-UK ends account for approximately 0.5% of leased line circuit ends);

- categorise it using information given to us by CPs (for example, as discussed above, in some CP datasets the B-end is generally a network site), which allows us to classify 10% of leased line ends;

- for certain products (specifically EFM and xDSL), one end is always a network site (usually a BT exchange) and so if there is missing postcode information for one end and the other end is a customer site, we assume the former is a network site (this allows us to classify around 2% of leased line ends); or else,

- we otherwise assume it is a customer site.

A15.115 The last assumption affects 6% of leased line circuit-ends. We have run our service share model assuming that unknown ends are network ends and the service shares in each market by operator do not significantly change so this assumption does not impact our interpretation of the results.

A15.116 This was the same approach we used in the BCMR 2013.[217] The benefit of the approach we have taken is that all CPs are treated alike and so any errors in the circuit allocations will be unbiased across CPs. There are, however, two important caveats to bear in mind with our approach. The first is that postcodes cover a number of buildings and so a circuit which terminates at a customer building in close proximity to a network site could be mistakenly classified as a network end in our methodology. In some cases, a customer site may even be in the same building as a network node and so the same mistake would be made. As discussed below, we have mitigated this by obtaining data from CPs on whether any of their network nodes are coincident with a customer premise (this includes some data centres). This allows us to exclude these postcodes when identifying network sites.

A15.117 Customer sites that are close to (but not coincident with) network sites would be excluded from our analysis by the above approach, but we expect that such omissions are unlikely to have material effect. This is because we assess service shares at the postcode sector level and, on average, there are 160 postcodes per postcode sector, meaning that customer sites and network sites will in most cases have different postcodes and so are unlikely to be confused. The main exception to this could be data centres, many of which are likely to host a significant number of customer connections and network nodes. However, as discussed in Annex 20 we have defined the largest data centres as core nodes within the AI market and therefore links between these are considered competitive. We do not therefore

[217] Paragraphs A5.57-A5.66 in Annex 5, Ofcom, *Business Connectivity Market Review*, 28 March 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes1-7.pdf.

need to include customer ends at these datacentre sites in our analysis of service shares for terminating segments.

A15.118 Our service share analysis is based on customer ends only and excludes leased line sales to the fixed network operators we have requested data from. So if Vodafone purchased a leased line from Virgin to connect two of its network sites, we would not count this in the service share analysis because in this case, Vodafone is the end-customer. As discussed above the focus of our analysis is on the access network. Although we have also calculated shares for MNO and LLU backhaul.

Joint customer-network sites

A15.119 Following our discussions with CPs after the last BCMR, we requested additional information as to whether each CP network site was coincident with a customer site (we refer to these hereafter as joint 'customer-network sites'). This was primarily for two reasons:

i) some CPs locate network sites at a customer's premise; and

ii) many customers require connections to data centres, which serve as network sites for a number of CPs.

A15.120 In the data consultation, we presented indicative service share estimates based on two scenarios: one where we treated all customer-network sites as network sites and another where we treated them as customer sites. This approach led to some significant variations in service share estimates, notably for AISBO in the WECLA but also for MISBO.[218] We noted that actual service shares would likely fall within the range we presented because in one scenario we are likely to include some circuit ends that do not terminate at a location requested by a customer (and so are network ends) whilst in the other scenario, we would likely exclude some customer ends from our analysis.

A15.121 In its response to the data consultation, BT argued that including all joint customer-network circuit ends does not provide a true limit to BT's service share because its exchanges are predominantly network nodes, whereas Ofcom's methodology counts some of BT's exchange connections as customer-ends and so counts a BT exchange as a joint site even though the vast majority of ends are network ends.[219] BT also argued that the 'joint customer-network ends excluded' scenario is biased against CPs, like itself, that do not generally co-locate network equipment at a customer site.[220]

A15.122 Following further analysis carried out after the consultation, we found that one of the main reasons why service shares varied depending on the inclusion or exclusion of customer-network sites was that they included a number of data centres. Some of these, particularly large data centres such as Telehouse, have several thousand connections going in. As discussed in Annex 20, we consider it

[218] See Table 8 of the data consultation. The consultation presented service share analysis based on the market definitions used in the 2013 BCMR and so we refer to those definitions here.

[219] BT response to 2014 BCMR Data Analysis Consultation, paragraphs 58-59.

[220] BT Response to 2014 Data Consultation, paragraph 56.

appropriate to treat certain data centres as core nodes and we propose to deregulate connections between them. We have therefore treated these as unambiguous network sites for our service share analysis.

A15.123 In terms of the remaining customer-network sites, as shown in Table A15.10 below the inclusion or exclusion of these in our analysis no longer has a significant impact on our results once data centres are excluded. In terms of forming our best estimate of service shares (or 'base case'), having removed data centre connections, we have adjusted our estimates such that if an operator has identified a postcode as a joint customer-network site, we only count circuit-ends in that postcode as customer ends for that specific operator. The following example illustrates this:

- Suppose we have a list of three network sites (or network postcodes) – A, B and C
- CP1 identifies A as a joint customer-network site
- CP2 identifies B as a joint customer-network site
- CP3 identifies no customer-network sites
- All of CP1's circuit-ends in postcode A are counted as customer-ends and all those in postcodes B and C are counted as network ends.
- All of CP2's circuit-ends in postcode B are counted as customer-ends and all those in postcodes A and C are counted as network ends.
- All of CP3's circuit ends in postcodes A, B and C are counted as network ends.

A15.124 This methodology ensures that we do not understate the competitive position of operators that build networks in a way that combines network nodes with customer sites and it also ensures that we do not overstate the position of operators that do not utilise customer sites as network nodes.

A15.125 Furthermore, it removes the bias that BT identified in one of our estimates in the data consultation.[221] As discussed above, there are two operators for whom we are missing a significant amount of B-end postcode information. Although we believe it is appropriate to classify these as network ends based on information received from the operators, BT argued that a service share estimate that includes joint customer-network sites for *all* operators would then understate the shares of the two CPs if some of the B-ends with no information were in fact in postcodes with joint sites. Similarly, this approach would then overstate the service share of operators that have provided more complete information and have identified joint customer-network sites.

A15.126 By assuming that a circuit-end at a joint site is a customer-end only for CPs that have identified it as such, the above bias is avoided. This is because where one of the above two operators has a B-end that terminates at a customer-site (whether this is a 'pure' customer site or one of the CPs' joint network-customer sites) then

[221] BT Response to 2014 Data Consultation, paragraphs 60 and 96.

they have provided the postcode and, as noted above, this gives us assurance that the B-ends with missing information are indeed located at network(-only) sites.

Uplift process

A15.127 As discussed above, a number of CPs have supplied incomplete data for some of their circuits. For example, in some cases the bandwidth is unknown or no valid postcode has been supplied. However, we want to include these circuits in our service share calculation and this means that we need to make an appropriate assumption to complete the dataset for each such circuit. We therefore allocate a bandwidth or postcode sector to each of the circuits with missing data in the same proportions as the various bandwidths and postcode sectors that are found in the circuits for which we have complete data. We then apply appropriate pro rata uplifts to the number of circuits for which we have data.

A15.128 As discussed in the data consultation, this method works well when the number of unknown variables is small, but becomes increasingly complex as the number increases. In general, with *x* variables unknown, we would have to consider 2^x scenarios and implement 2^x -1 separate uplifts. In the service share calculations, we are interested in five variables: interface; bandwidth; postcode sector; whether each end is a customer or network end; and whether each end is on-net or off-net. As we have not been able to obtain information for all circuits on any of these five variables, in principle we would have to calculate 2^5-1 = 31 separate uplifts to complete our dataset.

A15.129 We consider that calculating and applying 31 separate uplifts would be overly complex. In addition, the proportion of circuits with an unknown interface and end-type is relatively small, at less than 1% and 6% respectively (and we have established that our share estimates do not materially change if we treat unidentifiable circuit-ends as network ends). Therefore, we have estimated allocations for 3 unknown variables: bandwidth; postcode sector; and whether the circuit is on-net or off-net. This is a change to our methodology in the data consultation, where our model was only designed to uplift two unknown variables (bandwidth and postcode sector) which meant that we had to assume that if the majority (i.e. more than 50%) of a CP's sales are on-net (off-net) then we assumed that circuits with missing information are also on-net (off-net). We made this simplifying assumption because we had not developed a three-variable uplift process at the time of the consultation.

A15.130 In order to illustrate how the three-variable uplift process works, a numerical (and hypothetical) example of a CP's data for AI services is provided in Table A15.6.

Table A15.6: Hypothetical three-variable uplift example

Column/row		*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
		AI <=1G			**AI>1G**			**AI (unknown bw)**		
		On	**Off**	**Unk**	**On**	**Off**	**Unk**	**On**	**Off**	**Unk**
j	**Postcode Sector 1**	2	4	2	1	3	1	2	1	1
k	**Postcode Sector 2**	3	2	2	4	2	1	2	3	1
l	**Unknown Postcode**	2	1	1	1	2	1	1	1	2

* 'On' refers to on-net. 'Off' refers to off-net. 'Unk' refers to known.

A15.131 In this example, the CP has 49 circuit-ends in the AI market and we have complete information on 21 of them (identified in cells [a,j], [a,k], [b,j], [b,k], [d,j], [d,k], [e,j] and [e,k]). The allocations then work as follows:

- For circuits with one missing variable, for example on/off-net: the uplift is based on postcode and bandwidth information. So the 2 AI<=1G ends in postcode sector 1 with no on/off net information (cell [c,j]) are allocated in proportion to the six other AI<=1G circuit-ends in that postcode sector (in cells [a,j] and [b,j]. This means that 4/6 would be allocated as off-net and 2/6 would be allocated as on-net.[222]

- For circuits with two missing variables, for example on/off-net and bandwidth: the uplift is based on postcode information. So for the 1 circuit end in cell [i,j], this would be allocated in proportion to the 10 circuits with complete information in postcode 1 (in cells [a,j] , [b,j] , [d,j] and [e,j]). This means that 2/10 would be allocated as on-net AI<=1G, 4/10 would be allocated as off-net AI<=1G, 1/10 would be allocated as on-net AI>1G and 3/10 would be allocated as off-net AI>1G.[223]

- For circuits with three missing variables: the uplift is based on circuits with complete information. So the 2 circuit-ends with no information in cell [i,l] would be distributed in proportion to the 21 circuits with information on all variables.

[222] In a small number of cases, this 'primary' uplift does not work because there is not enough information. In the example given, this would occur if cells [a,j] and [b,j] were both zero. In this case, we apply a 'secondary' uplift where the two circuit-ends in cell [c,j] are kept in the same market (AI<=1G) and postcode sector (sector 1) but they are allocated as on/off net based on the proportion of the CP's on/off net circuits across the entire AI market. In our service share analysis, this secondary uplift is applied to around 7,500 circuit-ends.

[223] If there are no other known circuits in postcode 1, i.e. if cells [a,j], [b,j], [d,j] and [e,j] are all zero then there is not enough information to allocate the circuit-end and so it is dropped. Our uplift process drops around 500 circuit-ends so we do not believe this has a material impact on our results.

A15.132 An important point to note about our uplift process, as illustrated by the above example, is that it if a circuit is missing information for one or two variables it does not drop the information that is known. For example, if we know the bandwidth and postcode of a circuit but we do not know whether or not it is on-net or off-net, the uplift process ensures that this circuit remains in the given postcode sector and within the given product market – the only variable that is inferred using the uplift process for this circuit is whether or not it is on-net or off-net.

A15.133 Table A15.7 below presents the distribution of leased line circuit ends (at customer sites only) based on the information that is known and unknown. The table refers to TI, AI and WDM. Although we are proposing alternative market definitions in this consultation, our service share model maintains the distinction between AI and WDM as the latter are generally likely to be high bandwidth circuits and so we want to avoid a significant proportion of WDM circuits being allocated with low bandwidths

Table A15.7: Distribution of circuit information

Bandwidth	Postcode	On/off-net	All leased line ends	TI ends	AI ends	WDM ends*
Known	Known	Known	82%	82%	82%	61%*
Known	Known	Unknown	0%	0%	0%	0%
Known	Unknown	Known	11%	16%	7%	9%
Unknown	Known	Known	6%	1%	9%	20%
Unknown	Unknown	Known	0%	0%	0%	4%
Unknown	Known	Unknown	0%	0%	0%	1%
Known	Unknown	Unknown	0%	0%	0%	0%
Unknown	Unknown	Unknown	1%	0%	1%	5%

* *Although the proportion of WDM circuits with complete information is less than the others, in practice it is not essential to know the bandwidth because we assume they are likely to be high bandwidth (i.e. 1Gbit/s or higher). If we ignore bandwidth, we have complete information on 81% of WDM circuits.*

A15.134 In its response to the data consultation, BT argued that circuits with missing information may not be distributed evenly for each CP and that this assumption can have a significant impact on our market share estimates. For example, the missing data could all be associated with high bandwidth, low volume circuits. BT therefore suggested that Ofcom should present sensitivity analyses based on different

assumptions in our uplift process and that we should also present the cumulative effect on the possible range of service shares calculated.[224]

A15.135 We have considered BT's comments and we do not consider it appropriate to present service share estimates based on different assumptions in the uplift process. This is for both practical and conceptual reasons. The practical reason is that we have obtained data from 18 operators spread across several product markets and more than ten thousand postcode sectors. Therefore, as acknowledged by BT in its response[225], there would be an untenable number of permutations to consider. Furthermore, presenting a large number of combinations of hypothetical assumptions around bandwidth, geographic area and on/off net, when these are not supported by evidence, would result in a range of estimates that would not be very informative for the purposes of market definition and SMP.

A15.136 The conceptual reason is that the service share model we have developed is designed to address non-random distributions before the uplift process. For example, where a CP has indicated a specific rule that is applicable for circuits (such as assuming that all EFM circuits are on-net), we have implemented this when categorising circuit-ends as on-net or off-net. Similarly, if we know a circuit is delivered using EFM but there is no bandwidth information, it is unlikely to be appropriate to allocate this using the uplift process because such circuits will usually have relatively low bandwidths (less than 40Mbit/s). We therefore take this into account before the uplift process and ensure that EFM circuits are identified with a lower bandwidth. The model therefore allows us to classify circuits with missing information in a specific way if the CP provides information demonstrating that it is appropriate to do so (e.g. if an operator tells us that its Ethernet circuits with missing bandwidth information are most likely to be greater than 1Gbit/s then we can identify those circuits as such before the uplift process).

A15.137 Therefore, having dealt with potential non-random distributions early in the process it is reasonable to assume that the circuits with missing information can be allocated proportionately to circuits with known information. In the absence of information from an operator saying otherwise (and we note that BT did not provide such information), we do not consider it appropriate to change this assumption. Using BT's example, it would not be reasonable to put weight on a scenario where all of a CP's circuit-ends with missing bandwidth information are treated as high bandwidth (say above 1Gbit/s) if the vast majority of circuit-ends for which we do have information are actually below 1Gbit/s. A more reasonable assumption would be that the operator is focused on the lower bandwidth segment, that this focus is reflected in the data for which we have information (showing a small number of circuits above 1Gbit/s) and that the circuits with missing data are also in fact low bandwidth circuits.

A15.138 We therefore do not present ranges for our service share estimates based on different uplift assumptions. However, in the case of high bandwidth circuits we note that any service shares estimates are sensitive to the fact that volumes are relatively low. We have therefore carried out a more detailed analysis of this segment below.

[224] BT response to 2014 BCMR Data Analysis Consultation, paragraphs 73-82.

[225] Ibid, paragraph 81.

Data from MNOs and LLU operators

A15.139 The circuit cleaning process described above was applied to all sales and purchases of active leased lines by the 18 CPs with fixed access infrastructure. We created two additional databases for MNO purchases and LLU operator purchases. A similar mapping and cleaning process was used for these datasets as was used for the active leased lines and when calculating service shares we used the same uplift process (though for MNOs and LLU operators we had complete information on supplier so we only needed to uplift two variables, bandwidth and postcode).

A15.140 For the MNO data, the 'customer' ends that are counted in the service share estimates are the cell sites from which backhaul is being supplied or purchased. We do not count connections to aggregation or switch sites (which are assumed as 'network' ends for these purposes). For LLU data, the unbundled exchanges from which backhaul is being supplied (or purchased) are the 'customer' ends and the 'network' end is where the LLU operator aggregates traffic onto its own network (this could be its own site or it could be an Openreach Handover Point).

Dark fibre and duct leases

A15.141 As discussed above, we also requested data from operators active in the provision of dark fibre and duct leasing. CP records of these are not generally as complete as they are for leased lines so it is possible that we have not received full inventories. However, for the data we have received we have applied the above cleaning steps. Furthermore, when estimating shares of dark fibre/duct leasing there is only one variable that requires uplifting (postcode sector) because there is no bandwidth and the 'interface' is either dark fibre or duct. All duct and dark fibre leases are also on-net from the perspective of the company that owns the infrastructure.

A15.142 The classification of end types for dark fibre and duct leases uses the same network site list that is used for our leased line data. However, although this allows us to count dark fibre ends at customer sites in a consistent manner, it cannot be assumed that these all represent additional leased line services that are provided by operators with no fixed access network or services that are self-built by end-users. This is because if a fixed operator uses leased dark fibre to provide a leased line then this will already be captured in our estimates of active service shares. For example, suppose operator 1 leased dark fibre to a retail bank, which then installed its own equipment to connect two sites. This would not be captured in our estimates of wholesale leased lines. However, if the operator leased dark fibre to another fixed operator (say Colt or EU Networks) which then used it to provide a leased line to a media company, then this would already be captured in our leased line data. In order to distinguish between these two scenarios, we therefore requested customer details from the largest dark fibre providers where possible.

Network site data

A15.143 The main purpose of obtaining information on network sites was to allow us to distinguish between leased lines circuits that terminate at a business site and those that terminate at a network node. Each CP provided location details of its network sites, either in Eastings and Northings or with an address. We were therefore able to extract the information to create a list of postcodes where each CP has a network node (as discussed above we have around 9,000 unique network site postcodes).

A15.144 We also asked CPs to indicate which network nodes were coincident with a customer site, for the reasons discussed above. Some CPs were unable to provide this information but we have used it where it is available.

Data outputs

Comparisons with 2014 Data Consultation

A15.145 In this sub-section, we present an updated analysis of the network reach and service share outputs that were included in the data consultation. Although we propose to define different markets compared to the 2013 BCMR and we also consider different network reach assumptions in our analysis, we have presented the network reach and service share analysis in this section on the same basis as the data consultation so that stakeholders can see the impact of our changes in methodology.

Network reach analysis

A15.146 Table A15.8 shows our updated network reach analysis, with 'high network reach' (HNR) postcode sectors defined as in the BCMR 2013 (i.e. there are on average two or more operators, in addition to BT, with flexibility points within 200m of business sites). This is the similar to the outputs that we presented in the data consultation, though the precise figures are different for two reasons:

- we have updated the list of CP flexibility points based on feedback that operators provided in response to the data consultation; and,
- the analysis in the data consultation mistakenly included 17 WECLA postcode sectors in the 'UK excluding WECLA' area.

Table A15.8: Network Reach Descriptive Statistics

	Data Consultation Analysis		Updated Analysis	
	UK excl. WECLA	WECLA	UK excl. WECLA	WECLA
No. of large business sites	155,410	7,611	155 404	7 617
No. of postcode sectors	9,645	404	9,628	421
No. of HNR postcode sectors	779 (8%)	394 (98%)	780 (8%)	396 (94%)
No. of business sites in HNR sectors	24,781 (16%)	7,494 (98%)	24 908 (16%)	7 506 (99%)
No. of businesses with HNR (all sectors)	45,679 (29%)	7,183 (94%)	46 004 (30%)	7 306 (96%)

Service share analysis

A15.147 The following table shows which product market each circuit category falls in for the purposes of the service share analysis presented in this section.

Table A15.9: Market Definitions used for Service Shares

Circuit Category	Relevant market
ADSL	Other
Analogue	TI
ATM	TI
Broadcast Access	Other
CCTV	Other
Dark fibre	Other
EFM	AI
Ethernet	AI
Fibre Channel	AI
FICON	AI
Frame Relay	TI
NGA	Other
PSTN/ISDN	Other
Radio/Microwave[226]	Other
SDH and PDH	TI
SDSL	TI
WDM (bearer)	Other
WDM (wavelength)	MI
xDSL	Other
X25	TI
Other (not leased line)	Not leased line

A15.148 In Table A15.10 below we present the updated results of the service share analysis using both the 'on-net' methodology and the 2013 methodology for counting circuits (i.e. subtracting purchases from sales). In order to compare the estimates with those presented in the data consultation on a like-for-like basis, we have presented ranges based on the following scenarios:

i) All circuit ends that terminate in a postcode where a network site is located are considered network ends (we refer to this hereafter as 'Scenario 1')

[226] Although radio is a physical medium used to transmit a communications signal (rather than an interface), we include it as a separate category because it was not included in any of the relevant markets in the BCMR 2013.

ii) All circuit ends that terminate in a postcode where a CP has identified a joint customer-network site (excluding data centres) are considered customer-ends (we refer to this hereafter as 'Scenario 2')

A15.149 The table then presents our updated base case estimates in a separate column – the estimates using the sales less purchases approach are presented in brackets. As discussed above, in this scenario circuit-ends at a joint customer-network site postcode are only counted as customer-ends for those CPs that have identified the postcode as having a joint site. As Table A15.10 indicates, our base case service shares for a particular operator do not always fall within the range given by Scenarios 1 and 2. This is because both scenarios have the potential to overstate the service shares of operators that do not combine network nodes with customer sites; Scenario 1 excludes all circuits in joint customer-network sites whilst Scenario 2 may count a large number of operator circuits as customer-ends when they should be network-ends. The following example illustrates this:

- CP1 identifies Postcode A as a network site
- CP2 identifies Postcode B as a network site and Postcode A as a joint customer-network site
- Neither operator identifies Postcode C as a network site (i.e. all circuit-ends are customer-ends in this postcode)
- Circuit sales and service shares in our scenarios are given in the table below – in the base case, CP1's service shares are lower than in scenarios 1 and 2

	Sales in A	**Sales in B**	**Sales in C**	**Scenario 1 volumes**	**Scenario 2 volumes**	**Base case volumes**
CP1	15	10	25	25	25+15=40	25
CP2	20	15	5	5	5+20=25	5+20=25
Total	35	25	30	30	65	50
CP 1 Share				83%	62%	50%

A15.150 The service share analysis in Table A15.10 is based on the markets defined in the 2013 BCMR. Although we are proposing different definitions in this consultation, we use the 2013 definitions in order for operators to compare the results with what was presented in the data consultation.

A15.151 The table shows some differences compared to what was presented in the data consultation. This is primarily driven by the following changes:

- we have excluded core network data centres from the list of joint customer-network sites;

- we have updated our uplift process to incorporate three variables (rather than two);

- we have made changes to the circuit data following feedback from CPs in response to the data consultation (for example changes in the classification of some circuits, the removal of duplicate and inactive circuits and the identification of additional network sites);

- the shares for the MI segment now include all AI and TI circuits greater than 1Gbit/s.

A15.152 We have also presented our volume and service share estimates of passive infrastructure leasing (i.e. dark fibre and duct) based on the information provided to us by operators. In Table A15.11, we present our service share estimates of MNO backhaul (analysis of LLU backhaul is presented in Annex 12). We present two separate estimates for MNO backhaul, one including microwave links and one excluding them. The table suggests that the number of microwave links used for MNO backhaul is significantly higher than the number of copper and fibre links. In fact, the number of unique cell sites that use microwave links for MNO backhaul is smaller than the number that use fibre or copper (microwave accounts for just less than one third of links to unique cell sites). However, a significant proportion of microwave links are used to deliver multiple 64kbit/s or 2Mbit/s connections. We have counted each of these links separately, so for example where microwave is used to deliver 16 distinct 2Mbit/s connections (i.e. the bandwidth is reported as '16x2Mbit/s') then we have counted this as 16 circuit-ends (all at 2Mbit/s).

A15.153 It should also be noted that MNOs were generally unable to indicate whether the leased lines in their inventories were delivered using WDM technology. In Table A15.11, we have therefore not included estimates for the market previously defined as 'MISBO'. Instead, any WDM circuits will have been reported in the AISBO segment (whereas the service shares reported in Table A15.10 will include WDM mobile backhaul in the MISBO segment because fixed operators were generally able to indicate whether a circuit was delivered using WDM technology).

Table A15.10: Updated Service shares estimates

Product	Bandwidth (Mbit/s)	Geographic Market	Volumes (customer ends only)			Service shares		
			Data consultation (on-net)	Updated analysis (on-net)	Ofcom Base case*	Data consultation (on-net)	Updated analysis (on-net)	Ofcom Base case*
TI	<=8	UK less Hull	196,621 - 226,605	249,395 – 265,961	**249,976** (248,955)	BT: 84% - 87%	BT: 88%-89%	**BT: 89%** (BT: 89%)
		Hull	1,927 – 1,937	1,883 – 1,895	**1,893** (1,873)	KCOM: 81%	KCOM: 86%	**KCOM: 86%** (KCOM: 78%)
	>8, <=45**	UK less WECLA less Hull	2,453 - 2,826	2,138 - 2,456	**2,313** (2,736)	BT: 76% - 77%	BT: 76% - 82%	**BT: 76%** (BT: 64%)
		WECLA	964 - 1,707	1,020 – 1,352	**1,070** (1,058)	COLT: 31% - 33%	COLT: 34% - 36%	**COLT: 35%** (COLT: 34%)
	>45, <=155**	UK less WECLA less Hull	1,215 - 1,497	1,106 – 1,333	**1,134** (1,347)	BT: 68% - 70%	BT: 71%-72%	**BT: 70%** (BT: 59%)
		WECLA	499 - 1,141	554 - 769	**567** (598)	COLT: 35% - 42%	COLT: 45% - 49%	**COLT: 49%** (COLT: 47%)
AI	<=1000	UK less WECLA less Hull	281,390 - 300,654	250,149 – 257,809	**251,518** (272,756)	BT: 55% - 57% Virgin: 34% - 35%	BT: 57% Virgin: 30%	**BT: 57%** **Virgin: 30%** (BT: 51%) (Virgin: 32%)

		WECLA	42,515 - 79,618	41,171 – 54,036	**42,264** (42,044)	BT: 38% - 50% Virgin: 18% - 27% COLT: 18% - 19%	BT: 42% - 48% COLT: 19% - 20% Virgin: 13% - 20%	**BT: 47%** **COLT: 20%** **Virgin: 13%** (BT: 47%) (COLT: 19%) (Virgin: 13%)
		Hull	966 – 970	936 - 941	**938** (1,137)	KCOM: 84%	KCOM: 97%	**KCOM: 97%** (KCOM: 83%)
MI	>1000 and WDM**	UK less WECLA less Hull	7,166 - 9,155	7,139 – 8,487	**7,814** (8,376)	Virgin: 51% - 61% BT: 32% - 34%	Virgin: 51% - 55% BT: 32% - 33%	**Virgin: 55%** **BT: 29%** (Virgin: 55%) (BT: 27%)
		WECLA	2,016 - 5,943	2,675 – 4,281	**2,938** (3,110)	COLT: 19% - 24% Zayo: 17% - 18% Virgin: 17% - 22%	COLT: 31% - 35% Virgin: 20% - 23% Zayo: 13% - 16%	**COLT: 33%** **Virgin: 23%** **Zayo: 14%** (COLT: 31%) (Virgin: 22%) (Zayo: 14%)
Passive	N/A**	UK less WECLA less Hull	N/A	N/A	**3,793**	N/A	N/A	**Cityfibre: 32%** **Zayo: 20%** **Surf: 18%**
		WECLA	N/A	N/A	**1,658**	N/A	N/A	**Zayo: 70%** **Interoute: 20%**

* The estimates in brackets represent the service share estimates based on the ‘sales less purchases’ methodology.
** Volumes in Hull are not material so analysis has not been presented.

Table A15.11: Service share estimates for MNO backhaul

Product	Bandwidth (Mbit/s)	Geographic Market	Volumes		Service shares	
			Excluding microwave	Including microwave	Excluding microwave	Including microwave
TI	<=8	UK less Hull	38,361	189,619	BT: 96%	Self-supply: 76% BT: 23%
		Hull	367	1,341	KCOM: 70%	Self-supply: 64% KCOM: 19%
	>8, <=45*	UK less WECLA less Hull	-	1,485	Not material	Self-supply: 99%
		WECLA	-	55	Not material	Self-supply: 100%
	>45, <=155*	UK less WECLA less Hull	39	1,473	Not material	Self-supply: 97%
		WECLA	4	65	Not material	Self-supply: 100%

AI	<=1000	UK less WECLA less Hull	20,707	26,356	BT: 93%	BT: 73% Self-supply: 23%
		WECLA	1,785	1,933	BT: 89%	BT: 83%
		Hull	2	63	Not material	Self-supply: 97%
MI	>1000 and WDM**	UK less WECLA less Hull	-	-	-	-
		WECLA	-	-	-	-

* Volumes in Hull are not material so analysis has not been presented.

** MNOs were generally not able to indicate whether a circuit was delivered by WDM. Other AI or TI circuits greater than 1Gbit/s were small in number (less than 50), with the vast majority purchased from Virgin Media.

Table A15.12: Ofcom responses to stakeholder comments on data consultation

Comment Reference	Respondent	Comment	Ofcom response
1	BT	Noted that MLL owns infrastructure in the form of microwave radio links and so Ofcom should revisit the information provided by MLL.[227]	We did not seek to obtain a comprehensive list of microwave leased lines in the UK when issuing our s135 information requests (though we have received such information from some operators, including MNOs for whom we do have a list of microwave links used for mobile backhaul). The reason for this is that any organisation is capable of providing microwave links with an appropriate license and so obtaining information on all of these would be extremely difficult. Given that we found microwave links to be outside the scope of the BCMR 2013, we considered it disproportionate to obtain information unless it became apparent that they could be included in the current BCMR. As discussed in Annex 11, we have not included microwave links in any of our defined markets and so we have not requested information on these since the data consultation.
2	BT	Ofcom should publish breakdowns of how circuits with missing information are distributed across market segments.[228]	This has been provided in Table A15.7 above.
3	BT	Ofcom's uplift methodology only allocates circuits with missing postcodes to postcode sectors on records that do have postcode information. This does not take into account the fact that some circuits with missing information may be in other areas not covered by known postcodes.[229]	We believe that the allocation of circuits with missing postcodes to postcode sectors where we know (with certainty) the CP sells wholesale leased lines is the most reasonable and practicable solution to dealing with missing data. There would be an unmanageable number of scenarios to present if we assumed these circuits were in other postcode sectors and we do not believe that would be reasonable given the information available to us. Furthermore, as discussed in Sections 4 and 5 we define markets at a much broader level than postcode sector.

[227] BT Response to 2014 Data Consultation, paragraphs 12 and 36-37.

[228] BT Response to 2014 Data Consultation, paragraphs 18, 23, 70 and 95.

[229] BT Response to 2014 Data Consultation, paragraph 20.

4	BT	Concerned that the on-net/off-net status is missing in 11% of circuits in the dataset. Ofcom's allocation should be informed by market intelligence on CPs' business models.[230]	As discussed above, we have reduced the proportion of circuits with an unknown on-net/off-net status to 2% by using data on operator flexibility points. Our allocation of circuits with unknown on/off net information is based on data for which we have complete information and this will capture whether a CP is largely focused on a particular market segment.
5	BT	Ofcom applies each of the uplifts on a uniform basis across all circuits missing the relevant data attribute. There are better ways that the uplifts could be applied to give more accurate results, for example assuming that greater proportions of a CP's circuits are high bandwidth where this reflects a CP's commercial strategy.[231]	We do not apply uplifts on a uniform basis. They are applied based on a distribution that is specific to each CP, which is calculated using circuit data for which we have complete information. If a CP's commercial strategy is to focus on high bandwidth leased lines, this will be reflected in the known data and we will apply the uplifts to this segment. If circuit data for a CP indicates that a very small proportion of known circuits are high bandwidth, it would be misleading and inappropriate to uplift the majority of unknown circuits to this segment.
6	BT	Ofcom is missing data on self-supplied backhaul circuits used by MNOs, LLU operators and Virgin Media. It recommended that Ofcom obtain this information before assessing market power and considering remedies.[232]	We have requested, and received, self-supplied backhaul circuits used by MNOs (EE, Three, MBNL, Telefonica and Vodafone) and large LLU operators that do not have a fixed access network (i.e. Talk Talk, Sky, Updata and Zen).[233] BT is correct that we did not explicitly request self-supplied backhaul from other fixed network operators that sell wholesale leased lines. We have not done so for two reasons. Firstly, the focus of our service share analysis is the customer site. We intentionally exclude the network ends of circuits from this analysis as their inclusion would distort comparisons between CPs with different network topologies. In addition, we have developed other measures for identifying BT exchanges and datacentres which can be considered as parts of competitive core networks (these are set out in Annex 20). Secondly, obtaining data on backhaul from all fixed operators in a consistent
7	Vodafone	Concerned that the data we requested may not adequately capture the services both self-supplied and purchased for backhaul services, in particular those used by BT to create	

[230] BT Response to 2014 Data Consultation, paragraph 21.

[231] BT Response to 2014 Data Consultation, paragraph 25.

[232] BT response to 2014 BCMR Data Analysis Consultation, paragraph 41.

[233] By excluding LLU operators that have a fixed access network, we have not requested data on leased lines used for backhaul from operators such as Virgin and Vodafone.

		backhaul from cabinets and GEA parent handover nodes.[234]	manner is very difficult as CPs build their networks in different ways. Therefore, identifying a specific definition of 'backhaul' and 'core' that allows us to compare self-supply on a like-for-like basis is unlikely to be achievable. The two exceptions to this are MNO and LLU operators that do not have a fixed access network. We have requested data from these CPs because, unlike fixed operators, they are often reliant on third party leased lines for backhaul. Furthermore, due to the services these operators provide (mobile telephony and residential broadband) it is easier to obtain data in a consistent manner because we can define the connections between base stations and aggregation nodes (for MNO backhaul) and the connections from unbundled exchanges (for LLU backhaul).
8	BT	Expressed concern that we had missed some leased dark fibre. BT proposed that, where a CP leased dark fibre, we should approach the source company and request a complete list of their dark fibre customers.[235]	We re-checked the data submitted against our formal data request and verified that all the companies given as sources of dark fibre, were already on our list of CPs we had formally asked for information regarding their network and dark fibre sales. Thus we are not aware of any company leasing dark fibre that we have not contacted that would have a material impact on our analysis.
9	BT	Suggested that Ofcom extend our request for interconnect information between a CP and BT to include all interconnect information between any two CPs.[236]	The formal information requests sent to CPs included this question and we have received interconnect information between OCPs.
10	BT	Ofcom should critically assess and sense-check the data that CPs have provided. For example, if there is a	There are no postcode sectors with circuits that are only off-net. We have also sense-checked the data by looking at whether operators have provided on-net circuit data in postcode sectors where they have no flexibility points. There is a

[234] Vodafone response to 2014 BCMR Data Analysis Consultation (non-confidential version), Annex 2, page 2.

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

[235] BT Response to 2014 Data Consultation, paragraph 42.

[236] BT Response to 2014 Data Consultation, paragraph 43.

		geographic area where all CPs classified their circuits as 'off-net' then information must be missing.[237]	minimal number of circuit-ends meeting this criterion.
11	BT	Ofcom should confirm that all CPs have provided information on WDM circuits that are part of their own networks and that are used as inputs by their downstream retail operators.[238]	These circuits were in the scope of the s135 notice that we issued.
12	BT	In the last BCMR, BT data showed that there was evidence of network sites at almost 11,000 postcodes. As the list in Ofcom's analysis only uses around 8,500, it has included many true network ends. One contributing factor is that Ofcom has used a postcode matching method rather than a geographic matching method, meaning that network sites spanning multiple postcodes will not be fully captured in Ofcom's list.[239]	We are reliant on operators providing a complete list of their network sites. If a network site spans more than one postcode, then the relevant postcodes should be provided. We have reviewed the updated list of network sites BT has provided in response to the data consultation and have incorporated these into our analysis. Our response to BT's submission to the BCMR 2013 is contained in Annex 5, paragraphs A5.62 – A5.64 of the BCMR 2013 Statement.[240]
13	BT	Concerned that some CPs might have classed EFM services as off-net when	We are confident that in all cases EFM services are classed as on-net. We took considerable time to work with CPs to ensure they understood that EFM

[237] BT Response to 2014 Data Consultation, paragraph 45.

[238] BT Response to 2014 Data Consultation, paragraph 45.

[239] BT Response to 2014 Data Consultation, paragraph 57.

[240] BCMR and LLCC 2013 Statement, Annex 5.

http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes1-7.pdf

		for the purposes of the BCMR they are on-net.[241]	services needed to be reported and why they would be classed as on-net.
14	BT	CPs' estimated service shares are almost always higher under the 'on-net only' calculation than under the 'sales less purchases' approach. Ofcom should investigate and explain why this is the case.[242]	We note that the service shares in high volume segments in Table 8 of the data consultation did not significantly vary between the two approaches. A similar picture can be found in our updated analysis in Table A15.10 above. As discussed earlier, sales and purchase databases are often inconsistent and this leads to discrepancies between the two estimates. If sales are based on an engineering database and purchase databases are based on billing records, the latter may not capture all relevant circuits and so a CP's share would be overstated in the 'sales less purchases' approach. We observe this in the data submitted by CPs, where some report more off-net sales than purchases for certain products. For the reasons discussed above, we believe that counting on-net sales only is the most appropriate method to use as it does not try to reconcile two datasets that might be inconsistent.
15	BT	Concerned over Ofcom's choice of business sites and buffer distance to use in the analysis for the geographic market definition. Suggest we develop a demand distribution to select a more appropriate set of businesses.[243]	The data we collect does not presuppose the set of businesses or buffer distance we will use in the network reach analysis. Our proposals for assessing network reach are set out in Sections 4-6 and Annex 21. The data we collect and purchase allows us to analyse network reach against any set of businesses using a wide range of buffer distance assumptions. In the data consultation we used the assumptions from the last BCMR to provide a comparison view of the service share and network reach. We made it clear that this did not imply the same assumptions would be used in the current BCMR.
16	Colt	If 200m is the threshold above which the minimum conditions for effective competition are unlikely to be met, this does not constitute a basis for applying	

[241] BT Response to 2014 Data Consultation, paragraph 64.

[242] BT Response to 2014 Data Consultation, paragraph 64.

[243] BT response to 2014 BCMR Data Analysis Consultation, paragraphs 83 and 102-112.

		deregulation to everything below that threshold.[244]	
17	BT	Ofcom should sense check the leased line circuit data with the network reach data to determine whether any CP reported on-net sales of leased lines in areas where they didn't report network. BT was also concerned that where a CP was willing to extend from any part of its duct the flexibility points might not be sufficient to fully map its physical presence.[245]	As discussed above we have compared CPs on-net leased line sales against their network reach data and found there is a very good match, indicating that we have gathered comprehensive network reach data. As part of the data cleaning exercise we also investigated when a CPs network reach data showed a reduction in coverage from the last BCMR. We asked the CP for an explanation and, where necessary, requested additional data. In addition, where a CP reported physical duct rather than flexibility points, we derived our own set of flexibility point data which fully represented their duct network. It is this set of points we sent back to the CP for them to check. In all cases CPs confirmed our understanding of their network. For CPs who state they are willing to extend their network from any point on their duct network, rather than just from flexibility points, we note that: if they provide flexibility points they are sufficiently close to significantly overlap for buffer distances of 200m and greater; and if they do not provide flexibility points we generate flexibility points to provide a corridor 200m either side of their duct. From the above we are confident that we have gathered sufficient network reach data to provide a sufficiently accurate representation of physical network coverage to support our market definition work.
18	BT	Concerned with an apparent reduction in flexibility points in some parts of the UK. BT does not understand how physical network could be removed from service in a manner that did not allow	We queried CPs, as part of the data cleaning process, if their network reach information was missing data in areas they had reported network for the last BCMR. In most cases the CP provided additional data. In one case the CP explained that the missing network had been erroneously reported in the last BCMR. Whilst they still had physical network in the areas they didn't report,

[244] Colt response to 2014 BCMR Data Analysis Consultation, page 3.

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

[245] BT Response to 2014 Data Consultation, paragraph 84.

		for it to be brought back into service if economic conditions changed.[246]	they explained why it was not possible to access the network for customer connections. We accepted their explanation and agreed that such network was not relevant to our network reach analysis.
19	BT	Concerns over our treatment of Virgin Media's network in the last BCMR and asked whether our analysis correctly identified their network now.[247]	In preparation for this BCMR, and in the draft S.135 stage, we worked closely with all of the CPs we formally requested network information from to: understand their network; explain our market definition process; and ensure we gathered appropriate network data. We are confident that the flexibility point data we have from CPs, including Virgin Media, is an accurate reflection of where they have the ability to deliver on-net leased line services.
20	BT	Ofcom should move away from the use of postcode sectors in less built up areas where postcode sectors are relatively large. It argued that high network reach areas within these larger postcode sectors could be diluted by other areas within the same postcode sector where competitors had not built networks, with the result that competitive areas would not be counted.[248]	The data we collect does not presuppose the geographic area we will use in the network reach analysis. Our proposals for assessing network reach are set out in Sections 4-6 and Annex 21. The data we collect and purchased allows us to analyse network reach against any geographic area. In the data consultation we used the postcode sector assumption from the last BCMR to provide a comparison view of the service share and network reach. We made it clear that this did not imply the same assumptions would be used in the current BCMR. We note that BT did not propose an alternative geographic area to use instead of postcode sectors.
21	BT	Ofcom changed its supplier of business location information and using this new data with the 2013 BCMR flexpoint locations resulted in some differences between the set of postcode sectors defined as high network reach and the WECLA as defined in 2013. BT is concerned that there be no undue	The analysis we did for the data consultation suggested that any changes in our measure of network reach due to the change in the database would not result in a material loss of consistency over time. We also noted that some of the changes in network reach could reflect genuine changes in business locations. We agree with BT on the importance of regulatory stability and this is reflected in our proposals for market definition in this consultation.

[246] BT Response to 2014 Data Consultation, paragraph 85.

[247] BT Response to 2014 Data Consultation, paragraphs 86-87.

[248] BT response to 2014 BCMR Data Analysis Consultation, paragraph 111.

		switching of the regulatory status of postcode sectors solely due to the use of different data inputs and said that Ofcom should examine the results in detail to make sure of this.[249]	
22	BT	Ofcom should publish more granular information on service shares.	We provide this information in Section 4.
23	BT	Ofcom's analysis of the data is a 'single-ended' analysis of services to sites but its information request is couched in a framework of two-ended uncontended services between separate locations. This creates an underlying mismatch which will impact how CPs report their circuit information.[250]	As set out above leased lines are used in a variety of ways, including as a two-ended connection or as an input into a VPN (which is more consistent with a single-ended connection). We believe it was important to set this out in the information request so that it was clear to operators that we wanted data on all types of leased lines. Furthermore, operators do not hold data in a consistent manner. Some maintain single-ended records (essentially records of 'customer tails') whilst others maintain records of end-to-end connections (i.e. they record the customer at each end without reporting any intermediate links). If we followed BT's suggestion and based the information request purely on a single-ended service scoping definition, operators that record leased lines as two-ended connections may have either not provided us with all their circuits or they would have had to undertake data processing themselves before providing it to Ofcom. Such processing could have resulted in the omission of key information. The manner in which we framed our information request ensured that it was not biased to a particular database structure or network architecture and it ensured that operators provided all the information they had. We then processed the data ourselves to ensure that we could analyse it consistently across CPs.
24	BT	Ofcom defines leased lines as having "dedicated (i.e. uncontended) capacity	In the two scenarios provided by BT, we are confident that operators have provided data where leased line services are delivered in such a manner. In the

[249] BT response to 2014 BCMR Data Analysis Consultation, paragraph 112

[250] BT response to 2014 BCMR Data Analysis Consultation, Annex 1.

		between two locations" but there are two network implementation scenarios where such connectivity does not exist, even though they are technically equivalent to scenarios where such connectivity does exist. (i) Multi-tenanted end-users sites where a CP places a packet multiplexer at the end-user site and multiplexes services to the different customers present at the site. This uses packet multiplexing technology, which would be contended. (ii) When a CP uses a 'daisy-chain' topology between end user sites BT said that in these scenarios, a CP may have considered such services to be outside the scope of Ofcom's information request and so would not include them in their response.	case of multi-tenanted end-user sites, the relevant services are connections from each end-user site to sites (or network nodes) in another location. This is what is being purchased and so this is what operators have provided data for, regardless of whether or not a multiplexer is used at the multi-tenanted site. In BT's example of a daisy-chain topology, we have asked CPs that deliver services in this manner whether they have been included in the data they provided. Each CP confirmed that they have.
25	BT	Identified 16 operators that it believed could impact Ofcom's assessment of high bandwidth circuits (particularly those above 1Gbit/s), especially in small geographic areas.[251]	We have reviewed BT's list of operators and note that several were already included in our original list of CPs that were issued s135 requests (and so were already included in our analysis). This includes Geo, Interoute, euNetworks and Fibrespeed. We also note that BT identified some operators that do not have code powers.[252] Nevertheless, we contacted each operator that we did not have data for and found that none of them owned or operated access infrastructure to sell leased lines. However, one of the operators, Concept Solutions, has physical network and is a commercial provider of dark fibre. As the leasing of

[251] BT response to 2014 BCMR Data Analysis Consultation, Annex 2, page 32.

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

[252] This refers to the electronic communications code set out in Schedule 2 to the Telecommunications Act 1984.

			dark fibre was in the scope of our s135 request, we have obtained information from Concept Solutions on its dark fibre leases as well as its network flexibility points.
26	Colt	The network reach and service share outputs in the data consultation do not reflect Colt's perception of how the market has operated. The decline in Colt's market share is not borne by its understanding of how the market has developed. Ofcom should seek to better understand these underlying movements and, where possible, corroborate them with other sources of evidence. Ofcom should also give clarity on the extent to which changes are driven by differences in methodology, differences in data and actual market developments.[253]	The changes we have made to our methodology and data have resulted in an increase in Colt's service shares in the WECLA, as shown in Table A15.10 above. As discussed above, we have taken a number of steps to improve the quality of flexibility point and leased line data during this review. We have sent our clean data back to operators to ensure no errors have been made in terms of identifying circuit interfaces, bandwidths and postcodes. [✂ ✂]. As set out in the data consultation, the changes in service share estimates since 2011 are driven by a combination of improvements in data gathering and assumptions/judgements made in classifying and counting circuits (for example we did not use translation tables in the 2013 BCMR). However, it is not possible to quantify the impact of these on the service share results because when comparing 2011 and 2014 data we cannot distinguish between new circuits and those that were potentially excluded from our previous analysis. The results in Table A15.10 above indicate that the use of on-net information (rather than subtracting purchases from sales) has not driven the difference in high volume segments.
27	Sky	Table 8 of the data consultation suggests a noticeable change in BT's share of Alternative and Multiple Interface leased lines. Sky would like to understand what proportion of the changes in market shares, if any, are attributable to the classification of circuit-ends and the use of on-net and off-net information.[254]	

[253] Colt response to 2014 BCMR Data Analysis Consultation, page 1.

[254] Sky response to 2014 BCMR Data Analysis Consultation (non-confidential version).

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

28	Colt	Service share and network reach results should be put in perspective and checked against other sources.[255]	As set out in Sections 4-6, when assessing market definition and SMP we take into account a wide range of evidence in addition to network reach and service shares. This includes responses to market questionnaires, end-user surveys and case studies, pricing analysis qualitative evidence obtained from operators and so on.
29	Colt	Would like to understand better how the decision has been made to include some circuits as 'leased lines' and to exclude others. Table 7 in the data consultation suggested the deciding factor is the circuit's technology/interface but in the last BCMR, leased lines were defined as dedicated (meaning uncontended) and symmetric services. Would welcome clarity on the difference between Ofcom's definition of a leased line and other types of business connectivity service.[256]	Our definition of leased lines in our s135 notices is the same definition that was used in the BCMR 2013, i.e. a symmetric service of dedicated (uncontended) capacity between two fixed locations. Within this definition, a leased line can provide several interfaces to a customer, for example Ethernet, SDH or PDH. As we wish to distinguish between different interfaces in our economic analysis, we have a list of interfaces to classify each leased line (set out in Table A15.9 above). If we only received data on leased lines, our list would be restricted to technical interfaces. However, some CPs provided data on other types of business connectivity (for example xDSL and ISDN) and even non-connectivity services. We therefore identify further categories in our list of 'interfaces' to ensure that such circuits are classified in a manner that allows us to exclude them from our analysis of leased lines.
30	Colt	It would be useful to know the criterion that has been used to determine the boundaries of different types of business connectivity services that have been used to determine market shares, given that – at least in some market segments – traditional leased lines and NGA services are becoming increasingly interchangeable.[257]	Our service shares only include leased line connections, as defined above. We do not propose to include NGA services in the same market as leased lines, for the reasons given in Annex 9.

[255] Colt response to 2014 BCMR Data Analysis Consultation, page 1.

[256] Colt response to 2014 BCMR Data Analysis Consultation, page 2.

[257] Colt response to 2014 BCMR Data Analysis Consultation, page 2.

31	Colt	Ofcom's stylised network example (illustrated in Figure A15.2 above) is not representative of Colt's network topology, which is a ring rather than a star. The Figure suggests there is no possibility of a link between business customers and a core node. Colt does not distinguish services in terms of access vs backhaul vs core when providing a circuit to a customer. What is important to distinguish is the end-to-end location, i.e. Metro (circuits within the same city), National (between cities in the same country) or International (between two cities in a different country). Ofcom's data analysis and the conclusions it draws should not be prejudicial to any particular network architecture. The use of fibre rings means that CPE inside any given building can be both a CPE and a node. Colt does not recognise the distinction between aggregation nodes and core/trunk nodes.[258]	We accept that operators build their networks differently and that many are not represented by the illustration given in Figure A15.2. This is a hypothetical example to highlight what we mean by the terms 'access', 'backhaul' and 'core'. However, we acknowledge that some CPs do not distinguish between these. We do not believe that our data analysis is prejudiced against a particular network architecture. As discussed above, our primary interest in the service share analysis is to count leased lines that terminate in customer buildings. We do so by ensuring that any leased lines that terminate at a network site are excluded, whether this is a 'core' or other type of node. In Colt's example of linking business customers to a core node, our methodology will ensure that we count the customer connection and not the core node connection. Alternatively, where Colt reports an end-to-end connection between two businesses (whether it is Metro or National) then we will count both ends. As discussed above, we also acknowledge that some operators build their networks in a way that combines customer premise equipment and equipment for aggregating and switching other traffic. We have factored this into our analysis by including connections to joint customer-network sites. Furthermore, by counting such connections only where an operator has identified a postcode as a joint customer-network site (rather than applying such sites to all operators), we have ensured that our estimates are not biased against operators with different network architectures.
32	Colt	Colt does not agree that all flexibility points are 'available'. Postcodes considered as competitive are the ones for which the probability of having full or	As discussed above, no CP was able to consistently identify flexibility points that were unavailable and so it is not possible to filter such points out of our analysis. Given that all CPs suffer from such limitations to their physical network

[258] Colt response to 2014 BCMR Data Analysis Consultation, page 2.

		unusable manholes for expansion is the highest.[259]	access, we treat all flexibility points as being equally available. Furthermore, if there are areas where CPs do not use their physical networks to provide wholesale leased lines, this is will be reflected in our service share analysis.
33	MBNL	The data consultation did not include any analysis of data provided by MNOs, nor were MNOs provided with clean data at the same time as fixed operators. MBNL is unfairly disadvantaged and the extent to which it can comment on Ofcom's methodology is severely limited. Ofcom should provide MNOs with any data they provided on the same basis that Ofcom provided fixed operators and provide the opportunity for stakeholders to comment. [260]	Due to resource and timing constraints, we were unable to process and analyse all of the data we received in time for the data Consultation. We therefore focused on the data and analysis that was most central to our analysis of competition in leased line terminating segments (i.e. data from fixed operators). Shortly after the data consultation closed, we sent MNO and LLU operators clean data (along with supporting assumptions) for comment and we have taken this into account in our updated analysis.
34	MBNL	Ofcom should use the data provided by MNOs on mobile backhaul leased lines to reconcile the data it has received from fixed line operators. [261]	We have carried out cross-checks of MNO and fixed operator data. It is difficult to reconcile the two datasets precisely due to the different ways in which data is held. For example, MNOs may not record whether a circuit is delivered using WDM technology and will only record the underlying interface (e.g. Ethernet) whereas the fixed operator may indicate that the circuit uses WDM. Another example is where Openreach provides BT Wholesale with a 1Gbit/s leased line, which is used to provide mobile backhaul but with a lower capacity (e.g. 300Mbit/s). In this case, the information received on bandwidth would not reconcile.

[259] Colt response to 2014 BCMR Data Analysis Consultation, page 3.

[260] MBNL response to 2014 BCMR Data Analysis Consultation (non-confidential version).

http://stakeholders.ofcom.org.uk/consultations/bcmr-data-analysis/?showResponses=true

[261] Ibid.

			An additional obstacle to reconciling the data is that we do not have complete information on customers from fixed operators (due to a combination of data limitations and commercial confidentiality reasons). Nevertheless, we have sought to reconcile the two datasets where we can, for example by extracting cell site postcodes and checking that MNO suppliers are reporting leased line sales and flexibility points in those areas. These checks indicate that fixed operators have reported their leased line supply to MNOs.
35	Verizon	The method for calculation of service shares in the consultation is totally unreliable and likely to result in a significant degree of error.	We have updated our service share model to allow three variables to be uplifted so the simplifying assumption made in the data consultation has been removed. The model has also been subject to external audit and we believe that it is reliable and, as far as reasonably possible, free from material error.
36	Vodafone	When estimating service shares for WDM services, Ofcom should count bearers rather than wavelengths because once a customer has a bearer from a CP, all wavelengths will come from that CP. Individual customer ownership is therefore a better measure of competition than overall bandwidth ownership.	We believe that counting wavelengths is more appropriate than counting bearers because the former gives a better proxy for the value of the service (e.g. a provider that supplies 40 wavelengths over a bearer is given a higher share than a CP that supplies a single wavelength over a bearer). However, we note that counting bearers may provide a better indication of the number of unique customers that an operator sells leased lines to. We are unable to directly estimate the number of bearers because some operators only provided wavelengths and we cannot estimate the number of individual WDM routes because some operators provide data in the form of customer-tails. However, as a proxy we can count the number of unique postcodes that an operator sells a WDM service in. This is presented in our analysis of high bandwidth segments below.
37	BT/Analysys Mason	Dark fibre circuits sold by CPs to enterprises and government should be included in the market assessment for MISBO circuits. The potential exclusion of dark fibre sold by CPs to end users for self-supplied circuits could reduce	We have presented an analysis of the dark fibre and duct leases in Table A15.10. We note that some of the customer-ends reported in this analysis will have already been taken into account in our estimate of leased line service shares, where the duct or dark fibre is leased to a fixed operator from whom we have collected data.

		the overall size of the MISBO market by 5% or more.[262]	Research that we carried out in the 2013 BCMR[263], as well as research submitted by Analysys Mason on behalf of BT[264], suggests that self-supplied high bandwidth connectivity is generally pursued by a small sub-set of customers that have specific requirements for high bandwidth, low latency and/or network management. These are commonly large finance companies, media companies, universities and data centres. Based on a review of the customer information we have received, it is unlikely that the majority of dark fibre/duct leases are used to self-supply WDM connectivity or very high bandwidth services as they include organisations such as [✂ ✂]. Such organisations are unlikely to require the levels of capacity that are consumed by very high bandwidth users such as media and large finance companies. We discuss the potential constraint of dark fibre and self-supply on leased line services in Section 4.

[262] Analysys Mason Report for BT, 'Concerns related to Ofcom's treatment of very-high-speed circuits market in the BCMR data analysis consultation' (30 January 2015)

[263] CSMG, 'Research on Very High Bandwidth Connectivity' (February 2013)

http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/CSMG-report.pdf

[264] Analysys Mason, 'Summary report on very high-speed services' (September 2012)

http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/responses/BT_part_2.pdf

Table A15.13: Ofcom responses to stakeholder comments on clean data

Comment Reference	Respondent	Comment	Ofcom response
1	[✂ ✂]	[✂ ✂]	We have amended our cleaning rules in order to correctly classify these circuits.
2	[✂ ✂]	[✂ ✂]	[✂ ✂]
3	[✂ ✂]	Bandwidths missing in clean data for Ethernet circuits greater than 1Gbit/s.	This was an error caused by an incomplete service definition used in the service share model, which has since been updated and corrected.
4	[✂ ✂]	Some bandwidth information missing in clean data.	
5	[✂ ✂]	Identified errors for some circuit postcodes in clean data.	This was caused by a mapping error in our list of postcodes, which has since been corrected.
6	[✂ ✂]	Some circuit postcodes missing in the clean data.	
7	[✂ ✂]	[✂ ✂]	[✂

			✂]
8	[✂ ✂]	Queried how our Easting and Northing clean data had been derived from their postcode submission for network nodes.	The geographic analysis program MapInfo, using polygon data we purchased from Dotted Eyes, allowed us to derive a location point for any 2014 postcode.
9	Surf	Initially found it difficult to reconcile our cleaned data with their original submission.	We provided a spreadsheet showing Surf's original data with our cleaned data added as new columns. Surf was able to confirm our cleaned data was an accurate representation of their submission.
10	[✂ ✂]	[✂ ✂]	We have amended our cleaning rules in order to correctly classify these circuits.
11	[✂ ✂]	Provided additional data on leased line purchases	Additional data has been incorporated into our analysis, though they do not have a material impact.
12	[✂ ✂]	The inventory of leased lines originally provided included a number of duplicate records and circuits that were not installed (due to the customer cancelling the order before final provision).	We investigated this data in more detail and verified the existence of some duplicate records based on the fact that [✂ ✂]. We also verified that some of the circuits originally provided to Ofcom were never installed as [✂ ✂]. We have therefore removed both duplicate and inactive circuits from our analysis of service shares where these have been verified.
13	[✂ ✂]	[✂	[✂

		✂]	✂]. This suggests that our current estimates are reasonable based on the evidence available. [✂ ✂]

Data Analyses

A15.154 In this section of the Annex, we present a series of analyses that have been used in our assessment of market definition and SMP set out in Section 4.

A15.155 The following analyses are described in more detail:

i) Identification of potentially competitive areas in the UK

ii) Definition of Central London Area (CLA)

iii) Calculating very-high-bandwidth CISBO service shares based on bearers

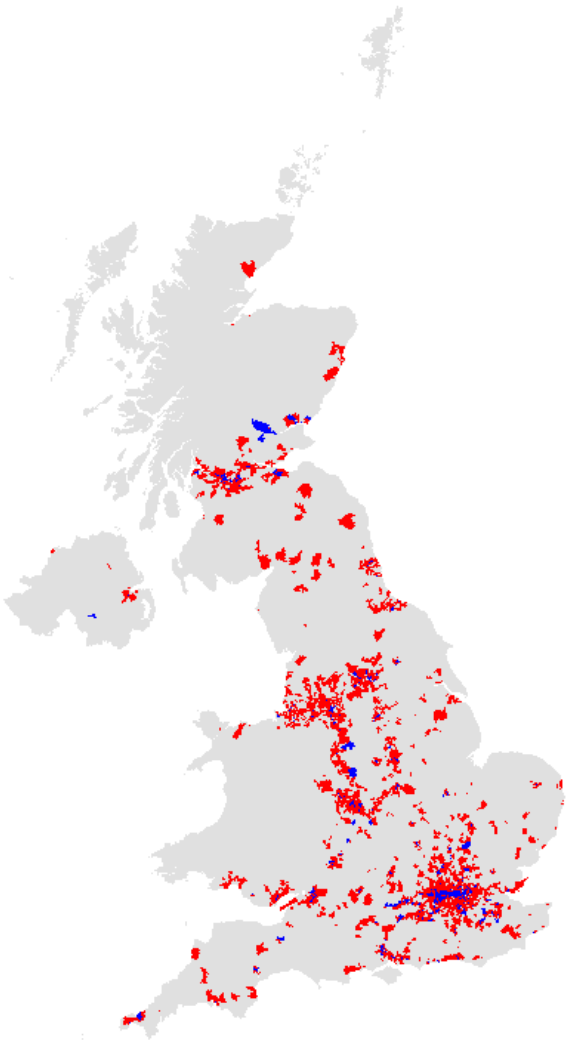
iv) Calculating CISBO service shares based on revenues

Identification of potentially competitive areas in the UK

A15.156 The following map (Figure A15.7) shows how rival infrastructure is distributed around the UK. Red areas on the map identify sectors with on average one OCP (i.e. sectors with network reach between 1 and 2), and blue areas identify sectors with on average more than two OCPs (i.e. sectors with network reach equal to or above 2).[265] More information on Ofcom's approach to determining appropriate buffer distances can be found in Annex 18.

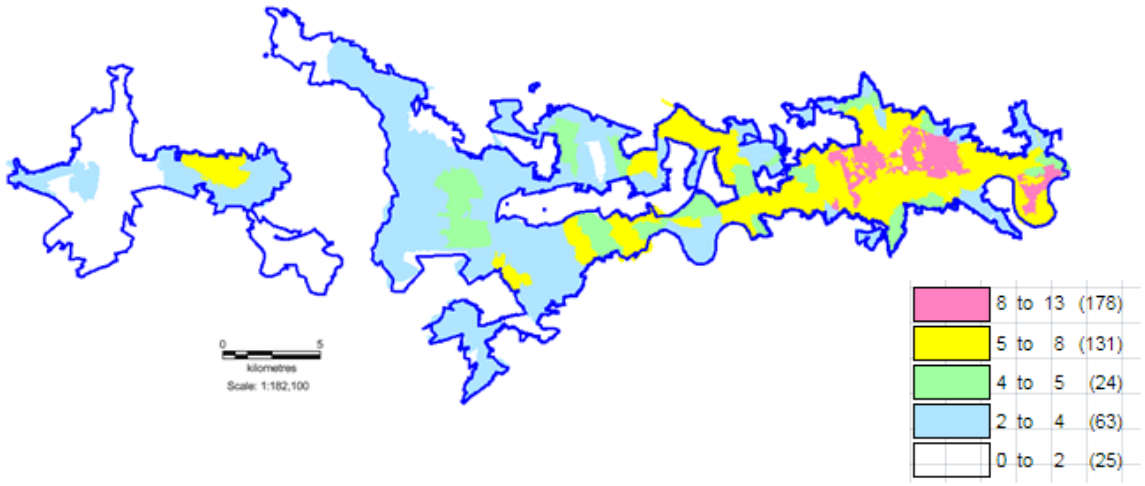
[265] "Network reach" is here defined as the average number of OCPs with a flexibility point within 200m of the large business sites in a postcode sector. Sectors with network reach value of two or more are then considered "high network reach" sectors.

Figure A15.7 – Map of rival infrastructure



A15.157 We used this analysis to identify the areas in which multiple OCPs have their infrastructure and which we consider in detail in Section 4. Firstly, we looked at the WECLA defined in the BCMR 2013. The following map (A15.8) shows the amount of rival infrastructure present inside the WECLA. The largest density of rival infrastructure can be found in central London (marked in red colour), where businesses are located within 200m of on average at least 8 different OCPs Moving further away from central London decreases the amount of rival infrastructure present to initially 5-8 OCPs, then to lower numbers.

Figure A15.8 - Network Reach inside WECLA



A15.158 Table A15.14 shows the numbers of postcode sectors, businesses and the number of leased lines sold in the WECLA. We also present the percentage distribution of businesses by number of OCPs with a flexpoint within 200m of the business site. For example, 55% of businesses located in the WECLA have at least 7 OCPs within 200m of their location with the overall average network reach for the WECLA being 6.3.

Table A15.14 – Statistics for the WECLA

	WECLA
No. of sectors	421
No. of business	7,617
Avg. network reach	6.3
b. within reach of 0 OCPs	0 %
b. within reach of 1 OCPs	4 %
b. within reach of 2 OCPs	6 %
b. within reach of 3 OCPs	9 %
b. within reach of 4 OCPs	11 %
b. within reach of 5 OCPs	7 %
b. within reach of 6 OCPs	9 %
b. within reach of 7+ OCPs	55 %
TISBO low	42,992
CISBO	45,202

A15.159 Additionally, we identified five cities with the largest density of rival infrastructure outside London – Birmingham, Bristol, Glasgow, Leeds and Manchester. In each of these cities, we identified the contiguous high network reach area.[266] In each case, the areas with highest network reach are located in the centre of the city. The next set of maps (Figures A15.9-A15.13) shows network reach values for the high network reach areas. Colours in the figures correspond to the colour scale used in the previous map for the WECLA.

Figure A15.9 - Network Reach: Birmingham

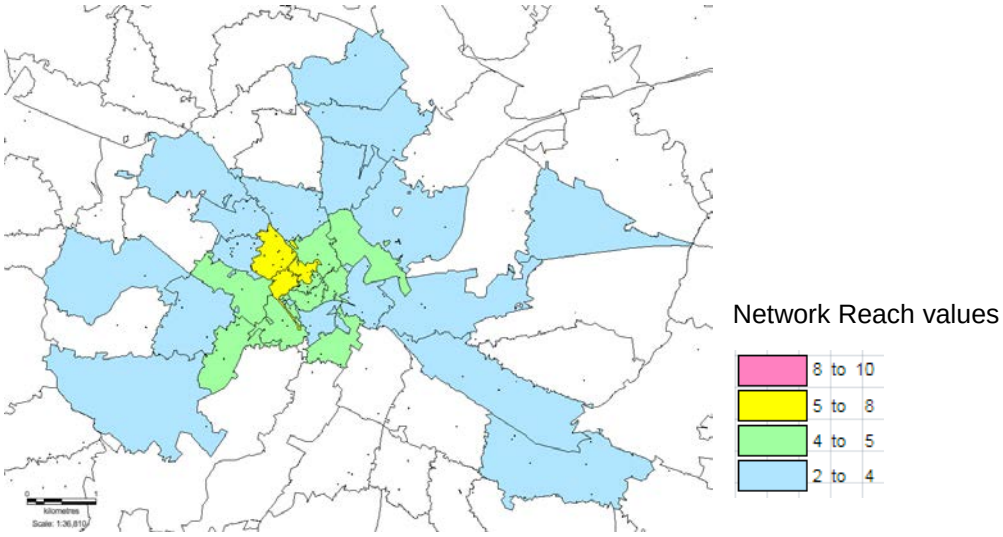
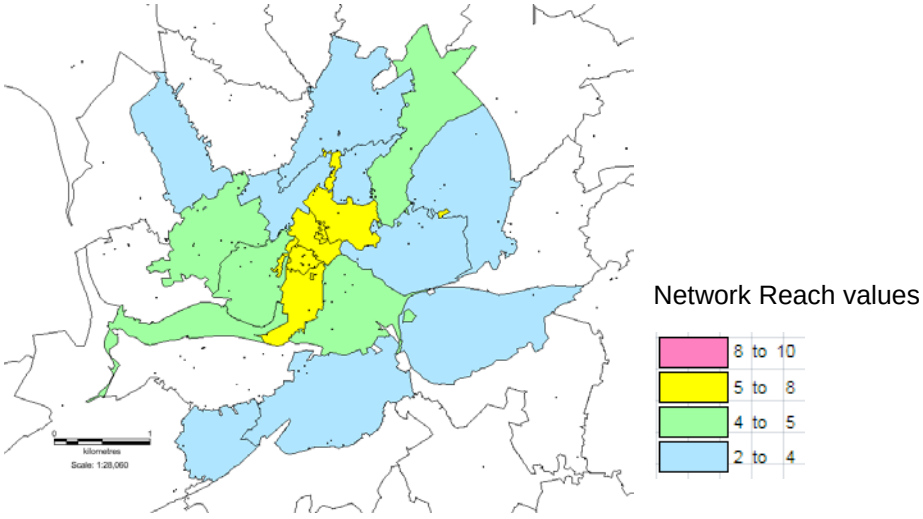


Figure A15.10 - Network Reach: Bristol



[266] See footnote 260 for definition.

Figure A15.11 - Network Reach: Glasgow

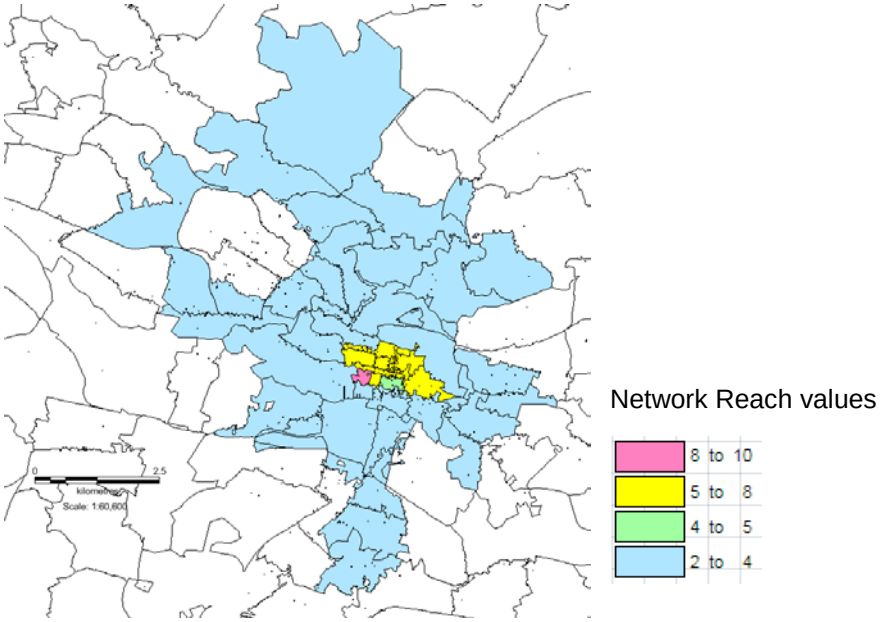


Figure A15.12 - Network Reach: Leeds

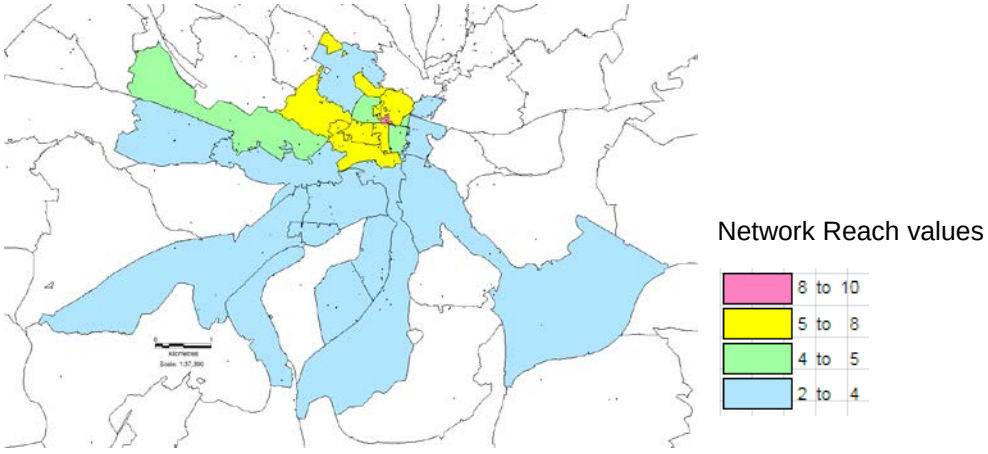
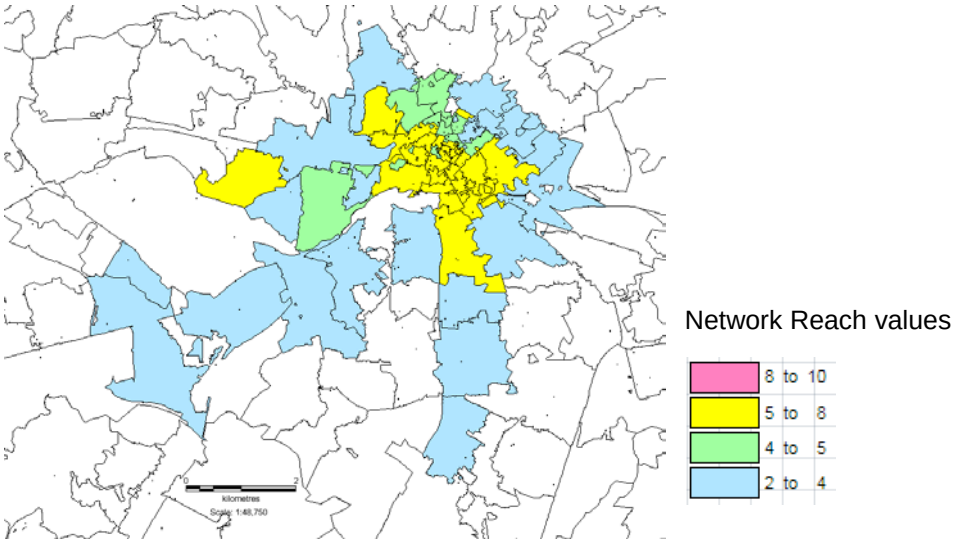


Figure A15.13 - Network Reach: Manchester



A15.160 The maps illustrate that most sectors in the contiguous high network reach areas of city centres have network reach values between 2 and 4 (shown in blue) and very few sectors have network reach equal to or above 4.

A15.161 In the next table (Table A15.15) we present the number of postcode sectors, businesses and leased lines sold in the high network reach areas of each selected city. Additionally we also present average network reach and density of rival infrastructure. The last column of the table shows figures for all five central business districts ("CBDs") combined. The numbers show, for example, that approximately half of the businesses located in the central business districts have at most 4 OCPs' flexibility points within 200m.

Table A15.15 - Statistics for CBDs

	Birmingham	Bristol	Glasgow	Leeds	Manchester	Combined
No. of sectors	28	15	43	23	49	158
No. of business	777	691	1,146	773	1,041	4,428
Avg. network reach	4.1	4.8	4.0	4.7	4.6	4.4
b. within reach of 0 OCPs	0%	0%	0%	2%	1%	1%
b. within reach of 1 OCPs	3%	2%	5%	5%	3%	4%
b. within reach of 2 OCPs	9%	7%	18%	8%	10%	11%
b. within reach of 3 OCPs	23%	17%	27%	14%	12%	19%
b. within reach of 4 OCPs	25%	19%	12%	24%	20%	19%
b. within reach of 5 OCPs	22%	20%	11%	13%	23%	18%
b. within reach of 6 OCPs	16%	10%	12%	11%	15%	13%
b. within reach of 7+ OCPs	2%	24%	15%	23%	16%	15%
TISBO low	1,773	951	2,095	1,405	1,648	7,873
CISBO	2,751	1,558	3,576	2,727	3,246	13,858

Definition of Central London Area (CLA)

A15.162 In Section 4, we explain that we propose to identify the parts of central London in which competition is likely to be fully effective across a range of products as a separate market, which we call the Central London Area (CLA).

A15.163 To identify the boundary of this market we use so called boundary test. The boundary of the CLA geographic market is then formed by postcode sectors which fulfil at least one of the conditions of the boundary test:

- Condition 1: Network Reach equal to or higher than 5 (i.e. number of OCPs >= 5)

- Condition 2: Network Reach equal to or higher than 4 and, in addition, at least 90% of businesses within the given postcode sector are no further than 100 metres from a flexibility point of at least 2 OCPs

A15.164 For the purposes of defining the CLA, Network Reach is calculated using a 100m buffer distance assumption.[267]

A15.165 Figures A15.14 and A15.15 show postcode sectors passing Condition 1 (shown in blue). Most of these sectors are located in the central London or Docklands area. The maps also show boundaries of geographic markets defined in previous BCMRs (the WECLA defined in BCMR 2013 is marked by blue line, CELA defined in BCMR 2008 is shown in brown line).

Figure A15.14 - Condition 1, WECLA

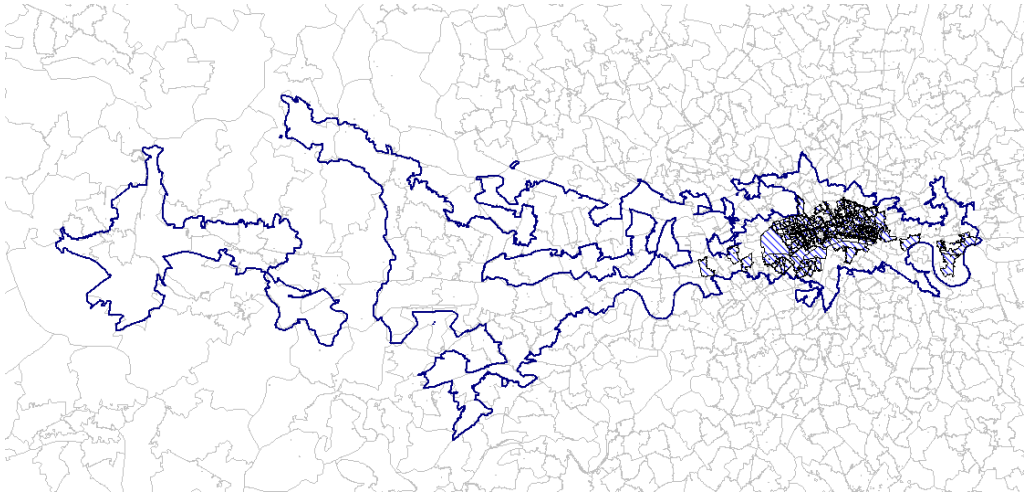
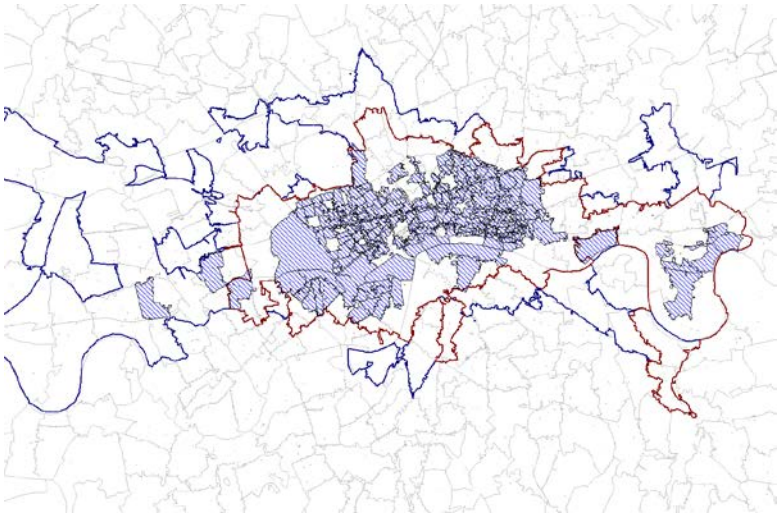


Figure A15.15 - Condition 1, Central London



[267] See Section 4 and Annex 18 for more detail.

A15.166 Figures A15.16 and A15.17 add postcode sectors passing Condition 2 of the boundary test (sectors coloured in red, sectors passing Condition 1 remain in blue). There is a significant overlap between sectors passing the Conditions 1 and 2 of the test, however there are also sectors on the margin fulfiling only one of the conditions.

Figure A15.16 - Both conditions, WECLA

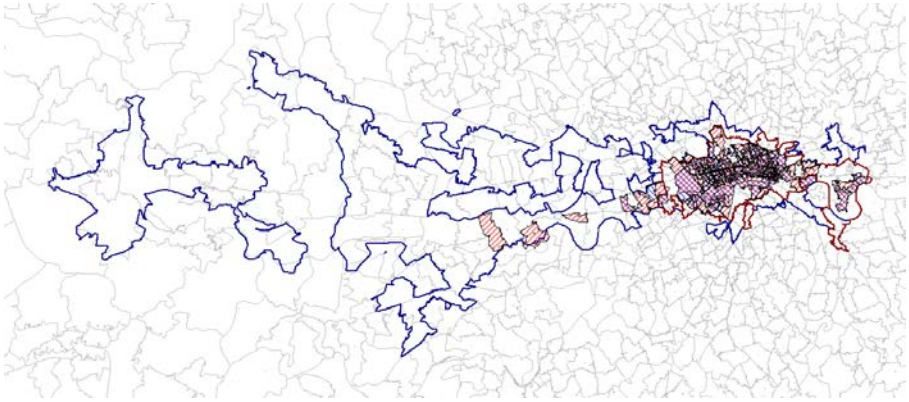
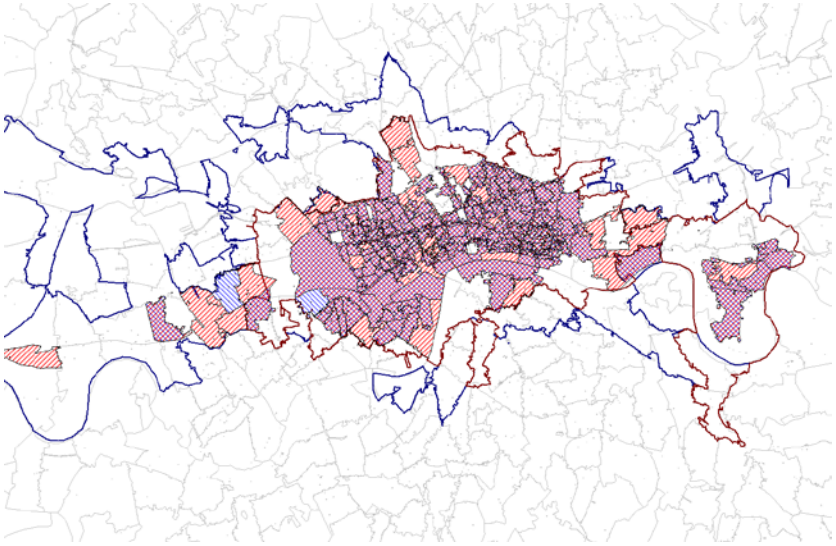


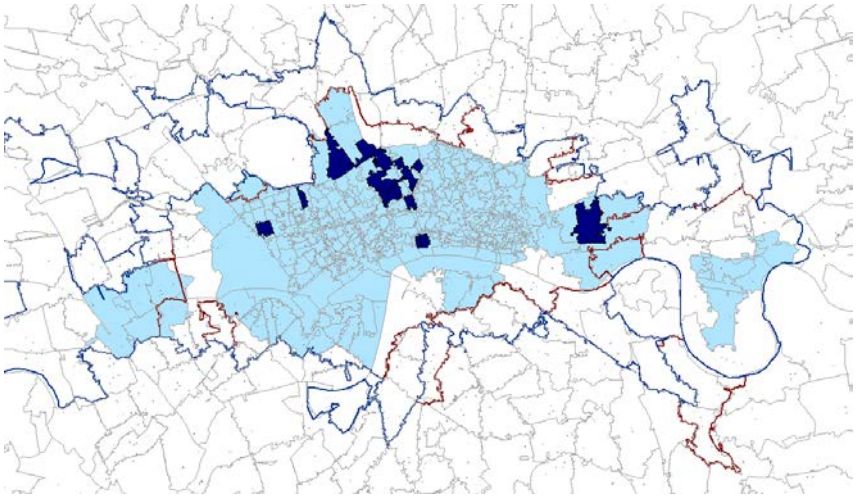
Figure A15.17 - Both conditions, Central London



A15.167 Postcode sectors passing either one of the conditions of the boundary test represent the area in central London where market conditions are likely to be the most competitive. As a result, these sectors form the basis for the relevant geographic market called the Central London Area (CLA).

A15.168 After performing the boundary test, we identified 11 postcode sectors located inside the CLA boundary but which did not pass either of the conditions set out above. All of these sectors are almost entirely surrounded by sectors passing the test. The location of these 11 sectors is shown on the following map (Figure A15.18, sectors shown in dark blue).

Figure A15.18 – Sectors not passing either condition inside resulting area

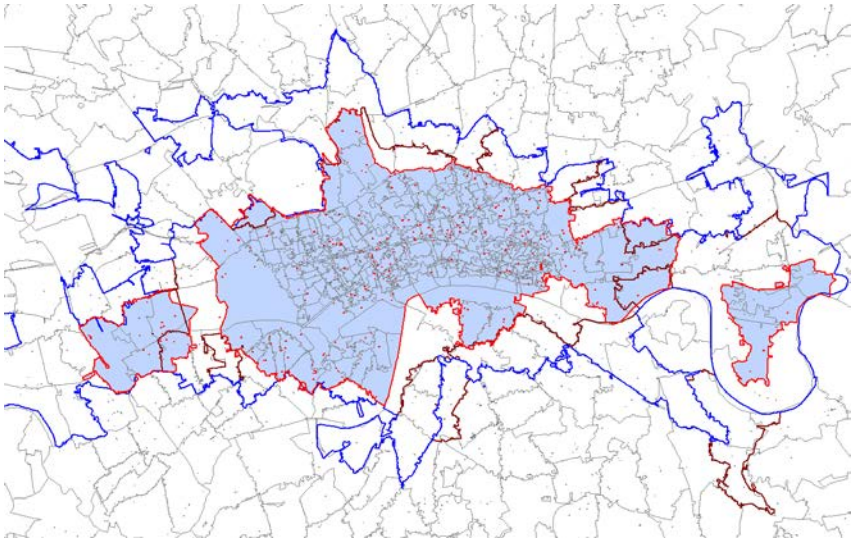


A15.169 We looked at the postcode sectors within the CLA boundary which did not pass the boundary test in more detail. We found that all of these sectors came very close to satisfying at least one of the conditions. For example, one sector has network reach between 4-5 while having 87% of businesses within reach of at least 2 OCPs; 6 sectors have network reach of 3-4 while having 100% of businesses with access to at least 2 OCPs. Even though these sectors do not have exactly the same amount and density of rival infrastructure present, they are contiguous with and indeed almost always entirely surrounded by sectors passing the boundary test.

A15.170 Additionally, 2 sectors of the 11 identified have no network reach value attributed to them as there are no businesses located in those sectors. However there are at least 4 OCPs present in these sectors and able to serve businesses which locate there in future.

A15.171 In the light of this, we consider that conditions in these 11 sectors are sufficiently similar to the conditions in the sectors passing the boundary test for these 11 sectors to be included in our proposed CLA definition. The final CLA definition is shown on the following map (Figure A15.19).

Figure A15.19 - Central London Area (CLA)



A15.172 The geographic area not included in the CLA, but included in WECLA, constitutes a relevant geographic market ("the London Periphery"). The following table (Table A15.16) shows key statistics for CLA and LP. We present the number of postcode sectors, businesses and leased lines sold. Additionally we also present average network reach and density of rival infrastructure in each of the areas.

Table A15.16 – Statistics for CLA and LP

	CLA	LP
No. of sectors	276	145
No. of business	4,239	3,378
Avg. network reach	8.0	4.1
b. within reach of 0 OCPs	0 %	1 %
b. within reach of 1 OCPs	0 %	8 %
b. within reach of 2 OCPs	0 %	13 %
b. within reach of 3 OCPs	0 %	19 %
b. within reach of 4 OCPs	1 %	23 %
b. within reach of 5 OCPs	2 %	12 %
b. within reach of 6 OCPs	8 %	12 %
b. within reach of 7+ OCPs	88 %	13 %
TISBO low	31,577	11,415
CISBO	32,766	12,436

Contiguity

A15.173 In the 2008 and 2013 BCMRs, the geographic markets we defined were, with one limited exception, composed of contiguous postcode sectors. We required contiguity because investment decisions in leased line markets are often incremental to current network build and because, for an operator to be able to compete across the geographic scope of an unregulated market it must have, or be able to obtain wholesale access to, infrastructure at both ends of the leased line and also any segments in between the two ends. We therefore considered that competitive market areas would tend to be contiguous.

A15.174 In the 2013 BCMR, we made an exception for some postcode sectors in the Slough area because this area was separated from the WECLA by a single (low network reach) postcode sector, and economic linkages between the Slough sectors and the WECLA appeared to be strong. We considered that, as other evidence suggested that competitive conditions across the Slough sectors and the WECLA were broadly similar, applying strict contiguity as the only reason for not combining the two would have resulted in placing too much weight on this requirement, particularly given the lack of economic significance attached to postcode sector boundaries.

A15.175 The result of the application of the boundary test set out above, with detailed analysis of the 11 postcode sectors within the boundary which do not meet the test

criteria, is an area composed of one large and two smaller contiguous blocks each separated from the main block by a single postcode sector. We consider that economic linkages between the three contiguous blocks are likely to be strong. Consistent with our approach in the 2013 BCMR, we think it reasonable to include these three blocks in the CLA market.

Alternative tests

A15.176 To test the robustness of the results from the boundary test used for the definition of CLA, we performed a sensitivity analysis. Firstly, we looked at a less strict version of the proposed test defined by the following conditions:

- Condition 1: Network Reach equal to or higher than 4 OCPs
- Condition 2: Network Reach equal to or higher than 3 if at least 90% of businesses within the given postcode sector are no further than 100 metres from a flexibility point of at least 2 OCPs

A15.177 Results of this test are shown in Figure A15.20 and A15.21. It can be seen that weakening the conditions of the test does not significantly change the resulting area. A few isolated postcodes located in western London pass one but not both of the conditions. Additionally, a few additional postcode sectors just outside the CLA boundary pass one or both conditions of the test (red line on the map marks the proposed CLA boundary).

Figure A15.20 - Alternative test 1, WECLA

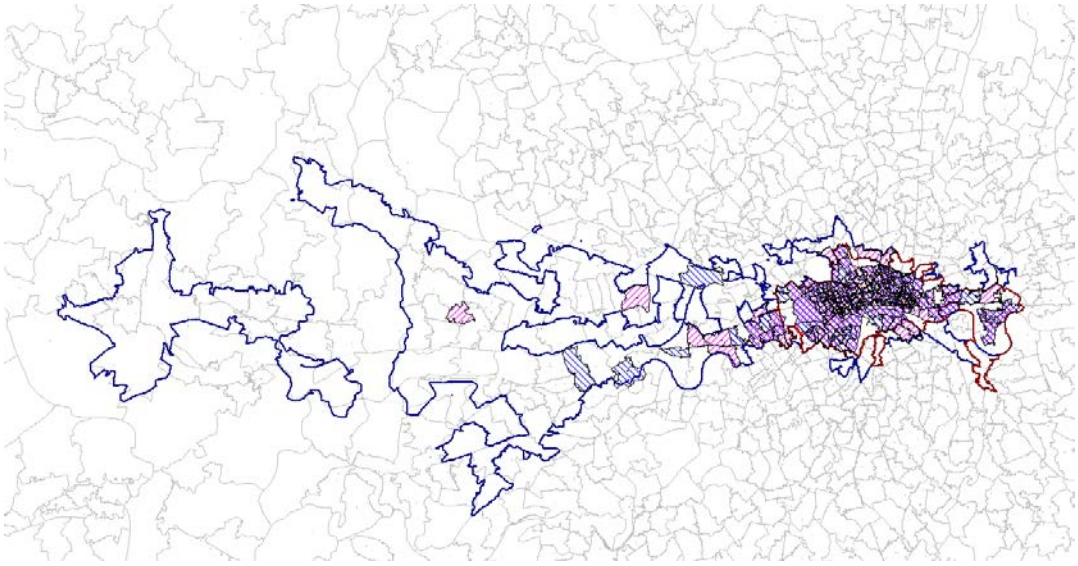
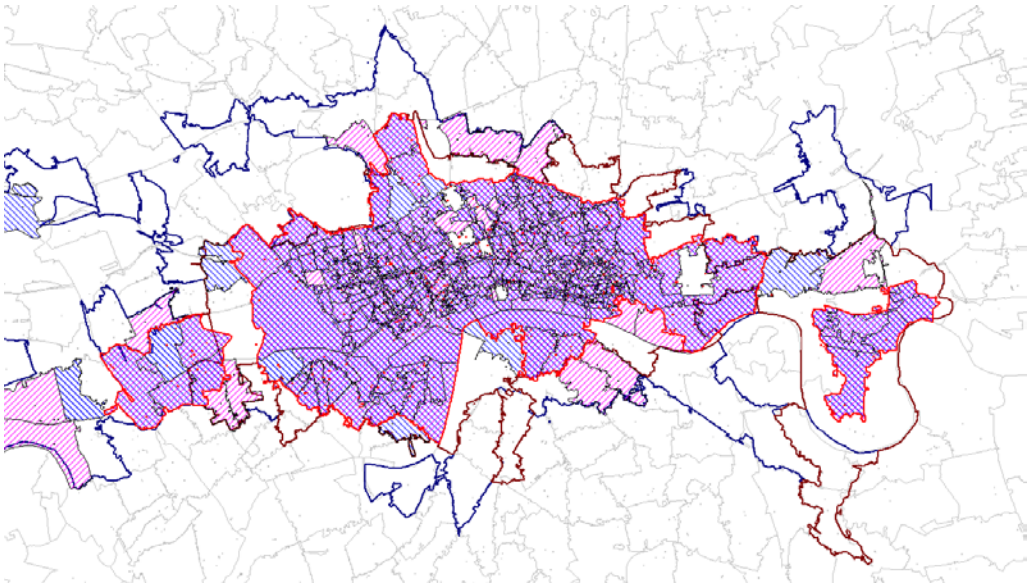


Figure A15.21 - Alternative test 1, Central London



A15.178 We also looked at a stricter version of the test. The conditions of this test were the following:

- Condition 1: Network Reach equal to or higher than 5
- Condition 2: Network Reach equal to or higher than 4 if at least 90% of businesses within the given postcode sector are no further than 100 meters from at least 3 OCPs

A15.179 As indicated by the maps (Figures A15.22 and A15.23), the area defined by the stricter conditions is again very similar to the proposed CLA area. There are a small number of postcode sectors inside the CLA boundary that do not pass the stricter test, but the vast majority of sectors pass even the stricter boundary test.

Figure A15.22 - Alternative test 2, WECLA

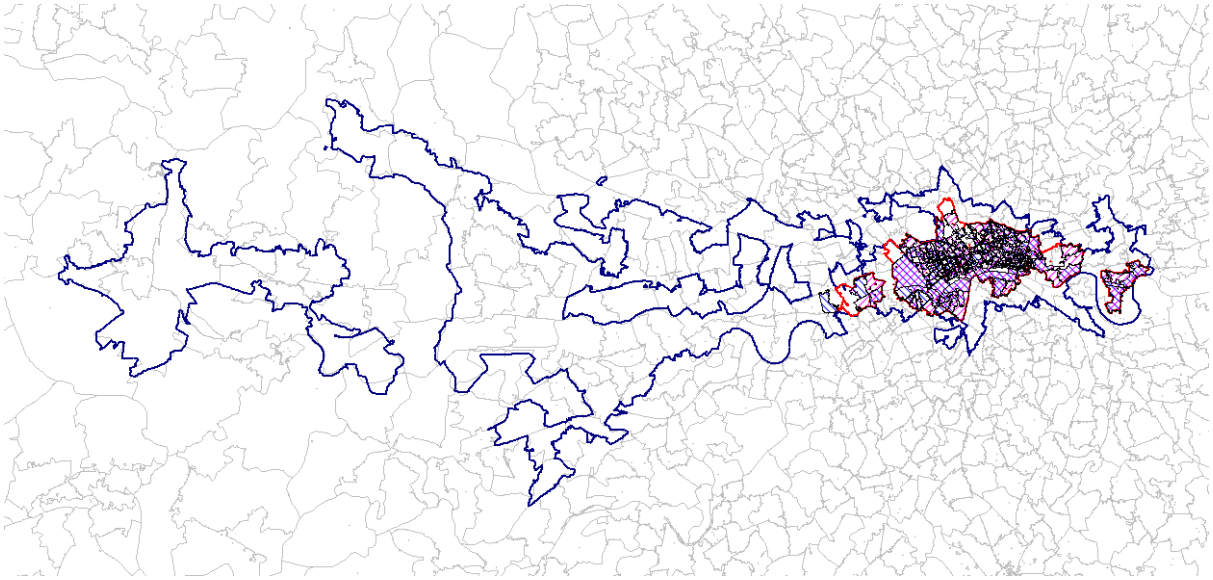
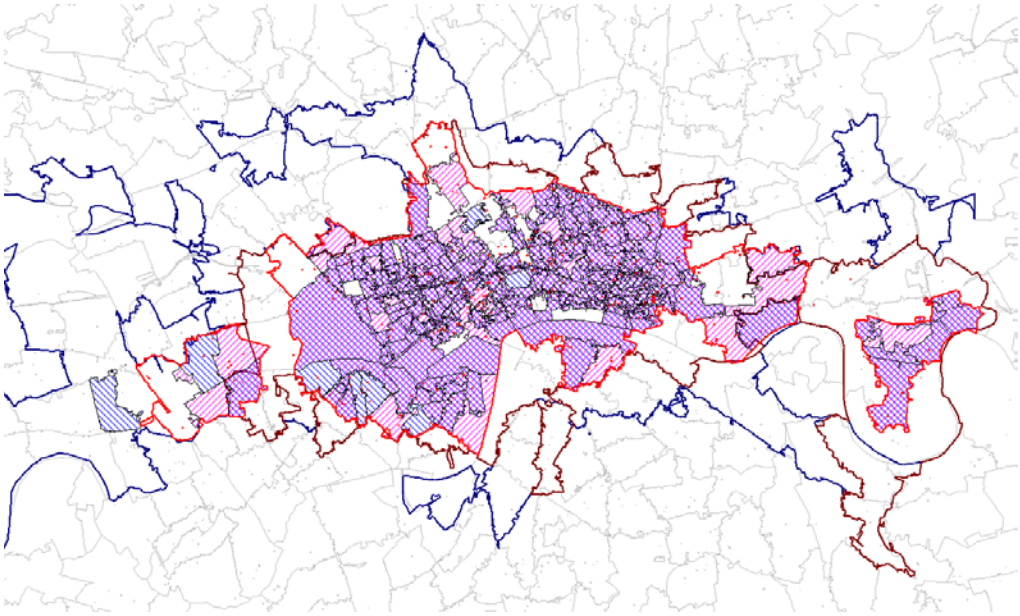


Figure A15.23 - Alternative test 2, Central London



A15.180 The sensitivity analysis has shown that the proposed definition of the CLA would not change significantly as a result of small changes to the conditions of the boundary test. We therefore consider the results robust and stable to alterations of the test conditions. The sensitivity analysis provides some assurance that competitive conditions inside the selected postcode sectors are sufficiently homogeneous and at the same time appreciably different from the conditions in the neighbouring areas.

Central Business Districts

A15.181 Lastly, we looked at individual CBDs (Birmingham, Bristol, Glasgow, Leeds and Manchester) and applied the same boundary test. Figures A15.24-A15.28 show postcode sectors in each city passing either one of the conditions defined by the boundary test. As previously, sectors passing the first condition are marked in blue, sectors passing the second condition are marked in red. The green line marks the high network reach area of the city centre in each CBD.[268]

[268] Network reach is defined as in footnote 1 for these purposes.

Figure A15.24 - Birmingham

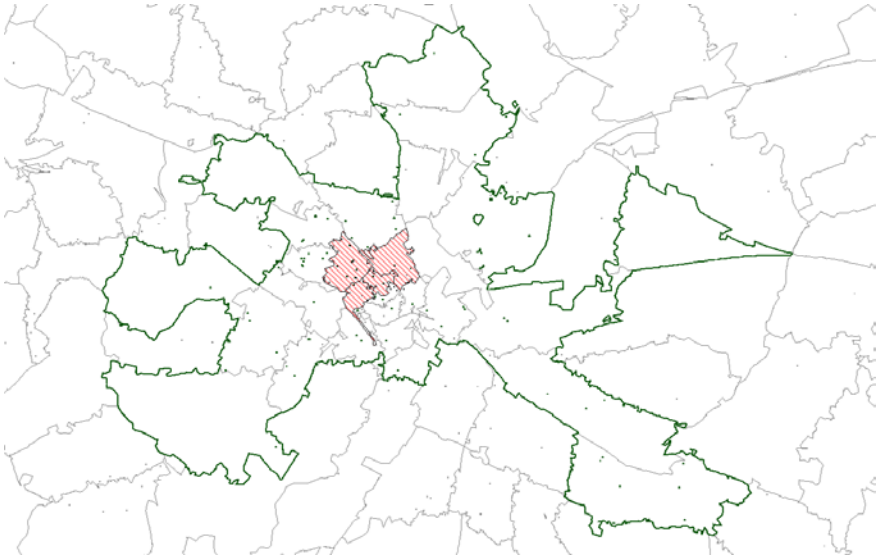


Figure A15.25 - Bristol

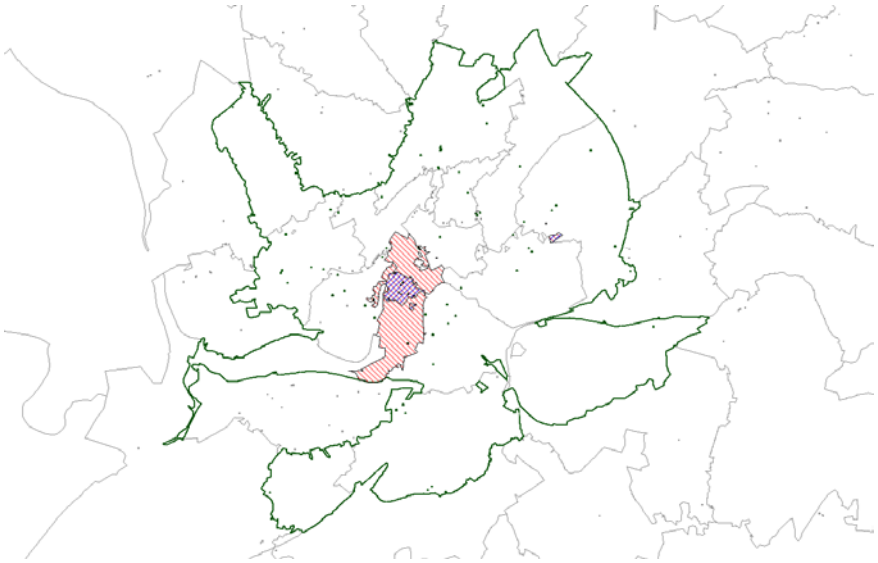


Figure A15.26 - Glasgow

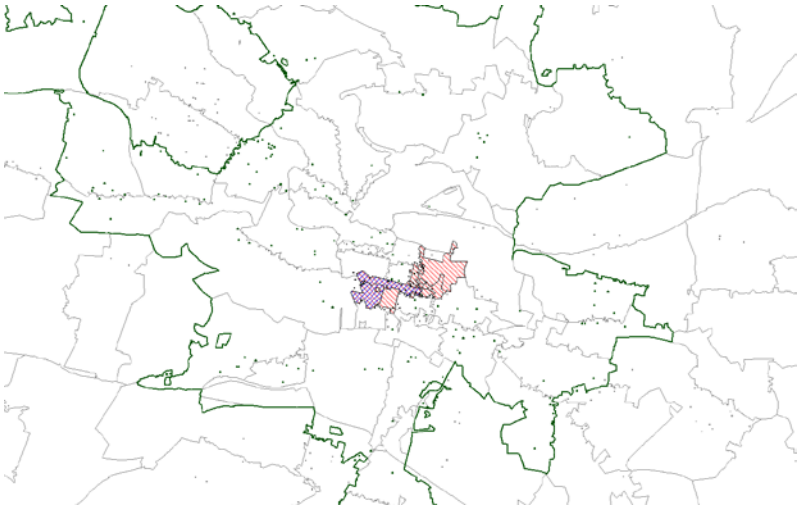


Figure A15.27 - Leeds

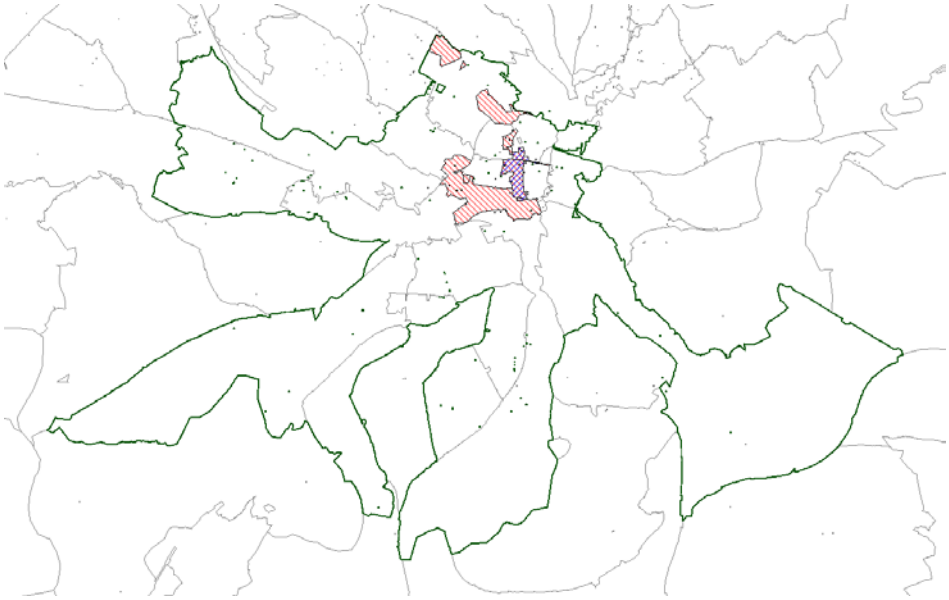
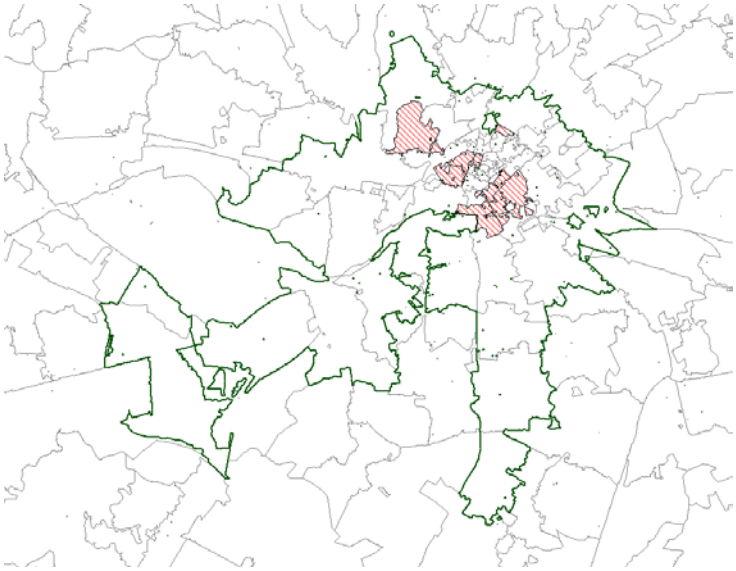


Figure A15.28 - Manchester



A15.182 The maps show that there are only a very few sectors in each city that pass either one of the conditions of the boundary test. The following table (Table A15.17) shows the number of sectors passing the boundary test for each CBD. We also present number of businesses and number of CISBO lines in those sectors. Comparing the values in Table A15.17 with values presented in Table A15.15 indicates only a small share of high network reach area within each city passes the boundary test.

Table A15.17 – Areas in CBDs passing the boundary test

	Sectors	Businesses	CISBO lines
Birmingham	4	139	650
Bristol	3	98	374
Glasgow	5	218	650
Leeds	5	145	540
Manchester	11	244	713

Calculating service shares of WDM services using bearers

A15.183 Our methodology for calculating service shares is based on counting active leased line services provided to a customer. In the case of very-high-bandwidth CISBO services provided with WDM technology at the customer premises, which can deliver multiple active services (wavelengths) over a single bearer, we count wavelengths. The alternative would be to count just the underlying WDM bearers, but this would not capture potentially significant differences in the value of the service being supplied as the number of wavelengths on a bearer could range from 1 to 80 or more.

A15.184 Vodafone expressed concern that calculating service shares based on active services (wavelengths) might not be appropriate for the very–high-bandwidth CISBO segment. It argued that customers being served by WDM-based services and using one wavelength from a particular CP are very likely to purchase additional wavelengths from the same CP rather than from different ones. Vodafone also argued that service shares would therefore be more informative of CPs' market power if the number of bearers, rather than number of wavelengths, were used for the calculation. In particular, it was concerned that BT's market power would be understated if shares were calculated from wavelength data rather than bearer numbers.

A15.185 We are unable to directly estimate the number of WDM bearers because some operators were able to provide only data on wavelengths, and we cannot estimate the number of individual WDM routes because some operators have provided data in the form of customer-tails, which means it is not possible to identify the A-end and corresponding B-end of a single connection. However, as a proxy, we counted the number of active WDM services provided by each CP in unique postcodes. Assuming that all WDM services terminating in one postcode terminate at the same site, and that it is connected using a single bearer, we estimated the number of bearers and number of wavelengths per bearer.

A15.186 The following table (Table A15.18) presents results of our analysis for BT and Virgin Media. The two companies combined provide 71 % of all WDM-based CISBO services across the entire UK.

Table A15.18 - Analysis of bearers vs wavelengths

	BT	VM
No. of WDM wavelengths	1,968	4,455
No. of supplied postcodes	[✂ ✂]	[✂ ✂]
No. of postcodes with a single wavelength	[✂ ✂]	[✂ ✂]
No. of postcodes with multiple wavelengths	[✂ ✂]	[✂ ✂]
Share of postcodes with multiple wavelengths	[✂ ✂]	[✂ ✂]
Average number of wavelengths per sector	[✂ ✂]	[✂ ✂]

Note: Data on several circuits of both BT and VM were missing information on their postcode. These were excluded from calculation of the average number of wavelengths per sector.

A15.187 While Virgin Media supplies multiple services on one bearer only in [✂ ✂] of cases, BT supplies multiple services on one bearer in [✂ ✂]of cases. This is also reflected in the average number of wavelengths supplied on a single bearer – while the average is [✂ ✂]for Virgin Media, BT supplies on average [✂ ✂]wavelengths on each bearer.

A15.188 We believe that counting wavelengths is more appropriate than counting bearers because the former gives a better proxy for the value of the service. Moreover, our calculations do not support Vodafone's contention. In fact, BT's share of wavelengths is higher than its share of bearers, because it provides on average more wavelengths per bearer than Virgin Media.

Calculating shares of CISBO services based on revenue

A15.189 In markets for differentiated products, like leased lines, shares of market value are often informative, in addition to shares of market volume. Our measure of market shares is calculated from the numbers or volume of leased line terminating segments supplied.

A15.190 We are unable to measure market shares based on leased lines revenues because many CPs were unable to present their revenue data at the required level of granularity. However, by using various proxies for leased line prices, we calculate revenue-based shares as a sensitivity test to our main volume-based approach.

A15.191 Our ability to estimate value-based shares is constrained by the limited availability of information on various CPs' prices and their services. As we have no revenue information, and as we do not have information on the prices of the various OCPs, we had to make a number of assumptions.

- First, we calculated BT's prices on an annualised basis, so prices reflect the annual charge including all relevant connection and rental charges over a three

year contract term. Where applicable, we assumed a 10km circuit distance (main link). We used these BT's CISBO prices as a proxy for the prices of CISBO products for all CPs

- Second, since prices for CISBO services were not available by geography, we used the same CISBO prices for CLA, LP and RoUK.[269]

A15.192 The following table (Table A15.19) shows the resulting estimates of CISBO service shares based on revenues for the four largest CPs. For comparison, we also report volume-based service shares.

Table A15.19 - Revenue based CISBO shares

		CLA	LP	RoUK
revenue	BT	37%	41%	53%
	Virgin Media	11%	28%	33%
	Colt	28%	13%	1%
	Vodafone	4%	6%	3%
volume	BT	44%	48%	56%
	Virgin Media	10%	26%	31%
	Colt	25%	11%	0%
	Vodafone	6%	7%	3%

A15.193 Comparing both sets of results shows that BT's estimated revenue-based shares are slightly lower than its volume-based shares in the CLA and LP (by 4 percentage points) whilst in the Rest of the UK the two measures are the same.

[269] [✂

✂]

Annex 16

Description of BT's wholesale products

Introduction

A16.1 In this section we describe the products that BT currently offers to satisfy its various SMP obligations across the wholesale leased lines markets. We also describe the associated interconnection services offered by BT.

Current Remedies

A16.2 In the 2013 Review we found BT to have Significant Market Power (SMP) in the following wholesale markets:

- Wholesale market for low bandwidth Traditional Interface Symmetric Broadband Origination (TISBO) in the UK excluding the Hull area at bandwidths up to and including 8Mbit/s;
- Wholesale market for medium bandwidth TISBO in the UK excluding the WECLA and the Hull area at bandwidths above 8Mbit/s and up to and including 45Mbit/s;
- Wholesale market for high bandwidth TISBO in the UK excluding the WECLA and the Hull area at bandwidths above 45Mbit/s and up to and including 155Mbit/s;
- Wholesale market for low bandwidth Alternative Interface Symmetric Broadband Origination (AISBO) in the UK excluding the Hull area at bandwidths up to and including 1Gbit/s;
- Wholesale market for Multiple Interface Symmetric Broadband Origination (MISBO) in the UK excluding the WECLA and the Hull area at bandwidth greater than 1Gbit/s and services of any bandwidth delivered using wavelength-division multiplex (WDM) at the end-user's premises; and
- Wholesale market for Traditional Interface (TI) regional trunk segments in the UK.

A16.3 The following obligations were applied to BT in each of the wholesale markets:

- an obligation to provide Network Access on reasonable request;
- a requirement not to unduly discriminate;
- a charge control;
- a requirement to publish a reference offer;
- an obligation to give 90 days' notice of changes to prices, terms and conditions for existing services;
- an obligation to give 28 days' notice of the introduction of prices, terms and conditions for new services;
- an obligation to give 28 days' notice of reductions in prices for existing services;

- a requirement to publish quality of service information;
- a requirement to notify technical information with 90 days' notice;
- obligations relating to requests for new network access;
- accounting separation and cost accounting obligations; and
- requirements to provide accommodation in BT exchanges and to provide specific types of interconnection service, namely:
  - customer-sited handover; and
  - in-building handover.

A16.4 Furthermore, the following obligations and directions were applied to BT in relation to specific wholesale markets.

Table A16.1: Specific wholesale remedies

Wholesale market	Remedy
Wholesale TISBO markets and TI regional trunk segments markets	• A direction under the general access condition requiring BT to provide TI terminating segments (including where appropriate trunk segments) known as Partial Private Circuits (the PPC Direction); and • in the low bandwidth TISBO market, a direction requiring it to provide Radio Base Station Backhaul (RBS Backhaul). • Requirements to provide accommodation in BT exchanges and to provide specific types of interconnection service: a) In-span handover; and b) In-span handover extension.
Wholesale AISBO market	• A requirement to provide disaggregated Ethernet access and backhaul, and end-to-end Ethernet products; and • a direction relating to Service Level Agreements (SLGs).
Wholesale AISBO and MISBO markets	• A requirement to provide network access on the basis of Equivalence of Inputs (EOI) (except for certain specified exceptions, including accommodation services).
Wholesale MISBO market	• A requirement to provide: a) disaggregated single-service Ethernet access and backhaul; b) end-to-end single-service Ethernet products; and c) end-to-end and backhaul services with WDM equipment at the customer's premises.

BT's TISBO products

A16.5 Below we describe Partial Private Circuits (PPCs) and RBS Backhaul services that BT is required to provide in the wholesale TISBO markets. In addition, we describe the disaggregated TI wholesale products, namely TDM Access Bearer and TDM Backhaul Bearer, which BT developed following the Openreach Industry Commitments in May 2009.[270]

A16.6 PPCs and RBS Backhaul are provided by BT Wholesale on a non-EOI basis and are therefore used by CPs but not by BT's downstream divisions. TDM Access Bearer and TDM Backhaul Bearer are provided on an EOI basis by Openreach.

Partial Private Circuits

A16.7 PPCs provide dedicated symmetric transmission using Plesiochronous Digital Hierarchy (PDH) or Synchronous Digital Hierarchy (SDH) technologies between an end-user's premises and a CP's network via a Point of Connection (POC).

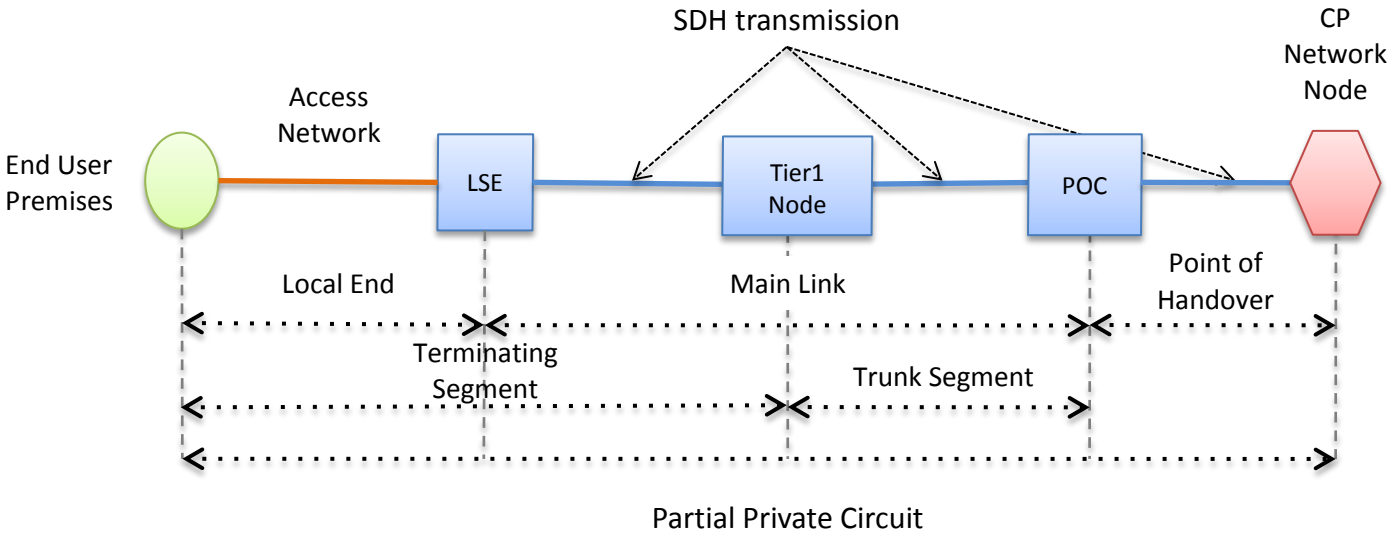
A16.8 PPCs are available with bandwidths of 64kbit/s, n x 64kbit/s where n varies from 2 to 29, 2Mbit/s, 34Mbit/s, 140Mbit/s, 155Mbit/s and 622Mbit/s.

A16.9 There are three main elements to a PPC:

- The 'Local End' is a dedicated link between the third party customer premise and the BT serving exchange generally using BT's copper or fibre access network or exceptionally a point-to-point microwave link.
- The 'Main Link' provides dedicated transmission capacity between the BT serving exchange and the CP's POC with BT's network. This Main Link can have a mixture of backhaul and trunk network transmission. The boundary between the backhaul and trunk element of a PPC is currently drawn at 46 aggregation nodes corresponding to major population and business centres.
- The Point of Handover (POH) is a high capacity link that connects the CP's network with BT's network. A POH can deliver multiple PPC circuits. BT is required to provide three different types of handover configuration:
    - In-Span Handover (ISH): interconnection is provided at a joint-box or man-hole adjacent to the BT POC exchange;
    - In-Span Handover Extension (ISH Extension): interconnection is provided at a joint-box or manhole further from the BT POC exchange; and
    - Customer Sited Handover (CSH): interconnection is provided at the CPs network node.

[270] The Openreach Industry Commitments are a set of product and systems developments that BT committed to undertake when some of its Undertakings commitments relating to support systems functional separation were relaxed.
http://stakeholders.ofcom.org.uk/consultations/btundertakings/statement/

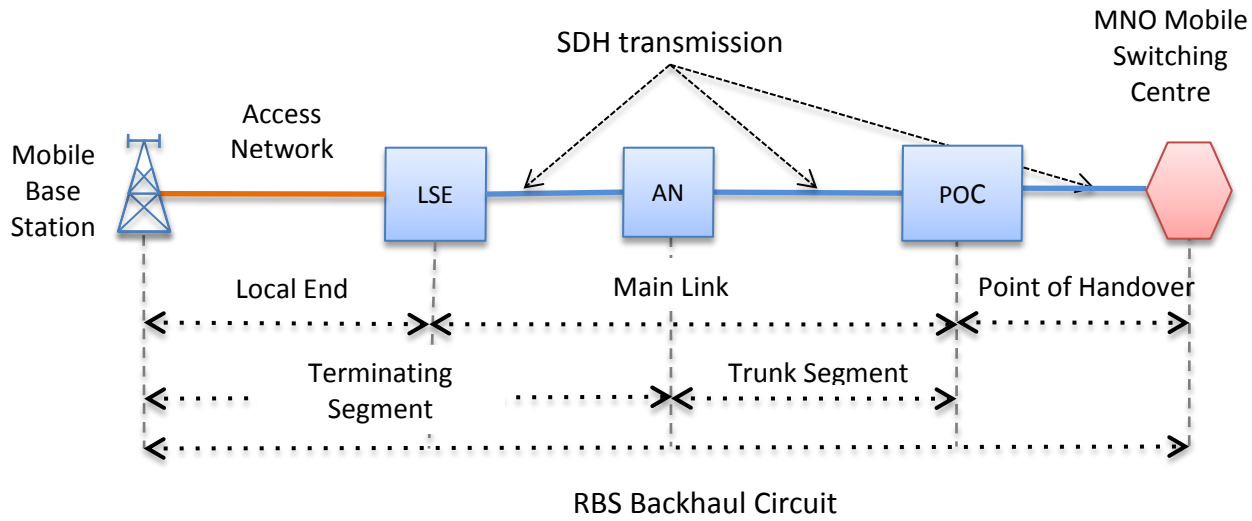
Figure A16.1: Partial Private Circuit



Radio Base Station Backhaul

A16.10 An RBS Backhaul circuit is a PPC that provides dedicated symmetric transmission at bandwidths up to 2Mbit/s between a Mobile Network Operator (MNO) radio base station and the MNO Mobile Switching Centre (MSC).The base station is linked to BT's local serving exchange using BT's copper or fibre access network or point-to-point microwave links.

Figure A16.2: Radio Base Station Backhaul



Disaggregated TI wholesale products

A16.11 The disaggregated TI wholesale products, TDM Access Bearer[271] and TDM Backhaul Bearer[272], were developed by BT following the Openreach Industry

[271] Also requested in February 2007 by CPs using the Openreach new product development SoR (Statement of Requirements) process. The TDM Access Bearer service is described in SoR 6165.

Commitments in May 2009. They were delivered by Openreach in the summer of 2012.

A16.12 These services use the same technology platform as Openreach's Ethernet services and have similar configurations.

A16.13 The TDM Access Bearer Service provides a permanently connected, point-to-point circuit using a 2.5Gbit/s bearer. It provides a single circuit with an SDH interface with a bandwidth of 155Mbit/s, 622Mbit/s or 2.5Gbit/s (STM-1, STM-4 or STM-16).

A16.14 The TDM Access Bearer service operates over a maximum route distance of 63km. Where the ends of a TDM Access Bearer circuit lie in different BT serving exchange areas, a main link charge is made based on the radial distance between the two BT serving exchanges.

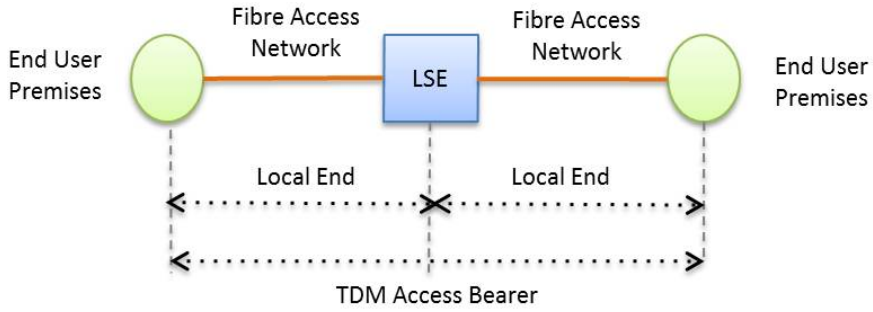
A16.15 One resilience option is available (RO2) comprising two separately routed circuits (primary and secondary). The circuits end on separate network terminating equipment (NTE). The preferred configuration is for the circuits to be diversely routed from the same circuit A-end to two different circuit B-end termination points. They can also be diversely routed between the same circuit A-end and B-end termination points. There are separate ports for connection to both primary and secondary circuits. If the primary circuit fails, it is the CPs, or their end-customers, responsibility to switch the traffic between the circuits. CPs are free to use each path as they wish.

A16.16 The primary and secondary fibre circuits are kept diverse throughout their life, meaning that a single fibre loss will not cause a total loss of service.

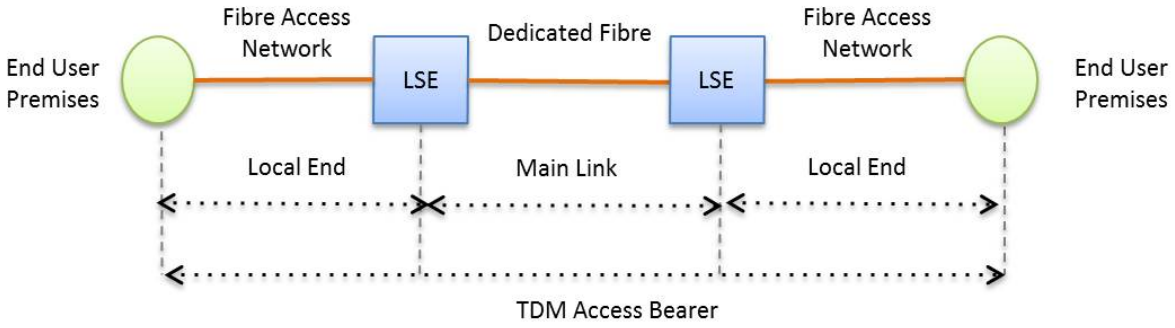
[272] Also requested in February 2007 the TDM Backhaul Bearer service is described in SoR 6169.

Figure A16.3: TDM Access bearer service

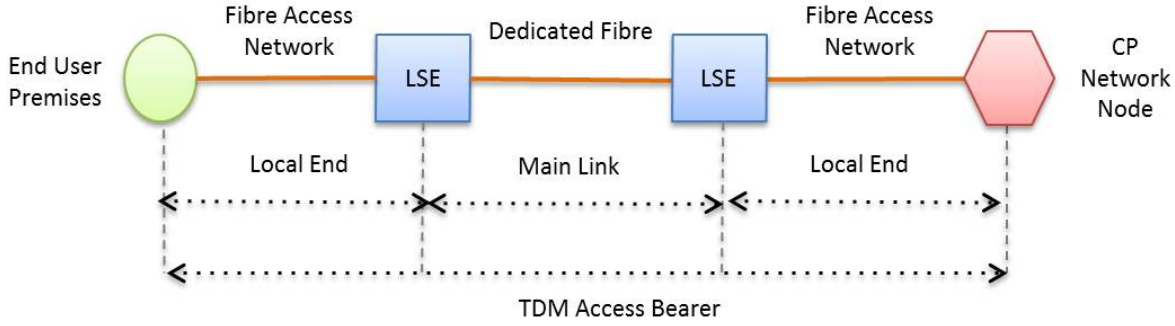
i) End-to-End circuit in same serving exchange area



ii) End-to-End circuit in different serving exchange areas



iii) End-user Premise to Remote CP Network Node in different serving exchange areas

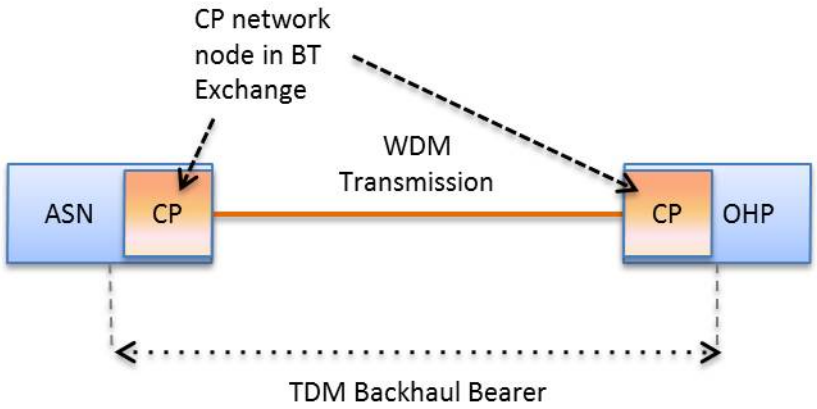


A16.17 The TDM Backhaul Bearer service operates between a CP's Point of Presence (PoP) in a BT exchange designated by Openreach as an Access Serving Node (ASN) and the same CP's core network PoP located at one of the parent exchanges designated as Openreach Handover Points (OHP) to which the ASN is connected or, if required, one of the other ASN to which it is connected.

A16.18 One resilience option is available (RO2) comprising a second TDM Backhaul Bearer circuit connected to either the secondary designated OHP or to the same OHP via a different route. Access is provided to the full capacity of both circuits.

A16.19 The TDM Backhaul Bearer is available with SDH interfaces and bandwidths of 2.5Gbit/s and 10Gbit/s (STM-16 or STM-64).

Figure A16.4: TDM Backhaul bearer service



BT's AISBO products

A16.20 As noted above, BT is currently required to provide both wholesale access and backhaul services in the AISBO markets. BT primarily satisfies this obligation by offering within its product portfolio EAD and EBD. EAD and EBD replaced the first-generation products Wholesale Extension Service (WES), Wholesale End-to-End Service (WEES) and Backhaul Ethernet Services (BES), which have been withdrawn from new supply[273], but are still used by some CPs. Openreach have announced that they will be withdrawing support for WES, WEES and BES in 2018.

A16.21 BT's AISBO products are provided by Openreach on an EOI basis and are therefore used by both CPs and BT's downstream divisions.

Wholesale AISBO access services

A16.22 BT's wholesale access Ethernet services EAD is used to provide short-range connections, typically up to 25 km (up to 35km in the case of EAD 1Gbit/s), and include:

i) end-to-end services between two end-users' premises;

ii) terminating segments between an end-user's site and a CP's network node (which could be located in the CP's building or in co-location space rented by the CP in a BT exchange); and

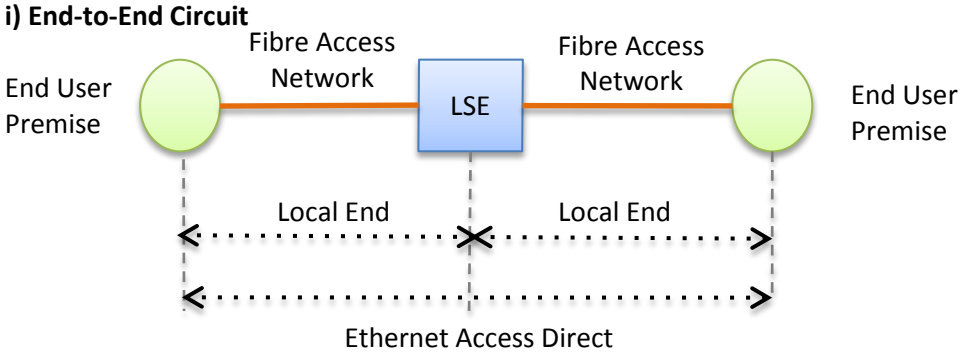
iii) terminating segments between CP's network nodes (which could be located in co-location facilities in a BT exchange or in the CP's own premises).

A16.23 Figure A16.5 below illustrates selected examples of these EAD configurations.

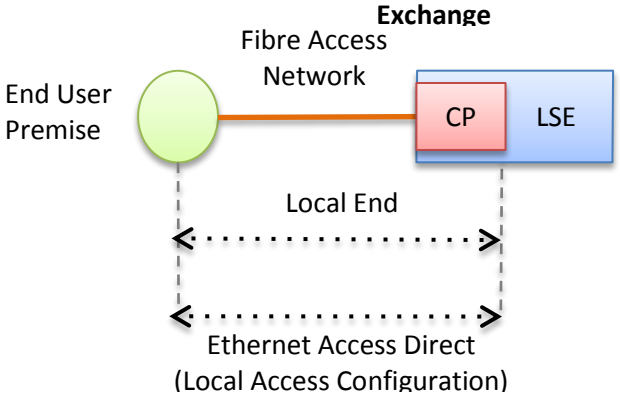
[273] The WES Aggregation product and the 2.5Gbit/s and 10Gbit/s versions of WES, WEES and BES are still available for new supply.

Figure A16.5: Wholesale Ethernet access services

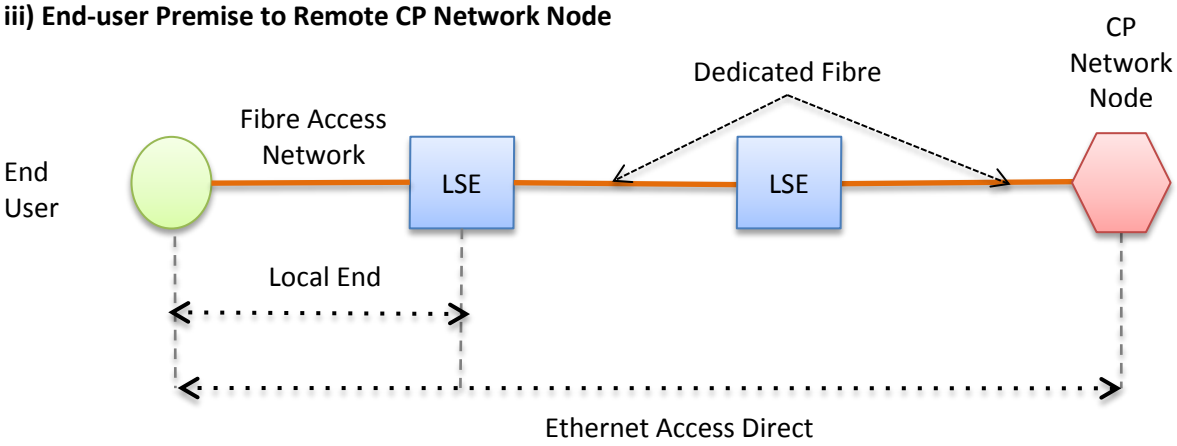
i) End-to-End Circuit



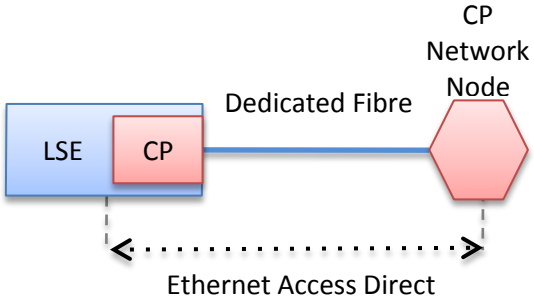
ii) End User Premise to a CP Network Node Located in a BT Local Serving Exchange



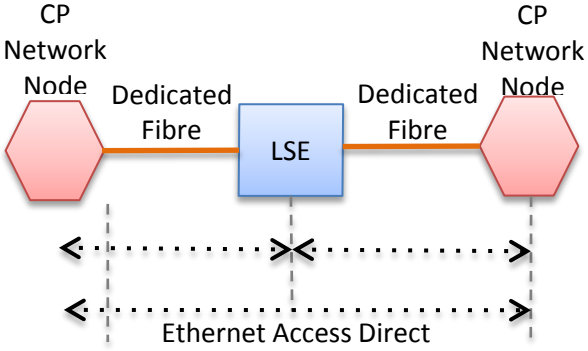
iii) End-user Premise to Remote CP Network Node



iv) Network Node located in a BT Exchange to Remote CP Network Node



v) CP Network Node to CP Network Node



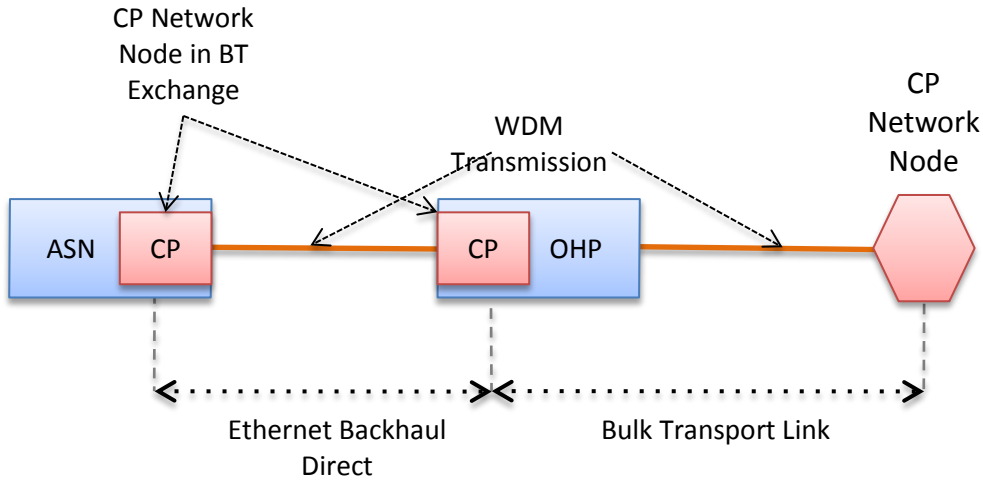
A16.24 EAD uses dedicated fibre circuits between the circuit end-points and does not make use of BTs' backhaul transmission systems.

A16.25 Two resilience options are available. Resilience option 1 (RO1) comprises a single bearer diversely routed over two paths. Both paths terminate on the same NTE. If the worker path fails the NTE automatically switches to the protection path. Resilience option 2 (RO2) comprises two separately routed circuits (primary and secondary). The circuits end on separate NTE. There are separate ports for connection to both primary and secondary circuits. If the primary circuit fails, it is the CPs, or their end-customers, responsibility to switch the traffic between the circuits. CPs are free to use each path as they wish.

Wholesale AISBO backhaul services

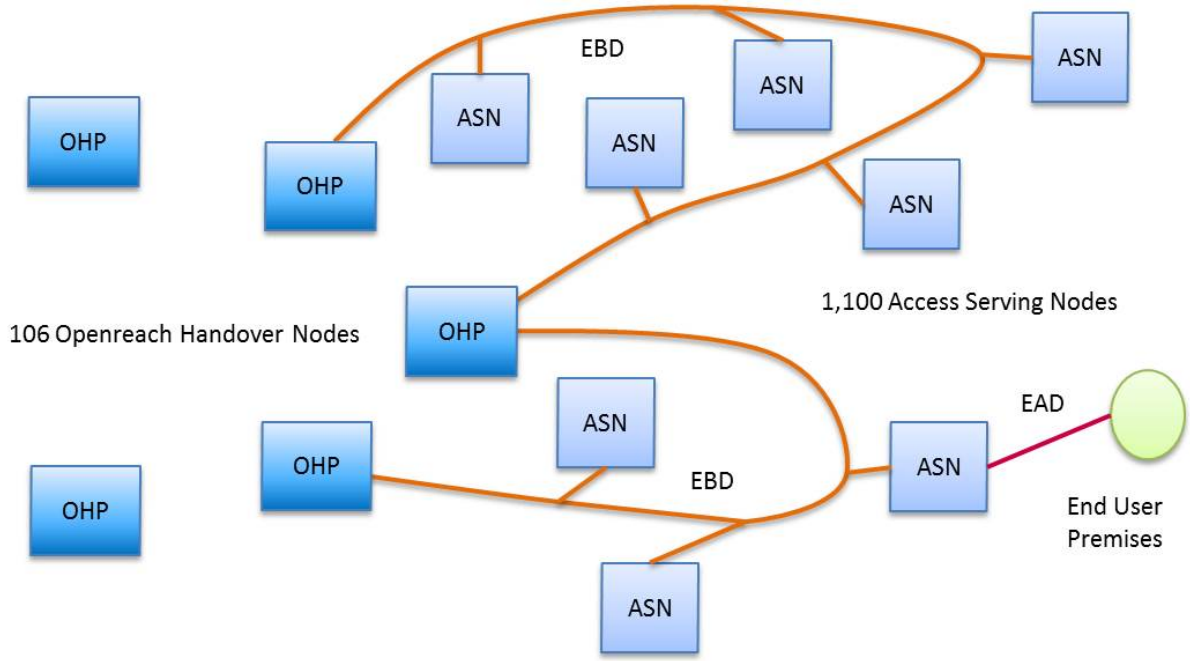
A16.26 BT's wholesale backhaul service EBD is used to provide high capacity backhaul links. This service makes use of BT's 21st Century Network (21CN) backhaul transmission systems and aggregates multiple individual circuits into higher capacity links. Figure A16.6 below illustrates the BT backhaul products EBD and Bulk Transport Link (BTL).

Figure A16.6: Wholesale Ethernet backhaul services



A16.27 EBD provides backhaul connectivity from around 1,100 BT exchanges - designated as ASNs, typically located in larger towns and cities - to corresponding major exchanges - designated as OHPs, which are co-located in major urban centres with BT's 21CN core network nodes. Below is a schematic of the EBD infrastructure.

Figure A16.7: Openreach EBD architecture



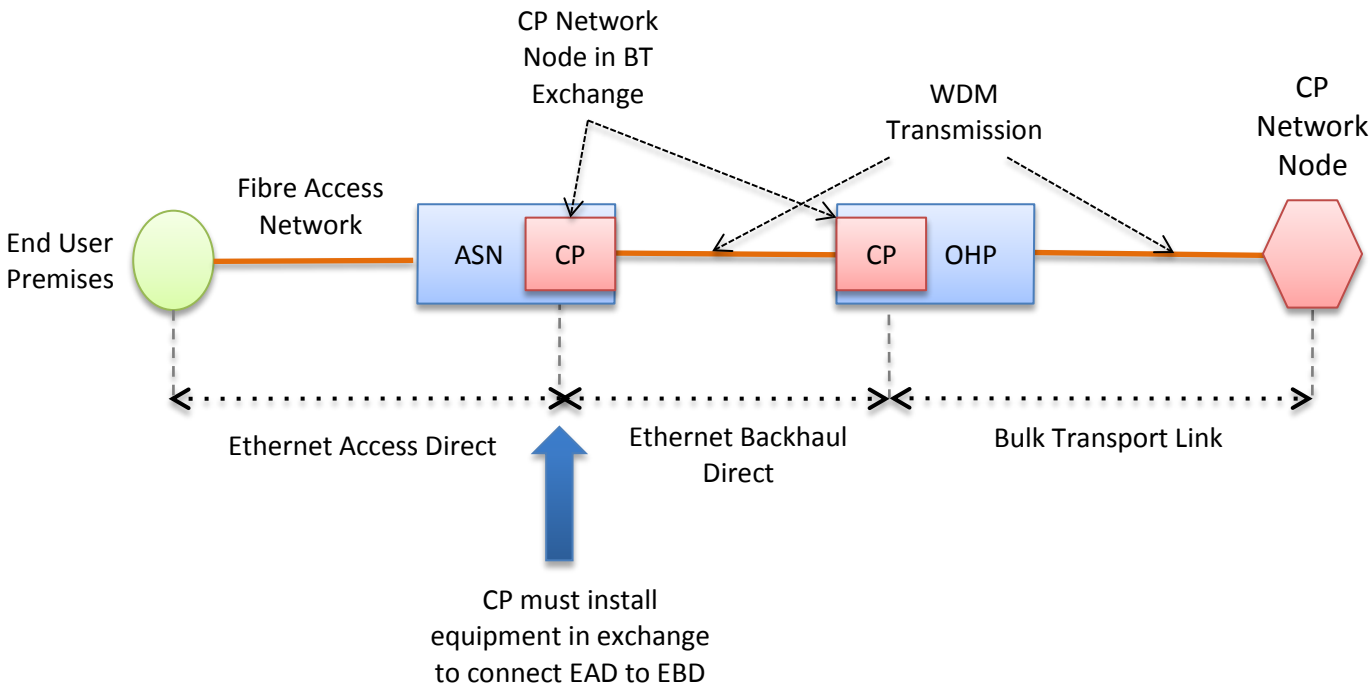
A16.28 The EBD service only provides connectivity from ASNs to their parent OHPs, therefore it is only available to purchase from the 1,100 ASNs. It is currently available with bandwidths of 1Gbit/s and 10Gbit/s.

A16.29 The BTL service facilitates handover of multiple EBD services at a CP's network node.

Comparison of PPCs and wholesale Ethernet services

A16.30 Figure A16.8 below illustrates how the BT wholesale access and backhaul Ethernet products may be used together to provide longer distance terminating segments for retail leased lines.

Figure A16.8: BT Ethernet portfolio



A16.31 It can be seen that there are similarities between the network topologies of BT's wholesale Ethernet services and TI PPCs. There are, however, several significant differences:

- the wholesale Ethernet services are only supplied on a disaggregated basis (i.e. access and backhaul services are sold separately and cannot be purchased as complete terminating segments comprising both access and backhaul);
- in order to connect EAD circuits to EBD circuits, CPs must rent co-location space in the BT ASN exchange and install their own multiplexing equipment; and
- there is no ISH option, so CPs must either rent co-location space at the OHP exchange where the circuit can be terminated and provide their own onward transmission, or use a BTL to have the circuit terminated at their own network node.

BT's MISBO products

A16.32 The 2013 Review defined a new market for MISBO, in the UK excluding the WECLA and the Hull area. This market encompasses:

- Ethernet services at bandwidths above 1Gbit/s; and
- Services of any bandwidth provided using WDM and the end-users premises.

A16.33 As noted above, BT is currently required to provide disaggregated wholesale access and backhaul Ethernet services and backhaul and end-to-end WDM services. BT satisfies this obligation by offering within its product portfolio

WES/WEES/BES at 2.5Gbit/s and 10Gbit/s, Optical Spectrum Access service (OSA) and Optical Spectrum Extended Access service (OSEA).

A16.34 WES/WEES/BES are single channel Ethernet services, whilst OSA and OSEA are multiple channel WDM services.

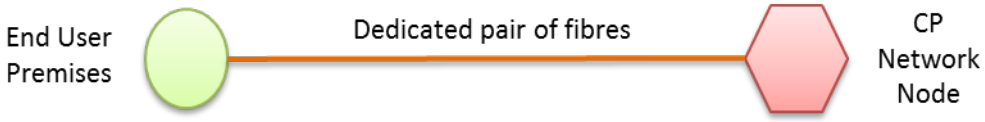
A16.35 BT's MISBO products are provided by Openreach on an EOI basis (with certain exceptions) and are therefore used by both CPs and BT's downstream divisions.

Wholesale Ethernet services

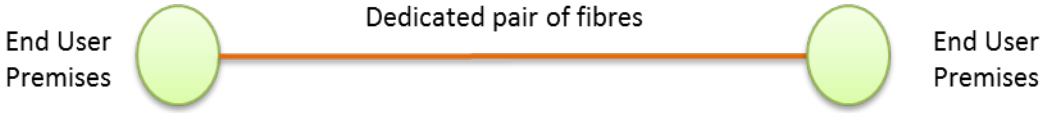
A16.36 WES provides a link between an end-customer's site and a CP's network site. WEES provides a link between two end-customer sites. BES provides a link between a CP's site and a BT exchange or between a BT exchange and another BT exchange (known as a Daisy Chain). Figure A16.9 below illustrates these configurations.

Figure A16.9 Wholesale Ethernet services for MISBO market

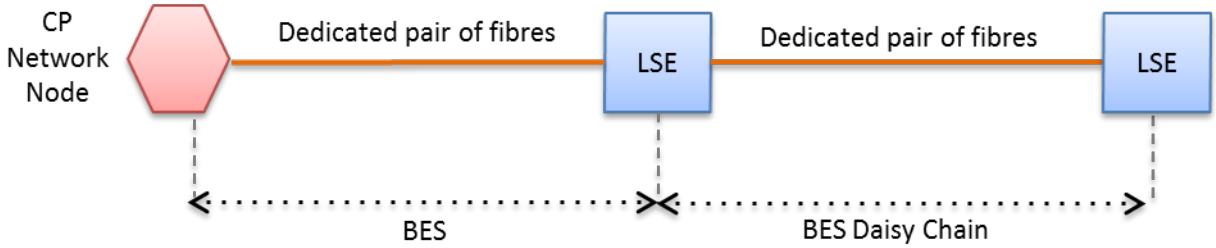
i) Wholesale Extension Service



ii) Wholesale End to end Ethernet Service



iii) Backhaul Extension Service



A16.37 Two resilience options are available for WES, WEES and BES. Resilience option 1 (RO1) comprises a single bearer diversely routed over two paths. Both paths terminate on the same NTE. If the worker path fails the NTE automatically switches to the protection path. Resilience option 2 (RO2) comprises two separately routed circuits (primary and secondary). The circuits end on separate NTE. There are separate ports for connection to both primary and secondary circuits. If the primary circuit fails, it is the CPs, or their end-customers, responsibility to switch the traffic between the circuits. CPs are free to use each path as they wish.

Wholesale WDM services

A16.38 OSA is a multiple channel, point-to-point data circuit using WDM technology. OSA has a maximum route distance of 100km.

A16.39 OSEA is a multiple channel data circuit that supports point-to-point, ring or chain configurations using WDM. OSEA has no maximum route distance. End-point and mid-point optical amplification may be required for longer fibre distances.

A16.40 OSA and OSEA support a range of interfaces. These include: Ethernet at bandwidths of 100Mbit/s,1Gbit/s, and 10Gbit/s, TI (SDH) at bandwidths of 155Mbit/s, 622Mbit/s, 2.5Gbit/s and 10Gbit/s (STM1, STM-4, STM-16 and STM-64; OTU-1, OTU-2); Fibre Channel at bandwidths of 1Gbit/s, 2Gbit/s and 4Gbit/s; FICON and ESCON.

A16.41 OSA and OSEA can be used to provide links between end customer sites, BT exchanges and CP network nodes. Figures A16.10 and A16.11 below illustrate the OSA and OSEA configurations.

Figure 16.10: Wholesale WDM services – OSA configuration

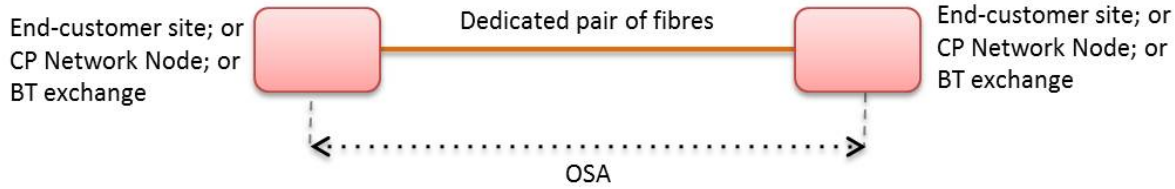
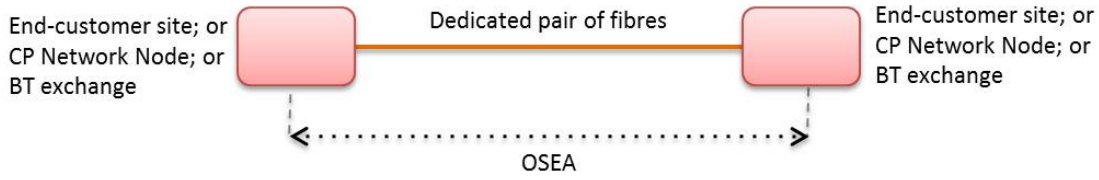
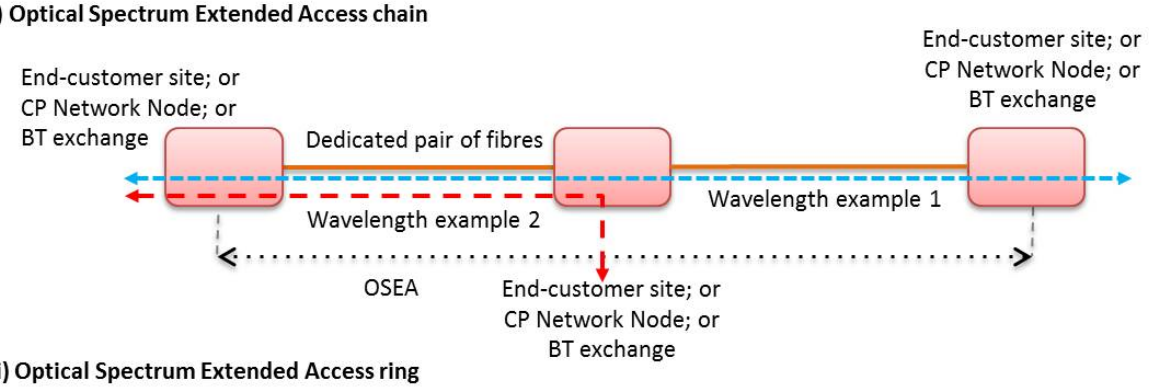


Figure A16.11: Wholesale WDM services – OSEA configurations

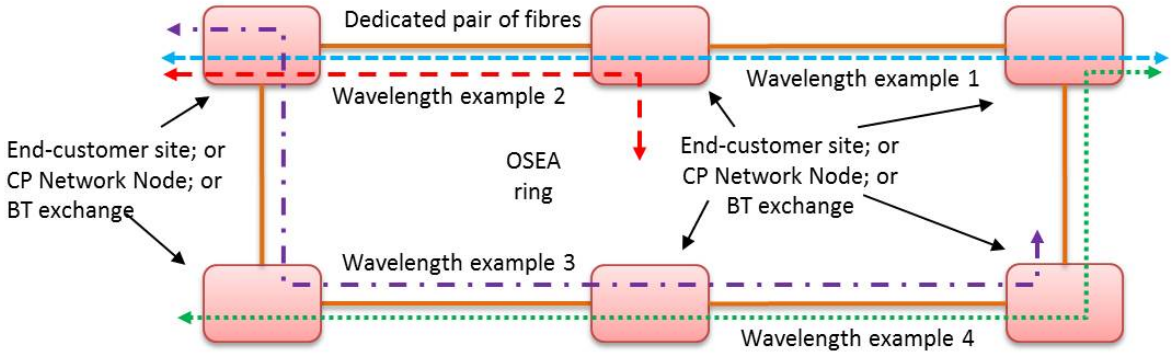
i) Optical Spectrum Extended Access point to point



ii) Optical Spectrum Extended Access chain



iii) Optical Spectrum Extended Access ring



A16.42 OSA and OSEA services have the same RO1 and RO2 resilience options as WES, WEES and BES services.

Additional support for interconnection of WDM services

A16.43 BT's WDM services support two technologies that provide additional support for interconnection of WDM based leased line services. As we discuss in more detail in Section 11, these have a bearing on the extent to which CPs are able to use BT's WDM services in conjunction with their own inputs to provide end-to-end services to their customers.

Optical Transport Unit interfaces[274]

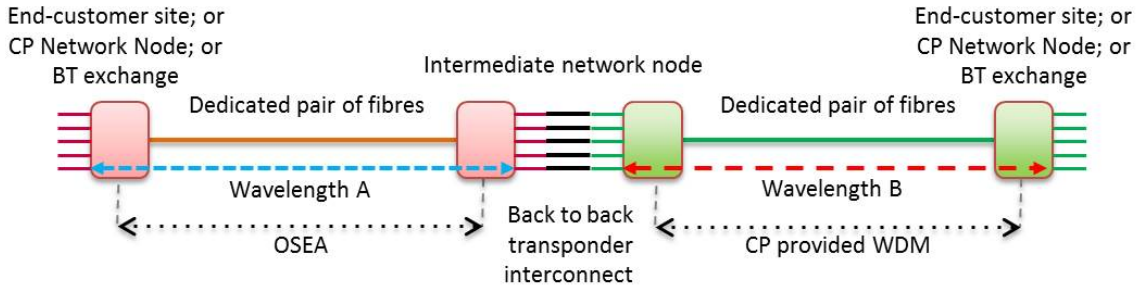
A16.44 OSA and OSEA support Optical Transport Unit (OTU) interfaces. These provide additional support for interconnection of services over WDM systems by facilitating end-to-end monitoring of interconnected circuits. This is achieved by the transmission of monitoring and supervisory information alongside the main circuit. Using OSA and OSEA OTU interfaces, BT can provide a CP with details of the quality of the service provided to the end-customer on individual channels and facilitate protection switching (where a diverse path is provisioned) in the event of degradation or failure of the primary path.

'Alien wavelength' capability of the Ciena 6500 variant of the OSEA product

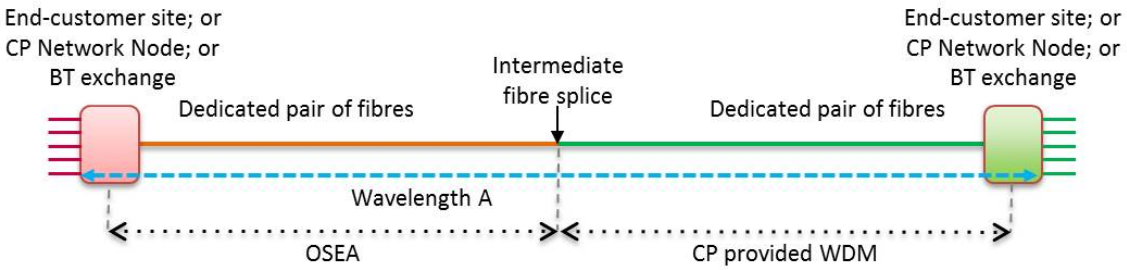
A16.45 In April 2014 BT introduced 40Gbit/s, OTU-3, 100Gbit/s, OTU-4 and 'friendly alien wavelength' services to the Ciena 6500 variant of the OSEA product range. Friendly alien wavelengths provide the ability to transport a BT originated wavelength across a CPs own network without the need for back to back transponders where the BT service meets the CP network. In effect, this enables a direct optical interconnection without and intermediate equipment. Only 40Gbit/s and 100Gbit/s wavelengths are supported in this solution and the CPs network must use the Ciena 6500 platform.[275] Figure A16.12 shows how friendly alien wavelengths provide a simplified WDM interconnect.

Figure A16.12 BT OSEA friendly alien wavelength configuration

i) OSEA interconnect with CP WDM system using back to back transponders



ii) OSEA interconnect with CP WDM system using alien friendly wavelengths



[274] In the 2013 BCMR we referred to these interfaces as Optical Transport Network, the name of the family of standards of which OTU is part.

[275] Alien refers to the wavelength originating from outside the CPs network. Friendly refers to the alien wavelength originating from the Ciena 6500 equipment, the same as must be used by the CP.

Interconnection remedies

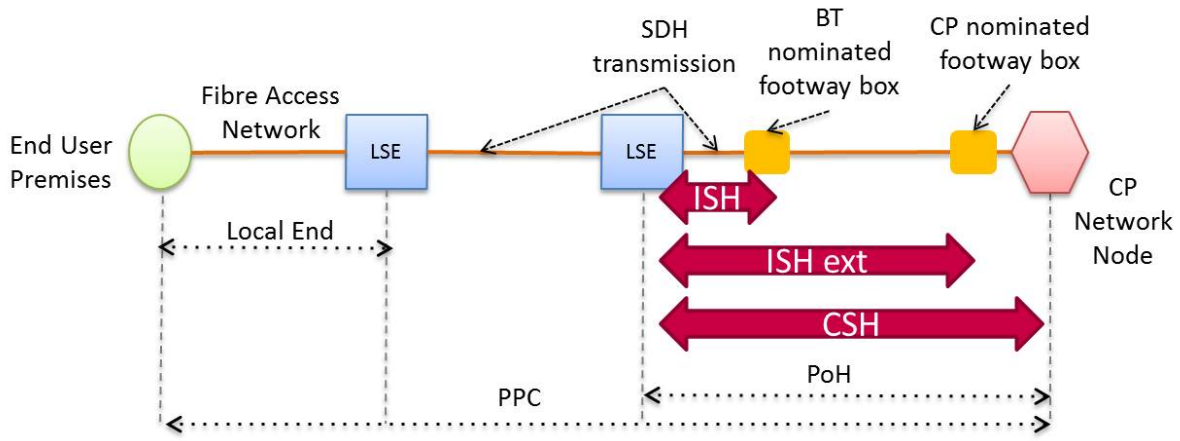
A16.46 A POC (or POH) is the point at which a CP's network interconnects with BT's network. The relevant services provided at a POC can broadly be divided into equipment and links. Equipment is provided at a POC in the form of multiplexers or terminal equipment which are used for the aggregation, disaggregation and termination of partial circuits ready for onward transmission. Links are circuits which link the equipment of two interconnecting CPs in order to allow transmission between the networks of these two CPs.

Interconnection for wholesale TISBO services

A16.47 BT currently provides the following types of interconnection service for wholesale TISBO services:

- CSH: BT provides a POC at the site of the interconnecting CP. In order to do so, BT has to extend its network out to the point of interconnection and provide a CSH link along with CSH POC equipment;
- In-Building Handover (IBH): BT provides a POC at co-location space rented by a CP in a BT local exchange (in support of disaggregated TISBO services). Currently BT terminates individual circuits in the co-location space without aggregation;
- ISH: both BT and another CP build out their networks to a handover point located between their premises. The handover point is adjacent to the BT exchange and therefore most of the build is the responsibility of the interconnecting CP. BT provides the part of the ISH link running from the handover point to its POC, along with ISH equipment at the POC. The CP provides the ISH equipment for their end of the POC; and
- ISH Extension: similar to In-Span Handover but the handover point is located further from the BT exchange but still within the serving area of the exchange.

Figure A16.13: PPC Point of Handover



A16.48 With the exception of IBH, each of these services support aggregated handover of terminating segments over high bandwidth links.

Interconnection for wholesale AISBO services

A16.49 BT currently provides the following types of interconnection service for wholesale AISBO services:

- CSH. BT provides two types:
  - Without aggregation: BT terminates individual circuits at the CP's site without aggregation (i.e. interconnection is part of the service and there is not separate interconnection link). This method is commonly used for WES and EAD circuits;
  - With aggregation: BT supplies BTL which aggregates multiple EBD services for delivery using WDM over a single interconnection link to the CP's site. As with TISBO CSH BT provides a POC at the site of the interconnecting CP. In order to do so, BT has to extend its network out to the point of interconnection and provide a CSH link along with CSH POC equipment.
- IBH: BT provides a POC at collocation space rented by a CP in a BT local exchange. BT terminates individual circuits in the collocation space without aggregation.

A16.50 BT does not offer ISH products for AI services.

A16.51 The pattern of usage of interconnection services for AISBO services differs significantly from TISBO services. CPs generally regard BTL as too expensive and consequently CSH (without aggregation) and IBH are more popular. CSH tends to be used by CPs with existing sites, but IBH appears more popular overall, particularly since BT introduced EAD Local Access (EADLA). This is because EADLA gives CPs an incentive to establish a PoP in a BT exchange to take advantage of its pricing (EADLA is cheaper than EAD) and this enables them to use IBH.

Interconnection for wholesale MISBO services

A16.52 In the 2013 Review we found for the first time that BT had SMP in the MISBO market and imposed obligations on BT to offer both CSH and IBH for MISBO services. These interconnection services are the same as those that BT provides for the lower bandwidth Ethernet services that fall within the AISBO market (i.e. as discussed above).

A16.53 BT's WDM services OSA and OSEA are generally provided on an end-to-end basis (i.e. between end-user premises), but BT also offers CSH and IBH.

Annex 17

Review of BT's Quality of Service

Introduction

A17.1 In this Annex we assess BT's recent quality of service in relation to Openreach' s provisioning and repair of wholesale Ethernet products. This serves to provide context for our proposals relating to quality of service which are set out in Section 13. This Annex is structured as follows:

- first, we summarise stakeholder responses to the Call for Inputs (CFI) relating to Openreach's quality of service;[276]
- second, we provide an overview of the existing Openreach Ethernet order and provisioning process;
- third, we analyse various aspects of Openreach's recent provisioning and repair performance; and
- fourth, we summarise our survey of customer expectations for Ethernet provisioning and repair performance.

CFI responses relating to quality of service

BT

A17.2 BT stated that it has a strong interest in ensuring high quality of service and that, like other CPs using Openreach products to provide business connectivity services, BT's downstream divisions also suffer when Openreach's quality of service is poor.[277]

A17.3 BT noted that in the majority of cases the level of service that Openreach provides is generally of a high standard. However, it added that there had been periods over the past year when it has not been acceptable to CPs, including BT's downstream divisions and their customers. This had been evidenced by an increase in contacts from business customers about service delivery and an increase in complaints.[278]

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[276] Ofcom, *Business Connectivity Market Review Timetable and initial call for inputs, Consultation*, 1 April 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/summary/Business-Connectivity-Market-Review.pdf. Non-confidential responses from stakeholders to our CFI are published at http://stakeholders.ofcom.org.uk/consultations/business-connectivity-market-review/?showResponses=true.

[277] Paragraph 49, page 13, BT response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/British_Telecommunications_PLC.pdf.

[278] Paragraph 50, page 13, BT response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/British_Telecommunications_PLC.pdf.

A17.4 BT said that "delivery against a firm commitment, within a reasonable and predictable timeframe" is of the upmost importance to business customers, who plan on the basis of the information that they receive from their CP. Alterations to the original timeframe, particularly where only short notice is given, is an area of particular dissatisfaction. BT indicated that poor planning and a lack of information are also areas of concern for business consumers.[279]

A17.5 BT considered that Openreach has strong incentives to deliver good service, including competition from other networks and a rigorous SLA/SLG regime. Referring to Openreach's more detailed response on quality of service, BT noted that Openreach recognised that provision performance had been below target recently. However, BT also noted that Openreach understood the root causes of the problems and is implementing measures to ensure a sustainable recovery, including recruitment, improvements to contractor performance and process re-engineering.

A17.6 BT concluded that service improvements were best achieved through industry negotiation rather than SMP regulation. This would be more flexible and CPs are better placed to judge what improvements are feasible and desirable. BT's downstream lines of business are working closely with other CPs and Openreach to deliver a range of improvements over the next two years including reduced lead times, self-appointing and changes to ECC charging arrangements.[280]

Openreach

A17.7 Openreach acknowledged that its recent provision performance for EAD services has not been at an acceptable standard. Performance in terms of the percentage of services delivered by CDD and some Mean Time to Provide (MTTP) measures had been below expected levels for some months. Openreach identified the immediate causes of the fall in performance as the unintended consequences arising from implementation of process changes and transformational projects within its delivery organisation and instances of poor performance by Openreach contractors. It had implemented a programme of actions to address these issues that included:

- recruitment to improve its capacity;
- working more closely with contractor organisations to improve their performance;
- process re-engineering and re-structuring of Openreach delivery team to improve throughput capacity and reduce failure hotspots; and
- proactive building of network in targeted locations to simplify delivery in demand hot-spots.

A17.8 Openreach said that it is committed to delivering tangible improvements in the short term. Its programme is intended to restore performance (in terms of the percentage

[279] Paragraph 51, page 13, BT response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/British_Telecommunications_PLC.pdf.

[280] Paragraphs 52-54, pages 13-14, BT response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/British_Telecommunications_PLC.pdf.

of orders completed by CDD) to target by the end of July 2014 and performance in the six weeks to the 2nd May 2014 showed steady improvement. [281]

A17.9 Openreach cautioned that more extensive changes would be required to sustain the improvements over the medium to long term. In particular, the current delivery process for Ethernet services is not fit for purpose for the future. The "Ethernet Evolution" programme comprising a set of improvements to the processes and features associated with EAD would transform the Ethernet delivery process. Also CPs and third parties would need to take action to address their own areas of responsibility in the delivery value chain.[282]

A17.10 Openreach proposed that its performance relating to repair had been consistently strong.[283]

A17.11 Openreach indicated that, given that the delivery of good service involves Openreach, CPs and thirds parties, some of the delays can be attributed to CP related issues and suggested that more accurate and comprehensive CP forecasting was needed to enable better service.[284]

A17.12 Openreach indicated that it already had strong existing incentives to provide high quality of service. It emphasised the importance of providing high quality of service in an increasingly competitive market, as well as the extensive set of existing SLA/SLGs.[285]

A17.13 Openreach said that industry negotiation and agreement was its preferred solution to addressing any quality of service problems, rather than micro-level regulatory intervention. It said that with regards to SLA/SLG development Ofcom should take a similar position to that taken in the Fixed Access Market Review (FAMR).[286]

[281] Figure 1 page 7, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[282] Pages 2,6,7, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[283] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[284] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[285] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[286] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

A17.14 Openreach suggested that there is a need for the revision of KPIs so as to better meet the requirements of both Openreach and its customers. Openreach also stated that it would consider which KPIs should be made public.[287]

A17.15 Openreach suggested that the incentives provided by the regulatory framework should not be confined to Openreach but should instead encompass all relevant players in the delivery value chain. Openreach also stated that the regulatory framework should focus on ensuring the successful delivery of the "Ethernet Evolution" programme.[288]

Colt

A17.16 Colt considered that Openreach's quality of service problems could be divided into the following areas:

- Provision: Colt noted that the quality of provision in terms of lead times and order progress was typically satisfactory for on-net orders, but that as soon as an order involved civil works it could become a very difficult experience.

- Responsiveness and communication: Colt considered that Openreach does not keep its customer sufficiently informed as to their order's progress. It noted that significant escalation activity was sometimes required in order to obtain a response to a basic update query. Colt also noted that, in the event that Openreach needs access to the customer site, that Openreach does not always agree access with the customer before actually going to the site.

- Complexity: Colt commented on the general difficulty of dealing with Openreach due to the complex and time consuming nature of its processes. It cited an example of relevant SLAs being unnecessarily difficult to find on Openreach's website.

A17.17 Colt does not believe that Openreach's KPIs give sufficient visibility of its performance, adding that Colt does not consider them reflective of Openreach's true quality of service. It noted that KPIs are based on the CDD, but that this was misleading as CDDs are "set with delays in the first place." Colt added that Openreach can manipulate its CDDs by "chossing to place orders into the 'customer delay function'". Colt considered that Openreach falsely placing orders into the customer delay function "in order to push the CDD out" was a regular occurrence. [289]

A17.18 [✂

[287] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[288] Page 2, Openreach response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Openreach.pdf.

[289] Page 22, Colt response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/COLT_Technology_Services.pdf.

✂].

A17.19 Colt advocated more reflective KPIs and increased regulation as the only way to resolve Openreach's quality of service problems. In general, Colt advocates the facilitation of competition at the infrastructure level to incentivise Openreach to improve its quality of service.[290]

KCOM

A17.20 KCOM's principal area for concern is in relation to provisioning. KCOM noted that although the level of quality of service for repairs also needs attention, due in part to KCOM's experience of short-term dips in performance in the past, The level of service for repairs is generally more acceptable and noticeably more stable.[291]

A17.21 KCOM suggested that Openreach's inability to achieve provisioning targets and fluctuating levels of quality in service delivery suggested there are serious problems with its service delivery organisation and processes. KCOM considered the service quality problems to be a regulatory issue because providers have no choice but to use Openreach infrastructure and are therefore solely reliant on Openreach's quality of service. [292]

A17.22 KCOM noted that there had been significant issues with Ethernet service quality for some time and that the OTA had worked with Openreach and industry to address them. However, improvements had not been sustained. [293] KCOM regarded this as unacceptable. In its view, Openreach's inability to address the issues suggested that it had been unable to identify the root cause of the problems.

A17.23 KCOM drew attention to the EAB's suggestion in its 2013 annual report that Openreach EAD provision performance appeared to favour BT CPs for the majority of the year. KCOM acknowledged that the EAO had not found any non-equivalence, but urged Ofcom to investigate this issue further with a particular focus on reviewing Openreach's Project Services offering.[294]

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[290] Page 23, Colt response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/COLT_Technology_Services.pdf.

[291] Response to Q3, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[292] Response to Q3, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[293] Response to Q3, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[294] Response to Q3, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

A17.24 With regards to the KPIs that Openreach currently provide, KCOM expressed concern that the figures only provide averages and therefore do not give a true picture of the situation, KCOM expressed particular concern that the KPIs may provide Openreach senior management with a "distorted view of performance".[295] KCOM cited one of Openreach's key measures 'the percentage of circuits delivered by Committed Delivery Date (CDD)' as an example. Performance is reported against the final CDD which could be the original CDD, a revised CDD agreed to by the CP or a revised CDD imposed by Openreach using the 'deemed consent' mechanism. KCOM also stated that their experience has been that once a CDD has been changed by Openreach, even in error, there is no way to bring the date back to the original CDD.[296]

A17.25 KCOM said that it had found that Openreach did not correct its KPIs after it had made valid challenges to them. It provided Ofcom with a list of challenges that it had raised and Openreach had accepted.[297]

A17.26 KCOM highlighted the importance that its customers place on both quality and timeliness, noting that "all aspects of Openreach service delivery have a direct impact on our customer relationships" and that it is KCOM that has to answer to its customer's complaints. KCOM stated that due to the complexity of many of the installations that it undertakes, there are often significant financial implications which it is held responsible for should anything go wrong.[298]

A17.27 KCOM suggested that these issues are exacerbated by a lack of understanding of BT's structure amongst customers and specifically, the role of Openreach in the delivery of services. KCOM further alluded to the fact that customers believe that they will receive a better service from BT CPs.[299]

A17.28 KCOM suggested that it is difficult to specify what alterations BT could make to address issues relating to its provision and repair services but noted that it does not believe "simply specifying a target will deliver real improvements." KCOM suggested that there are deep rooted issues within Openreach that Ofcom would need to address if there is to be an effective regulatory solution.[300]

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[295] Response to Q4, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[296] Response to Q4, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[297] Response to Q4, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[298] Response to Q5, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[299] Response to Q5, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[300] Response to Q6, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

A17.29 Regarding BT's incentives, KCOM pointed to the fact that the contracts under which Openreach provides services are not normal commercial contracts and that it has little bargaining power to be able to force changes to the contract proposed by Openreach. As a result, quality provisions in Openreach contracts are "not as detailed and comprehensive as we would expect" nor do they "require delivery to the standards which we and our customers would expect". [301]

A17.30 KCOM considered that the SLGs are insufficient to compensate CPs and their customers adequately. KCOM is accountable to its customers for service delivery and may incur financial penalties and reputational damage when Openreach does not meet its SLAs.

A17.31 Finally, KCOM raised concerns around the escalation and jeopardy management process that Openreach operates and its experience of these being largely ineffective. KCOM urged Ofcom to consider the overall process of Openreach service delivery, including, what happens when things do go wrong. [302]

Sky

A17.32 Sky stated that the quality of service that it delivers to its customers is directly impacted by the quality of the backhaul services provided by Openreach, given the importance of broadband and telephony to its customers, Sky consider it vital that Openreach provide and repair circuits quickly and to a high standard.[303]

A17.33 Sky considered that Openreach has little incentive to improve its quality of service due to its SMP, this is indicated by the fact that Openreach's poor service has persisted over time. Sky also suggested that as a result of charge controls imposed on business connectivity products Openreach has an incentive to reduce costs but not to ensure an acceptable level of quality of service. Sky stated that CPs have very little negotiating power with regards to SLAs and SLGs due to Openreach's SMP and the disparity in information that is available to Openreach and CPs regarding quality of service metrics, this situation has led to SLA and SLGs that are inadequate.[304]

A17.34 Sky suggested that improvements could be made by implementing minimum standards for quality of service similar to those introduced through the FAMR, Sky

[301] Response to Q7, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[302] Response to Q7, KCOM response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/KCOM_Group.pdf.

[303] Paragraph 6.1, Sky response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/BSKYB.pdf.

[304] Paragraph 6.3-6.5, Sky response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/BSKYB.pdf.

also advocated time-bound SLA/SLG negotiations that would be overseen by the OTA.[305]

TalkTalk

A17.35 TalkTalk suggested that the approach taken by Ofcom in relation to quality of service within the BCMR should mirror that adopted in the FAMR, whereby minimum standards were imposed on BT. TalkTalk stated that quality regulation should focus on the time it takes for Openreach to provision Ethernet products, which has been too high for an extended period of time.[306]

A17.36 TalkTalk also raised concerns about Openreach's Project Services offering. TalkTalk argued that Openreach had "been successful in driving demand for project management through the inappropriately low quality of service which it offers on the basis of its standard charges." It suggested that Project Services should be included within the scope of a charge control.[307]

UKCTA

A17.37 UKCTA stated that business connectivity services, like the fixed access market, have experienced poor levels of quality of service, specifically UKCTA pointed to the provision of Ethernet services which has been inconsistent since 2010.[308]

A17.38 UKCTA suggested that as a result of Openreach often failing to meet the CDD customers confidence that the CDD will be met is low. UKCTA stated that this therefore requires "closer liaison" during provisioning and repair which consequently increases the overheads of CPs to account for the failings of Openreach.[309]

A17.39 UKCTA pointed to "carve-outs and gaps in the SLA/G regime" which meant that BT's KPIs likely overestimate BT's performance. UKCTA also expressed concern that Openreach were able to misuse 'deemed consent' and push back the CDD, UKCTA believe that this is exercised too often with insufficient justification. UCKTA suggests that in doing so, Openreach are able to make the CDD statistics appear

[305] Paragraph 6.7, Sky response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/BSKYB.pdf.

[306] Paragraph 5.1, TalkTalk response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/BSKYB.pdf.

[307] Paragraph 4.12, TalkTalk response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/BSKYB.pdf.

[308] Page 2, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[309] Page 3, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

more favourable and advocated the public reporting of 'deemed consent' application.[310]

A17.40 UKCTA also expressed concern around insufficient KCI information, lack of information, incorrect reason codes and complex works being started too late. [311]

A17.41 UKCTA suggested that despite BT being able to waive SLGs when MBORC is declared, CPs do not have a clear idea of BT's MBORC policy. UKCTA stated that the criteria and application of MBORC should be consulted upon and agreed with CPs, allowing more informed engagement with customers and a process to ensure that Openreach are appropriately adhering to its policy.[312]

A17.42 UKCTA's primary concern in relation to the impact that Openreach's poor quality of service had on its customers was that in instances of poor service, CPs have to expend greater resources to manage the necessary increase in customer engagement. UKCTA also expressed concern over the perception that customers can receive a better level of service from BT CPs and instances whereby customers have cancelled the provisioning of a line from a CP due to Openreach quality of service issues.[313]

A17.43 UKCTA expressed its support for the process change as advocated by Vodafone which would see additional SLA/SLGs introduced for the entire service journey rather than merely a single SLG based on whether the CDD was met. UKCTA clarified that they do not seek an increase in the SLG, but merely a redistribution of the SLG throughout the provisioning process.[314]

A17.44 With regards to repair, UKCTA suggested that SLA/SLGs are too narrow and do not effectively cover all areas of poor performance, for example:

- There are no out of hours engineers for 10Gb/s services meaning that there is a 12 hour repair lead time;
- there are only SLA/SLGs for complete service failure and not for severe performance degradation;
- insufficient reporting information; and

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[310] Page 4, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[311] Page 4, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[312] Page 5, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[313] Page 5, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[314] Page 6, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

- there is no escalation procedure for instances where CPs dispute Openreach's judgement of whether an SLA/SLG has been met.[315]

A17.45 UKCTA did not believe that BT has sufficient incentives to provide a quality of service that its customers require, it considered the fact that service issues have continued over a number of years and that SLGs are often paid out but service levels are not improved, indication of this. UKCTA suggested that BT are only incentivised to reduce the level of SLG payments through 'deemed consent' and MBORC.[316]

A17.46 UKCTA advocated the implementation of minimum standards on service levels for Openreach's leased line services similar to those introduced in the FAMR. UKCTA also suggested that the appropriate mechanisms need to be in place so that the OTA, BT and CPs can address any concerns over the current SLA/SLGs. UKCTA stated that Ofcom should consider the disparity in information between CPs and Openreach and should introduce time-bound negotiations with a view to intervention if an agreement is not reached.[317]

Verizon

A17.47 Verizon stated that quality of service has been a considerable source of concern for a number of years during which there has been inconsistency in performance levels but where the general trend has been a "continuous degradation" of quality of service. Verizon observed that this applied to both repairs and provisioning but that provisioning was the area of the most concern.[318]

A17.48 Verizon suggested that due to the inconsistency of Openreach's quality of service, it is very difficult for Verizon to then provide a consistent level of quality of service to its customers. Verizon indicated that its customers are often not aware of the relationship between Openreach and Verizon. Verizon expressed concern that Openreach do not have sufficient incentives to ensure that the quality of service for repairs or provisioning is of a high standard.[319]

A17.49 With regards to KPIs, Verizon did not believe that the current KPIs are satisfactory in representing the true level of Openreach's performance; this is predominantly the result of Openreach's ability to use 'deemed consent' to 'skew' results. Verizon believed that Openreach use 'deemed consent' as a "get out of jail free card" which allows them to mask its shortcomings and produce KPIs that appear to show that it is meeting its targets. As a result, Verizon suggested that SLA/SLG payments from Openreach are almost non-existent. Verizon advocated a process whereby CPs

[315] Page 8, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[316] Page 8, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[317] Page 8, UKCTA response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/UK_Competitive_Telecoms_Association.pdf.

[318] Paragraph 11, Verizon response to the CFI.

[319] Paragraph 12, Verizon response to the CFI.

could challenge a situation whereby Openreach have implemented 'deemed consent'.[320]

A17.50 Verizon stated that Ethernet service delivery has been of a low standard for some time and Verizon does not believe that there is any intention by Openreach to improve the situation. Without engagement with industry and appropriate regulatory involvement, Verizon sees little prospect of the current situation improving.[321]

A17.51 Verizon drew attention to the fact that Openreach has complete control over its reporting requirements which allows it to "manipulate situations to its advantage", Verizon suggested that even when a CP is able to prove Openreach misreported, Openreach is under no obligation to reflect these mistakes in its reported performances. [322]

A17.52 Verizon also pointed to situations where Openreach has claimed its engineers have made an appointment but have been unable to gain access to the site and were unable to complete the job. In these situations, Verizon have claimed, Openreach record the appointment as being met. Verizon suggested that a solution to this would be for Openreach to provide proof that its engineer had visited the site and a reason for why access was not possible, advocating the introduction of time stamped photos as a way of proof.[323]

A17.53 Verizon drew attention to the DSO process as a clear example of a process that does not work and acts as evidence of the inefficiency of processes aimed at managing the interfaces between Openreach and the rest of the industry.[324]

A17.54 Verizon suggested that delays to repair or provisioning require significant resources on behalf of the CP in terms of scheduling issues and additional costs. CPs also face significant 'brand damage' as customers will often blame the CP rather than Openreach. Verizon suggested that Openreach is able to utilise its position as being 'protected' from 'brand damage' in this sense.[325]

A17.55 For end customers, Verizon stated that delays can have significant impacts in terms of their ability to meet business plans and that although much of this impact could be mitigated by effective communication, Openreach often only give a short notice of delay, thus reducing the customers' ability to mitigate the impact. [326]

A17.56 Verizon suggested that "rigorous and transparent metrics" should be introduced for timeliness and quality and Openreach should be held accountable if these are not met.[327]

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[320] Paragraph 13 and 36, Verizon response to the CFI.

[321] Paragraph 14, Verizon response to the CFI.

[322] Paragraph 16, Verizon response to the CFI.

[323] Paragraph 17-19, Verizon response to the CFI.

[324] Paragraph 20-23, Verizon response to the CFI.

[325] Paragraph 26, Verizon response to the CFI.

[326] Paragraph 27-28, Verizon response to the CFI.

[327] Paragraph 29, Verizon response to the CFI.

A17.57 Verizon stated that Openreach's SLAs are not suitable for business consumers and due to the fact that they have not been altered in many years, they are inferior to Verizon's own targets. Verizon suggested that it was important Openreach improve its communication with CPs and end- customers.[328]

A17.58 Verizon stated that Openreach's incentives to provide a standard of quality of service that its customers required were insufficient.[329]

A17.59 Verizon suggested that Openreach should change the onus of its engineers to 'number of jobs successfully completed' rather than 'number of appointments met'.[330]

A17.60 Verizon also advocated steps to realign the working practices of third party contractors and Openreach.[331]

Virgin Media

A17.61 Virgin Media suggested that Ofcom needs to avoid a situation whereby Openreach are able to improve the performance of one service at the expense of another.[332]

A17.62 Virgin Media expressed particular concern over the provision of Cablelink which it stated was essential in the supply of wholesale services and, given Openreach's monopoly on this service, the current level of poor performance was not acceptable.[333]

A17.63 Virgin Media suggested that as Openreach has not adjusted its lead times for Cablelink for some time, they are no longer appropriate given the complexity of external connectivity that is now required. Virgin Media also noted that the lead times provided by Openreach are used to provide timescales for end-users so when a lead time is not met by Openreach, Virgin Media fail to deliver to its customers within the timescale.[334]

A17.64 Virgin Media stated that delays caused by Openreach are exacerbated by a lack of visibility over order progress and an escalation process that is not fit for purpose. To mitigate these issues, Virgin Media has purchased Project Services from

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[328] Paragraph 31-32, Verizon response to the CFI.

[329] Paragraph 33, Verizon response to the CFI.

[330] Paragraph 37, Verizon response to the CFI.

[331] Paragraph 38, Verizon response to the CFI.

[332] Page 4, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[333] Page 4, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[334] Page 5, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

Openreach at an additional cost, indirect financial impacts of delays have further contributed to the monetary burden placed on Virgin Media.[335]

A17.65 Virgin Media claimed that it has also experienced a high fault rate with Openreach responsible for the vast majority of the faults.[336]

A17.66 Virgin Media stated that Openreach's poor performance had a number of negative impacts on the purchasing CP:

- failure to meet agreed timeframes due to excessive Openreach lead times;
- a negative impact on brand reputation due to the inability to deliver on time; and
- it is nearly impossible to set a new contract delivery time where there is a reliance upon an Openreach input.[337]

A17.67 Virgin Media suggested a link between a lack of engineering experience and the general under resourcing of Openreach and that Charge Controls imposed by Ofcom need to account for quality of service.[338]

A17.68 Virgin Media expressed concern over the switch to fixed rate ECC charging and suggested that Ofcom continue to monitor the implementation and take up of EAD to ensure that it remains "competitively neutral". Virgin Media believe that this could be done within the remit of the BCMR.[339]

Vodafone

A17.69 Vodafone expressed frustration over Openreach's service delivery which in its view has been inconsistent for an extended period, Vodafone noted that this was the second time in recent years that a prolonged service failure had occurred.[340]

A17.70 Vodafone noted that it had been informed that planning engineers had been moved between Openreach's product groups to resolve problems that have occurred in the

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[335] Page 5, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[336] Page 5, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[337] Page 6, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[338] Page 6, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[339] Page 6, Virgin Media response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Virgin_Media.pdf.

[340] Page 6, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

planning of provisioning. Vodafone stated that so far this had not been successful in alleviating the problem. Vodafone referred to Ofcom's findings in the FAMR and noted that it is clear Openreach has not "invested sufficiently in the resources necessary to provide a fit-for-purpose service".[341]

A17.71 Vodafone suggested that Openreach's inability to meet CDDs has led to it "seeking to officially invalidate the CDD by invoking either deemed consent or MBORC". Vodafone noted that MBORC has been explored in the FAMR and suggested that all the points are applicable to the BCM.[342]

A17.72 [✂

✂][343]

A17.73 Vodafone stated that Openreach provisioning problems become provisioning problems for the CPs. Vodafone drew attention to the importance of its services to its customers and noted a desire from customers for increased liaison and updates. Vodafone claimed that Openreach's updates to CPs were inaccurate and lacked informative, conclusive data.[344]

A17.74 Vodafone suggested that the following information should be provided via KPIs:[345]

- percentage of orders provisioned on time (both to eventual CDD and original one offered at KCI3);
- volume of orders submitted;
- volume of orders completed;

[341] Page 7, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[342] Page 7, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[343] Page 8, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf

[344] Page 8, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[345] Page 9-10, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

- on Time KCI1 performance percentage with times to process in a distribution curve;
- on Time KCI2 performance percentage;
- on Time KCI3 performance percentage;
- backlog volume & percentage of WIP;
- update frequency post KCI3 performance;
- volume of orders impacted by MBORC;
- reporting for deemed consent;
- on time repair;
- repeat fault rates;
- Dead on Arrival (DOA) rates – circuits that do not function at the point of installation;
- Mean Time to Repair; and
- volume of repairs impacted by MBORC.

A17.75 Vodafone stated that Openreach's inability to provide services within a specified timeframe has a direct impact on Vodafone's ability to provide services to its customers on time and that this can lead to both customer detriment and a breakdown in trust. Vodafone claimed that due to this decrease in trust, customers are now seeking far greater levels of engagement on behalf of the CP; this has led to Vodafone expending greater resources to deal with this aspect of the provisioning process. Further, Vodafone claimed that Openreach's failures have led to a "rampant mistrust" of Openreach and Vodafone by its customers.[346]

A17.76 Vodafone provided an annex that outlined its submission to the OTA regarding a suggestion for the improvement of the current repair and provisioning process, this suggestion revolves around the introduction of SLA/SLGs throughout the process rather than merely in relation to the CDD.[347]

[346] Page 10, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[347] Page 10, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

A17.77 Vodafone stated that the length of time that the 'service crisis' has been going on for demonstrates that Openreach does not have the appropriate incentives to provide the required level of quality of service.[348]

A17.78 Vodafone advocated the implementation of a minimum standard similar to that introduced in the FAMR. Vodafone stated that it is only Openreach's SMP that ensures that it is still able to attract customers, and that in a competitive market Openreach's quality of service would not be tolerated.[349]

A17.79 Vodafone acknowledged Openreach's 'Ethernet Evolution' plans but warned that any proposal that aims to give Openreach more flexibility to meet the existing SLA should be viewed with caution.[350]

City of London Corporation

A17.80 City of London Corporation claimed that quality of service in provisioning was an industry-wide problem but that "BT is one of (if not) the worst provider(s) for delivery of leased line services." It stated that failure to deliver new telecoms supplies in a timely manner was having a "hugely damaging effect on businesses' operation and their ability to occupy new office properties." [351]

A17.81 City of London Corporation commented on BT's inability to provide appropriate updates or effectively respond to issues that arise during the provisioning process. In particular, it stated that "we consistently see poor performance from BT in terms of the timeliness of their engagement with our street works team in relation to planned installations or repairs." It strongly recommended that BT engage with the authority much earlier in the provisioning process, in order to avoid refusals for permits and hence frustration for end users.[352]

A17.82 In relation to the KPIs that BT provide, City of London Corporation claimed that they give no real indication of its quality of service as "it is not clear what metrics have been used to derive the data and how they compare to previous years". City of London Corporation also suggested that the general public might have difficulty understanding or scrutinising the data and therefore they should be presented in a

[348] Page 10, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[349] Page 10-11, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[350] Page 11, Vodafone response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Vodafone.pdf.

[351] Response to Q5, City of London Corporation response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/City_of_London_Corporation.pdf.

[352] Response to Q3, City of London Corporation response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/City_of_London_Corporation.pdf.

format that is easier to understand. It added that greater granularity is needed with regards to how BT performs against the lead time it quotes to consumers.[353]

A17.83 City of London Corporation drew attention to Ofcom and OTA2's suggestion that slow delivery is largely a resource issue within BT and other operators, however, it suggested that other operators have stated that it was less an issue of resources and more to do with agreeing wayleaves with landlords (although BT advised this was not an issue). City of London Corporation planned to hold a roundtable meeting with all the telecoms providers operating in the City to address issues relating to untimely delivery.[354]

A17.84 City of London Corporation suggested that BT and other operators need to be more realistic in their installation time quotes and that it would not be opposed to BT introducing a longer lead time if this meant greater date certainty, as this would at least give businesses the opportunity to make appropriate plans.

A17.85 City of London Corporation stated that Ofcom needs to develop a process aimed at ensuring BT and other providers deliver connections in accordance with "key milestone delivery dates" and that Ofcom should be able to fine those who do not meet these standards.[355]

A17.86 City of London Corporation also coordinated responses from various other organisations who use leased lines. These responses raise the same issues as above and have not been reprised here.

Grange Hotels

A17.87 Grange Hotels raised concerns over BT's lead times being much longer than expected and the fact that this lead time also slipped "causing us project delay and considerable stress and concern." Grange Hotels suggested that the length of the lead time was principally caused by a lack of capacity in the local roads infrastructure and that this was an issue that it had encountered before.[356]

A17.88 As a hotel chain, Grange Hotels noted the disruption to bookings that a loss of service can cause. Grange Hotels also pointed to the impact that a loss of service can have on its customers, such as the inability to use the phone provided in their

[353] Response to Q4, City of London Corporation response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/City_of_London_Corporation.pdf.

[354] Response to Q5, City of London Corporation response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/City_of_London_Corporation.pdf.

[355] Response to Q7, City of London Corporation response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/City_of_London_Corporation.pdf.

[356] Response to Q3, Grange Hotels response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Grange_Hotels.pdf.

room. Grange Hotels noted that a same day or next day fix is usually achieved by BT and that it pays extra for weekend cover at key locations.[357]

A17.89 Grange Hotels drew attention to delays in wholesale provisioning and suggested that a maximum delivery target of perhaps 6 months should be introduced. With penalties commensurate with the scale of the project. Grange Hotels pointed to the penalty regime that ISDN 30 business circuits are subject to but stated that it had no reason to claim with this regard for a number of years as it was not normally customer critical.[358]

Key themes emerging from the CFI

A17.90 We note below the key issues that were raised in the CFI reponses summarised above, and indicate where these issues are addressed in the consultant document.

A17.91 Provisioning performance – all respondents identified issues with Openreach's provisioning performance, with some calling for the implementation of minimum standards. We analyse Openreach's performance in detail in this Annex, and in Section 13 we outline our proposal for remedies on provision performance.

A17.92 SLA/SLG and Deemed Consent – CPs identified deemed consent as a mechanism by which Openreach could avoid its liabilities under the SLA/SLG regime. We set out our reasons for not proposing to intervene directly on deemed consent in Section 13 paragraph 13.118. However we address the uncertainty in delivery date caused by deemed consent changes through our proposals for minimum standards in Section 13 paragraph 13.140 onwards.

A17.93 SLA/SLG regime – two resondents suggested amendments to the SLA/SLG regime itself. We make proposals for the continuation of the current regime and a potential mechanism for its evolution in Section 13.

A17.94 Openreach processes – several repondents identified shortcomings in Openreach processes and recommended means by which they could be reformed. We note in particular and concur with the suggestions that this is best handled by industry through negotiation. We set out a mechanism and some boundaries for this in Section 13.

A17.95 KPIs – The current suite of KPIs was noted as being potentially misleading or susceptible to manipulation and gaming. We make proposals for a new set of KPIs in Section 13.

A17.96 Cablelink – Virgin Media noted shortcomings with the Cablelink product. We consider this product in Section 12.

[357] Response to Q5, Grange Hotels response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Grange_Hotels.pdf.

[358] Response to Q7, Grange Hotels response to the CFI at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity-market-review/responses/Grange_Hotels.pdf.

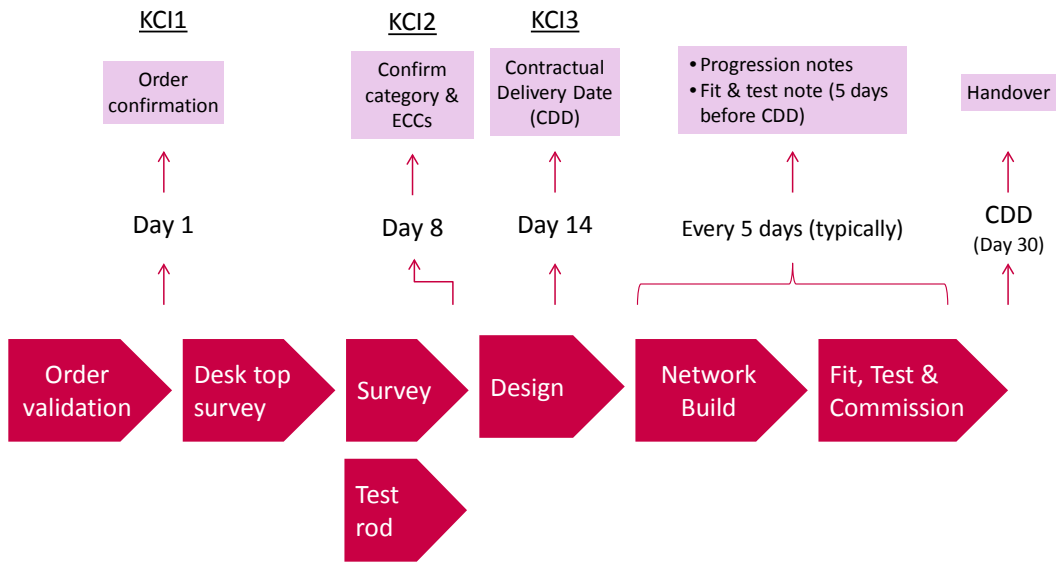
Openreach Ethernet order and provisioning process

A17.97 In this section we present a high-level view of Openreach's Ethernet product provisioning process. We include some details of how it has been operating in practice. We also provide brief details of the changes to the process that are currently being trialled by Openreach and CPs, which could form the basis of the future process.

A17.98 Figure A17.1 presents a high-level structural view of the process showing the key processes, milestones and deliverables (information and physical). The process was designed to deliver Ethernet products in a standard 30 day timescale at a standard basic installation charge. However the evidence we have gathered shows that the majority of orders exceed this standard.

A17.99 Three key milestones relate to the delivery of key information to customers. These are known as "keep customer informed" or KCI milestones and are summarised in the Table A17.2 below. They are further described in the process description which we set out below.

Figure A17.1: Openreach Ethernet provisioning process[359]



Source: Ofcom based on Openreach presentation "Ethernet Education Openreach/Ofcom 16th June 2014".

[359] Combined summary of slides 7 and 25 from presentation titled "Building Britain's Connected Future, Ethernet Education, Openreach/Ofcom 16 June 2014", BT Openreach.

Table A17.2: Keep customer informed (KCI) milestones[360]

Milestone	Timing (working day)	Information delivered to customer
KCI1	Day 1	Order acknowledgement including order reference and service ID
KCI2	Day 8	Confirm order category and excess construction charges (ECCs), if any
KCI3	Day 14	Offer contractual delivery date (CDD) to customer

Source: Ofcom based on Openreach presentation "Ethernet Education Openreach/Ofcom 16th June 2014".

A17.100 The first stage in the provisioning process is order validation. Openreach checks that the order contains the information they require and whether the order satisfies Openreach's business rules. The customer is then informed of whether the order is accepted or rejected. Openreach's target to complete this stage is 5pm on the day following the day on which the order is placed. The date when an order is accepted is taken as "Day 1" in the provisioning process for that order.

A17.101 Once accepted an order then progresses to the planning stage. A desktop survey determines whether suitable infrastructure and fibre is available between the sites to be connected and the route taken. Surveys of the customer sites are also carried out. Openreach use the findings of these activities to classify the provisioning task into one of four categories, described in Table A17.3 below supported by Figure A17.4 below, and produce a costed solution. These activities should be completed by "Day 8", the KCI2 milestone, when Openreach will inform the customer of the provision category and any excess construction charges (ECCs) required.

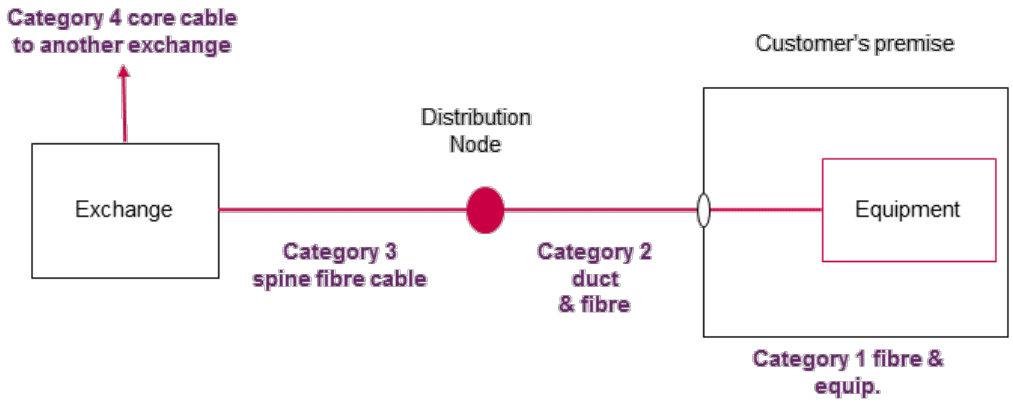
[360] Summary of slide 25 from presentation titled "Building Britain's Connected Future, Ethernet Education, Openreach/Ofcom 16 June 2014", BT Openreach.

Table A17.3: Openreach provision categories for Ethernet products[361]

Category	Definition[362]
1	Fibre connection available between customer's premises. Possible installation and connection of fibre and equipment within the customer's premises and service testing and commissioning required.
2	Fibre connection is available between Openreach network distribution nodes. In addition to possible Category 1 activities installation of duct and fibre (cable or tubing with blown fibre) is required from Openreach network distribution node(s) to the customer's premises.
3	In addition to possible Category 1 and 2 activities a new spine fibre connection is required in part or whole between Openreach distribution nodes and serving exchange.
4	In addition to possible Category 1, 2 or 3 activities a new core fibre cable is required between exchanges.

Source: Ofcom based on Openreach presentation "Ethernet Education Openreach/Ofcom 16th June 2014".

Figure A17.4: Key provision category components in Ethernet connection



Source: Ofcom based on Openreach presentation "Ethernet Education Openreach/Ofcom 16th June 2014".

[361] Extracted from presentation titled "Ethernet Service Pack, October 2014", BT Openreach.

[362] The majority of provisions regardless of category will require electronic equipment to be installed at customer sites and possibly in the exchange as well.

A17.102 Openreach require customers to agree the ECCs before they will proceed to the next stage of the provisioning process. This has been a source of delay in completing the provision orders. In order to reduce the number of orders delayed by agreeing ECCs, Openreach introduced in 2014 flat rate ECCs that cover a wide range of provision orders and do not need the agreement of the customers.

A17.103 Following customer approval of ECCs or the notification of flat rate ECCs, orders progress to the design stage of the planning activity where a range of activities take place, some in parallel, depending on the complexity of the order:

- design the fibre access network required to deliver the solution including the necessary planning for installation;
- where necessary plan and perform "test rodding"[363] of the planned fibre route, ordering appropriate rectification activities where blockages are found;
- determine the equipment needed and design and plan its installation at the customer and exchange sites;
- order civil infrastructure, fibre, equipment and respective installation as required; and
- where necessary apply for and obtain wayleave and permission for street work activities.

A17.104 Openreach offers the initial contractual delivery date (CDD) at the KCI3 milestone, typically on day 14 after the order was validated and usually before the above design stage activities are complete. The initial CDD is not always available at day 14. Our analysis, as portrayed in Figure A17.15 below, shows that the mean time to issue the initial CDD is considerably greater than 14 days after order validation except for Category 1 orders.

A17.105 During the stages after the issue of the initial CDD, Openreach unilateraly updates the CDD through a contractual mechanism called deemed consent where the customer gives prior agreement to a range of changes by accepting the provisioning contract.[364] Openreach have identified many reasons for deeming consent. As well as delays caused by their own activities, Openreach also identify many factors they consider to be outside their control, e.g. customer caused delays, wayleave and street work permission. Table A17.9 presents a list of Openreach deemed consent descriptions and the associated codes. Delays are usually notified to the customer by a progression note including the appropriate deemed consent code.

A17.106 Many delays subsequent to the initial CDD arise from the design activities not being complete when the initial CDD is issued including the test rod activity, which is often not started until after the initial CDD has been issued, contrary to the ideal process

[363] Test rodding is the physical activity of feeding flexible rods through the duct where a new cable (or sub-duct for blown fibre) is to be installed to determine if there are any blockages due to collapsed ducts, too many cables, etc.

[364] If the customer does not agree to the terms and conditions of the Openreach contract, including the deemed consent clauses, Openreach do not proceed with the order.

shown in Figure A17.1 above.[365] Test rodding provides important information about the state of the duct and the amount of work required to complete the provisioning work.[366] Further delay can also occur where Openreach find further duct blockages due to multiple blockages not being detected by the initial test rodding.[367]

A17.107 Near or on completion of the network build or after the end of the planning stage where there is no network build, Openreach plan to notify the customer, typically five days before the CDD, of an appointment for the fitting and testing of the electronic equipment on the customer site.

A17.108 Once testing and commissioning is complete, Openreach issue a "Completion and Handover Update", ideally on or within 1 day of CDD, to confirm to the customer that the service is installed and working. This is the end of the provision process and the service is transferred into operation and maintenance.

Possible future changes to the process

A17.109 Openreach are trialling some significant changes to the Ethernet provision process. The final process, agreed between industry and openreach once the trial is complete may differ from the initial proposal. We have included a brief overview of the changes to illustrate the extent of proposed, potential process changes we may have to accommodate in any remedies we may propose. The possible changes include:

- six instead of four order categories to better match the actual complexity of the required network build;
- use of historical information to issue a more accurate initial CDD (KCI3) to reduce the uncertainty and possibly the number of times it will change; and
- introduction of some new KCI's, at least one of which will include an update on the CDD based on real planned dates after the physical network has been checked.

Recent performance

A17.110 In this section we analyse Openreach's recent Ethernet provisioning and fault repair performance. The Ethernet products included in the following analysis unless otherwise specified are EAD, EAD LA, EBD, WES, WES LA, WES Aggregation, WEES, BES and Cablelink.

A17.111 We obtained performance, demand and, where possible, resource data from Openreach using our statutory information gathering powers. The provisioning performance data also included information relating to the causes of delays.

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[365] Openreach – Ofcom meeting at Uxbridge control centre on 21 July 2014.

[366] Test rodding is often delayed so that the whole activity of test rodding, duct blockage clearance and fibre installation is all part of the same activity and potentially more efficient but it can cause unexpected delay.

[367] Test rodding can only identify the first blockage in a duct when approached from a particular direction. Consequently at best it can find two blockages in a duct, but a third (or more) blockage between the two points identified cannot be found until the first blockages are cleared.

A17.112 This section is structured as follows:

- first, we describe the performance data we obtained and how this influenced our analysis;
- second, we summarise Openreach's provision performance, against relevant SLAs where applicable, and explore what level of performance can be attributed to Openreach;
- third, we summarise Openreach's fault repair performance including against SLA targets where applicable; and
- finally, we consider the various factors that may have had an impact on Openreach's recent provision performance.

Availability and integrity of Ethernet provison and repair performance data

A17.113 The data available to us bounded the analysis we were able to perform.

A17.114 Using our formal powers we initially requested Ethernet provision and repair performance data for the period January 2008 to July 2014. A subsequent request extended this period to November 2014.

A17.115 Repair performance data was only available across all the relevant products from January 2011. Prior to January 2011 repair performance data was available for a subset of the products but for the period prior to March 2009 Openreach was unable to find and retrieve appropriate data in the time available to respond to our formal requests.[368]

A17.116 Generally provision performance data was available from January 2008 but Openreach noted in its responses that:

- initial CDD data was not available before October 2012 due to data retention policies;
- initial CDD data was not available for Cablelink and EBD because it is not recorded for these products; and
- provision categorisation data for all products either did not exist or was unreliable prior to September 2011.[369]

A17.117 Our own analysis of provision categorisation within the performance data supplied by Openreach, shown in Table A17.5, indicates that prior to 2011 provision categorisation is either very poor or non-existent but from 2011 non categorisation constitutes about 8 to 12% of all provision orders for a given year.

[368] Openreach response dated 10 October 2014 to our 3rd section 135 notice dated 29 August 2014.

[369] Openreach response dated 26 September 2014 to our 3rd section 135 notice dated 29 August 2014.

Table A17.5: Percentage of provision orders not categorised

Year	Percentage provision orders not categorised
2008	98%
2009	99%
2010	58%
2011	10%
2012	8%
2013	12%
2014	8%

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

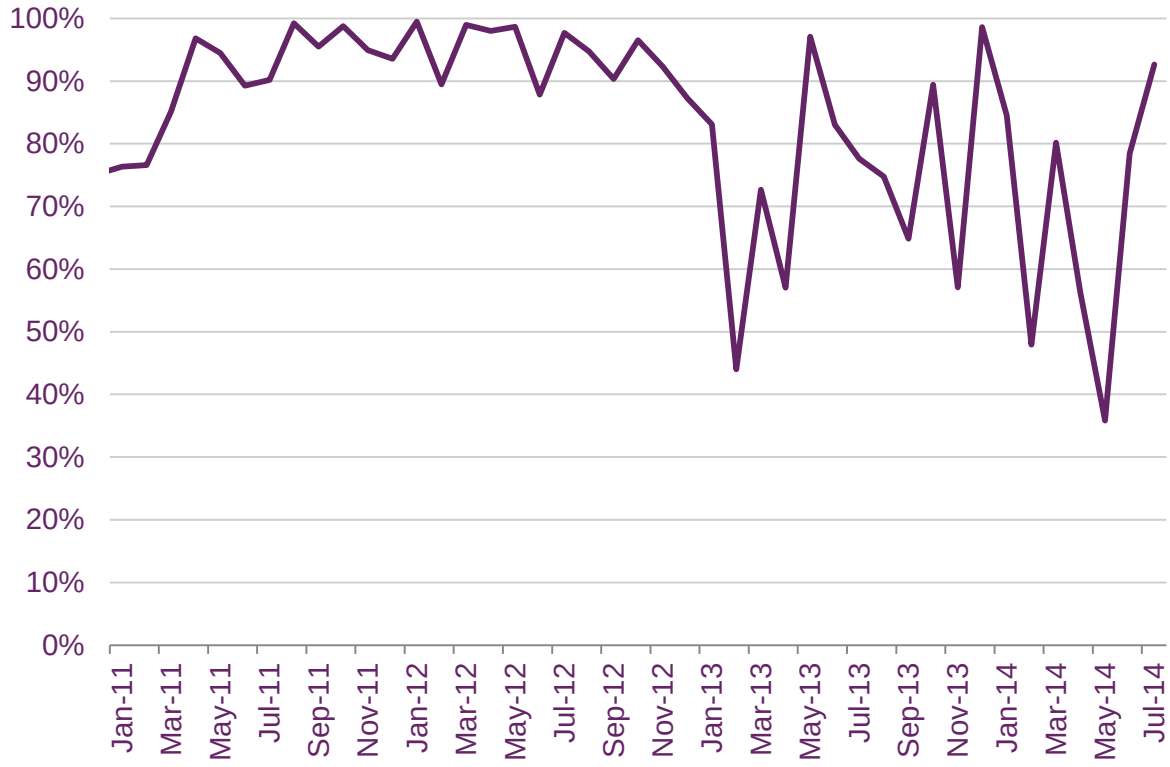
A17.118 Our subsequent analysis has also not shown any other significant issues arising from provision categorisation in 2011. Consequently we believe the data from 2011 onwards to be sufficiently reliable for our analysis and remedy design purposes. We have therefore concentrated our performance analysis and remedy design based on performance data for the period January 2011 to November 2014.

Provision performance

Order Validation

A17.119 Openreach's target to complete the validation stage (milestone KCI1 in the provisioning process) is 5pm on the next working day after an order is placed. Figure A17.6 below shows Openreach's performance against this target between January 2011 and July 2014 for EAD (all variants) orders. Approximately 95% of orders were validated within the target timescale during the first half of this period. However, between October 2012 and July 2014 performance fluctuated significantly from month to month, between a peak of 99% and a trough of 36%

Figure A17.6: Percentage of orders validated by 5pm the next working day

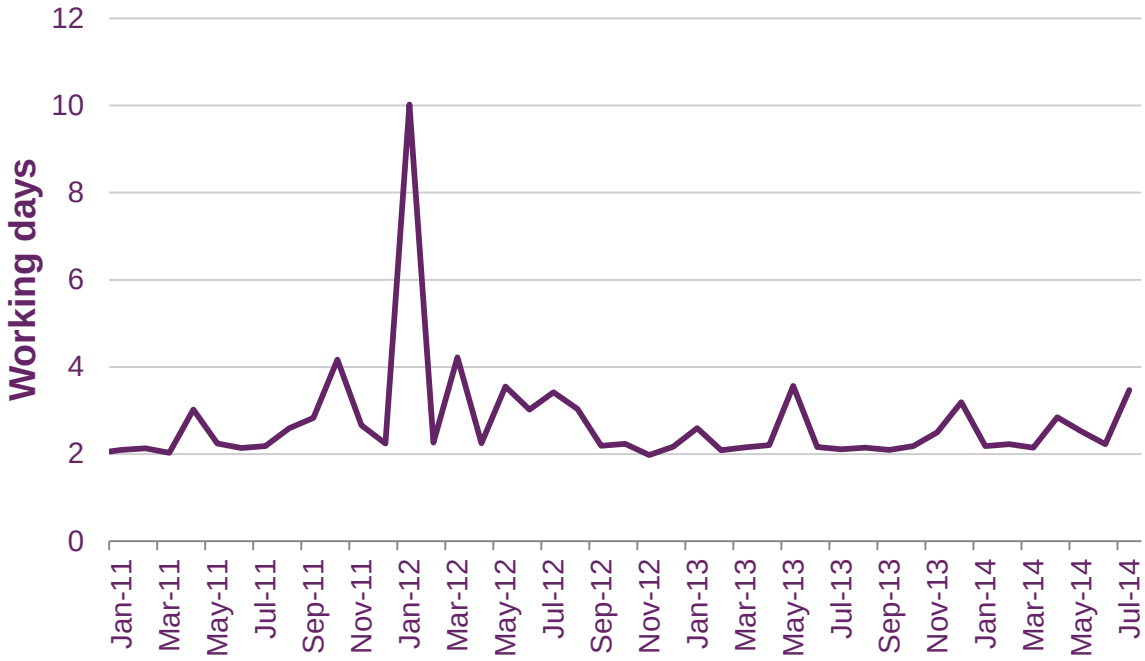


Source: Ofcom analysis of Openreach section 135 responses dated 19 September 2014 and 22 October 2014.[370]

A17.120 Figure A17.7 plots the average delay for orders not validated by 5pm the next working day. The average delay is consistently between two and four days (with the exception of an outlier in January 2012). Although the proportion of orders validated within the target timescale fluctuated significantly between October 2012 and July 2014, the average impact of missing the target was relatively stable at just over two days.

[370] Derived from Openreach responses to our 3rd section 135 notice question 8 (validation duration) and our 5th section 135 notice question 6e (volume of orders completed)

Figure A17.7: Average delay (working days) until validation, for orders not validated by 5pm the next working day



Source: Ofcom analysis of Openreach section 135 responses dated 19 September 2014 and 22 October 2014. [371]

Overall lead time between order validation and delivery

A17.121 We now consider the lead time between order validation and order delivery followed by consideration of what proportion of this lead time it is appropriate to attribute to Openreach. We then consider measures of the time between various stages of the provisioning process using measures we consider appropriate to attribute to Openreach.

A17.122 Note that all of these measures take the day on which an order is validated as "Day 0", and that "days" refers to working days unless otherwise noted.

A17.123 We focus on performance disaggregated by order category, as this is the main dimension along which orders vary in their complexity (see Table A17.3 above for a description of each order category). We have however also considered performance disaggregated by product.

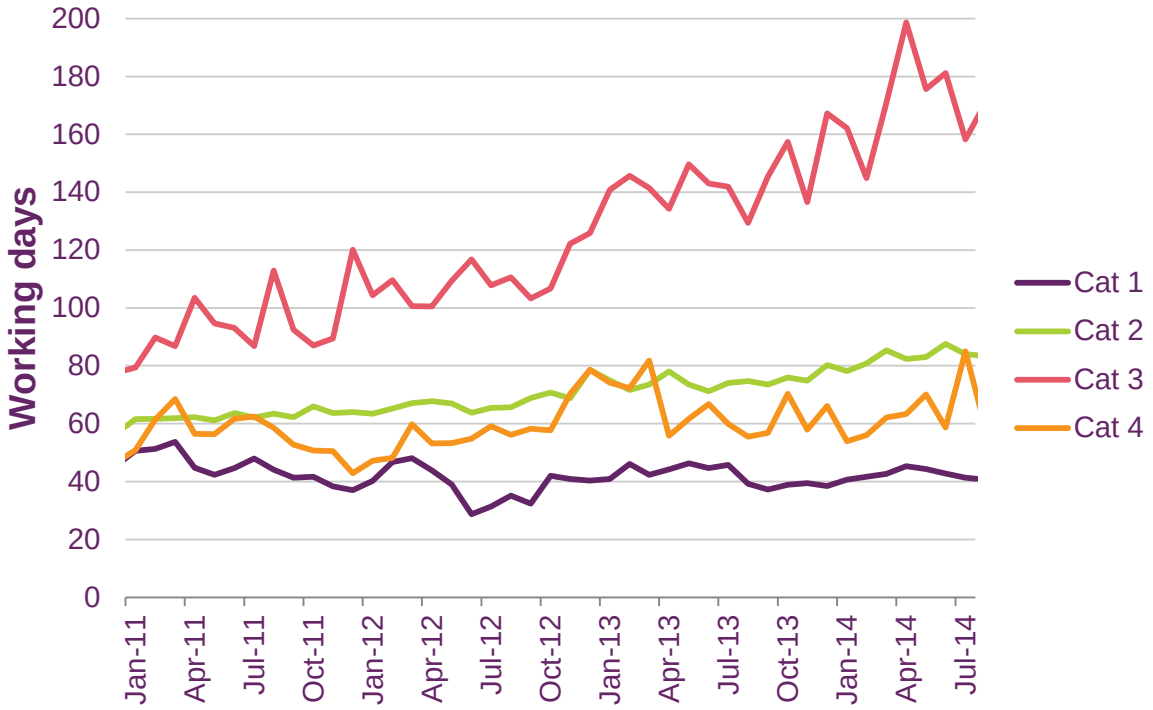
A17.124 Figure A17.8 shows the mean time to provide (MTTP)[372] for each order category between January 2011 and July 2014. This portrays a gross measure of performance and includes delays that are not caused by Openreach and are outside Openreach's control.

[371] Derived from Openreach responses to our 3rd section 135 notice question 8 (validation duration) and our 5th section 135 notice question 6e (volume of orders completed).

[372] MTTP is defined as the average number of days between an order being validated and Openreach advising the customer of its completion.

A17.125 Category 1 orders exhibit relatively stable, slightly improving, performance with an MTTP of about 40 days throughout most of the period. MTTP for Category 3 increased significantly from around 80 days at the start of 2011 to consistently over 140 days since 2013. The scale of deterioration of Category 3 somewhat masks the steady deterioration of Category 2 MTTP, which increases from 60 working days at the start of 2011 to over 80 working days during the first half of 2014. Category 4 performance was very volatile throughout the period and also appears to have deteriorated slightly.

Figure A17.8: Mean time to provide (MTTP), by provision type



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

Lead time performance attributable to Openreach

A17.126 We now explore how much of the above lead time is attributable to Openreach.

A17.127 A contractual term known as deemed consent permits Openreach, under certain defined circumstances, to change the contractual delivery date (CDD) of an order. The application of deemed consent has in practice been commonplace rather than exceptional; 71% of all provide and regrade orders completed by Openreach between 2011 and 2014 were subject to at least one deemed consent application, see Table A17.17 below. CPs and end-users have indicated to us that significant uncertainty over the final delivery date, rather than a longer lead time in itself, is their primary concern with recent Openreach provisioning performance.

A17.128 Openreach identify deemed consent changes with a set of deemed consent codes (DCC). Each code identifies a specific reason for the change. The DCC is also classified into two groups, one covering those changes that Openreach consider are caused by their customers while the other group covers those DCC that Openreach attribute to “third-party” causes. Table A17.9 below presents the Openreach DCC with their meanings and the group to which Openreach allocates them.

A17.129 Technically deemed consent can only be applied after the initial CDD has been issued. However, Openreach also use the coding to identify and record changes to the delivery date before the initial CDD is issued.

A17.130 We use the Openreach DCC and their groups to analyse how much of the overall lead time delay for each order for the period January 2011 to July 2014 (and in some cases to November 2014) can be attributed to Openreach, their customers or to other "non-customer" reasons. The changes and differences (delay) in lead time identified in our analysis include those contributions due to changes before as well as after the initial CDD is issued.

Table A17.9: Deemed consent codes and their meanings

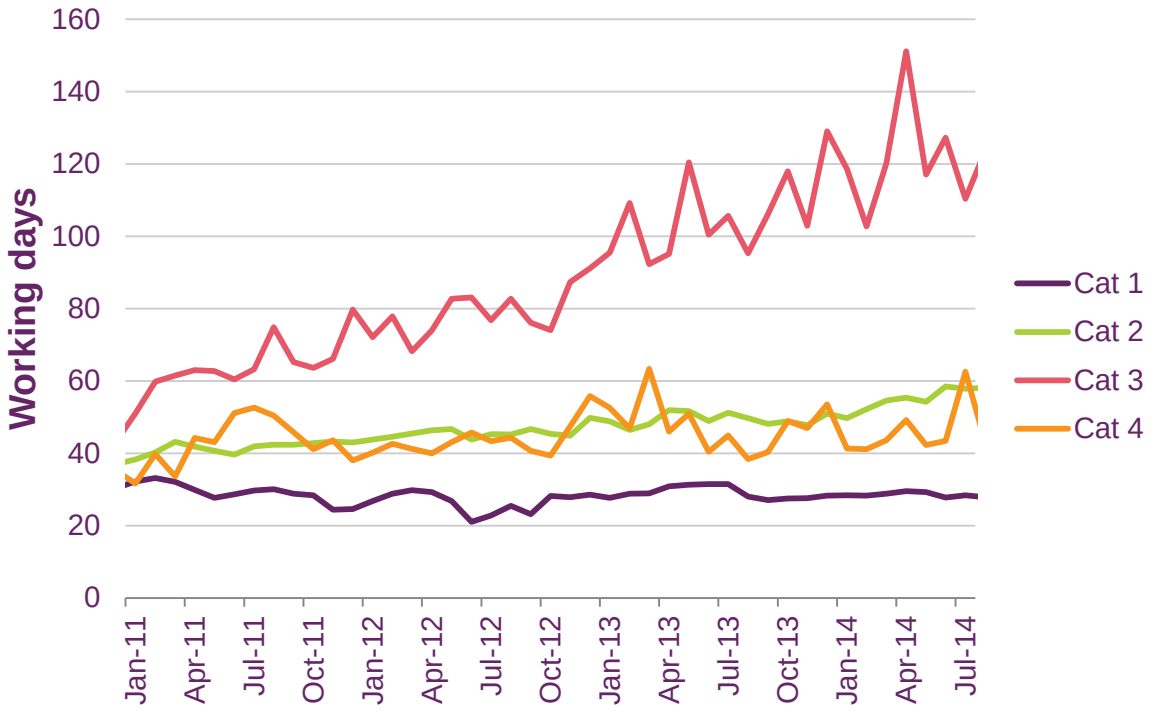
Deemed consent code	Meaning	Cause Group
DC21	Order is awaiting customer acceptance of ECC	Customer
DC7A	Customer site not ready for installation	Customer
DC7B	The Communications Provider is in breach of any part of the contract or Openreach suspends the service or any part of it in accordance with the contract	Customer
DC7C	Customer site access delay/customer down time required	Customer
DC7D	The Communications Provider and Openreach agree a different timescale for performance of the service	Customer
DC7E	Delayed awaiting customer information	Customer
DC7I	The failure is due to an inaccurate order being submitted by the Communications Provider	Customer
DC7J	No access after failing to reach the 3 named contacts	Customer
DC7K	No access after an appointment has been made	Customer
DC7L	No specific location access after appointment made	Customer
DC7M	Customer appointment outside the 48 hour period	Customer

DC7N	Order suspended at customer's request	Customer
DC7O	Delays on driver circuit impacting on this circuit	Customer
DC7P	Weekend or bank holiday access is requested by customer	Customer
DC7Q	Customer network freeze periods in operation	Customer
DC7R	Customer downtime is required to complete provision work	Customer
DC7S	Risk assessment/method statements to be agreed by customer	Customer
DC22	There is a need for infrastructure build	Non-customer
DC23	There is cable or exchange breakdown	Non-customer
DC24	There is collapsed blocked (e.g. cement) or damaged duct/manhole	Non-customer
DC25	Notice is required under the Traffic Management Act or Traffic Scotland Act	Non-customer
DC26	There is a manhole or footway box that is contaminated with or by a substance which requires special treatment	Non-customer
DC27	Asbestos has been identified	Non-customer
DC28	Security clearance is required but not yet agreed	Non-customer
DC29	Main frame compression or extension is required	Non-customer
DC7F	Customer wayleave	Non-customer
DC7G	The failure is due to a Force Majeure event	Non-customer
DC7H	The failure is due to a scheduled outage	Non-customer

Source: Ofcom based on Openreach information provided in presentation "DC Codes.pptx" in email from Openreach to Ofcom dated 29 July 2014.

A17.131 Figure A17.10 shows the mean time to provide (MTTP)[373] for each order category between January 2011 and July 2014 with CDD changes and their contribution to lead time. Changes that Openreach class as customer caused are excluded. The chart shows broadly similar patterns for each order category that were portrayed for the gross MTTP in Figure A17.8. The key difference is an overall reduction in the MTTP for each category of about 10 working days for Category 1, about 20 working days for Category 2, about 40 working days for Category 3 and about 20 working days for Category 4. Some of the volatilty in Category 4 has also reduced and left a very slight upwards trend.

Figure A17.10: Mean time to provide (MTTP) excluding customer caused delays



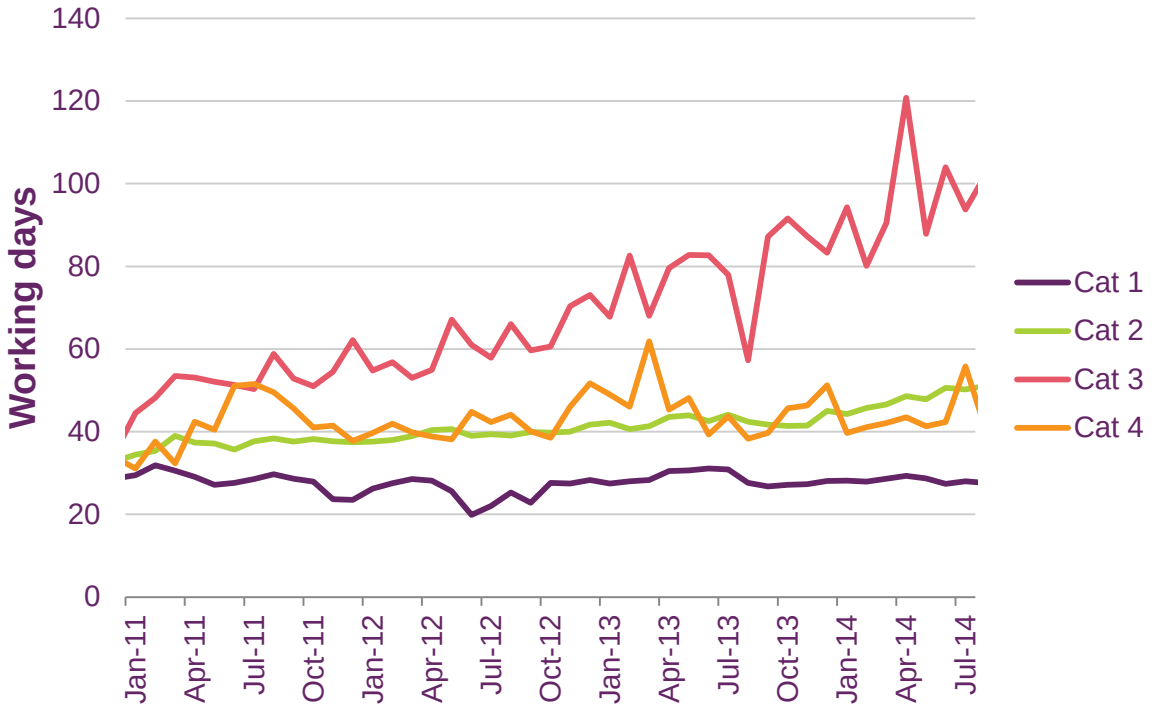
Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.132 In Figure A17.11 we exclude the changes and delays attributed by Openreach to the "third party" (non-customer) DCC as well as those attributed to customers. There is no significant difference in the performance of categories 1 and 4 and the deterioration in MTTP for the other categories remains although:

- the MTTP for Category 2 is generally lower by about 10 working days; and
- Category 3 lead time performance does not increase as much over the period, increasing to a lead time of circa 100 working days instead of to circa 120 working days.

[373] MTTP is defined as the average number of days between an order being validated and Openreach advising the customer of its completion.

Figure A17.11: Mean time to provide (MTTP) excluding customer and non-customer ("third party") delays



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

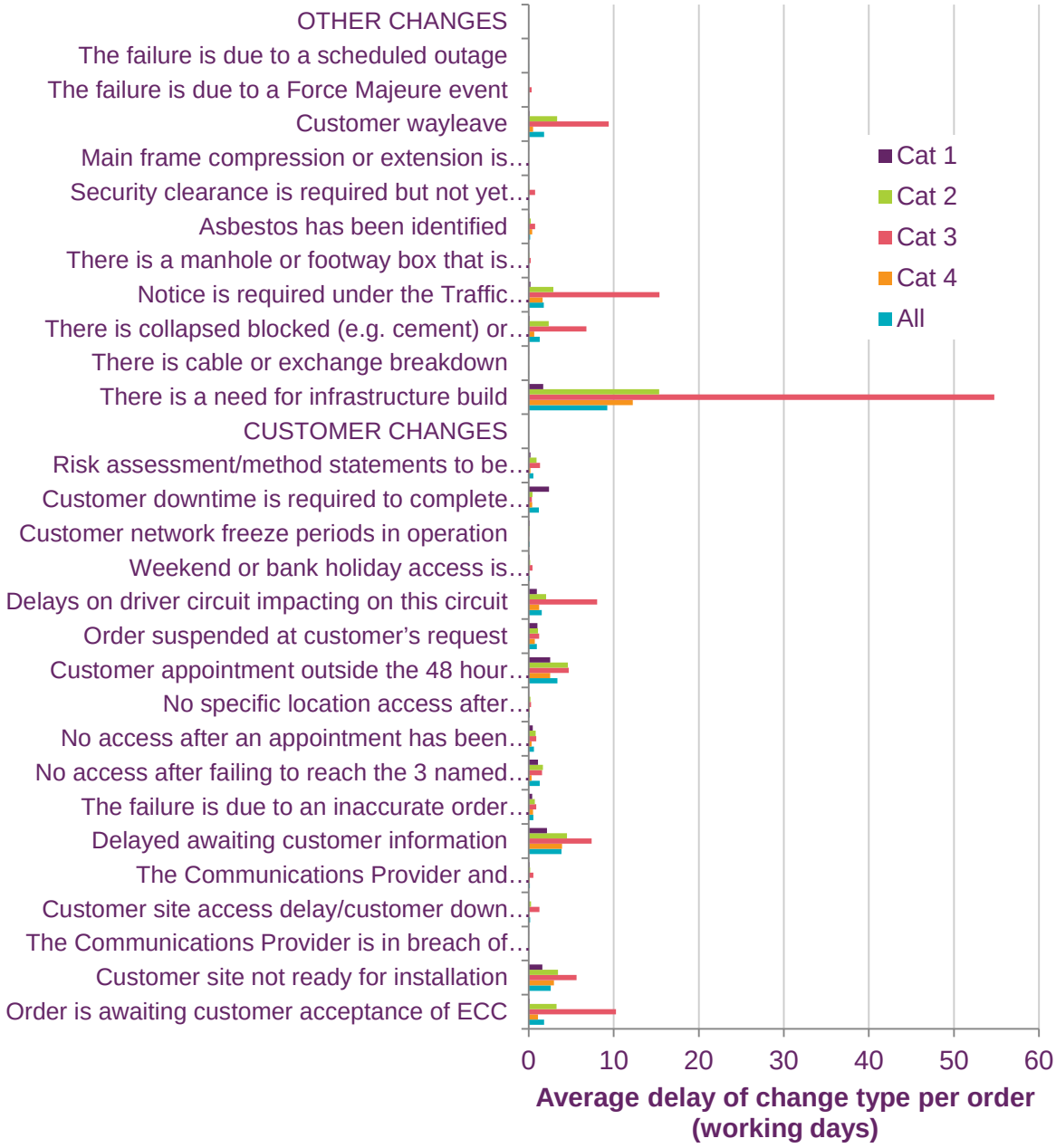
A17.133 When considering what the appropriate delay in lead time to attribute to Openreach is, it might seem appropriate, given the above findings, to exclude all customer caused delay and the non-customer caused delay, especially if the latter is entirely attributable to third parties.

A17.134 To better understand where the changes in lead time come from we investigated the DCC registered against each change for each order for each year in the period 2011 to 2014. Figure A17.12 presents the average contribution each type of change identified by DCC makes to the number of lead time changes for each category of order in the year 2014 while Figure A17.13 shows the corresponding contribution to the associated delay. Other years were similar but reflected the lower MTTP in earlier years.

Figure A17.12: Volume of CDD changes per order arising from given deemed consent reasons, 2014

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

Figure A17.13: Lead time change delay per order arising from given deemed consent reasons, 2014



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.135 The contributions coming from the changes attributed to customers (via the DCC) appear to be spread across a wide range of reasons with none dominant. Table A17.17 below shows that about two thirds of the changes are attributed to customers. We checked to what extent this may be inaccurate by asking the CPs using our formal powers how often and how successfully they challenged the deemed consent changes applied to their orders. In response to our section 135 notices we found the CPs either had no records, or where they had records the volume of challenges was either very low or not accessible in the time available. Consequently we did not receive any data to substantiate the comments in the CFI responses that deemed consent has been improperly applied. Where data was

available we estimate the volume of challenges and the volume of successful challenges formed an immaterial propotion of the overall volume of changes seen by Openreach customers. Consequently, given the DCC meanings and the low level of evidence of successful challenge to the application of the DCC we cannot consider Openreach to be responsible for this group of changes.

A17.136 However a study of the changes attributed to non-customers ("third parties") reveals that there are four DCC categories contributing most to the increase in non-customer caused lead time change volume and delay. They are:

i) "a need for infrastructure build" (DC22);

ii) "a collapsed blocked or damaged duct / manhole" (DC24;

iii) "notice is required under the Traffic Management Act or Traffic Scotland Act" (DC25); and

iv) "customer wayleave" (DC7F).

A17.137 While we have not carried out a detailed investigation into these causes we believe that none of the above four reasons (DC22, DC24, DC25 and DC7F) can be attributed completely to third parties or natural events external to Openreach. The " need for infrastructure build" is probably least attributable to causes external to Openreach whilst the "collapsed blocked or damaged duct / manhole" could be mitigated or reduced to some extent (but not entirely) by regular inspection and maintenance by Openreach. The last two could result from late application to the respective third parties just as much as it could be the third parties delaying their response or delaying the time when access is permitted. We note here the observation from the City of London Corporation (CoLC) in paragraph A17.81 that Openreach does not liaise with the CoLC streetworks team in a timely fashion.

A17.138 We therefore conclude it is appropriate to assume that the lead time delay attributed to customers is outside the direct control of Openreach and should therefore be excluded from further analysis and consideration of Openreach's performance.

A17.139 However we also conclude it is not appropriate to assume the same for the non-customer delay. The non-customer (so called "third party") is as much attributable to Openreach as it is to genuine third parties and while they are outside Openreach's direct control we believe Openreach could and should influence these parties to behave in a timely manner. Therefore we consider it appropriate to assume the non-customer delay is not excluded from further analysis and consideration of Openreach's performance. We also believe it is not appropriate to label the non-customer changes as "third party".

A17.140 Consequently we concentrate the remainder of our analysis on lead times and other performance parameters that exclude customer caused delays but include delays arising from non-customer causes.

A17.141 We therefore believe Figure A17.10 appropriately portrays Openreach lead time MTTP performance which with Table A17.14 shows a decline in performance over the period 2011 to 2014. These clearly show Category 3 exhibits the worst performance and the worst decline although Category 2 also declines significantly.

A17.142 We also note that the impact of customer and "third party" (non-customer) delays on MTTP, while substantial, is relatively static over time. We therefore do not think that customer and/or non-customer ("third party") delays are a significant factor in explaining Openreach's recent provision performance.

Table A17.14: Mean time to provide (MTTP) in working days for lead times excluding customer caused delay but including non-customer caused delay[374]

	Provision category				
Provision category	**1**	**2**	**3**	**4**	**All**
2011	29	42	64	43	40
2012	26	46	78	43	39
2013	29	49	105	47	41
2014	29	58	133	48	46

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

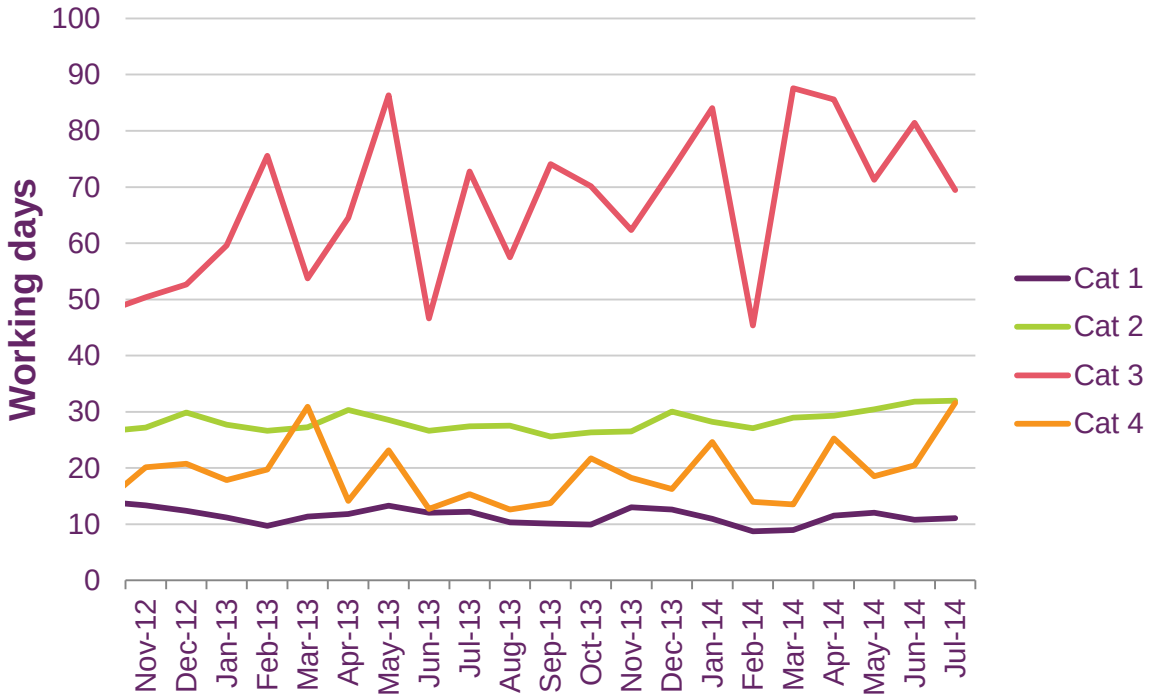
Other aspects of lead time performance

A17.143 Having established what is an appropriate measure of lead time performance we now consider other aspects of lead time, i.e. the average time to issue an initial contractual delivery date (CDD) and the average time between validation and the value of the initial CDD. We exclude customer caused delay from these measures for the reasons given above.

A17.144 Figure A17.15 shows the average time taken by Openreach to issue customers with an initial CDD between November 2012 and July 2014. Openreach's target for issuing an initial CDD, which corresponds to milestone KCI3 in the provisioning process, is 14 days.

[374] Ofcom analysis of Openreach data. MTTP is the average time between the time when the order is validated and accepted and the time when the order provisioning is complete and the service is handed over to the cutomer.

Figure A17.15: Average time to issue initial CDD excluding customer caused delays



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

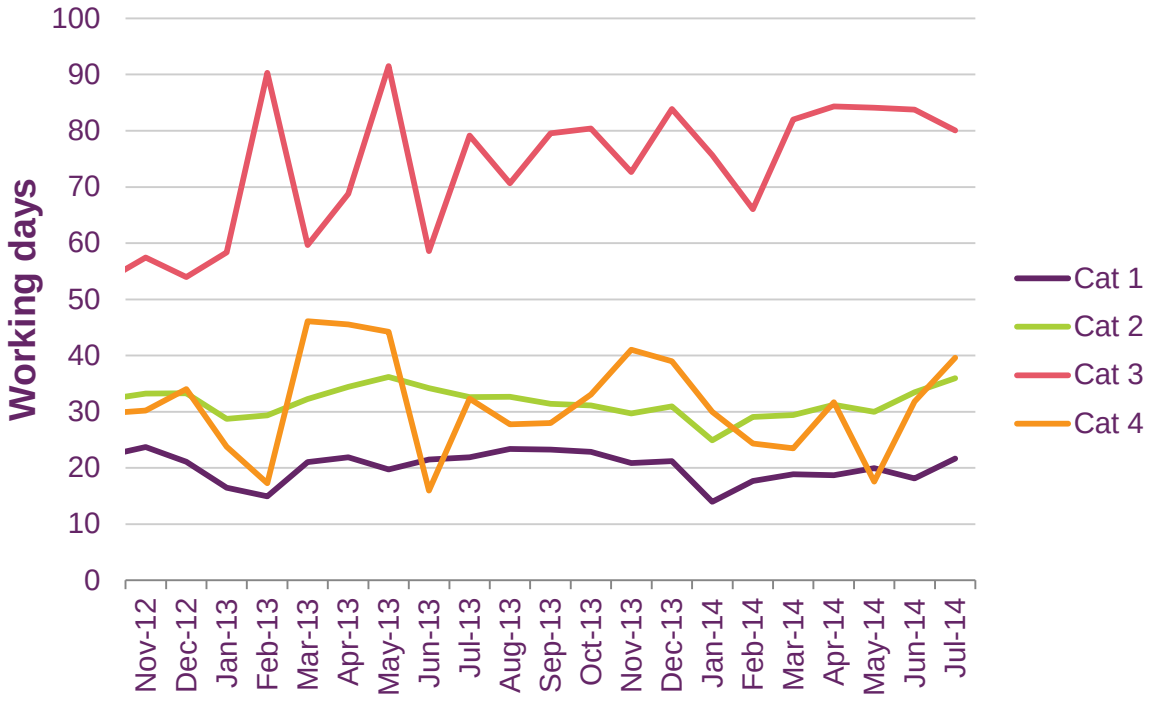
A17.145 Category 1 orders consistently achieve the 14 day target for KCI3 throughout the period. An initial CDD is also at times issued within 14 days for Category 4 orders. However, on average Category 2 and 3 orders fail to meet the Day 14 standard. For Category 2 this measure is stable at approximately 27 days. Category 3 performance is highly unstable, and the time taken to issue an initial CDD deteriorates from 50 days at the end of 2012 to between 70 and 80 days during the first half of 2014.

A17.146 Figure A17.16 shows the average time between order validation and the initial CDD issued by Openreach. For Category 1 and Category 2 orders performance is stable at 20 and 30 days respectively. Category 4 is more variable, fluctuating about a mean of 30 days throughout the period but does not demonstrate a particular long term trend in any direction.

A17.147 For Category 3 orders, performance against this measure deteriorates from 50 days in late 2012 to over 80 days during the first half of 2014. The initial CDD for Category 3 orders did not, on average meet the 30 day advertised lead time between November 2012 and July 2014.

A17.148 We also note the similarity in the time to issue the initial CDD and the value of the initial CDD (both measured from order validation). We have been unable to explain why this is the case but it suggests that the initial CDD is given a date close to the date on which it is issued.

Figure A17.16: Average time between order validation and initial CDD, excluding customer caused delays



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

Lead time uncertainty – volumes of CDD changes and associated delays

A17.149 We now consider the key characteristics of lead time uncertainty, the number of changes an order experiences and the associated delay (change in lead time).

A17.150 For each year in the period 2011 to 2014, Table A17.17 below presents a summary of average volume of changes and average delay in lead time per order, split by order category, that can be attributed to the deemed consent codes in Table A17.9 above. The table also shows the proportion of changes attributed to customers and non-customers (Openreach so called "third parties") as well as identifying the proportion of changes made after the initial CDD is issued that customers will see as changes to the CDD.[375]

[375] See Table A17.9 for a description of each deemed consent code, including its classification as either customer or non-customer delay.

Table A17.17: Lead time change volume and associated delay[376]

Provision Category	Year	Proportion of orders changed	Mean volume of changes to lead time per order	Mean lead time change per order (working days)	Proportion changes attributed to customers	Proportion of changes made after after initial CDD issued
All	2011	76%	3.0	30.3	66%	53%
	2012	70%	3.3	29.2	63%	49%
	2013	69%	3.0	29.7	66%	49%
	2014	71%	3.1	34.4	62%	55%
1	2011	64%	2.2	19.3	85%	69%
	2012	53%	1.9	14.9	84%	65%
	2013	53%	1.6	14.9	89%	74%
	2014	53%	1.5	15.7	87%	79%
2	2011	87%	3.8	35.6	63%	50%
	2012	87%	4.7	39.5	59%	45%
	2013	91%	4.6	44.7	61%	44%
	2014	88%	4.6	49.3	57%	50%
3	2011	95%	5.4	66.5	50%	48%
	2012	94%	8.0	80.7	44%	41%
	2013	95%	9.6	111.5	41%	35%
	2014	96%	9.9	134.6	39%	42%
4	2011	74%	2.2	18.9	70%	65%
	2012	64%	2.5	22.5	67%	60%
	2013	80%	2.9	30.3	64%	58%
	2014	83%	2.7	30.4	52%	52%

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.151 Nearly three-quarters of all orders experience some form of delay. Orders in Category 3, and to a lesser extent those in Category 2, experience a much greater number of changes and much greater associated additional delay than those in categories 1 and 4. This possibly reflects the need for civil infrastructure build in categories in 2 and 3.

A17.152 Table A17.17 also summarises our estimates of the proportion of changes that occur after the initial CDD has been issued. The data indicates two layers of uncertainty for customers. Approximately half the changes occur after the initial CDD is issued although this does vary by category with Category 3 exhibiting fewer changes and Category 1 the most. Changes made before the initial CDD is issued

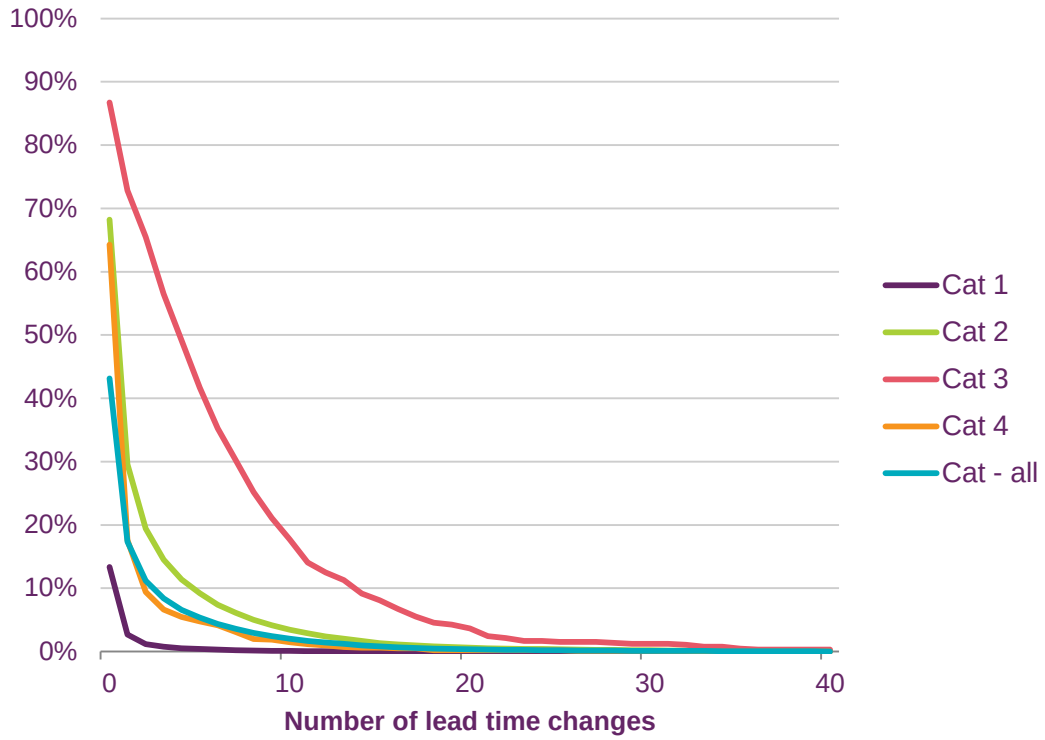
[376] The table presents the proportion of changes made after the CDD is issued. The proportion of delay that occurs after the initial CDD is issued due to these changes is about 0 to 5 percentage points greater. Similarly the proportion of delay attributed to customers is 2 to 9 percentage points greater than the proportion of changes attributed to customers.

will be seen as part of the initial CDD, appearing as an apparent delay compared to the standard 30 day lead time. Consequently, when an order is placed there is uncertainty as to whether the 30 day standard lead time will be adhered to and once the initial CDD has been issued there is uncertainty in the CDD issued.

A17.153 The average values in Table A17.17 hide the spread in the number of changes and associated delay in the CDD. Figures A17.18 and A17.19 present the percentage of orders experiencing more than a given number of changes or delay (excluding customer caused changes). The spread in values can be seen to depend on provision category. Approximately one in ten Category 2 orders experience on average five or more CDD changes and approximately one in ten Category 3 orders experience on average thirteen or more CDD changes.

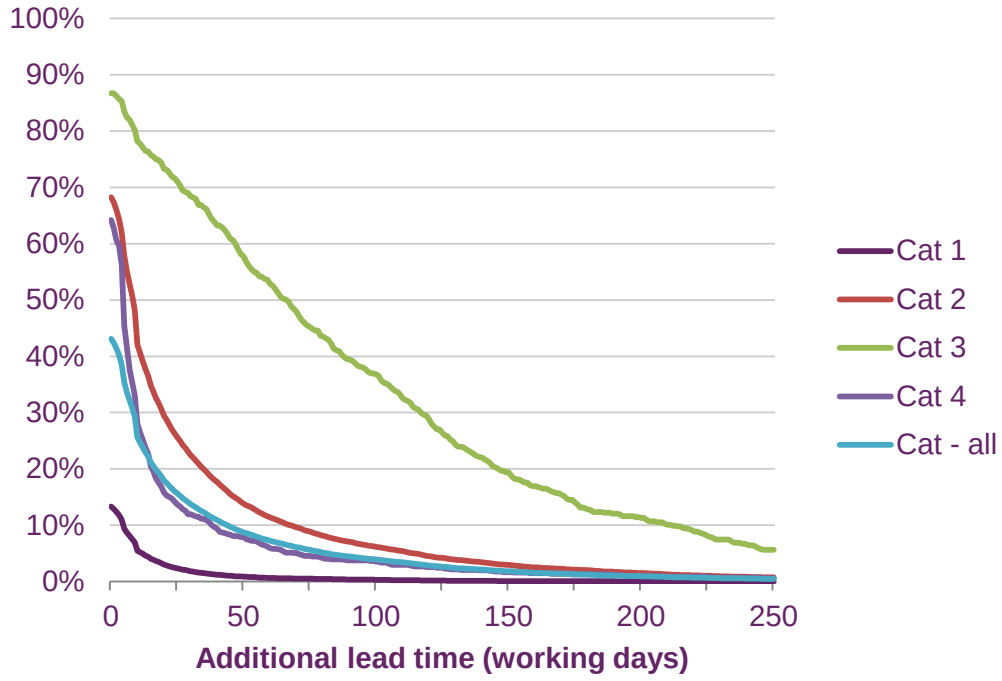
A17.154 We provisionally conclude that there is a significant issue of uncertainty and volatility in the provisioning process for Category 2, 3, and 4 orders, which form over 50% of relevant volumes.

Figure A17.18: Percentage of orders experiencing more than a given number of changes in lead time(2014, excluding customer caused changes)



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

Figure A17.19: Percentage of orders experiencing more than a given level of change in lead time, i.e. delay (2014, excluding customer caused changes)



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

SLG payments

A17.155 Another indicator of performance is the level of SLG payments made. Openreach is liable for SLG payments in the event that an order is not completed by the final CDD to be issued. Table A17.17 shows that there has been an approximate fivefold increase in the proportion of Openreach provisions subject to an SLG payment between financial years 2011/12 and 2013/14.

A17.156 Despite the potential for the deemed consent mechanism to undermine the SLA/SLG regime, since the SLA refers to the final CDD which can be changed (sometimes on numerous occasions), there has still been a significant increase in SLGs paid out by Openreach as a consequence of lower quality of service in provisioning.

Table A17.20: Openreach provisioning SLG payments[377]

	Percentage of provisions subject to an SLG payment	Total value of provisioning SLG payments
2011/12	[✂ ✂]	[✂ ✂]
2012/13	[✂ ✂]	[✂ ✂]
2013/14	[✂ ✂]	[✂ ✂]

Source: Ofcom analysis of Openreach section 135 response dated 19 September 2014.

Project services

A17.157 Project Services is a premium project coordination and management service offered by Openreach. As outlined above, some CPs raised in their reponses to the CFI concerns about orders placed with Project Services possibly receiving preferential treatment, for example better lead times or better information concerning lead time delays.

A17.158 Table A17.21 shows MTTP (excluding customer caused delays) for orders placed both with and without Project Services, disaggregated by order category. We observe that performance for Category 1 to 3 orders placed via Project Services is slightly worse, possibly reflecting that the delivery to sites on some multiple site orders are delayed so that delivery can be synchronised across the sites. Category 4 orders placed via Project Services appear to receive consistently lower lead times over the period investigated compared to non project service orders. However we note that over the period Category 4 orders constitute less than 5% of all orders.

[377] Percentage of provisions subject to an SLG payment is taken as a percentage of all order types, e.g. provides, re-grades, shifts, ceases, etc.

Table A17.21: Comparison of MTTP (working days) excluding customer caused delay between orders placed with and not with Project Services (PS)[378]

	Category 1		Category 2		Category 3		Category 4	
	PS	Non-PS	PS	Non-PS	PS	Non-PS	PS	Non-PS
2011	29	29	43	42	70	63	40	47
2012	33	25	56	43	87	75	43	43
2013	31	29	55	47	113	101	42	49
2014	30	28	63	56	152	123	45	49

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.159 Table A17.22 compares orders placed with and without Project Services across a range of metrics relating to the application of deemed consent. Project Services orders are typically subject to more changes and greater delay than standard orders.

[378] Alternatively known as average lead time.

Table A17.22: Project Services, comparison of lead time changes

	Year	Proportion of orders changed		Average no. of changes		Average delay (days)	
		PS	Non-PS	PS	Non-PS	PS	Non-PS
All	2011	79%	76%	3.8	2.8	37	28
	2012	79%	67%	5.6	2.9	51	25
	2013	77%	66%	4.2	2.6	43	25
	2014	75%	69%	3.9	2.8	43	31
Cat 1	2011	70%	62%	2.7	2.0	25	18
	2012	71%	49%	3.6	1.5	30	12
	2013	60%	51%	2.0	1.5	19	14
	2014	59%	50%	1.8	1.4	19	14
Cat 2	2011	93%	86%	5.5	3.4	54	31
	2012	92%	86%	7.8	4.0	70	33
	2013	91%	91%	5.9	4.1	58	39
	2014	89%	88%	5.5	4.2	60	45
Cat 3	2011	98%	94%	7.5	5.0	98	60
	2012	98%	93%	9.7	7.3	104	72
	2013	98%	94%	11.5	8.7	127	104
	2014	97%	95%	11.1	9.3	150	127
Cat 4	2011	58%	91%	1.2	3.4	8	31
	2012	49%	82%	1.3	4.1	13	35
	2013	78%	82%	2.9	2.8	34	28
	2014	73%	89%	2.6	2.7	31	30

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.160 Orders placed with Project Services are on average likely to be more complex to provision than standard orders. We also understand that many orders are subject to coordinated delivery across a number of sites. Therefore, evidence of similar or slightly worse performance does not necessarily rule out the possibility that such orders are expedited or receive relatively higher quality of service in other aspects

of the provisioning process such as certainty of the CDD. However, we do not have sufficient data to estimate the counterfactual performance for a given order had it not been provisioned under Project Services. Overall, given the evidence that is available , we do not consider that there is evidence that Project Services orders received favourable treatment over the period considered.

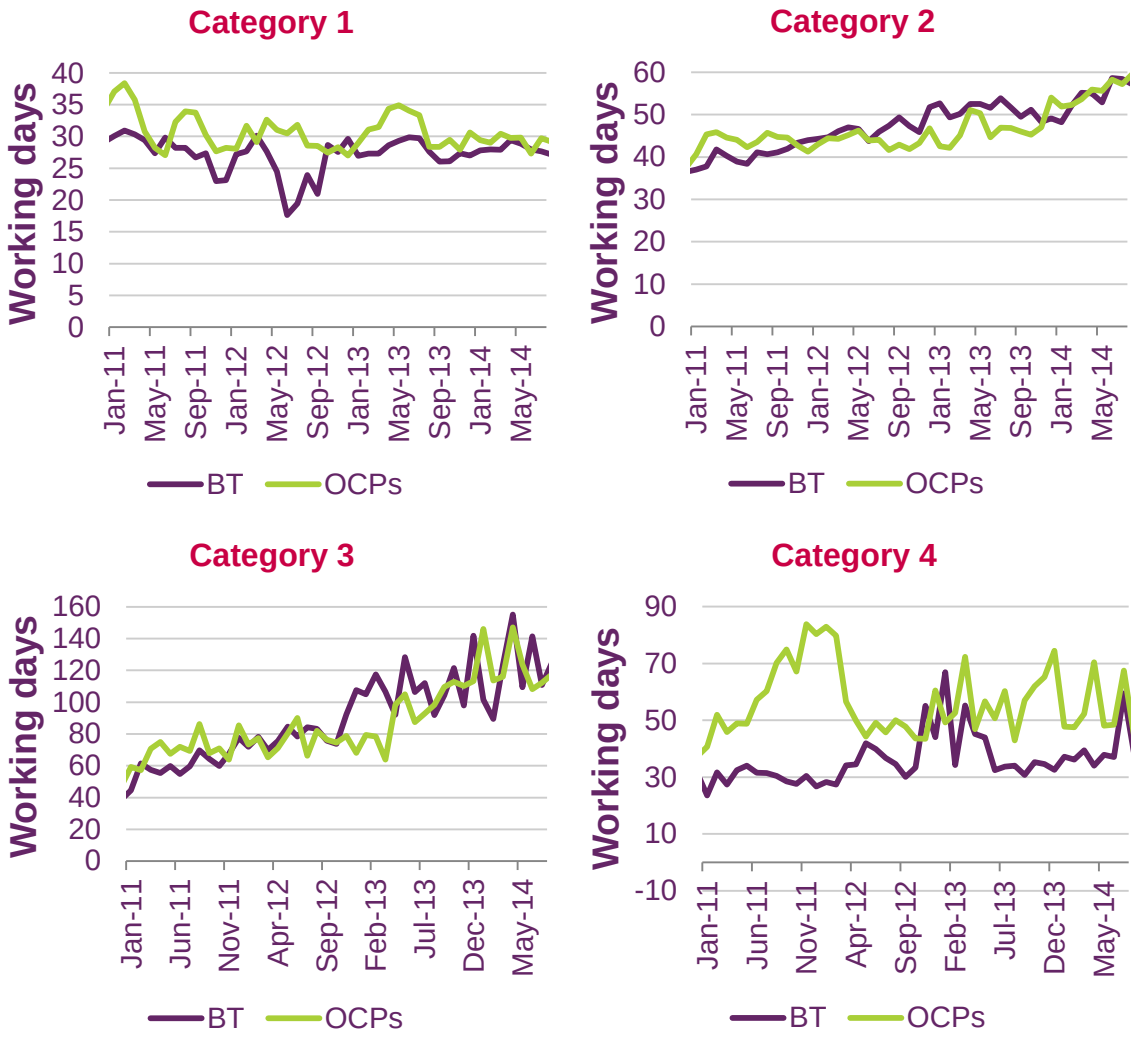
Comparison of internal and external provisioning performance

A17.161 The final aspect of provisioning performance that we consider is whether there has been any significant difference in the quality of service provided by Openreach to downstream divisions of BT, in comparison to that provided to other Communications Providers (OCPs) purchasing Openreach inputs. We restrict our attention to potential differences in provisioning performance, given that repair performance has been maintained at a generally good standard.

A17.162 The charts in Figure A17.23 below show MTTP for each order category, distinguishing between orders placed by downstream divisions of BT[379] and OCPs. In general, there is little evidence of any systematic bias in Openreach performance in favour of either downstream divisions of BT or OCPs in terms of MTTP with the possible exception of Category 4, where BT downstream CPs appear to receive consistently lower lead times (MTTP) than the OCPs.

[379] i.e. BT Business, BT Wholesale and BT Global Services

Figure A17.23: Comparison of internal and external MTTP



Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

A17.163 Table A17.24 summarises the incidence, frequency and impact of deemed consent on orders depending on whether they were placed by downstream divisions of BT or OCPs. Again, we do not consider that there is evidence of systematic bias with the possible exception of Category 4 orders. However we note that over the period 2011 to 2014 Category 4 orders constitute fewer than 5% of all orders.

Table A17.24: Deemed consent, internal vs. external

	Year	Proportion of orders changed		Average no. of changes		Average delay (days)	
		BT	OCPs	BT	OCPs	BT	OCPs
All	2011	75%	80%	3.1	2.9	31	29
	2012	66%	75%	3.4	3.2	30	28
	2013	68%	70%	3.1	2.8	31	28
	2014	69%	73%	3.0	3.2	33	37
Cat 1	2011	63%	67%	2.2	2.1	20	18
	2012	48%	63%	1.8	2.1	14	17
	2013	51%	56%	1.5	1.7	14	17
	2014	52%	55%	1.5	1.7	15	17
Cat 2	2011	86%	89%	3.9	3.6	37	33
	2012	86%	89%	4.9	4.2	42	35
	2013	90%	91%	4.9	4.2	48	40
	2014	88%	89%	4.6	4.5	49	50
Cat 3	2011	94%	97%	5.5	5.3	68	65
	2012	93%	96%	8.3	7.5	85	74
	2013	96%	94%	10.3	8.4	120	97
	2014	97%	95%	10.3	9.5	138	131
Cat 4	2011	67%	83%	2.1	2.3	16	23
	2012	48%	81%	1.7	3.5	15	31
	2013	76%	85%	2.6	3.1	26	35
	2014	83%	82%	2.7	2.6	30	31

Source: Ofcom analysis of Openreach section 135 response dated 18 March 2015.

Repair performance

A17.164 Table A17.25 below summarises the volume of fault reports received by Openreach for Ethernet products relative to installed volumes, as well as the proportion of these faults that were classified as “fault not found”. Together these two indicators provide a high-level overview of the demand faced by Openreach for Ethernet repairs, which appears to be relatively stable over time.

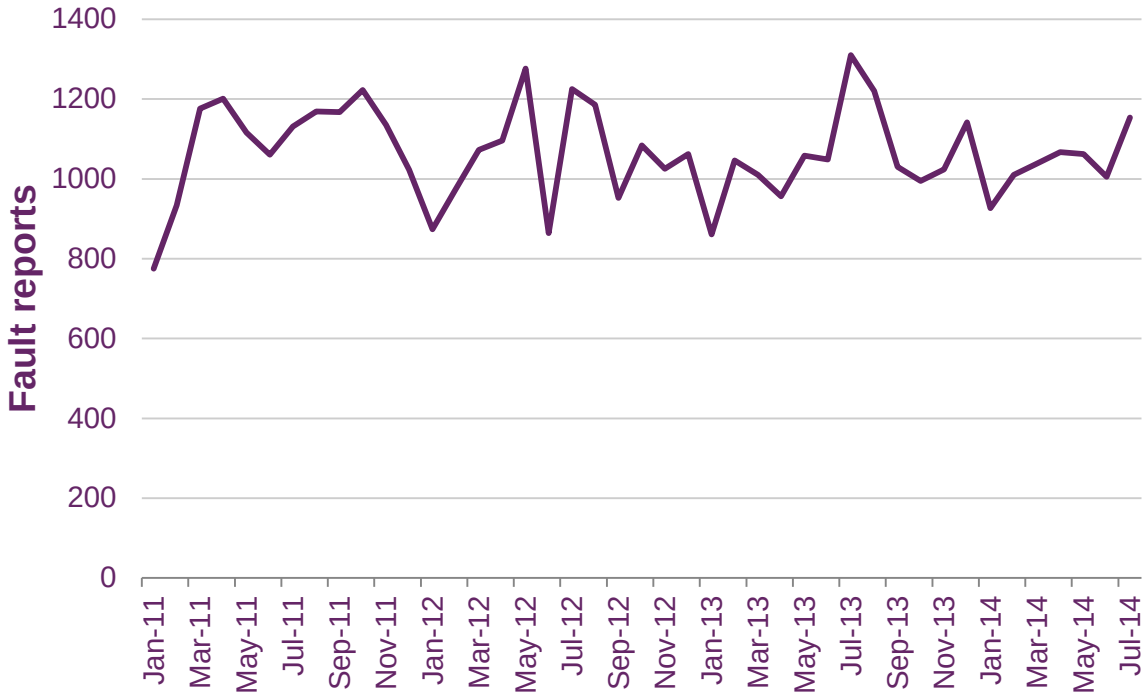
Table A17.25: Fault reports as a percentage of installed volumes[380]

Year	Fault reports as a percentage of installed volumes	Percentage of reports classified as "fault not found"
2011/12	9.2%	38%
2012/13	7.8%	38%
2013/14	7.4%	39%

Source: Ofcom analysis of Openreach section 135 response dated 10 October 2014.

A17.165 Figure A17.26 plots the volume of fault reports received by Openreach for Ethernet products on a monthly basis between January 2011 and July 2014. It can be seen that even on a monthly basis the volume of fault reports did not vary significantly over this period.

Figure A17.26: Ethernet fault report volumes



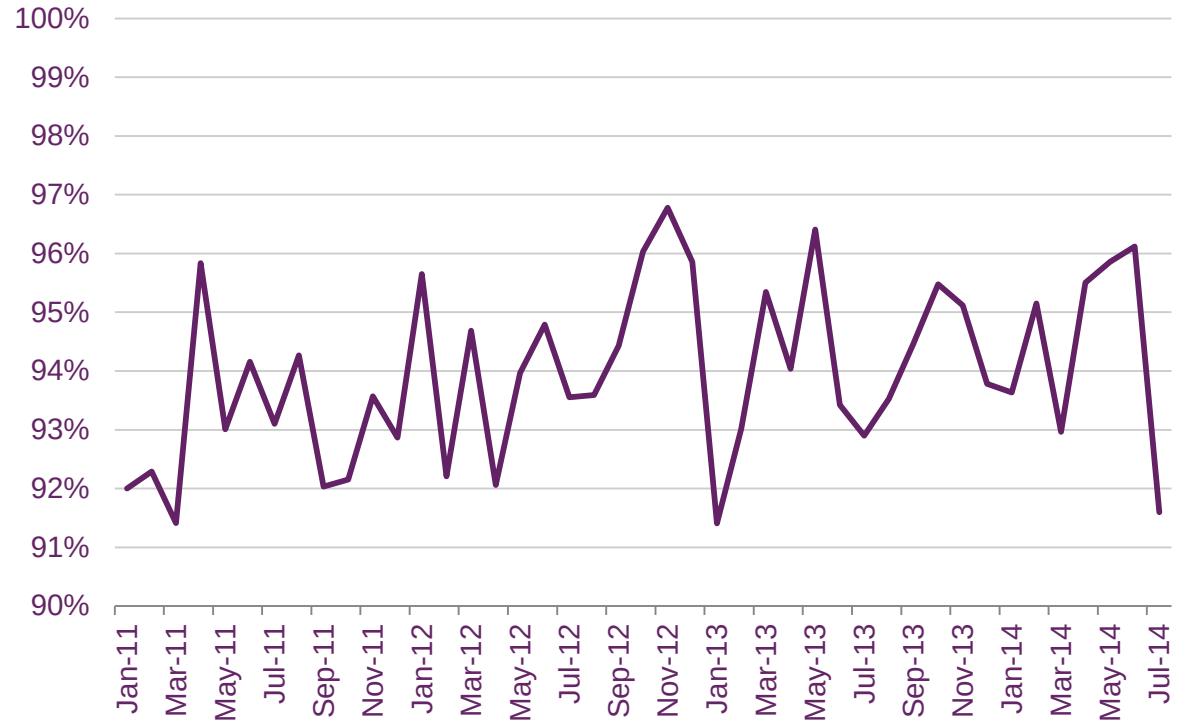
Source: Ofcom analysis of Openreach section 135 response dated 10 October 2014.

A17.166 Figure A17.27 shows the percentage of faults repaired within the timeframe specified by the SLA. The repair SLA for Openreach Ethernet products is five

[380] Ofcom analysis of Openreach data, includes the following products: EAD, EAD LA, WES, WES LA, WES Agg, EBD, BES and Cablelink.

hours, with the exception of Cablelink which was covered by a 48 hour SLA until it was changed to a five hour repair time in early 2015. Openreach performance against repair SLAs is fairly stable over the period, fluctuating about an average of 94% and never falling below 91%.

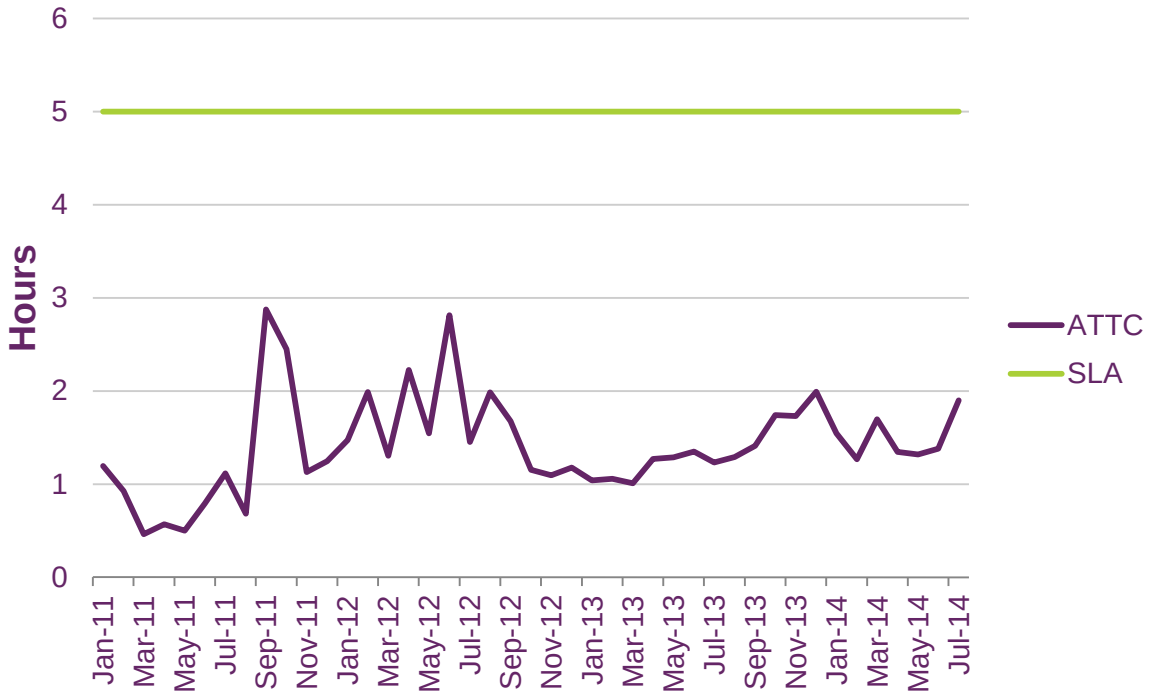
Figure A17.27: Percentage of faults repaired within time specified by SLA



Source: Ofcom analysis of Openreach section 135 response dated 10 October 2014.

A17.167 Figure A17.28 shows the average time to clear faults for EAD (all variants) between January 2011 and July 2014. The average time to clear is within the five hour SLA. We also investigated this metric for other Ethernet products, observing broadly similar results. Overall, our analysis of Openreach repair data supports the view that Ethernet repair performance has generally been maintained at a good level since 2011.

Figure A17.28: Average time to clear (ATTC), EAD all variants



Source: Ofcom analysis of Openreach section 135 response dated 10 October 2014.

Factors affecting provision performance

A17.168 We now consider potential explanations for the deterioration in Openreach's provision performance that has been observed since 2011.

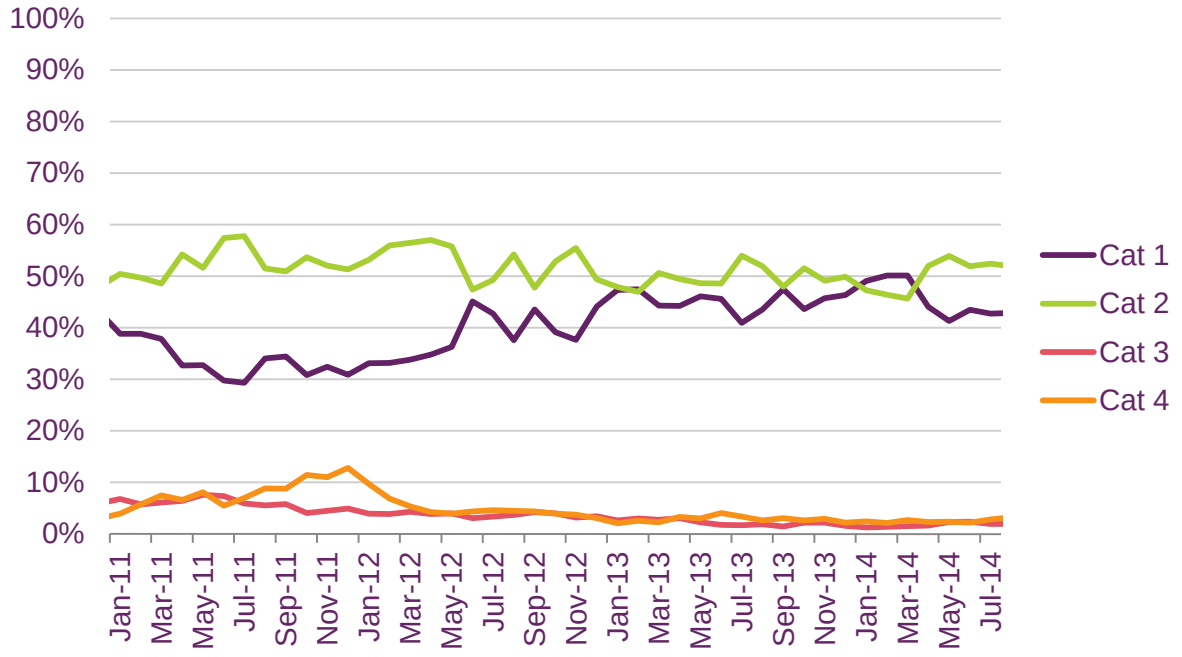
Composition of orders

A17.169 It is possible that longer lead times could be driven by a shift in the relative volumes of each order category. For instance, a shift in the composition of orders by category away from Category 1 orders towards Category 2, 3 and 4 orders that require network build would naturally lead to an increase in the MTTP calculated across all orders. Further, given that resources are to some extent fixed in the short term, it is also likely that this change would increase the MTTP for each order category.[381]

A17.170 However, Figure A17.29 shows that the composition of orders by category is relatively stable over time. Indeed, there appears to have been a slight shift towards Category 1 orders during the period over which provision performance has declined.

[381] In the long term, if the shift in the relative volumes of each order category was not transitory, we would expect Openreach resources to adjust accordingly to re-establish some target level of performance for each category.

Figure A17.29 Composition of orders by category



Source: Ofcom analysis of Openreach section 135 responses dated 15 January 2015.

Fault repair

A17.171 Another factor that may affect provision performance is the amount of resource required by Openreach to repair faults. For instance, a significant increase in faults due to an external factor (e.g. unusually high rainfall) may divert resources from provisioning to repair, which could in turn lead to longer lead times in provisioning.

A17.172 Table A17.25 shows that the fault report rate[382] for Ethernet services has been stable at approximately 8% of installed volumes between 2011/12 and 2013/14. Further, the table also shows no significant change in the proportion of faults classified by Openreach as "fault not found". This second indicator is important to consider, as a decrease in the proportion of faults classified as "fault not found" implies that a greater amount of resource is required to address a given fault report rate. However, as both indicators of repair demand are very stable over time, we conclude that Openreach's provision performance is not explained by interactions with its repair activities.

Resources and demand

A17.173 Table A17.30 shows that based on the volume of accepted orders, Openreach has faced an increase in demand for Ethernet services of approximately 40% over the period 2011 to 2014.

A17.174 Meanwhile, the amount of resources deployed by Openreach, has increased proportionately less than demand. This is reflected by the decline in the ratio of resource to demand from approximately 30 during 2011 to 25 since 2013. While the

[382] The volume of fault reports submitted, expressed as a proportion of installed volumes.

reduction in resource relative to demand could arguably be down to efficiency gains, we do not observe any significant reduction in resource per completed order over the period 2011 to 2014. Therefore we do not believe changes in Openreach provisioning efficiency account for resources not keeping pace with demand.

A17.175 There is also a sustained gap between orders being accepted and completed. The size of this gap tends to increase throughout the period. The difference could potentially be explained by a consistently large number of cancelled or suspended orders. If this were the case, the observed gap might not have significant implications for Openreach's work stack.

Table A17.30: Summary of Openreach order volumes and resources

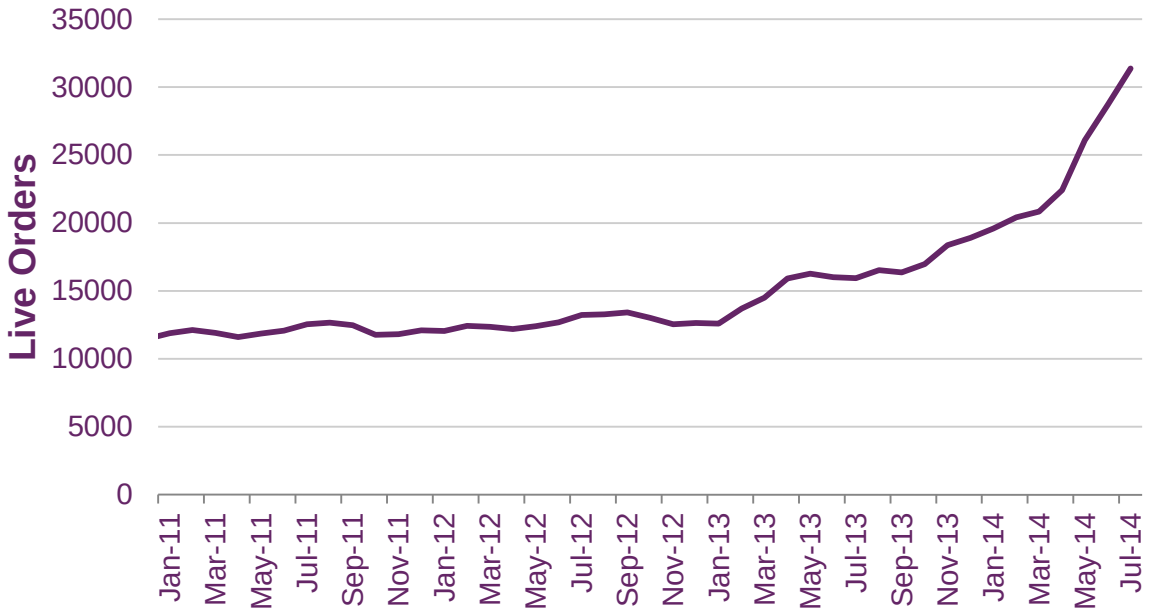
	Accepted orders	Completed orders	Total kilo-man-hours	Ratio of resource to demand [✂ ✂]	Ratio of resource to completed orders [✂ ✂]
2011 Q1	14772	11518	[✂ ✂]	27	35
2011 Q2	14222	11392	[✂ ✂]	33	41
2011 Q3	16456	12908	[✂ ✂]	30	38
2011 Q4	16770	14123	[✂ ✂]	32	38
2012 Q1	16494	13151	[✂ ✂]	30	37
2012 Q2	18579	15226	[✂ ✂]	27	33
2012 Q3	18180	14464	[✂ ✂]	28	35
2012 Q4	16478	14040	[✂ ✂]	30	36
2013 Q1	17911	13112	[✂ ✂]	25	34
2013 Q2	20313	15696	[✂ ✂]	25	32
2013 Q3	19497	15651	[✂ ✂]	29	36
2013 Q4	20667	14641	[✂ ✂]	26	37
2014 Q1	21208	15447	[✂ ✂]	25	35
2014 Q2	24784	12926	[✂ ✂]	23	43

Source: Ofcom analysis of Openreach section 135 responses dated 22 October 2014 and 29 October 2014.

A17.176 Figure A17.31 below shows that the volume of Live Orders (which excludes cancelled and suspended orders) at the end of each month increased significantly

between January 2013 and July 2014. This corresponds to the period when the gap between accepted and completed orders widens from approximately 3k to 5k per quarter. We conclude that the widening of the gap between accepted and completed orders, rather than the existence of a gap in itself, has contributed to an increase in Openreach's backlog of orders and decline in performance.

Figure A17.31: Volume of Live Orders at the end of each month



Source: Ofcom analysis of Openreach section 135 response dated 29 October 2014.

Customer expectations for Ethernet provisioning and repair quality of service

A17.177 We presented above our analysis and conclusions concerning current and past levels of quality of service for Ethernet provisioning and repair activities and their impact on downstream competition and customers. We now consider end customer expectations for Ethernet provisioning and repair quality of service.

A17.178 We engaged BDRC Continental to conduct research into the value businesses and public sector organisations place on those elements of service performance which are directly attributable to Openreach's service quality. The BDRC report is published alongside this consultation document. It is accessible at http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/QoS_report_27th_April.pdf.

A17.179 In order to put the evidence from our market research in context, it is important to be clear about the provisioning processes with which we are making comparisons. Openreach's installation order processes cover a range of products and varying degrees of complexity. The categories are detailed in Table A17.3.

A17.180 The actual process, and timing, involved with provisioning can vary significantly depending on the nature of the order. In particular the timescale depends on whether network provision already exists, in whole or in part along the route of the circuit which is reflected in the provision category assigned to the order as discussed above. In particular Category 3 orders and to a lesser extent Category 2

orders exhibit significant deteriorations in performance in respect of lead time and CDD certainty. Category 3 orders are a small proportion (circa 3% to 5%) of the overall mix of orders and we assume that customers are referring to the predominant Category 1 and 2 type orders when they responded in the following survey.

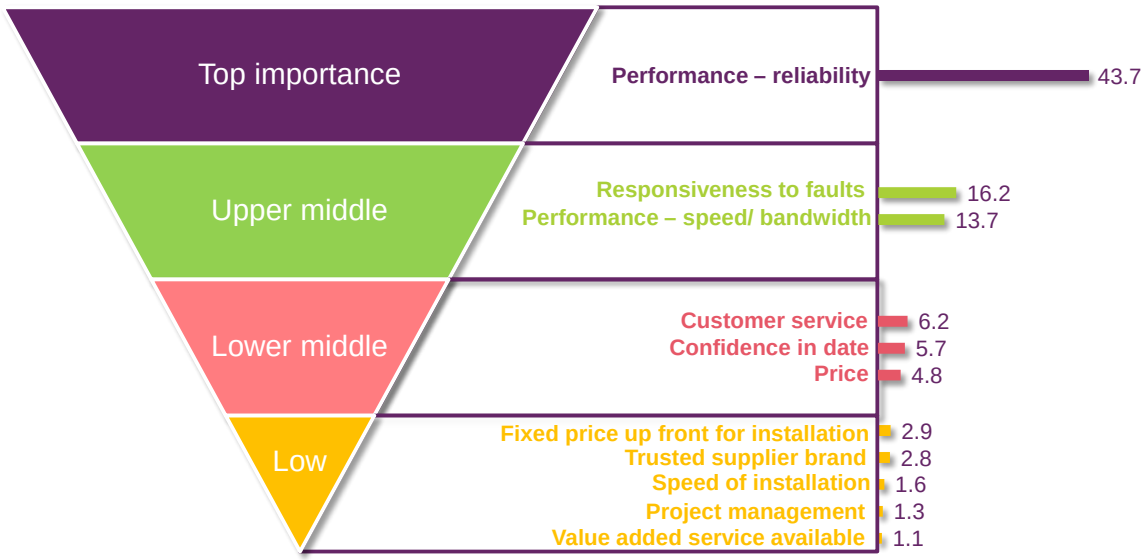
Service Priorities

A17.181 BDRC Continental used a Max Diff approach to assess which service attributes are of most importance to customers. This allows the service attributes to be scored, and their relative importance to be scored. The attributes were then allocated to groupings of top, upper middle, lower middle and low to aid interpretation.

A17.182 The attribute of most importance to businesses in their selection of a provider for Ethernet leased lines was 'Performance – reliability'. With a score of 43.7 for all businesses this is more than twice as important as the next ranked attribute – 'Responsiveness to faults' – 16.2.

A17.183 The only attribute related to delivery of installation which was not in the 'low' range was 'Confidence in installation date' (5.7). This scored more than price (4.8).

Figure A17.32: Relative importance of service features when choosing a supplier



Source: BDRC Quality of Service: Ethernet Leased Lines 2014 survey report.

'Reasonable' and 'expected' provisioning processes

A17.184 Participants were asked to choose between various provisioning scenarios in order to establish the relative importance of characteristics of the provisioning process. Four attributes came out with approximately equal importance:

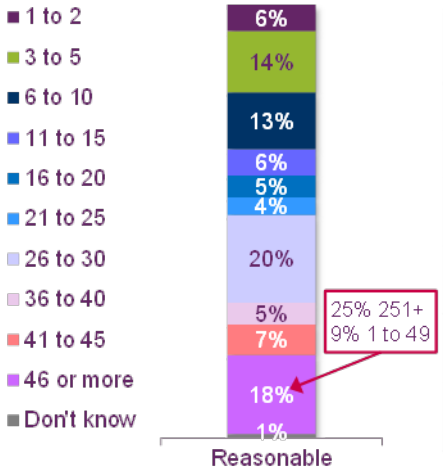
- having an installation date within 50 working days;
- having the service activated on the scheduled date;
- being provided with regular updates; and
- the supplier meeting other key milestones.

A17.185 It is worth noting that installations within 20 days and 30 days were found to be similarly 'reasonable' to those within 50 days.

A17.186 Attitude statements confirmed the findings of the conjoint analysis, as there were a majority of respondents indicating that they preferred a degree of certainty in their completion dates (76% agreed) and costs (73% agreed), even if it meant longer timings.

A17.187 The averages for reasonable installation lead times mask the range of responses that we received. What was considered to be 'reasonable' ranged from 6% for 1 to 2 days to 18% tolerating 46 days or more (mostly comprising 60 days for 8% and 90 days for 8%).

Figure A17.33: Reasonable lead times by organisation size



	Total	1-250	(251+)	251-499	500+
Mean	30	30	34	34	33
Median	26	26	28	28	29
1-5 days	20%	20%	11%	10%	11%
6-20 days	25%	24%	29%	30%	25%
21-50 days	36%	36%	36%	36%	36%
51+ days	18%	18%	24%	22%	26%

Base: All businesses (n=450), 1-250 employees (157), 251+ (293), 251-499 (118), 500+ (175)*
Source: Q1. You call a communications provider to place an order for a new Ethernet leased line for your business. How long do you think is 'reasonable' for the maximum wait until the service is activated? 'Reasonable' does not have to mean your 'ideal' situation, but one that would be generally satisfactory to you. Please give your answer in terms of working days. UNPROMPTED

Source: BDRC Quality of Service: Ethernet Leased Lines 2014 survey report.

A17.188 We note therefore that on average customers perceive installation times of circa. 30 days to be reasonable.

Relative importance of installation timing

A17.189 We also asked respondents to rate the importance of different components of service installation in order to understand how important the timing of installation is relative to other aspects of the installation.

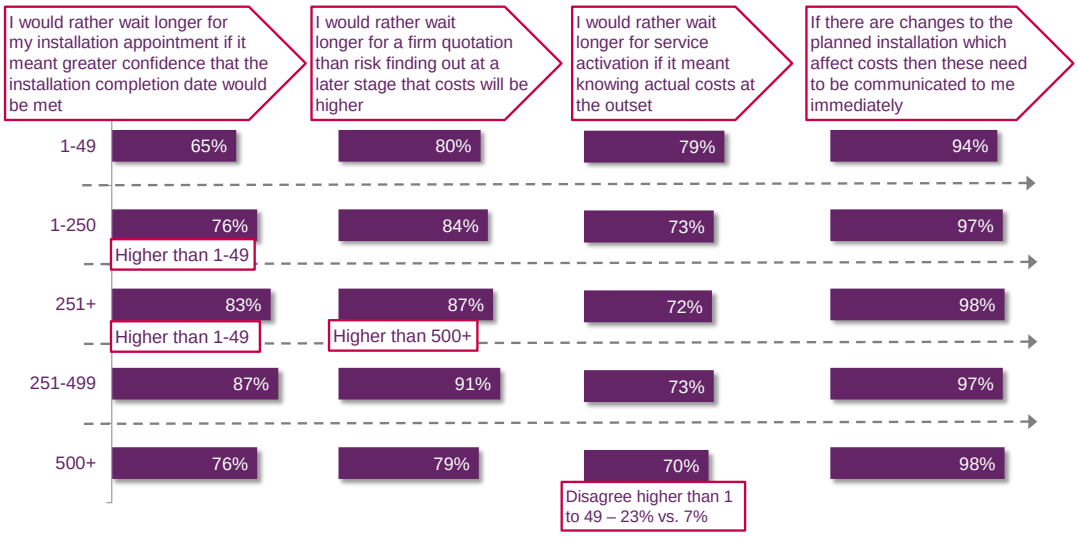
A17.190 Customers expressed a strong preference for certainty in both costs and timescales, over the actual delivery time itself.

A17.191 Three in four businesses (76%) surveyed indicated they agreed that they 'would rather wait longer for my installation appointment if it meant greater confidence that the installation completion date would be met' (36% strongly, and 40% slightly).

A17.192 (84%) agreed overall that they 'would rather wait longer for a firm quotation than risk finding out at a later stage that costs will be higher' (61% strongly, and 23% slightly). Just under three in four (73%) agreed they 'would rather wait longer for service activation if it meant knowing actual costs at the outset' (44% strongly, and 29% slightly).

A17.193 While there was a small level of variation in the strength with which customers valued certainty by organisation, there are only three data points which demonstrate a statistically significant difference. All customer groups demonstrated a strong desire for rapid communication of cost changes.

Figure A17.34: Priorities in installations – by company size



Source: BDRC Quality of Service: Ethernet Leased Lines 2014 survey report.

Value placed on installation timescales

A17.194 All respondents were asked how likely they would be to consider using four different types of 'enhanced' services that they would need to pay for. These were:

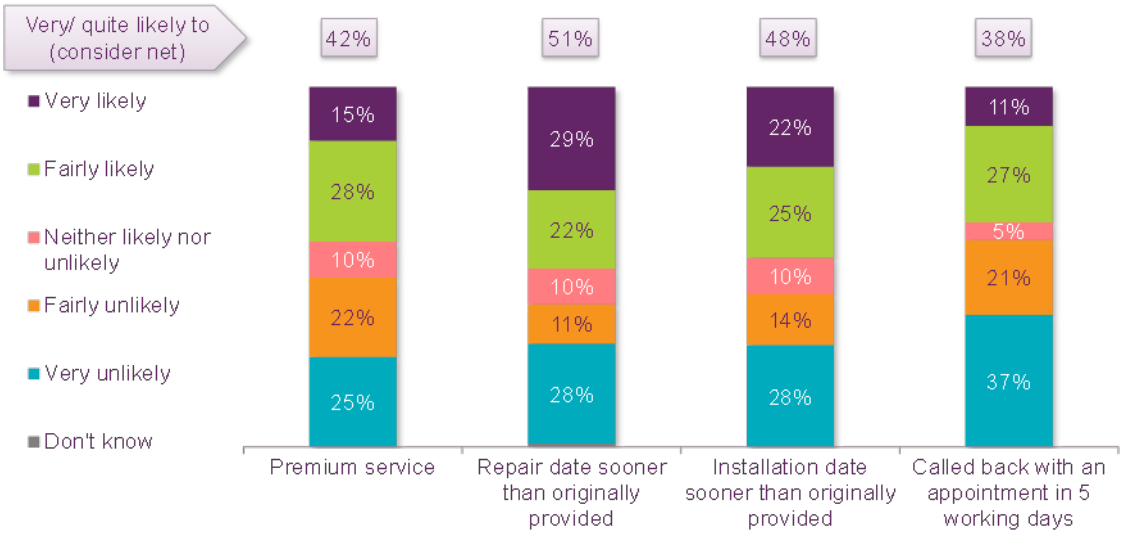
- premium service (where you paid more than for the standard service but were provided with a dedicated project manager who liaised with you on a regular basis. It could also increase the chance of an agreed installation completion date being met.);
- repair date sooner than originally provided;
- installation sooner than originally provided; and
- called back with an installation appointment within 5 working days.

A17.195 Overall approximately 2 in 5 customers said they would be very likely or fairly likely to pay for a premium service, faster installation date, and being called back with an appointment within 5 working days, and half were very likely or fairly likely to pay for faster repair.

A17.196 This indicates a reasonably consistent segment of the market that is willing to consider paying for enhanced levels of service. The price these customers are willing to pay varies from around £50 for faster installation and repair to £65 for

confirmation of an installation appointment in 5 working days, and £277 for premium services.

Figure A17.35: Likelihood of purchasing enhanced services



Source: BDRC Quality of Service: Ethernet Leased Lines 2014 survey report.

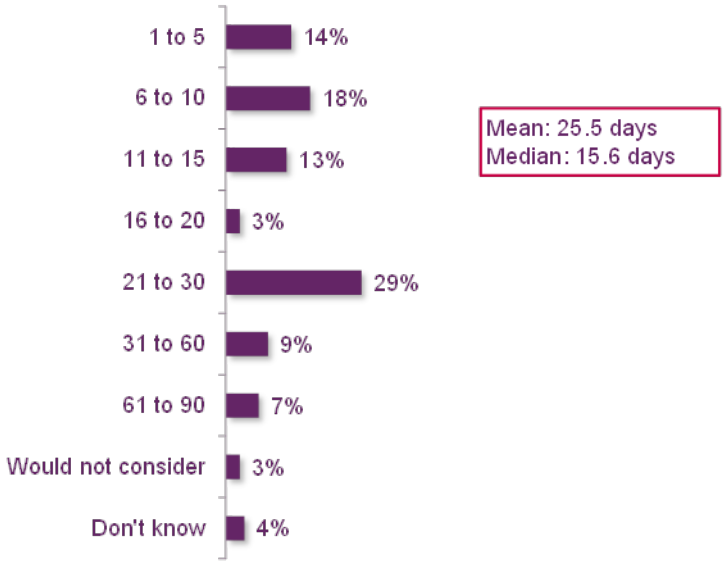
Installation timescales leading to consideration of switching

A17.197 Leased line switching rates are higher than in consumer markets, with a range of 7 – 22% switching provider in the last 12 months and 12-19% 1 to 3 years ago(based on size of business).

A17.198 Respondents were asked what action they would take where installation arrangements were not considered reasonable. The most common action indicated was to 'complain to provider/ chase up/ escalate it' (71%), followed by 'look into switching to an alternative provider of the same service (38%). A fifth (18%) would 'request compensation from provider', and this is something more likely to be considered by those in organisations with more than 250 employees (24%).

A17.199 Those respondents that indicated they would consider switching were asked how long they would wait for an installation of an Ethernet leased line before they would consider this course of action, with results shown in Figure A17.36. There was a wide range in the level of wait that could trigger consideration of a switch – from 14% for 1 to 5 days to 7% for 61 to 90 days. The average (median) was 16 days, whereas the longer waits tolerated by some respondents pushes the mean to 26 days.

Figure A17.36: Length of wait for installation before considering switching



Source: BDRC Quality of Service: Ethernet Leased Lines 2014 survey report.

Summary of results on provisioning timescales and comparison to current performance

A17.200 Taken at face value, this research indicates that satisfaction with installation service is likely to be maximised if timescales are around 30 days.

A17.201 We also consider it is important to balance these views on installation times against the value which consumers and SMEs place on these timescales. It is clear that speed of installation is not the most important issue when choosing a CP. Customers place considerably more weight on service reliability and responsiveness to faults. When considering the actual installation scenario, more importance is placed on the installation being carried out successfully on the first appointment. Therefore, it seems likely that they would be more willing to accept a longer lead time beyond 30 days, provided that that installation can be guaranteed and the number of delays is reduced.

A17.202 It is clear that the lead times being experienced in 2014 in relation to provisioning were considerably out of line with both consumer and SME expectations.

Other potentially relevant benchmarks

Comparison with other European countries

A17.203 We contacted other European national regulatory authorities ('NRAs') in order to determine what service standards apply in other markets. We received a range of responses, covering a variety of scenarios. A summary of the results for Ethernet services is given below:

Table A17.37: Ethernet lead time comparisons

Country	Lead time where fibre is present	Lead time where build is required
Austria	31 working days	
Belgium	30 working days	
Czech Republic	14 days	
France	56 days	Subject to survey
Germany	40 working days	4-6 months
Portugal	20 to 40 days	40 to 80 days
Spain	60 days to be met in 85% of cases by CP customer	

Source: Ofcom based on responses from European NRAs received circa August 2014.

A17.204 Although the results were not directly comparable, there is a distinct clustering of expected lead times for less complex / fibre present type orders in the 30-40 day range, and considerable scope for variation with complex orders.

SLAs in other industries

A17.205 In terms of other industries we have found limited comparable benchmarks. Ofgem publishes a list of standards for electricity and gas distribution networks which it monitors and enforces. These include SLAs such as a requirement for electricity supply to be restored within 18 hours if there is an interruption to supply under normal conditions, and within 48 hours when there are severe weather conditions, keeping to timed appointments, as well as a requirement to provide two days notice for a planned interruption of an electricity supply and five working days for gas supply. If the networks do not meet these conditions they are required to pay penalties to the customer.

A17.206 Ofwat also sets out guaranteed service standards for water supply companies and where the suppliers do not meet these service levels they are required to pay compensation to their customers. These standards include making and keeping appointments, notification of any interruption to supply at least 48 hours in advance, restoring service within 48 hours if it is due to a leak or burst pipe.

Annex 18

Dig Distance and Costs

Introduction

A18.1 This Annex sets out our analysis of the distances that CPs typically dig to extend their network to new customers' sites. We use this to inform our analysis of differences in competition by geographic area. We first provide an overview of digging costs (Part I). Then we present the available evidence on CPs actual dig distances (Part II) and provide our observations on stakeholder submissions and our conclusions on the buffer distances (Part III).

A18.2 The parameter we use as a proxy for required dig distances is the distance between a customer site and the nearest flexibility point on a CP's network, which we refer to as the "buffer distance".[383]

Part I: Dig costs

A18.3 Leased line services are services provided using a physical network infrastructure. When a CP wants to provide leased line services to a new customer, it needs to connect that customer's sites to its network infrastructure. Some of the customer's sites might be located outside of the CP's network coverage area and the CP might therefore need to extend the reach of its network using civil engineering works.

A18.4 Civil engineering costs associated with extending a physical infrastructure are largely sunk, common to most fixed telecommunications services and represent a significant proportion of total costs.

A18.5 When deciding whether to extend its network to reach a new customer, a CP will compare these costs to the revenues it expects to earn and to the costs of any available alternative means of supplying the customer without incurring the costs of digging. The most likely alternative is purchase of a regulated service from BT. In the 2013 BCMR, we imposed network access obligations and a charge control on BT across most of the UK (with some deregulation or lighter touch regulation in the WECLA). With this regulation in place, CPs are often faced with a decision to either 'build' their own network or 'buy' wholesale services from BT on regulated terms (or sometimes on commercial terms from other networks). In order to understand incentives to invest, it is useful therefore to compare estimated dig costs to BT wholesale service prices.

A18.6 The typical cost of digging and laying fibre varies depending on location which reflects a range of cost variables such as the material being dug, surface type (e.g. block paving has higher reinstatement costs), wayleave costs, construction permits (including lane closures, parking bay suspensions, etc.), restrictions on the time of works (higher labour rate for night work), traffic management, and contract size

[383] We note that the CP may not have to dig this far in all cases in order to connect the customer if it has existing duct which passes closer to the customer site. The CP may then be able to reduce costs by running fibre through existing duct partway, and only digging the minimum amount necessary. In other cases the CP may need to dig further than we calculate if the connection requires a route that deviates from the straight line distance between the flexibility point and the customer site.

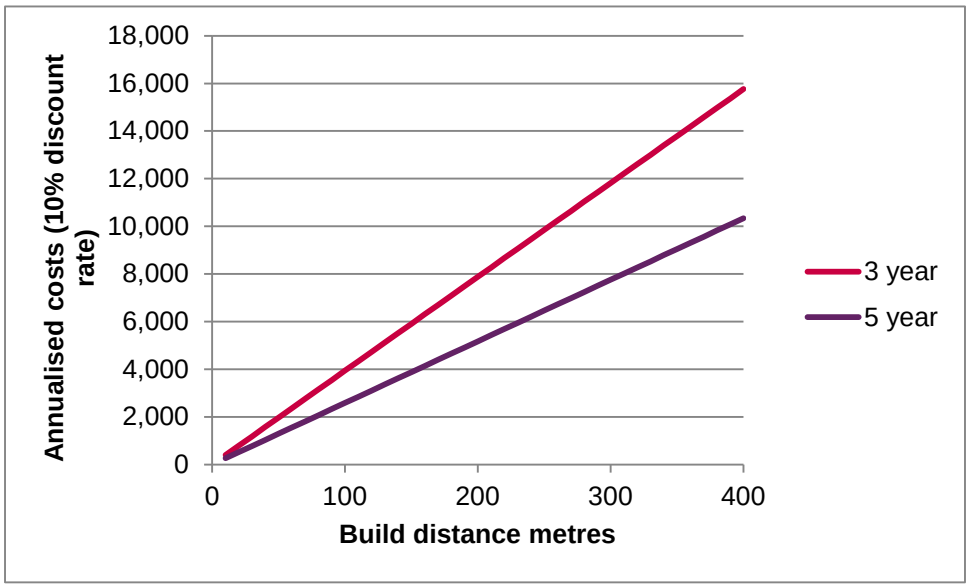
(construction firms offer volume discounts). A report to Ofcom by CSMG provided some estimates of typical dig costs in early 2010 by location geo-types. The results are reproduced in Table A18.1 below.[384]

Table A18.1: CSMG estimates of dig costs

Cost [£/m]	Lowest	Lower Quartile	Mean	Upper Quartile	Highest
Urban	75	120	134	156	181
Suburban	63	76	98	118	160
Footway	30	42	57	58	120
Soft Ground	15	27	33	40	50

A18.7 Figure A18.1 below shows how total dig costs vary with distance dug, assuming average dig costs for a suburban area (£98/m) and recovery on an annualised basis over a 3 or 5 year term.

Figure A18.1: Dig costs and build distance



Source: Ofcom 2015 based on S135 responses.

A18.8 For example, a CP seeking to recover the costs of a 200 metre build over 3 years would need to charge £8,000 per annum (£4,000 for 100 metres). This excludes any other costs such as equipment, fibre and installation, but shows that the costs of extending network are significant. Given that BT is usually already connected to a site, it will have a significant cost advantage.

[384] The Economics of shared infrastructure access, CSMG, Final report 18 February 2010: http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/csmg.pdf

We have not adjusted for inflation in view of the illustrative nature of the calculation.

A18.9 The significance of dig costs also means that possession of a large network with more existing connections than rivals can be a big advantage. Effective competition and deregulation is only likely to be sustainable in areas where CPs have largely eliminated asymmetries which favour BT therefore.

A18.10 Below, we look at evidence we have gathered from CPs on the distances they have actually dug to connect new customers, noting that this will reflect the impact of existing regulation.

Part II: Dig Distance Analysis and methodology

A18.11 Using data collected from all major CPs[385], we have looked at the extent to which OCPs extended their networks in 2013. Each CP submitted information for each new connection made in 2013 and requiring network extension. This information included the distance dug to make the connection and costs associated with necessary civil work.

A18.12 First, we look at what proportion of new leased lines sold by CPs in 2013 required extension of CPs' networks.[386] The following table (Table A18.2) shows the number of new leased lines sold in 2013 by a CP and the number (and share) of leased lines which required new physical connection.

A18.13 BT extended its network for only [✂ ✂]of the new leased lines it sold in 2013. Other CPs had to create new physical connections significantly more often – for example Virgin Media had to extend its network for [✂ ✂]of the new leased lines it sold in 2013. The disparity is likely to be due to the greater size of BT's network. However, this may not be the only reason. For example, the difference between the share of Virgin Media circuits which required network extension and that of Vodafone may be at least partly explained by differences in strategy.

A18.14 The size of the network gives BT a considerable advantage as it does not need to undertake costly network extensions for a large proportion of its new customers. As a result, BT can connect most of its new customers at lower costs than OCPs.

Table A18.2 – Leased line sales requiring network extension in 2013

	Sales requiring digging	Total Sales	Share
[✂ ✂]Operator 1	[✂ ✂]	[✂ ✂]	[✂ ✂]
[✂ ✂]Operator 2	[✂ ✂]	[✂ ✂]	[✂ ✂]
[✂ ✂]Operator 3	[✂ ✂]	[✂ ✂]	[✂ ✂]
[✂ ✂]Operator 4	[✂ ✂]	[✂ ✂]	[✂ ✂]

Source: Data obtained from CPs under S135

[385] CityFibre, Colt, EU Networks, FibreSpeed, **[✂]**, KCOM, Level3, MS3, Surf, Verizon, Virgin Media, BT, Vodafone

[386] New leased lines refer to any leased lines newly provided in 2013 by a given CP. This includes new leased lines provided to new customers as well as to existing customers. The data do not include upgrades of existing leased lines.

A18.15 Second, we look in more detail specifically at new connections for which CPs had to extend their networks. The analysis is based on data originating from responses to a formal information request issued by Ofcom at the beginning of March.[387] Data were provided on a per-circuit basis and include details on bandwidth and interface of each circuit and civil engineering costs incurred to connect the circuit to the customer's site. As set out in the information request, the costs used in the analysis include the costs of digging trenches, duct construction, cable installation and installing transmission equipment.

Results

A18.16 Firstly, we compare the latest data on dig distance statistics with equivalent figures reported in the previous BCMR. These are summarised in the following table:

Table A18.3 – BCMR 2013-2016

	BCMR 2013	BCMR 2016
Average distance dug	65 m	95 m
Median distance dug	22 m	40 m
Percentage of digs shorter than 200m	95%	93%

Source: Data obtained from CPs under S135

A18.17 Table A18.3 indicates that the mean and median distance dug by OCPs have increased since the previous BCMR. We note also that in 93% of cases, network extensions were less than 200m. In the 2013 BCMR, we said that it is appropriate for the buffer distance to be some way above the observed mean dig distance for two main reasons[388]:

- as noted above, observed build distances are likely to have been affected by the availability of regulated wholesale products from BT. It is possible that operators would be prepared to dig further than they actually dug in practice if such products were not available as an alternative to investment in their own infrastructure.

- In most cases, the actual distance which an operator needs to dig to reach a customer will be less than the maximum, simply because some businesses will inevitably be located less than the maximum distance from a flexibility point.

[387] Question C2 of the information request asked each CP to provide details on distance dug when connecting new on-net buildings during the year 2013.

[388] BCMR 2013 Statement, paragraph 5.59. See also paragraphs 5.133 – 5.141 at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/Section5.pdf

A18.18 In 7% of cases CPs dug more than 200m. However, we do not consider that the existence of some instances of longer dig distances indicates that in general OCPs are likely to be able to compete for leased line sales where they have to dig 200m or more.[389] The longest distance dug may reflect special circumstances, for example connecting particularly high-value customers or where there is a particular concentration of customers (such as to a data centre).

A18.19 Table A18.3 above shows average and median distances dug. The average value is higher than the median because the average is influenced by a small number of cases in which OCPs dug very long distances, whilst most digs are much shorter. [390] In our view the median is the better measure of the typical distance that CPs dig to connect new customers. As noted above, actual dig distances are likely to be lower than the maximum distances CPs might be prepared to dig, so the buffer distance will be somewhat above the actual distance.

A18.20 A buffer distance assumption of significantly less than 200m is therefore most consistent with the information on actual dig distances and we consider that the fact that average dig distances are substantially less than 200m supports our view that a 200m buffer distance is likely to exceed in most cases the distances at which OCPs will find it commercially viable. Accordingly we think a substantially shorter buffer distance is appropriate when we are seeking to determine geographic areas where infrastructure based competition can be expected to be effectively competitive, such as in determining the boundary of the CLA. However, it is clear that CPs are sometimes willing to dig 200m or more and we continue to use a 200m buffer distance as a basis for distinguishing those areas that have some potential to be more competitive than the UK overall.

A18.21 Some CPs, including BT, pointed out that the actual distance which operators would be willing to dig would depend on the value of the business they would gain by doing so, and this would in turn depend on the type of customer and particularly the margins that can be earned on the circuits to be supplied. Given BT's current pricing structure, services providing higher bandwidths generate higher revenues and higher margins and therefore increase CPs' ability to undercut BT's regulated prices notwithstanding the substantial costs of digging a connection.

A18.22 Table A18.4 shows average and median distances by which OCPs extended their networks when providing different leased lines services. The results give some indication that CPs tend to extend their networks for longer distances when connecting to provide higher-value services. With only 63 observations and a large difference between the average and median distance (which indicates the presence of some very long dig distances that are unlikely to be representative), we treat the very high CISBO data with caution. A clear difference is noticeable between TISBO, CISBO and, the data suggests, very high CISBO services.

[389] Figure A18.2 shows that there were a small number of digs of 1km or more.

[390] Statisticians describe distributions like this as "positively skewed". This skewness is also clear from figure A18.2, which shows that most digs are relatively short, whilst a small number are very much longer than the average.

Table A18.4 – Descriptive statistics by product segment

	Bandwidth (Mbit/s)	Number of observations	Average distance (m)	Median distance (m)
TISBO	<10	125	25	16
Low CISBO	<=10	2,178	109	41
Mid CISBO	>10 & <=100	3,264	94	45
High CISBO	>100 & <=1000	842	81	36
Very high CISBO[391]		63	339	129

Source: Data obtained from CPs under S135

A18.23 Next, we looked at the distribution of BT's and OCPs' network extensions made in 2013. Results are illustrated in Figure 1, which shows the frequency of network extensions for OCPs and BT by their distance.[392]

A18.24 First, it can be seen that the vast majority of network extensions made by BT or OCPs were shorter than 100 metres. This is true for[✂ ✂]of extensions made by OCPs and [✂ ✂]of extensions made by BT.

A18.25 Second, it is apparent that BT benefits from its large network. Figure A18.2 clearly shows that BT connects new customers using a shorter extension to its network on average. For [✂ ✂]of the new connections made by BT and which required BT to extend its network, the distance dug was shorter than 25 metres. The same is true for only [✂ ✂] of new connections made by OCPs.

A18.26 The results of this analysis suggest that BT can connect new customers at lower costs than OCPs as it incurs digging costs in a smaller proportion of cases. Additionally, when a new connection requires BT to extend its network, this extension is generally shorter than for other CPs and BT may also need less time to provide new customers with leased line services. Overall, BT benefits from this competitive advantage even in areas where competitors have their own access network infrastructure.

[391] Defined for these purposes as "any WDM connection + all connections above (and excl.) 1Gbps" (equivalent to the MISBO market defined in the 2013 BCMR).

[392] Figure 5.3 of the 2013 BCMR statement showed information on the distance which CPs had actually built in order to install leased lines for business customers over the preceding three years (the data related to single circuit network extensions). A comparison with Figure A20.2 below suggests that economic build distances have not significantly changed since the 2013 BCMR statement. The dig distance analysis conducted in the BCMR 2013 is available in the Statement, paras 5.57-5.62 and 5.98 – 5.105

Figure A18.2 – The distribution of build distance in network extensions in 2013 [✂

✂]

Source: Ofcom 2015 based on S135 responses.

Data Issues on [✂ ✂] dig distance data

A18.27 One CP [✂ ✂] told us that it does not monitor the length of individual network extensions but that it does, however, collect information on the costs of civil work needed to make new connections. Using this information and information on costs of digging one metre it calculated the distance dug in each case and submitted this data to Ofcom. The length of the vast majority of new connections made by this CP was calculated using a cost assumption of [✂ ✂] per metre of civil work.

A18.28 Comparing the average digging costs of one metre for the main OCPs covered in the dataset, we identified that average costs of this CP [✂ ✂] were significantly lower than the average costs of other OCPs. As a result, and given the way this CP [✂ ✂] calculates dig distance, the reported average distance dug by this particular CP [✂ ✂] is longer than the average for other operators.

Table A18.5 – Average dig cost and dig distance for selected CPs

	Average costs/m	Distance dug	
		Average	Median
[✂ ✂] Operator 1	[✂ ✂]	[✂ ✂]	[✂ ✂]
[✂ ✂] Operator 2	[✂ ✂]	[✂ ✂]	[✂ ✂]
[✂ ✂] Operator 3	[✂ ✂]	[✂ ✂]	[✂ ✂]

A18.29 Because of the disparity between this CP [✂ ✂]and other CPs, and because digging data from this CP formed an important part of our dataset, we cross-checked the data of this CP and performed a sensitivity test to calculate its average dig distance using alternative dig cost assumptions.

A18.30 The CP [✂ ✂]provided further explanation on how it calculate costs for one metre of digging. The CP responded: [✂

✂]. We therefore consider that the dig cost value used by the CP is correct, as it is an output of an internal database tracking the CP's network extensions, although of course it reflects the specific CP's mix of dig geotypes which may not be the same as other CPs'.

A18.31 Additionally, we performed a sensitivity analysis, in which we recalculated this CP's [✂ ✂]dig distances with the original assumption of [✂ ✂]replaced by the average cost per metre of other OCPs (£153/m). This naturally produced a lower figure for the CP's [✂ ✂]average dig distance and it also affected the average distance dug across all CPs (which include [✂ ✂]). The following table shows the results of the sensitivity analysis as well as the values based on the original data.

Table A18.6: Dig distances - sensitivity assuming all OCPs have the same average dig costs

	BCMR 2013	BCMR 2016	BCMR 2016 (adjusted)
Average distance dug	65 m	95 m	58 m
Median distance dug	22 m	40 m	14 m
Percentage of digs shorter than 200m	95 %	93 %	95 %

Source: Data obtained from CPs under S135

A18.32 The average and median distances dug by OCPs are substantially lower under our sensitivity analysis (and are now much closer to, though somewhat lower than the

dig distances relied on in the 2013 BCMR), supporting our view that in general CPs are unlikely to dig long distances in many instances.

Part III: Stakeholder views and Interpretation of results

A18.33 In this section we first consider stakeholders submissions from Towerhouse consulting and Analysys Mason to the current review.[393] Both Towerhouse and Analysys Mason express views on the appropriate buffer distance assumption. We then set out our proposed buffer assumptions in the light of these and the latest data on dig distances.

Stakeholder views

A18.34 Towerhouse Consulting argue that it is wrong to believe that, in the absence of regulated access services, CPs would be prepared to dig longer distances than actually observed and submitted that a 200 metre buffer distance is unrealistic.

A18.35 Towerhouse put forward two main reasons for this. First, Towerhouse argue that, in the vast majority of cases, CPs are not competitive unless the customer is already connected to the network,[394] as borne out by the very low proportion of new physical connections. Secondly, the build distance data shows that digs of around 200 metres are very rare. At this distance, again barring exceptions such as datacentres, a CP will certainly not be competitive with network operators already connected to the site, and is unlikely to be competitive with CPs with network much closer to the site.

A18.36 Towerhouse point out that leased line prices have fallen since the days "before regulated access services were available" when network build was at its height and argue that this will have affected investment incentives.[395] Towerhouse infer that economic build distances are now shorter than at the time of previous reviews.

A18.37 The report from Analysys Mason focuses on very-high bandwidth services. Analysys Mason argue that, for very-high bandwidth circuits (those defined in the 2013 BCMR as MISBO circuits), 200 metres is too short and longer dig distances should be considered. Analysys Mason make the general observation that dig-costs are largely bandwidth-invariant and a CP will likely be willing to dig further for a circuit that will generate more revenue or profit, such as MISBO circuits.

A18.38 Analysys Mason provided a simplified example to show how higher value customers would potentially generate net positive revenues.[396] It recognised that

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[393] The Towerhouse report was commissioned by Colt, Sky, TalkTalk and Vodafone. The Analysys Mason report was commissioned by BT.

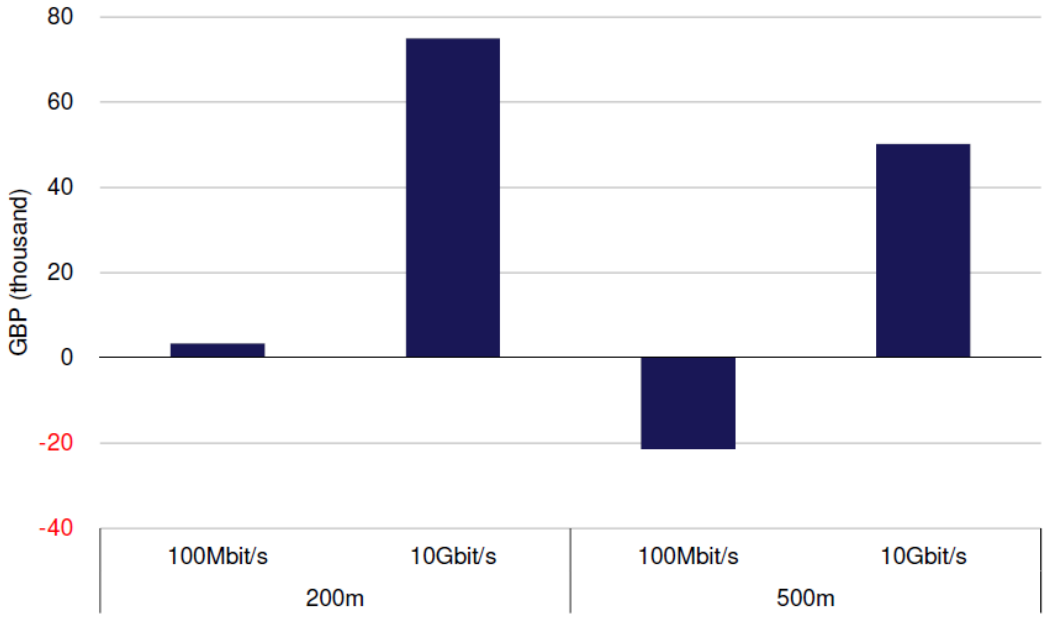
[394] Towerhouse recognised there may be some cases where longer builds are observed. For example, where a supplier is willing to cross-subsidise the connection cost to win or keep an important customer (on the expectation of other, more profitable business); or a customer is willing to pay extra to connect to a particular CP network, or perhaps to gain physical network diversity. However, it considered these were exceptions and did not reflect normal market transactions.

[395] Towerhouse LLP, paragraph 3.42. BT has been required to provide wholesale leased lines since early 2001. http://stakeholders.ofcom.org.uk/binaries/telecoms/market-reviews/Geographic_market_definition_Towerhouse.pdf

[396] The figures in the chart are based on Openreach's excess construction charges (£82.62 per metre for new ductwork – carriage (including wayleave costs)). The revenue figures are calculated over a

the example did not include all relevant costs but considered that it illustrated that operators are likely to dig further for higher-value circuits.

Figure A18.3: Analysys Mason example of net revenues after dig-costs



Source: Analysys Mason 2015

A18.39 Analysys Mason observed that, outside urban areas, dig-distances could be longer due to the lower cost per metre of digging. It also submitted that as circuits are rarely bought in isolation, a CP is likely to consider the whole contract being sold to an organisation with multiple sites rather than just the costs and revenues associated with an individual circuit.[397] Analysys Mason also referred to Ofcom evidence of dig distances which were significantly longer than 200 metres.[398]

Ofcom's response

A18.40 We note that the phase of network build to which Towerhouse refers began in the 1990s from a position in which rivals to BT initially had no existing customer base or network in place. The absence of regulated services placed OCPs at a much bigger disadvantage than they are now, or would be in a fully competitive market. We consider that willingness to invest in new customer connections has not necessarily

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five-year period, are based on Openreach's current price list and assume that a CP charges its customer a 30% premium over the base Openreach price. 10Gbit/s circuits, for which prices are not publicly available, have been assumed to generate twice the revenues of 1Gbit/s circuits.

[397] Analysys Mason provided the example of a CP is bidding for a contract with a financial institution with multiple branches. Analysys Mason suggested that such a CP may be willing to dig distances longer than 200 metres for a high bandwidth circuit to connect a head office, in order to win the overall contract. http://stakeholders.ofcom.org.uk/binaries/telecoms/market-reviews/Analysys_Mason_Report_for_BT_on_BCMR_30-1-2015.pdf

[398] Out of around 3000 network extensions, 40, or 1.3%, were further than 500 metres, 22 of which were distances greater than 1 kilometre.

fallen therefore, since in many respects the environment is now more favourable. Moreover, we are also aware that plans for investment in new local access networks exist and that construction is under way. In any case, we have up-to-date evidence on dig distances, summarised earlier in this Annex, and do not rely on historic data.

A18.41 However, we agree that a buffer distance of 200m may not accurately reflect CPs' willingness to dig for single circuits across the range of services in the CISBO market in competitive conditions. In the CLA most particularly, most businesses have several CPs' networks within much less than 200m.

A18.42 We also recognise that CPs may be willing to dig particularly long distances to connect some customers where the potential value of the connection is particularly high, as Analysys Mason suggest. But these are a very small proportion of the market and, in addition, current incentives to dig may be influenced by BT's high prices for very high CISBO services. As noted above, the small number of long digs to reach such customers results in the distribution of dig distances being highly skewed. The vast majority of digs are much shorter and, for our purposes, we consider that the buffer distance assumption should reflect the shorter distances likely to be more typical in an unregulated market.

A18.43 BT states that: [✂ ✂].[399] This suggests that BT will be no more than [✂] metres away from a site and in many cases closer, so any CP which has to dig further than is likely to find itself at a disadvantage to BT. The fact that CPs do on occasion dig further suggest that these instances reflect a combination of regulation which prevents BT exploiting cost advantages, BT service prices being above cost, and customer-specific factors.

A18.44 More generally, we agree with Towerhouse that a CP which is already connected to a site is likely to have an advantage over another CP which does not already have a connection. Asymmetries of this kind can be a barrier to entry and a source of market power, and we take them into account in our analysis of SMP. In practice, a CP's decision to dig will be influenced by a range of factors, as Towerhouse themselves recognise. These factors, including asymmetries, will be reflected in the distances actually dug, which we have taken into account in determining appropriate buffer distance assumptions for use in the network reach analysis.

A18.45 We also note that, in Central London, the number and density of customers means that entry barriers are of much reduced significance. While existing suppliers would still face some costs of expansion in connecting customer sites, the number of rival networks in these areas indicates that these expansion costs allow for effective competition.

A18.46 Finally, we note that Towerhouse suggest using a buffer distance of 75m, which is within the range of assumptions we consider reasonable for the purposes of defining the CLA boundary.[400] Hence, whilst we do not agree with all the points made by Towerhouse, we are in broad agreement about the appropriate buffer distance. We set out our reasons for choosing our range of assumptions below.

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[399] See: [✂]

[400] Towerhouse LLP paragraph 3.54

Ofcom's views on the appropriate buffer distance

A18.47 We explain in section 4 that the criteria we use to identify the boundaries of a competitive market area need to be sufficiently stringent for us to be confident that leased line users will be protected by effective competition. We have therefore considered appropriate buffer distances with this in mind. We have also taken account of the changes to product markets we are proposing in this review, which are also set out in Section 4. These can also affect the appropriate buffer distance, as we explain below.

A18.48 In previous reviews, we defined separate product markets for AISBO and high value MISBO services, and there was still significant demand for the relatively high-priced medium and high-bandwidth TISBO services. We also noted that "we can capture variations in competitive conditions between relevant markets in our analysis of service shares", and that a 200m buffer distance was therefore reasonable despite inevitable variations in actual dig distance depending on the value of the service.[401]

A18.49 In this review, we propose a single CISBO market comprising services at all bandwidths and interfaces (except low bandwidth TISBO), whilst we no longer define markets for higher bandwidth TISBO services. In addition, we put more weight on the presence of alternative infrastructure as a more direct indicator of competitive conditions.

A18.50 We have therefore considered what the buffer distance should be for consistency with the product market definition we are proposing for this review. We consider that we now need to use a shorter buffer distance so that we can identify areas which are effectively competitive across the full range of CISBO services. Only the highest value services were found to be competitive in the 2008 and 2013 BCMRs using the 200m assumption.[402]

A18.51 We propose to use a buffer distance in the range 50m - 100m to identify areas where competition in the CISBO market is effective. We consider that using a buffer distance in this range:

- Is consistent with the data on actual dig distances which CPs have provided. It is reasonable for the buffer distance to be longer than the distances actually dug in many cases;
- Is broadly consistent with what CPs have told us. For example the submission by Towerhouse Consulting suggests a buffer distance of 75m, as noted above;

A18.52 We note that a buffer distance of less than 50m would be significantly less than the actual mean distance dug, and one of less than 40m would be below the median. We consider that such short distances would be less appropriate for the purposes of the network reach test.

[401] Para 5.144, BCMR 2013 Statement.

[402] The market for medium bandwidth TISBO in the WECLA, the market for high bandwidth TISBO in the WECLA, the market for very high bandwidth TISBO in the UK outside Hull and the market for MISBO in the WECLA were found to be competitive.

A18.53 In any case, the buffer distance is only one parameter of the network reach analysis, which also takes account of the number of CPs within reach of the businesses in an area, to assess the intensity of competition. So, for example, a test based on the presence of four or five CPs within 100m allows for the possibility that not all of these might be prepared to connect a new customer 100m away in every case. An alternative way of getting to the same outcome might be to use a shorter buffer distance than 100m but combined with a requirement for a smaller number of CPs to be within that distance of business sites. The objective in each case is to identify the area in which BT is subject to effective and sustainable competitive constraints.

A18.54 Drawing a precise market boundary is never straightforward and, in principle, this could be done taking account of a range of measures of competitive intensity. In the case of the CLA, we find that, however the precise criteria are determined, the area which emerges is very similar. This gives us confidence that the proposed market boundary is robust. The test used for delineating boundaries of the CLA is described in more detail in Annex 15.

A18.55 We also consider that analysis of network reach with a 200m buffer remains useful as a means of distinguishing areas where competition is likely to be more intense than in the rest of the UK. An area in which the average business has less than two OCPs within 200m is very unlikely to be competitive.

Annex 19

TI Trunk market definition

Introduction

A19.1 Trunk segments are the links between major centres of demand such as towns and cities. These links can support sufficient volumes of aggregated traffic to allow a number of OCPs to generate the economies of scale necessary for them to build competing networks. Identifying trunk segments in the BCMR is an important step in trying to identify the boundary between the part of the market that is likely to be competitive and the part that is likely not to be.

A19.2 As set out in the EC Recommendation, these national trunk segments are presumed competitive and a market not susceptible to regulation:

> "…[a] clear distinction between the terminating and trunk segment is important as the market for wholesale trunk segments of leased lines has been removed from the list of markets susceptible to ex ante regulation in the 2007 Recommendation. Nowadays, almost all Member States have deregulated this wholesale market for trunk segments. Therefore the presumption that trunk segments are replicable on a national scale remains valid. Consequently, NRAs should not revisit their analysis of trunk segments of leased lines where these have been previously found to be effectively competitive. This assumption does not exclude, however, that individual NRAs might find that certain trunk routes fulfil the three criteria and thus warrant *ex ante* regulation."

A19.3 Below we set out our proposals not to revisit our analysis of competitive TI trunk segments, in line with the EC Recommendation.

A19.4 We propose that other non-competitive circuits are included in the terminating segments market. Consequently, we do not propose to make a distinction between 'regional' and 'local' circuits as in the 2013 BCMR Statement ('regional trunk' and 'TISBO' services). We found both of these segments as not effectively competitive and we consider that the position since the last review has not changed given network consolidation in the TI market. In this review we again find BT to have SMP in the low bandwidth TISBO market.

Background

Trunk segments

A19.5 A number of major CPs have their own competing trunk networks and rely on BT mainly for access and backhaul to end-users. Reflecting this and similar situations in other Member States, the EC Recommendation (2007) only included terminating segments of leased lines, and not trunk segments, on the list of markets susceptible to ex-ante regulation.

We used TANs to define trunk markets

A19.6 To identify the boundary between trunk and terminating segment markets we identified so-called Trunk Aggregation Nodes (TANs).

A19.7 In the 2008 BCMR, we observed that, in large urban centres (like London), BT has multiple major nodes.[403] Other scale CPs also have a core of trunk routes between major urban centres (but to a lesser extent than BT). These CPs often interconnect with BT at least at one major exchange (and sometimes more than one exchange) in each major urban centre.

A19.8 We grouped some (but not all) of the 67 Tier 1 nodes into TANs. We identified 46 TANs for the TI market in the 2008 BCMR. We based our identification of the relevant TANs on an assessment of aggregation opportunities for CPs other than BT. Our reasoning was that other CPs would be unlikely to aggregate their traffic back to points of interconnect at each and every one of the 67 Tier 1 nodes (or at an equivalent point on their own network).

A19.9 Taking as the starting point BT's Tier 1 nodes, we identified TI TANs by looking at two major pieces of information:

- the extent of interconnection by CPs; and
- the number of circuits potentially served by a particular node and its proximity to another Tier 1 node.

A19.10 For example, in the Birmingham area there were two Tier 1 nodes close to each other. Based on the volume of traffic served in the Birmingham area and the close proximity of those nodes we grouped these nodes into the "Birmingham TAN". This was based on the notion that a reasonably sized CP would choose to interconnect with at least one Tier 1 node, but not necessarily both.

A19.11 For London, we identified more than one TAN reflecting the greater volume of traffic in the capital. Hence, even if some Tier 1 nodes were relatively close to each other, it would be likely that a reasonably sized CP would interconnect in more than one location in the capital.

TI TANs had a 'catchment area'

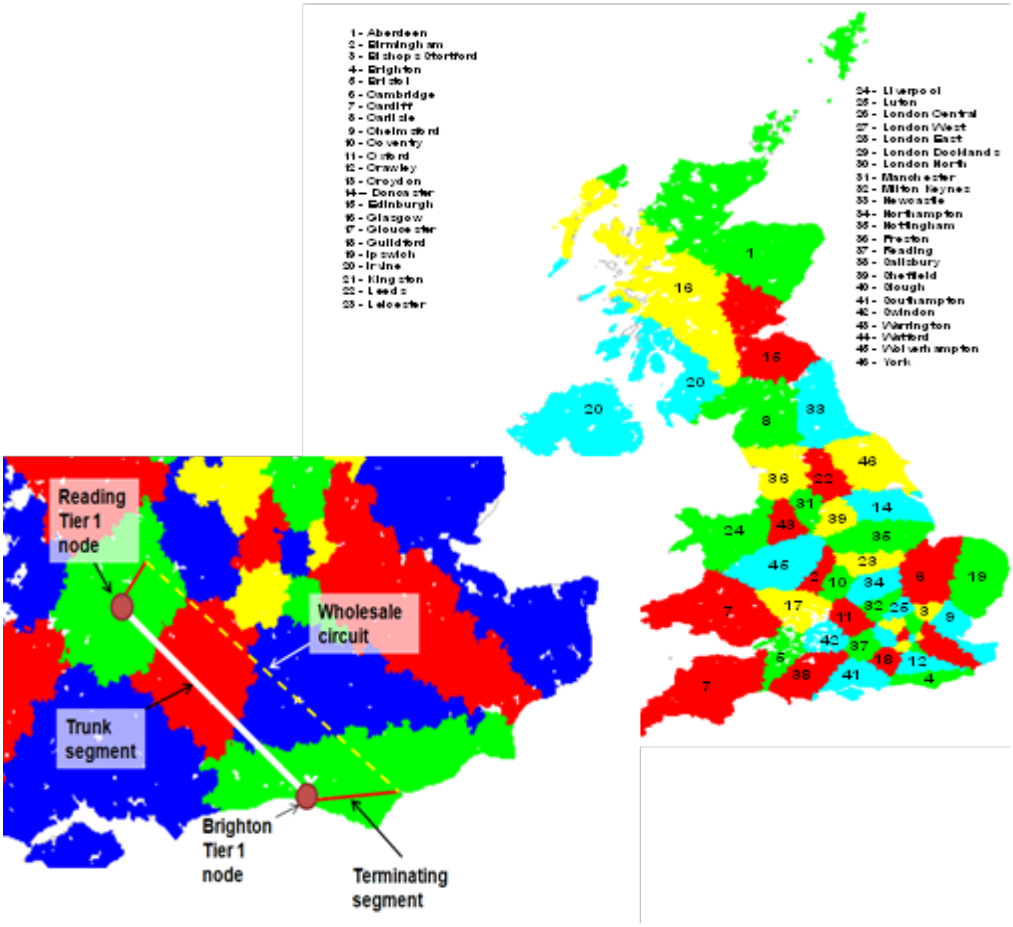
A19.12 A TAN therefore represents a group of major BT Tier 1 network nodes. For each TI TAN we relied on the "catchment area" of each TAN to assess which circuits would require a trunk segment based on whether the circuit ends are in different catchment areas.

A19.13 Catchment areas were originally identified by BT for each of its Tier 1 nodes, so the TI TAN catchment areas represents all of the smaller exchanges and customer end-points that the major Tier 1 nodes are assumed to serve (as set out in Figure A19.1 below). In the 2008 BCMR, we defined any circuit linking A and B-ends in different TAN catchment areas as containing a trunk segment routed via a Tier 1

[403] BT's SDH network is split into a hierarchy of Tier 1, Tier 2 and Tier 3 nodes. There are fewer Tier 1 nodes (67) relative to Tier 2 and Tier 3 nodes.

node. We combined the catchment areas of different Tier 1 nodes into 46 TAN catchment areas covering the whole of the UK.

Figure A19.1: Catchment areas and circuit routing assumptions



Source: Ofcom, BCMR 2013 Statement.

A19.14 In the 2008 BCMR, we defined any circuit linking A and B-ends in different TAN catchment areas as containing a trunk segment. In our market definition for TI trunk, we also assumed that a circuit between catchment areas was routed via the Tier 1 nodes, even if actual routing on BT's network was different to this.

A19.15 For example, in Figure A19.1 above, we show an OCP purchasing a wholesale circuit from BT between the Brighton catchment area (4) and the Reading catchment area (37). The wholesale circuit is represented by the yellow dotted line. As the circuit links different catchment areas, it would contain a trunk segment. For market definition purposes, the circuit is assumed to go via the Tier 1 nodes nearest to the circuit end points in each of the catchment areas.

Distinction between regional and national trunk

A19.16 We adapted the TI trunk definition further in the 2013 BCMR. In a number of cases, we found that CPs were purchasing short distance circuits that happen to cross the boundary of adjacent TAN catchment areas (e.g. in Figure A19.1 between the Brighton catchment area (4) and the Crawley catchment area (12)). As such, there

were a number of circuits purchased from a customer end to a Point of Handover at a BT exchange in an adjacent area. Under the rules governing routing, [404] such circuits were deemed to be routed via the Tier 1 nodes in the two TANs, thus notionally using a trunk segment. We were concerned that competitive conditions in the provision of these short distance circuits were more like those of a terminating segment. For these short distance circuits, BT tends to provide direct links from end-user sites to CPs' network points of connection, including short distance links that happen to cross a TAN boundary.

A19.17 To avoid grouping circuits providing this local connectivity together with circuits that were more obviously trunk (i.e. national routes such as London to Edinburgh, London to Manchester etc.) we segmented the trunk markets. We identified a market for 'regional trunk' routes between adjacent TANs and a market for 'national trunk' routes between non-adjacent TANs.

A19.18 We found BT to have SMP for the regional trunk and we deregulated the national trunk routes.

Market developments

A19.19 Before discussing each option, we consider what is happening in the TI markets, based on the latest available information and analysis. We show below that significant declines are forecast in relation to the TI trunk market. The decline in PPC circuits is also reflected in BT's sales of interconnection services for TI services known as Points of Handover (POH).

A19.20 As discussed in Section 3, significant declines in PPCs by different bandwidths are forecast and this is reflected in BT's forecasts of the different network components including trunk segments (based on km of trunk sold) in Figure A19.2 below.

[404] For charging purposes, BT uses circuit routing rules to determine the proportions of the length of a circuit that are respectively trunk and terminating segments. These are logical routing rules that might be independent of the actual 'physical' routing of the circuit, which is a function of various network management issues such as available capacity etc. The proportion of a circuit that is trunk is based on the distance between Tier 1 nodes in different areas. BT uses these proportions to calculate the charges BT makes for wholesale TI circuits (PPCs) sold to third parties and to its own retail arm.

Figure A19.2: Forecast declines by TI network components

[✂]

Source: Ofcom 2015, based on BT forecasts.

A19.21 The above figures suggest that BT's volumes of trunk reduced by nearly half over the period 2011/12 to 2013/14 with decline expected to continue.

A19.22 The declines in the TI market are also reflected in the services CPs use to interconnect their own core networks with BT, known as POH services. In its regulatory financial statements, BT states that *"PoH has been impacted by customers rationalising their networks, i.e. reducing the number of sites and consequently points of handover, and instead increasing the bandwidth to remaining sites."*[405]

A19.23 The significant decrease in POH is shown in Table A17.1 below. As suggested by BT the number of overall interconnections and sites is in decline (reflected in 3rd party POH volumes). In Span Handover (ISH) interconnect services are services where OCPs can aggregate together multiple lower bandwidth TISBO circuits over a single higher capacity interconnect link. They are a more efficient way to handover circuits where an OCP has sufficient volumes of circuits. The volumes of these services increased marginally from 497 to 526 between 2012 to 2013 and

[405] Page 106, http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/CurrentCostFinancialStatements2013.pdf

Pages 72-74, http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2014/Current_Cost_Financial_Statement_2014.pdf

remained unchanged in 2014 reflecting the OCPs' rationalisation on their networks mentioned by BT.

Table A19.1: Point of handover volumes (RFS)

	Year			Units
	2012	2013	2014	
CSH connections	83	0	0	connections
CSH rentals	376	369	363	lines
ISH connections	1	0	0	connections
ISH rentals	497	526	526	lines
3rd party POH rental 64 Kbit/s	12462	3865	3,096	local end
3rd party POH rental 2 Mbit/s non CLZ	49977	4889	4,175	local end
3rd party POH rental 2 Mbit/s CLZ + other	4909	678	611	local end
3rd party POH rental equipment	n/a	46152	33,798	local end
CSH connections	83	0	0	connections

Source: Ofcom 2015, based on BT RFS[406]

A19.24 In addition to the significant decline in existing POH lines, there were only 84 new PoH connections in 2012 and none at all in 2013 and 2014. This evidence is consistent with OCPs consolidating and reducing the number of interconnect points with BT for TI trunk services.

Responses to the April 2014 CFI

A19.25 In response to the April 2014 Call for Inputs, BT submitted two papers. One was an overall position paper on TI trunk and the second a critique by consultants SPC Network, whom BT had previously commissioned to review our analysis during the 2013 Review. BT set out some objections to our analysis for the 2013 Review, such as our service share calculations. It summarised its position with respect to TI trunk as follows:

> "We have not developed yet further proposals for TI services regarding either the market boundaries or SMP designation given the life cycle of the products. However and without prejudice to our position, we believe regulation should be reduced should Ofcom wish to continue with its current approach into the next BCMR.

[406] Ibid

> In our view, a safeguard cap with no direct regulatory restrictions on competing below this price would enable fair competition but still allow for end-users to be protected from any danger of excessive pricing. The provision of TI services is in rapid decline with substitution to other networks where there is regulation already in place where BT is deemed by Ofcom to have market power."

A19.26 BT's main concerns are about what it regards as the inappropriate application of our approach to TI trunk market definition to AI core conveyance. We discuss the definition of CI core conveyance in Annex 20.

A19.27 The SPC Networks paper sets out its responses to Ofcom's 2013 BCMR Statement, in which we explained why we had not adopted an approach to trunk market definition proposed by SPC Networks in a paper that BT submitted during the 2013 Review. We have not revisited SPC's arguments in this Annex as the decline in TI volumes means they are now less relevant, as discussed further below.[407]

We propose not adding additional TAN nodes

A19.28 We discuss our proposal to define TI trunk based on the existing 46 TANs. On this basis, any circuit between non-adjacent TAN areas would be treated as including a trunk segment.

A19.29 Our proposal to use the same TI TAN areas as in the 2013 Statement reflects the forecast ongoing decline in TI circuit volumes. Unlike AI core, CPs are not expanding the coverage of their TI trunk networks. The declines in the TI market have negatively affected the degree of interconnection by CPs with BT for TI services.

A19.30 There has been a significant reduction in the volume of the wholesale services CPs use to interconnect their own core networks with BT, known as POH services since the BCMR 2013. In addition to the significant decline in the number of existing POH lines, there were no new POH connections in 2013 or 2014.

A19.31 The reason for these declines is that, as retail volumes decline in TI markets, it may become no longer cost effective for CPs to support extensive interconnection for TI services alone. Interconnect typically involves renting space in a BT exchange and/or purchasing high capacity interconnection links from BT. Such on-going costs are only justified where there is sufficient traffic going over those links. Indeed, we note that certain operators have chosen to exit the TI market entirely and have sold their existing base of circuits to other CPs such as Vodafone.

A19.32 As noted above, BT has commented on the decline in this market, providing evidence of network rationalisation and the reduction in the number of sites and POHs.

A19.33 Clearly therefore, a change now to, say, increase the number of TANs (and hence deregulate further) would be against the direction of travel within the market. If anything, as set out above, the evidence suggests that OCPs are actively reducing

[407] "Report for BT group plc TI trunk - Market definition and assessment of market power: Response to Ofcom's BCMR Statement", SPC Network, 07 May 2014, (unpublished BT submission).

the number of interconnection points for TI services with no new PoH connections expected. But, to the extent that at least some demand remains, the key demand centres for TI services will not have changed fundamentally. Our TANs definition identifies at least one trunk node for most of the major urban centres in the UK.

A19.34 As there is no strong case for changing the number of TANs and in the interests of regulatory stability, on which we place some weight, we have decided to retain our existing TAN definition.

Regional trunk circuits as part of the terminating segments market

A19.35 In the 2013 BCMR Statement, our analysis suggested that regional trunk circuits faced similar competitive conditions to terminating segments. We observed that many circuits which included a regional trunk segment were relatively short distance circuits linking customer end-points to OCPs' interconnect points at a nearby BT exchange. In this context, the designation of circuits between adjacent TANs as including a trunk segment was often notional, and a product of where particular 'catchment area' boundaries were drawn.

A19.36 However, and in contrast to shorter distance circuits, it was clear that circuits between non-adjacent TANs in major urban centres would be more likely to be routed across OCPs' own competing trunk networks.

A19.37 In light of the fact that the competitive conditions for these shorter distance regional circuits and terminating segments are similar, we propose to include regional circuits within the terminating segments market, which is consistent with the approach of other European NRAs that have included only the most competitive routes within the core markets.

A19.38 A similar approach has been adopted by some European NRAs, for example in its last review of leased lines the Irish NRA, ComReg, explained:

> "It is clear that there are large parts of the core network where investment in alternative infrastructure has not occurred and where competitive products and services are unavailable. Where these (i.e. uncompetitive) supply conditions exist, [....] the services provided are regarded as being in the terminating segment market."[408]

A19.39 In the 2013 BCMR Statement, we observed similar competitive conditions in both regional trunk and terminating segments overall. The factors underlying SMP in the provision of terminating segments will also apply to similar 'regional trunk' circuits that happen to cross a TAN boundary. This is because the evidence shows that nationally OCPs are only able to supply a very small proportion of the local end infrastructure for TI low bandwidths on their own networks. This is the case even in geographic locations such as London where there is significant rival network. BT retains a very high share of the terminating segments markets in those locations. Given the similar competitive fundamentals, there is limited benefit (for market definition purposes) in considering them separately.

A19.40 There is however a clearer difference between 'terminating segments' and national trunk (where we previously found no SMP). On this basis, we have adopted a

[408] Page 4: http://www.comreg.ie/_fileupload/publications/comreg0874.pdf

simplified approach whereby circuits between a customer site and a CP POH that cross an adjacent TAN boundary (previously regional trunk) fall within the terminating segments market. This does not change our SMP findings. We therefore no longer propose to define a regional trunk market.

A19.41 We note that this simpler product market definition could have implications for remedy design. The network access rules for TI services are designed to ensure equivalent outcomes in terms of downstream retail competition. We therefore discuss in Section 11 the need to ensure that BT provides TI terminating segments (including those which used services previously called 'regional trunk') on a non-discriminatory basis.

Annex 20

CI core market definition analysis

Introduction

A20.1 In Section 4 we briefly summarised our approach to, and proposals for, defining the boundary between terminating segments and core conveyance networks for CI services. In this Annex we set out in detail our analysis concerning CI core market definition. Identifying core segments in the BCMR is an important step in trying to identify the boundary between the part of the market that is likely to be competitive and the part that is likely not to be.

A20.2 Our proposals are as follows:

- We propose that core conveyance between the 56 TANs as defined in the 2013 BCMR statement remains competitive.
- Our initial analysis suggests that there is scope for an additional 96 BT exchanges (listed at the end of this Annex) to be treated as CI core nodes for the purposes of defining the CI core conveyance market, by being defined either as part of an existing TAN or as a new TAN. This is based primarily on an assessment of CP presence at BT exchanges.
- As part of this consultation, however, we want to consult with stakeholders on the degree of competition at these additional BT exchanges to ensure they warrant de-regulation.
- We have identified 60 data centres (also listed at the end of this Annex) that appear to be used as core network nodes by multiple CPs. We propose to define these data centres as core nodes constituting new separate TANs within the CI market.
- Where one or more of the 96 candidate competitive exchanges are sufficiently close to another competitive node (either an existing TAN or another competitive exchange) we group them together in a (new or existing) TAN. The implication is that BT would not be required to provide core conveyance between exchanges in different TANs but would still be required to provide circuits between exchanges within the same TAN.

Background

A20.3 Most communications providers in the UK have high capacity infrastructure allowing them to provide connectivity between major urban locations and network hubs. This reflects the economies of scale (and scope) generated by the concentrations of demand at these locations. For CI markets, we refer to services over these segments as core conveyance (CI core).

A20.4 As set out in the explanatory note to the EC Recommendation, these segments are presumed to be competitive and not susceptible to ex-ante regulation:

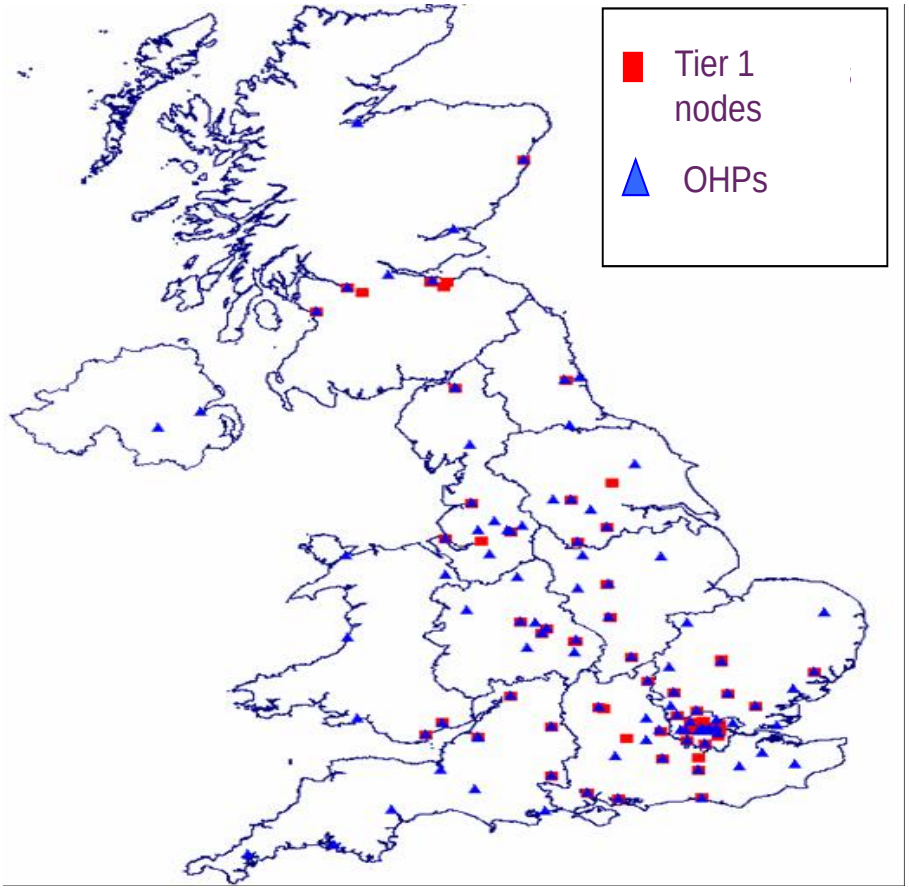
> "…[a] clear distinction between the terminating and trunk segment is important as the market for wholesale trunk segments of leased lines

has been removed from the list of markets susceptible to ex ante regulation in the 2007 Recommendation. Nowadays, almost all Member States have deregulated this wholesale market for trunk segments. Therefore the presumption that trunk segments are replicable on a national scale remains valid. Consequently, NRAs should not revisit their analysis of trunk segments of leased lines where these have been previously found to be effectively competitive. This assumption does not exclude, however, that individual NRAs might find that certain trunk routes fulfil the three criteria and thus warrant *ex ante* regulation.."[409]

A20.5 In defining the CI core market during previous reviews (at that time referred to as AI core) we adopted an approach similar, but not identical to, that used for TI Trunk markets. This reflected some differences in the development of AI and TI markets.

A20.6 We noted that, for AI markets, the Openreach 'owned' fibre access network was separated from BT's core through the identification of nodes in BT's network called Openreach Handover Points (OHPs). These OHP locations are pictured below alongside BT's main nodes for TI markets (Tier 1 nodes).

Figure A20.1: BT's main network node locations



Source: BCMR 2008

[409] Pages 49 to 50.

A20.7 There are 106 OHPs located around the UK typically in the main urban centres. Large urban centres (like London) have multiple OHPs. Circuits from these OHPs going deeper into the network (i.e. away from the core) are terminating segments (comprising access and backhaul segments). Openreach uses terminating segments to provide various wholesale leased line access and backhaul products to other CPs including BT's downstream divisions.

A20.8 Recognising that other larger CPs also have a core of trunk routes between major urban centres (but to a lesser extent than BT), and identifying and grouping some (but not all) of BT's 106 OHPs into Trunk Aggregation Nodes (TANs), enabled us to identify (for regulatory purposes) a non-CP specific competitive 'core'.

A20.9 We designated 56 UK TANs mainly centred on UK cities. Circuits sold between OHPs that belonged to different TANs were classified as part of the competitive AI core. Other AI circuits, including those between OHPs within the same TAN, were classified as terminating segments.

A20.10 The identification of the 56 TANs was a feature of the 2008 and 2013 Reviews and was based on an assessment of opportunities for CPs other than BT to aggregate together traffic from customers using AI services. The logic underlying the grouping of OHPs was that other CPs would be unlikely to aggregate their traffic back to points of interconnect at each and every one of BT's 106 OHPs (or their own equivalent network nodes). We concluded that, given the extent to which demand was concentrated at particular OHPs, BT's competitors could reasonably be expected to interconnect with BT in 56 TANs, and would then only need to rely on BT for wholesale services in order to aggregate traffic from deeper in the network back to the 56 TANs.

Review of analysis and approach

A20.11 The assessment discussed above was conducted for the 2007/8 Review and updated for the 2013 Review. Since that time the Ethernet leased lines markets have grown significantly, and so too has the market for Next Generation Access (NGA). The increase in aggregation opportunities, and specifically the economies of scale and scope that this growth has generated, may have led to increased investment by OCPs in expanding their core networks. As a result, OCPs may be able to hand over BT terminating segments to their own network (or that of a third party) at a greater number of locations than the 56 TANs identified for the purposes of the 2013 BCMR AI core market definition.

A20.12 As discussed in Section 3 we have seen the emergence of a number of data centres that CPs use as network nodes within their core networks, and from which they may provide services to end-users using regulated terminating segments. BT noted this development in its response to the 2014 BCMR Call for Inputs. It argued that a large number of data centres were competitively supplied with core network and should therefore be included within our CI core market definition.

A20.13 BT also suggested that we examine competitive conditions at its exchanges. It presented evidence that CPs purchase interconnect products at over 1000 BT exchanges. It considered that this implied that OCPs are able to interconnect terminating segments with their own core networks, or those of third parties, at a much deeper level in BT's network than at OHPs (e.g. at local exchanges).

A20.14 In the light of this, we agree that some expansion of competing CI core networks is likely to have occurred since the BCMR 2013, but we have reservations about the detail of BT's proposal that we explain below.

A20.15 As discussed above, OCPs that can generate sufficient scale can reduce their own costs by minimising use of the BT network and using their own core networks. But in order to do so they must incur significant sunk costs to roll out core networks.

A20.16 How far a CP chooses to extend its core network depends on where it is optimal for it to hand over regulated services from BT to its own core network. Such handover points may include BT exchanges or data centre locations. The choice of handover location is likely to be influenced by regulation (i.e. the ability to purchase regulated terminating segments from BT at that location).

A20.17 Therefore, in attempting to identify the extent of the competitive core, we need to identify the area where the presence of rival infrastructure acts to provide a material competitive constraint. Deregulation of core networks is consistent with, or may even facilitate, competition in retail markets if there are rival infrastructure providers using their own core networks (combined with regulated terminating segments) to compete effectively on an end-to-end basis for retail circuits. However, the presence of rival infrastructure is only a necessary, not a sufficient condition for effective competition. Competition may not be effective if some OCPs still need to rely on BT for core conveyance to and from a particular exchange, even if others, perhaps only accounting for a small proportion of core conveyance from that exchange, are able to use their own core infrastructure for this purpose.

A20.18 If we were to lift regulation solely on the basis that purchase of interconnect products indicated the presence of rival infrastructure, then this would risk raising costs for some downstream competitors if the presence of OCPs does not translate into effective competition to provide connections. Such OCPs would either have to continue purchasing from BT (which is already typically supplying the terminating segment), build their own core infrastructure or purchase from a third party in that location. The last two options may increase the costs to the OCP in question, as there are costs of establishing new contractual arrangements and interconnection with alternative operators. In turn, this could allow BT to raise charges for the newly deregulated 'core segment'. In these circumstances, competition based on limited operator presence may not be enough to constrain BT in its sales of core segments.

A20.19 Hence, we need to ensure that any CI core market definition, which necessarily entails identifying a 'competitive' part of the market, is also consistent with effective regulation of terminating segments (in those areas where market power continues to exist). We need to ensure that our assessment of the CI core market definition is based on evidence of competition that will be sustainable and that the resulting de-regulation does not make competition downstream less effective.

Framework for assessment

A20.20 Our analysis is divided into two main parts. We consider evidence of greater competition at a) BT exchanges, and b) data centres. In particular, we assess whether there is evidence to support the view that a subset of data centres and BT exchanges (in addition to those already defined as part of the AI core in previous reviews) are competitively served with core network.

A20.21 In both cases it is important to first establish the presence of alternative operators at these locations. However, in order to identify the core network, we want to ensure that this presence has a material and sustainable impact on competition for core conveyance. Therefore we also consider the evidence provided by a range of other indicators. This approach is consistent with BEREC guidelines on market definition, which state that *"a segmentation based on a single criterion (e.g. the number of operators) will usually not be appropriate."*

Exchanges

A20.22 We propose that core conveyance between TANs as listed in the 2013 BCMR statement remains competitive. The 85 OHPs that were defined as part of a TAN in the 2013 BCMR statement are therefore excluded from any analysis below. This approach is consistent with our view that (i) the competitive core is not likely to have contracted and may have expanded, (ii) maintaining regulatory stability is important, and (iii) this is consistent with the EC Recommendation that *"NRAs should not revisit their analysis of trunk segments of leased lines."*

A20.23 Therefore, we consider below whether there is sufficient evidence that additional exchanges should be included within our CI core market definition.

Step 1. Indicators of operator presence

A20.24 BT proposed that we consider OCPs' purchases of interconnect products from BT as an indicator of operator presence at one of its exchanges. BT identified the relevant interconnect products for the CI markets as Bulk Transport Link (BTL) and External Cablelink. BTL is a high capacity link that enables CPs to transport multiple backhaul circuits from an exchange to a remote point-of-presence (PoP) without needing to install their own equipment at the exchange. In contrast, the external variant of the Cablelink product allows OCPs to connect network terminating equipment within an exchange to fibre from outside of the exchange.

A20.25 We agree that examining purchases of interconnect products might be a useful indicator of the presence of competitive CI core networks, as where OCPs are interconnecting with BT may mark the point at which they aggregate circuits onto their own networks. We think that in principle an exchange should have at least two CPs purchasing interconnection products to be considered as potentially competitive. However, as we discuss below, this may not be sufficient.

Limitations of interconnection purchases as a measure of infrastructure-based competition

A20.26 One limitation of interconnection circuit purchases as a measure of the apparent 'presence' of CPs at a BT exchange is that it may overstate the number of CPs with their own core network at that exchange. For example, at a given exchange we might observe two OCPs purchasing interconnect circuits, but only one of those CPs might have core infrastructure at that location. The other OCP may simply be purchasing core conveyance from the one OCP that has its own infrastructure. In this example the presence of two CPs purchasing interconnect products does not mean that there are two infrastructure-based competitors to BT for core conveyance – in fact there is only one.

Number of competitors needed to establish candidate competitive nodes

A20.27 We do not consider that the presence of two OCPs would be sufficient, on its own, to indicate effective competition. The number of competitors was an issue

discussed in detail in the BCMR 2013 Statement (see paragraphs 6.250 to 6.262). In particular, we were critical of BT's arguments that the 'presence' of two or more OCPs was sufficient on its own to establish a competitive core. Indeed, consistent with the approach advocated in the BEREC guidelines on market definition, it is usually necessary to consider a wider set of criteria in order to identify separate markets.

A20.28 Even if an OCP has some presence at a BT exchange, it may not always be the case that an OCP can provide core circuits that compete effectively with BT's own provision of circuits.[410] Limitations on the ability of an OCP to compete might include the costs of interconnection or capacity constraints. There are also potential issues related to the fact that OCPs do not have as extensive a network as BT. For instance, OCPs may be less able to provide resilience (e.g. two diverse paths) from each exchange location where they are 'present'. Further, 'presence' at an exchange does not guarantee that an OCP is able to provide core conveyance from that location across the UK. During the 2013 BCMR, CWW (now Vodafone) told us that some of its Points of Handover (POH) for TI services did not actually sit on its core network.[411]

A20.29 For this reason, as part of the consultation process we will be asking CPs directly if they have any similar concerns in relation to candidate competitive core nodes we identify.

Step 2. Indicators of competition differences

A20.30 As previously noted, we want to ensure that OCP presence has a material and sustainable impact on competition for core conveyance before classifying an exchange as competitive. This requires looking at additional indicators of competition such as service shares.

A20.31 In practice there are difficulties that prevent us from computing service shares for core conveyance. This is because CPs do not routinely collect data that maps exactly what they sell (at the retail level) to their wholesale purchases or self-supply (see Annex 15 on data analysis for more information). Calculation of service shares is further complicated when a retail service is purchased that links multiple sites over a common core network.

A20.32 In the absence of information that would give us an accurate method of computing service shares for CI core, we have looked at other metrics that should in principle indicate competition at BT exchanges. In particular, we have considered the number of interconnecting CPs with flexibility points near an exchange. The logic is that if an OCP has network sufficiently close to an exchange at which it is present, then we can infer that the OCP is using the interconnection product to connect to its

[410] A more detailed discussion of the limitations of 'presence' as an indicator of competition in backhaul (in the context of TI services, though largely also relevant to AI services) can be found in 6.278 to 6.294 of the 2013 BCMR statement

http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/Sections6-7.pdf

[411] 6.283 of the 2013 BCMR statement

http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/Sections6-7.pdf

own network and that this presence constitutes infrastructure-based competition. This approach is somewhat similar to our analysis of network reach in the markets for terminating segments, with an exchange assuming the role of a business site in a test for high network reach.

A20.33 Nevertheless, as we discuss at the end of this Annex, these indicators do not provide a complete picture of competition for core segments. For this reason, we are planning, after this consultation, to ask each OCP for further evidence about their use of their own network, or that of rivals, at the BT exchanges we identify as candidate competitive exchanges. [412]

Data centres

Identification

A20.34 We identified an initial list of 354 UK data centres from a variety of sources. These sources include: responses to the market questionnaire and the 2014 BCMR Call for Inputs, lists of CPs' network nodes obtained under formal information request, publicly available information on the internet[413],and the websites of the data centres in question.

A20.35 For each data centre we recorded details such as its postcode, name and parent company. We also recorded its carrier neutrality status. A carrier neutral data centre allows interconnection between multiple CPs. In contrast, a non-carrier neutral data centre may permit interconnection only onto the network of the CP that owns the data centre.

Step 1. Indicators of operator presence

A20.36 In order to establish operator presence at data centres, we matched data centre postcodes to on-net circuit information, obtained from CPs under formal information request.

A20.37 Consistent with the framework we used for analysis of BT exchanges, we think that the presence of at least two alternative CPs to BT is a necessary but not sufficient condition for a data centre to be considered as competitively supplied with core network.

Step 2. Indicators of competition differences

A20.38 We want to identify data centres not just where two OCPs are present, but that also appear to be used as core nodes on multiple CPs' networks. Our initial view for data centres that are part of a competitive core network is that:

- there should be a diversity of routes to other core node locations, and;
- there should be a large amount of traffic and a depth of competition on these routes.

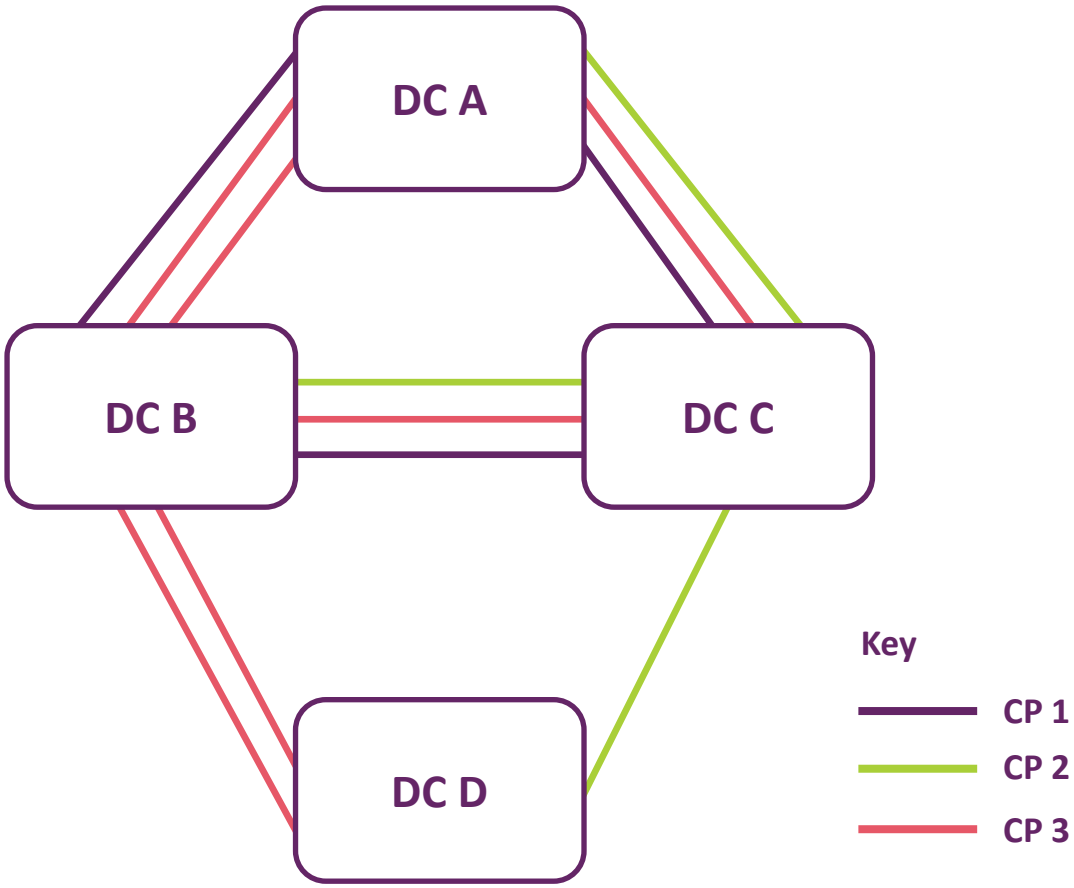
[412] As we discuss below, we will share our data with CPs that apparently have network at BT exchanges and data-centres and will gather their views on use of that network to provide core conveyance on a self-supplied basis and/or sold to third parties.

[413] See for example, www.datacentermap.com

A20.39 Our approach is to look at interconnectivity between carrier neutral data centres since, if a data centre site is being used as a node in a CP's core network, we would expect it to have connectivity to other nodes of its type. Specifically, we think that the number of other data centres to which a data centre has links, and the number of CPs competing to provide these links, are relevant criteria for identifying data centres that function as competitive core nodes.

A20.40 For the purpose of our analysis, we define a single 'route' between a pair of data centres when there is at least one circuit that connects them. In the event that a route between two data centres exists, we count the number of CPs that provide circuits on that route.

Figure A20.2: Inter data centre connectivity example



Source: Ofcom 2015

A20.41 To illustrate, consider Figure A20.2 above which shows circuits between four data centres (DCs A, B, C and D). Each line between two data centres represents a circuit, and the colour of the line gives the identity of the CP to whom the circuit belongs. DCs A and D are both defined as having two routes to other data centres (i.e. both have circuits to DCs B and C). Meanwhile, DCs B and C each have 3 routes. We would only view DCs A, B and C as competitive, as they have more than one CP on multiple routes out of each data centre. In the case of DC D, neither route is competitive as there is only one CP serving each of the routes to another DC from this location, therefore for the purpose of our analysis we would not identify it as a competitive network node.

A20.42 We have estimated service shares at a data centre based on a CP's share of all circuits that have at least one end at that data centre. This will include circuits to other data centres, to network sites, and to customer sites. We regard a low BT share of all CI circuits at a data centre as more consistent with classification of that data centre as competitive than a high BT share. However,we place most weight on indicators of competing infrastructure and do not place significant weight on service shares (and in any case we can not directly measure CI core service shares).

Results of our analysis

A20.43 We now turn to our analysis of competition at exchanges and data centres in turn, based on the frameworks set out above.

Exchanges

Step 1. Indicators of operator presence

A20.44 The table below summarises the 'presence' of OCPs at exchanges as defined by the purchase of an interconnect product from BT (this Table excludes existing TANs). We count purchases of interconnect products only by OCPs with significant on-net supply of core conveyance.[414]

Table A20.1: CP presence at BT exchanges beyond existing TANs*

Number of CPs purchasing interconnect circuits	Count of exchanges
At least 1	680
At least 2	169
At least 3	22

*Figures exclude 85 OHPs already allocated to TANs

Source: Ofcom 2015.

A20.45 Our reasoning for excluding certain OCPs with no, or limited, core network infrastructure of their own is that their presence is unlikely to provide a material and/or independent competitive constraint on BT for core conveyance.

[414] Defined as: Vodafone, Virgin Media, Colt, Gamma, Interoute, KCOM, Level 3, Neos and Zayo.

Interconnect purchases by the following companies were excluded: Carillion Construction, Convergence Group Solutions, Daisy, Edge Telecom, Eircom, Excell Business Systems, Exponential E, Hyperoptic, Intechnology, Internet Technology Products, Kenton Research, Lancaster University, Networking People Northwest, Novosco, One Connect, Orange, Service Direct Newco, Sky, TalkTalk, Thales, Updata, Venus Business Communications, Viatel and Zen.

A20.46 Excluding OCPs that almost exclusively rely on third party infrastructure reduces the count of OCPs that are apparently 'present' at BT exchanges, which is appropriate as these operators are unlikely to use their own networks to compete. For instance, TalkTalk is the single largest purchaser of interconnect products from BT, yet [✂ ✂]of its backhaul is accounted for by BT and only [✂ ✂] by third parties with [✂ ✂].

A20.47 In addition to operators such as [✂ ✂], we note that some operators listed as purchasing interconnect products are unlikely to provide a material competitive constraint. For example, even if some customers have their own infrastructure in a particular locality, e.g. [✂ ✂], the scope for them to provide national core/trunk solutions is obviously limited. Therefore we have also excluded smaller operators that would not impose a material competitive constraint.

A20.48 We propose the 'presence' of at least two OCPs as a necessary but not sufficient condition for an exchange to be considered as competitively supplied with core network. In our analysis, we consider an OCP present at an exchange if it purchases one of two BT interconnect products: external Cablelink and BTL. Cablelink accounts for the vast majority of interconnect links and so is most relevant for these purposes. [415]

Step 2. Indicators of competition differences

A20.49 As shown in Table A20.1, beyond the 85 OHPs already deemed competitive (as part of TANs), there are 169 exchanges where at least two OCPs are present. Our next step is to identify a subset of these 169 exchanges where, on the basis of our competition indicators, OCP 'presence' might be more likely to be translated into actual competition. We would like to ensure that not only are at least two CPs 'present', but – further – that at least two of these CPs have their own infrastructure at the exchange.

A20.50 To some extent this concern is addressed by excluding OCPs with no/limited infrastructure from our 'presence' indicator (i.e. based on interconnect purchases). However, even OCPs with significant core networks of their own may still rely on third party supply. For example, at some exchanges, a large national operator such as Vodafone may purchase one end of a circuit (including core network) from Virgin Media.

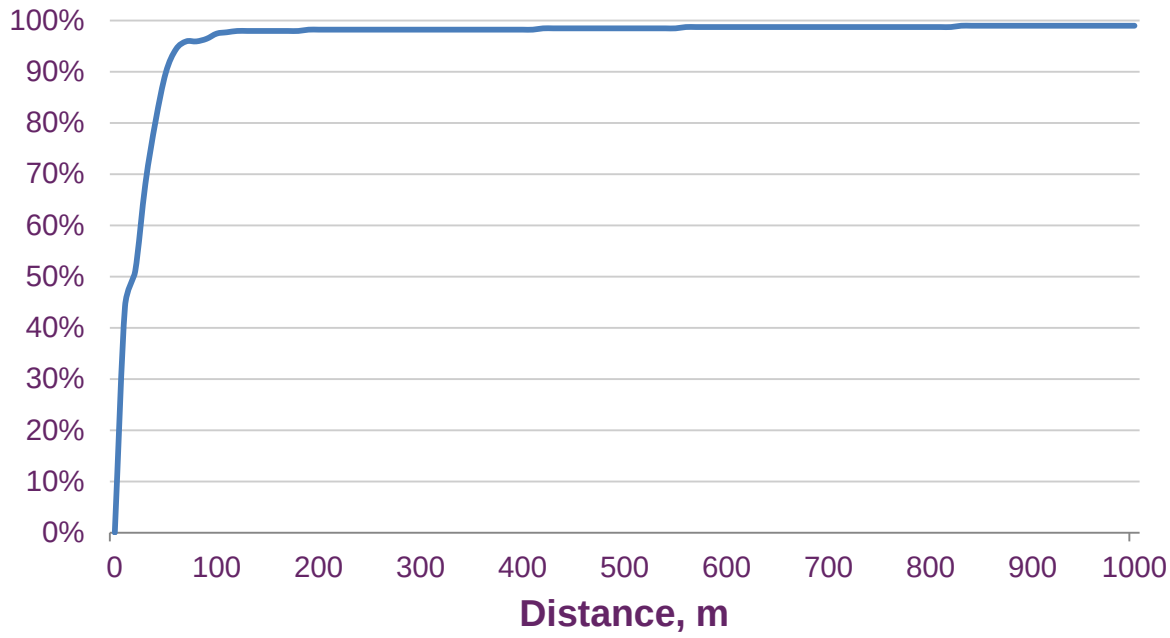
[415] Suppose that a CP purchases external Cablelink and connects to its own fibre (i.e. it is not interconnecting on to a third party's network). We expect our record of this CP's flexibility points to include a point that corresponds to the exchange in question, reflecting the fact that the CP has built network to the exchange. If the CP instead bought BTL then the same reasoning would not necessarily apply. This is because BTL connects an exchange and a CP's remote point-of-presence (PoP) using BT infrastructure. In principle the CP's remote PoP could be a significant distance from the exchange. However, BTL accounts for just 4% of interconnect purchases while external Cablelink accounts for 96%. In addition, BTL is not actually purchased by any of the CPs included in our 'presence' analysis. This means that only the external Cablelink example is relevant. It follows that a CP present at an exchange and using its own infrastructure should have a flexibility point corresponding to that exchange.

A20.51 We therefore propose an additional criterion related to the proximity of OCP infrastructure to exchanges. Specifically, we look at the number of interconnecting OCPs that have flexibility points[416] within a specified distance of an exchange site.

A20.52 We make the inference that if an OCP is present at an exchange and also has a sufficiently close flexibility point, then the CP is likely to be interconnecting onto its own network. If an OCP is present but has no network near the exchange, then we infer that it is using the network of another OCP present at the exchange.

A20.53 To proceed we need to define a distance between an exchange and flexibility point where we think that these inferences are likely to be valid. In Figure A20.3 we present analysis of the distribution of OCP network distances (based on flexibility points) to BT exchanges. We have confined this analysis to exchanges where only one CP is present, as there is a higher probability that at this exchange the CP must be interconnecting on to its own network. This allows us to get an idea of just how far flexibility points are from BT exchanges when a CP is interconnecting on to its own network.

Figure A20.3: For exchanges where only one OCP is present, cumulative distribution of nearest flexibility point of that OCP



Source: Ofcom 2015.

A20.54 Figure A20.3 shows that at approximately 98% of exchanges where only one OCP is present, the CP has a flexibility point within 200m.[417] As a result, we think that 200m is a reasonable maximum distance between an exchange and the nearest flexibility point of a CP that interconnects using its own network. If a CP is 'present'

[416] Flexibility points are points on a network from which a CP can build out to connect to a new site

[417] The logic behind focusing on exchanges where only one CP is present is that the CP in question must be interconnecting on to its own network. This suggests that the CP's nearest flexibility point is one that refers to the exchange.

at an exchange and has a flexibility point within a 200m radius we propose to count this OCP as an infrastructure-based competitor at that exchange.

A20.55 The case for a higher threshold than 200m is that it would give a lower probability of false negative results. However, Figure A20.3 suggests that a 200m radius will capture the vast majority of cases where an OCP is using its own infrastructure at an exchange. Increasing the threshold even as far as 1000m captures only an additional 1% of the relevant flexibility points. Doing so would be at the expense of increasing the likelihood of false positive results (instances where we incorrectly classify an OCP as being present at an exchange with its own infrastructure).

A20.56 Similarly it could be argued that the threshold should be lower than 200m to even further reduce the likelihood of false positive results. Figure A20.3 shows that a 100m threshold still captures 97% of relevant flexibility points, just one percentage point fewer than the 200m threshold. Table A20.2 below shows how the number of candidate competitive exchanges varies with this distance parameter. Our results are not particularly sensitive to a 25% variation in either direction of the proposed 200m threshold. Further, the reduction to a 100m threshold would potentially exclude an additional nine exchanges. Even very large increases do not have a significant impact on the number of candidate competitive exchanges. To the extent that these large increases do have an impact, the analysis above suggests that the additional exchanges captured are likely to be false positive results.

Table A20.2: Sensitivity of candidate competitive exchanges to distance parameter

2+ CPs present, 2+ of which have flexibility points within [x]m	
[x] equal to	**Count of exchanges**
100m	87
150m	92
200m	96
250m	101
500m	107
1000m	112

Source: Ofcom 2015.

A20.57 Therefore, if we apply the following cumulative criteria:

- there are at least two OCPs present (purchasing interconnection products from BT); and
- at least two of these OCPs have flexibility points within 200m of the exchange.

A20.58 Then we can identify 96 candidate competitive exchanges (listed at the end of this annex) that satisfy these criteria. We note however that this initial list of locations does not provide our final view on the potential scope of core networks as there are some limitations to the data available to us. As a result, we have inferred where interconnection products are being used to support competition in core conveyance on the basis of the proximity of OCPs' networks to BT exchanges.

A20.59 Therefore, shortly after publishing this consultation, we plan to ask each OCP to review the information we have compiled on their presence at BT exchanges. This is with a view to understanding their capability to self-supply and/or provide core connectivity to third parties.

Data centres

Step 1. Indicators of operator presence

A20.60 The table below summarises CP presence at UK data centres. This is based on matching data centre postcodes with on-net circuit information. As shown below in Table A20.3, there are at least 5 CPs present at over 25% of the 354 data centres that we identified.

Table A20.3: CP presence at UK data centres

Number of CPs	Count of data centres
At least 2	294
At least 3	219
At least 4	148
At least 5	96

Source: Ofcom 2015.

Step 2. Indicators of competition differences

A20.61 We consider that competition is more likely to be effective at a data centre which is "carrier neutral".

A20.62 A carrier neutral data centre does not favour any CP over another. By definition such data centres benefit from encouraging the presence of multiple CPs to increase customer choice. At these locations migration of end-user services from one CP to another could be achieved with a low-cost interconnect with the new CP at a data centre. This freedom of interconnection also applies between CPs. For instance, a CP can co-locate at a carrier neutral data centre and, via an interconnect, leverage the network footprint of any other CP co-located at that data centre.

A20.63 In contrast, a carrier-owned data centre may not have been designed to host or interconnect third party infrastructure. This can therefore result in restrictions on interconnect activity (e.g. permitting interconnection only on to the owner's network), or even preventing other CPs from building network to the data centre in the first place.

Table A20.4: CP presence at data centres, by type

Data centre type	Count of data centres	Average CP presence
Carrier neutral	167	5.0
Carrier owned	187	3.0

Source: Ofcom 2015.

A20.64 Our first criterion for the identification of competitive data centres is carrier neutrality. First, as shown in Table A20.4, CP presence is significantly higher at carrier neutral data centres. Second, even when multiple CPs are present at carrier owned data centres this does not necessarily mean a competitive choice of CPs for core conveyance to other locations, for the reasons outlined above. This criterion reduces the set of potentially competitive data centres from 354 to 167.

A20.65 We proceed by looking at interconnectivity between these 167 carrier neutral data centres. We propose that a data centre should have at least two competitive routes (within the set of carrier neutral data centres). We also consider that each route would be competitive if our circuit data suggests that at least two OCPs provide circuits on that route.

A20.66 60 of the data centres that we identified are carrier neutral and have at least two competitive routes (to other carrier neutral data centres). Table A20.5 below compares these data centres, across a range of relevant metrics, with the 107 data centres that are carrier neutral but do not satisfy the additional criteria.

Table A20.5: Comparison of proposed competitive and uncompetitive carrier neutral data centres

	Data centre is carrier neutral with:	
	2+ competitive routes	<2 competitive routes
No. of data centres	60	107
Average CP presence at DC	9	3
Average no. of routes	31	3
Average no. of competitive routes	16	0
Average total capacity (Gbits)	733	26

Source: Ofcom 2015.

A20.67 On average there is much greater CP presence at data centres with two or more competitive routes to them than there is at data centres with fewer than two competitive routes to them. On average there are nine CPs present at carrier neutral data centres that satisfy our criteria, compared to only three at those that do not. Data centres in the candidate competitive set are also much more highly interconnected, with many far exceeding our minimum threshold for the number of competitive routes. Further, as intended, the proposed criteria tend to capture data centres where there is a high density of traffic[418] suggestive of that data centre acting as a major network node.

A20.68 Finally, we note that BT's estimated share of CISBO circuits is below 40% at almost all of the candidate competitive data centres. Whilst we do not put much weight on service shares, this is consistent with the view that the data centres identified are competitively supplied with core network.

A20.69 In summary, we propose a set of 60 candidate competitive data centres (listed at the end of this annex) that satisfy the following criteria:

- the data centre is carrier neutral;
- it has at least two routes to other carrier neutral data centres; and
- at least two of these routes are contested by two or more OCPs.

Market definition proposals

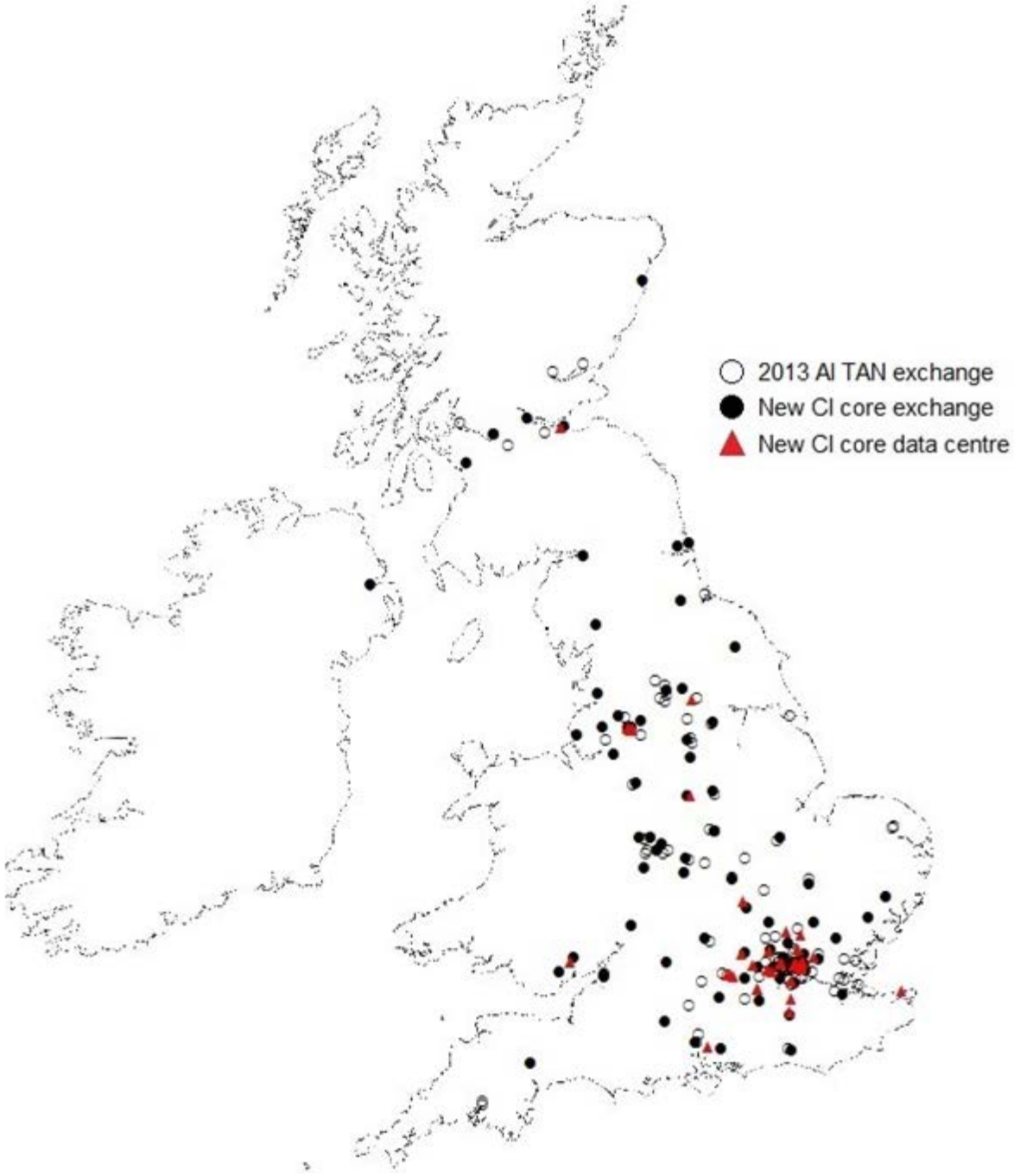
A20.70 We identified 96 candidate competitive exchanges (listed at the end of this Annex).

[418] As measured by total capacity: the sum of the bandwidth of all circuits at a data centre.

A20.71 We also identified 60 candidate competitive data centres (also listed at the end of this Annex).

A20.72 Figure A20.4 shows the locations of these candidate additional CI core nodes.

Figure A20.4: Initial candidate competitive data centres and candidate competitive core nodes



Source: Ofcom 2015

Identification of candidate competitive nodes as TANs

A20.73 If we proceed with our proposal and define the candidate competitive exchanges and data centres as core nodes we will also need to consider how we should treat circuits between nodes in close proximity to each other. In particular, in the previous BCMR reviews, we grouped core node exchanges in close proximity into TANs and defined circuits between nodes in the same TAN as terminating segments.

A20.74 We consider below whether we should retain the TAN approach or identify each candidate competitive data centre or new candidate competitive exchange as a core node in its own right. These approaches would have the following implications:

- If we identify the candidate competitive nodes as individual core nodes then circuits between the nodes and the existing TANs would be regarded as part of the competitive CI core and would therefore not be regulated.

- If we group candidate competitive nodes into existing or new TANs then we would not identify links between those nodes as part of the competitive core (to be de-regulated). Instead, circuits between nodes in the same TAN would be designated as terminating segments, and subject to any regulation that applies in the relevant CISBO market.

A20.75 We consider this issue separately for BT exchanges and data centre locations.

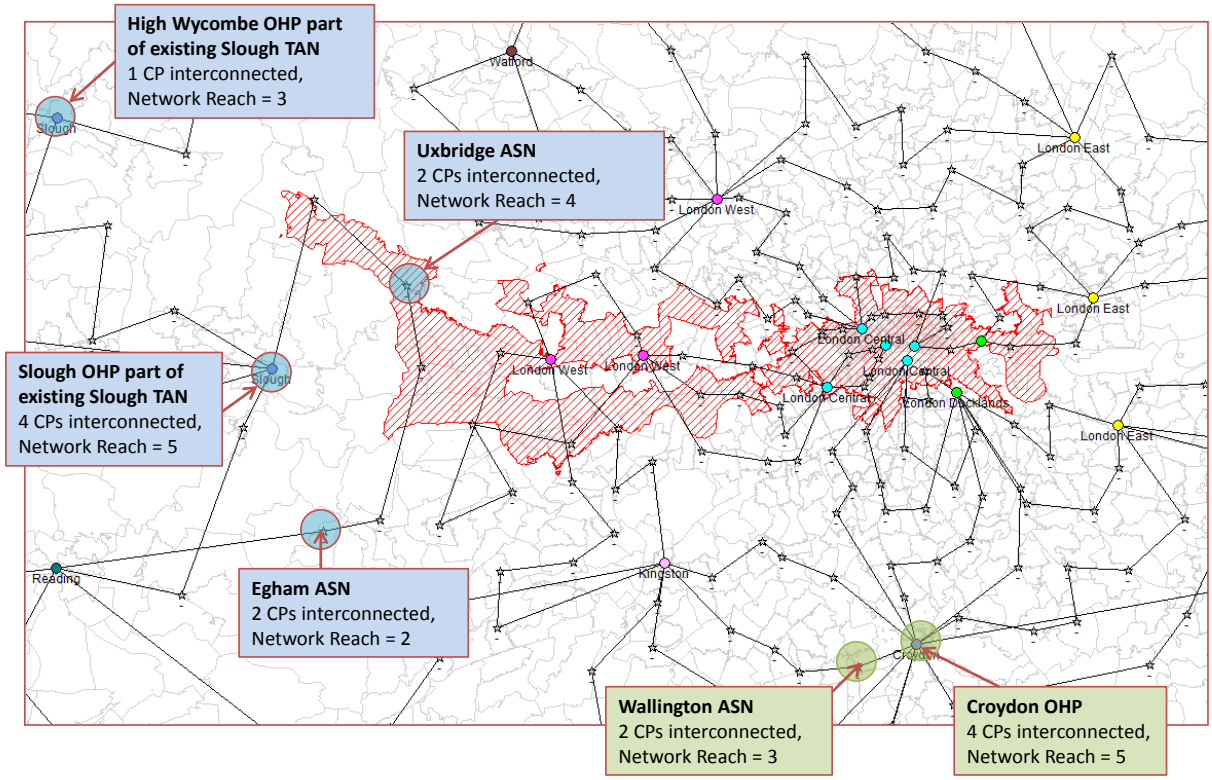
Existing TANs

A20.76 We propose to retain the existing TANs defined in the BCMR 2013 for the BT exchanges already identified as core nodes in the 2013 Review.

A20.77 Each individual TAN was formed by grouping together a number of BT OHPs which were in close proximity to each other (e.g. the Slough TAN was formed from the High Wycombe and Slough OHPs). This was because an OCP serving customers in that region might be expected to have one point of interconnection (POI) in the Slough TAN area but would not be likely to have a POI at both BT OHPs.

A20.78 Indeed, our analysis in Figure A20.5 below shows one OCP interconnected in the High Wycombe OHP and four OCPs at the Slough OHP. The OCPs located at each of BT's OHPs are different (i.e. the OCP at the High Wycombe node [✂ ✂] is not the same as the other four OCPs at the Slough OHP).

Figure A20.5: Example of TAN groupings



Source: Ofcom 2015.

A20.79 The regulation relevant to TANs means that BT is still required to provide OCPs with backhaul between OHPs in the same TAN (i.e. a circuit between the Slough and High Wycombe TAN would be part of a terminating segment). So, for example, the CP in High Wycombe [✂ ✂] would be able to purchase from BT a circuit between the Slough OHP and the High Wycombe OHP on regulated terms. However, a circuit from High Wycombe or Slough to any other TAN (e.g. Reading) would be classified as a core segment.

The TAN approach applied to candidate competitive exchanges

A20.80 Turning to the question of whether candidate competitive exchanges should be grouped together, we refer to the examples in Figure A20.5. In the case of the Slough TAN, we observe, in addition to High Wycombe and the Slough OHPs, two new BT exchanges – the Uxbridge and Egham ASNs - as candidate competitive exchanges.

A20.81 One difference to the existing TANs is that the candidate competitive exchanges are not necessarily OHPs, but may be 'lower-tier' exchanges on BT's network. This may make it less likely that an OCP will have a POI there as well as at an OHP in the vicinity.

A20.82 We note, for example, that at the Uxbridge and Egham exchanges the same two large operators [✂ ✂], are apparently 'present' - referred to herein as OCP 1 and 2. If each new candidate competitive exchange were treated as a separate TAN then this would imply that there would no longer be a requirement for Openreach to provide a circuit between Egham and Slough where an OCP may have existing interconnection. For OCP1 and OCP2, this is potentially

not a concern as they have interconnected in the Egham and Uxbridge ASNs and apparently have network in the locality.

A20.83 The concern may arise, however, for a third OCP3 that currently interconnects in Slough and can no longer obtain a circuit it previously purchased from BT on regulated terms. Arguably, OCP1 or 2 could offer a circuit between Egham and Slough. However, over relatively short distances and with limited circuit volumes from Egham to Slough, such an arrangement is unlikely to be economic. In other words, there would be inefficiencies to OCP3 associated with:

- handover of an access circuit from Openreach in Egham to OCP 1's or OCP 2's core network;
- conveyance of the circuit from Egham to Slough on that rival core network; and
- handover of the circuit to OCP 3's own core network in Slough.

A20.84 Indeed, it is revealing that, at the lower tier exchange (Egham), no OCP other than OCP1 and 2 purchases interconnect products to handover circuits to a non-BT core network. The same situation also applies in Figure A20.2 with the example of another potential TAN grouping, this time for the Wallington ASN and the existing Croydon TAN. Again, the same two large OCPs are present at the lower tier Wallington exchange but most interconnection that does occur with BT is at the Croydon exchange.

A20.85 On the basis of the above reasoning, we consider that there is a case for grouping new exchanges into existing TANs, as over short distances and with relatively low volumes of circuits there is still limited scope for smaller players to rely on rivals to BT such as OCP1 and 2. This will reflect, for example, the general tendency for there to be fewer CPs and more limited aggregation opportunities at lower levels in the network.

Data centres

A20.86 It is not clear that grouping data centres within the TANs is the right approach. The data centres we have selected are carrier-neutral sites that function as network nodes. By definition these are independent stand-alone sites. In addition, each might be viewed as a TAN in its own right since our preliminary assessment suggests that multiple CPs are interconnected at that data centre. Furthermore, each data centre is highly interconnected with others, and the identified competitive data centres have a highly meshed set of competitive routes between them. We therefore do not consider there is a strong case for data centres to be grouped with other network nodes to form TANs.

Proximity analysis for BT exchanges

A20.87 In light of the above discussion we therefore propose to group together exchanges which are in close proximity to each other to form TANs. We propose to do so using the method developed to define the original TANs for the 2008 BCMR.

A20.88 This method is designed to reflect the trade-offs facing an OCP reliant on BT for terminating segments and considering investing in network expansion and new POIs with BT. The trade-off such an OCP faces is between the costs of extending its own core network and the costs of continuing to use BT to backhaul the additional distance to its existing network. It will only be cheaper for the OCP to

build out its core network if there are sufficient volumes of traffic for the cost savings due to the economies of scale associated with aggregated core conveyance to be large enough. In general, the closer that two network nodes are to each other, the greater the volume of circuits required to make it worthwhile to interconnect at both nodes.

A20.89 In the 2008 BCMR, OHPs outside London were grouped into TANs according to "low", "medium" and "high" proximity assumptions (of 10km, 15km and 20km respectively) depending on the volume of circuits originating from or terminating at a given OHP.[419] In the London area (which included a number of nodes falling within the WECLA), we used much shorter proximity assumptions of 2.5km to 5km, reflecting far higher circuit volumes.

A20.90 We consider it appropriate to apply relatively short proximity assumptions for the London TANs. The high volume of circuits in London makes it more likely that an OCP will find it economic to interconnect at more than one node, even when they are relatively close together. Hence, the use of the shorter distance assumption for London is justified by the scale of demand within London. In London, the number of large businesses in the postcode sector of a candidate competitive exchange is on average 213 compared to 137 for those outside London (we also note that in terms of businesses per square km, there are roughly 1,851 in London compared to 125 in the rest of the UK). This high-level indicator of business concentration and hence aggregation opportunities suggests that a longer distance assumption is appropriate for exchanges outside London.

A20.91 Table A20.6 shows the results of applying the 2.5 to 5km assumptions to exchanges and TANs in the London area. For the London Central and London Docklands TANs, all exchanges are within 2.5km, and in the outer London nodes (East, West and North) they are within 5km. In general, the new competitive core exchanges are allocated to one of the existing London TANs. However, we have identified a new London North TAN based around the north west London exchanges.[420]

[419] The lowest distance was used for the exchanges with the highest volume of circuits and vice versa. For more information see Annex 7 of the 2008 BCMR Statement http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr08/summary/bcmr08.pdf

[420] The Wembley, Cricklewood, Golders Green, Willesden, Kenton Road, and South Harrow form of group of exchanges in that area. The only existing TAN in proximity to these nodes was Colindale, which was formerly part of the London West. However, we consider there is merit in two separate London TANs rather than a single node encompassing all exchanges within the London North and West TANs.

Table A20.6: Proposed London node groupings (existing exchanges and associated TANs in red)

London Central	BT Tower (West Block); Covent Garden, Faraday Te (Moorgate), South Kensington; Southbank; Whitehall; Gerrard St (Soho); Monument; Bishopsgate; Shoreditch; Kings Cross; Euston; Marylebone; Paddington; Kingsland Green; Hackney
London Docklands	Bermondsey; Stepney Green; Poplar; Mile End
London East	Hornchurch, Kidbrooke, Upton Park; Woodford; Bexley Heath; Ingrebourne; Leytonstone
London North	Colindale; Wembley; Cricklewood; Golders Green; Willesden; Kenton Road; South Harrow
London West	Ealing; Southall; Isleworth; Hammersmith; Shepherd's Bush; Fulham

Source: Ofcom 2015

A20.92 Outside of the London area, we have first identified exchanges within 10km (our shortest distance assumption) of another TAN exchange. Of those candidate competitive exchanges not within 10km of another TAN exchange, we have then identified those which are within 15km of another TAN exchange. Although a distance of 25km was used for grouping the lowest volume exchanges in the 2008 BCMR, we do not propose to use a longer proximity distance above 15km in this review.[421] Applying longer distance assumptions would tend to reduce the number of TANs, and there is an argument that a longer distance could be appropriate as the competitive candidate exchanges are typically lower-tier nodes on BT's network.[422] However, we consider that the growth in CI services since 2008 is more consistent with the use of the proximity assumptions now proposed.

A20.93 Table A20.7 below shows the results of this analysis. We have highlighted in red any existing core exchanges already associated with an existing TAN. In the left-

[421] We have grouped the Ware exchange with Bishops Stortford as they are within 15.2km of each other, only marginally outside the 15km range.

[422] In the 2008 BCMR, we used a proximity assumption of 15km for exchanges serving in excess of ≈300 Ethernet circuits (see Figure A7.2 of 2008 BCMR Statement). We identify three TANs (Barnsley, Hamilton and Livingstone) that are within 15-20km of another TAN. Furthermore, we identify five TANs (Andover, Bedford, Kettering, Middlesbrough and Newbury) that are within 20-25km of another TAN. The remaining exchanges are further than 25km from another TAN.

hand column, we list all the proposed new and existing TANs outside London. The second column from the left then shows the exchanges (core nodes) which form each TAN. The third and fourth columns then show whether the exchanges in the TAN satisfy the 10km or the 15km proximity test. The right most column shows, where relevant, the distance to the nearest existing TAN exchange. The greyed out rows show existing TANs that are not sufficiently close to any candidate competitive exchanges for any new exchanges to be allocated to them. These existing TANs (marked in grey) remain unchanged relative to the 2013 BCMR Statement as none of the candidate competitive exchanges are allocated to those particular TANs.

Table A20.7: Proximity of exchanges outside London TANs (red shows existing exchanges allocated to TANs)

TAN name	BT exchanges associated with TAN	Groupings based on 10km assumption	Grouping based on 15km assumption	Notes
Aberdeen	Aberdeen Central	Existing TAN		
Andover	Andover	✓	✓	Newbury - 24km
Barnsley	Barnsley	✓	✓	Attercliffe - 18km, Sheffield >20km
Basingstoke	Basingstoke/Bounty	Existing TAN		
Bedford	Bedford	✓	✓	Milton Keynes - 23km
Belfast	Belfast/City; Belfast/Seymour	Existing TAN		
Birmingham	Birmingham Central; Birmingham Midland; Birmingham Perryfields (Bromsgrove); Erdington; Chelmsley Wood; Acocks Green; Blackheath; Halesowen	✓(except Halesowen)	✓	Halesowen -> 10.2km
Bishops Stortford	Bishops Stortford, Ware	×	✓	Ware -> Bishops Stortford - 15.2km
Brighton	Brighton Hove; Portslade	Existing TAN		
Bristol	Bedminster; Bristol Redcliffe; Bristol North	✓	✓	
Cambridge	Cambridge Trunks; Cambridge Science Park	✓	✓	
Cardiff/Newport	Cardiff; Newport (Gwent)	Existing TAN		
Carlisle	Carlisle	Existing TAN		
Chelmsford	Chelmsford Town	Existing TAN		
Coventry	Coventry Greyfriar; Leamington Spa; Binley	✓	✓	
Crawley	Crawley	Existing TAN		
Croydon	Croydon; Beckenham; Beulah Hill; Bromley; Mitcham; Wallington	✓	✓	
Darlington	Darlington	Existing TAN		
Derby	Derby	Existing TAN		
Doncaster	Doncaster; Balby	✓	✓	
Dundee	Dundee Main	✓	✓	29km to Perth
Edinburgh	Edinburgh Donaldson	Existing TAN		
Exeter	Exeter Castle	Existing TAN		
Falkirk	Falkirk	Existing TAN		
Gillingham	Gillingham; Strood; Sittingbourne	✓(except Sittingbourne)	✓	Sittingbourne -> Gillingham - 14km to Gillingham
Glasgow/Clyde Valley	Glasgow Central; Glasgow Douglas	Existing TAN		
Gloucester	Gloucester	Existing TAN		
Greenock	Greenock	✓	✓	32km to Glasgow Central
Grimsby	Grimsby	✓	✓	70km to Doncaster
Guildford	Guildford/Martyr, Aldershot	Existing TAN		
Hamilton	Hamilton	✓	✓	17km to Glasgow
Ipswich	Colchester Town; Ipswich Town;	Existing TAN		
Irvine	Irvine	Existing TAN		
Kendal	Kendal	Existing TAN		
Kettering	Kettering	✓	✓	20km to Kingsthorpe & Northampton
Kingston	Kingston	Existing TAN		
Leeds	Bradford (2); Leeds (3); Keighley; Shipley; Low Moor; Halifax; Brighouse; Castleford	✓ (except Castleford)	✓	
Leicester	Leicester Montfort; Leicester Central; Glenfield	✓✓	✓✓	
Liverpool	Liverpool Central	Existing TAN		
Livingston	Livingston Station	✓	✓	19km to Edinburgh
Luton	Luton Ate/Tower Block	Existing TAN		
Maidstone	Maidstone; West Malling	✓	✓	
Manchester	Bolton; Dial House (Manchester); Oldham; Pendleton; Trafford; Central; Woodley; Radcliffe	✓	✓	
Middlesbrough	Middlesbrough	✓	✓	22km to Darlington
Milton Keynes	Milton Keynes	Existing TAN		
Newbury	Newbury	✓	✓	21km to Tilehurst, 22km to Basingstoke
Newcastle	Newcastle Central; South Shields	Existing TAN		
Northampton	Northampton; Kingsthorpe	✓	✓	
Norwich	Norwich City; Norwich West	✓	✓	62km to Ipswich
Nottingham	Nottingham Longbow; Trentside	✓	✓	
Oxford	Oxford City; Cowley	✓	✓	
Perth	Perth	✓	✓	29km to Dundee
Peterborough	Peterborough Wentw; Ortons	✓	✓	
Plymouth	Plymouth; Crownhill	✓	✓	56km to Exeter
Portsmouth/Southampton	Cosham; Southampton; Eastleigh; Woolston	✓	✓	
Potters Bar	Potters Bar, Enfield, Palmers Green	✓	✓	
Preston	Preston (Lancs)	Existing TAN		
Reading	Bracknell; Reading; Tilehurst	✓	✓	
Rugby	Rugby	✓	✓	79km to Coventry
Salisbury	Salisbury	Existing TAN		
Sheffield	Chesterfield; Sheffield Cutler; Attercliffe; Intake	✓	✓	
Slough	High Wycombe; Slough; Egham; Uxbridge	✓	✓	
Southend	Southend; South Benfleet	✓	✓	
Stoke	Stoke Trinity/Pott; Newcastle Under Lyme	✓	✓	
Swindon	Swindon	Existing TAN		
Warrington	Ashton In Makerfield; Northwich; Warrington	✓	✓	
Watford	Watford, Hemel Hempstead, St Albans	×	✓	St Albans -> Watford 11.7km; Hemel Hempstead -> Watford 11.2km
Wolverhampton	Walsall Central; Wolverhampton Central; Bilston	✓	✓	
York	Malton	Existing TAN		

Source: Ofcom 2015

A20.94 In a number of cases, the candidate exchanges are within 15km and, in many cases, 10km of another node that we have allocated to an existing TAN. On the other hand, some candidate new competitive exchanges are significantly further from another TAN exchange. In these cases, we have identified a new TAN location for that node or set of nodes. For example, there are two candidate competitive exchanges within the Plymouth area (Plymouth and Crownhill). These exchanges are not in close proximity to another TAN in that locality (the nearest exchange in Exeter is 56km). We therefore identify a Plymouth TAN which consists of the two candidate competitive exchanges.

A20.95 The final proposed groupings for all TANs including both those inside and those outside of London are set out in Table A20.8 below. We identify 74 separate TANs (this includes new and existing TANs) as compared to 56 TANs identified in the 2013 BCMR statement.

Table A20.8: Candidate competitive exchanges

Acocks Green (CMACO)	Isleworth (LWISL)	Ware (EAWAR)
Aldershot (THAD)	Keighley (MYKEI)	Warrington (LVWAR)
Andover (STANDVR)	Kenton Road (LWKROA)	Wembley (LWWEM)
Attercliffe (SLAC)	Kettering (EMKTTER)	West Malling (NDWMA)
Balby (SLBAL)	Kings Cross (CLKXX)	Whitehall (WRWHI)
Barnsley (SLBY)	Kingsland Green (CLKLG)	Willesden (LWWIL)
Beckenham (LSBEC)	Kingsthorpe (EMKINGS)	Woodley (MRWOO)
Bedford (SMBF)	Leicester (EMCENTL)	Woolston (STWLSTN)
Beulah Hill (LSBEU)	Leytonstone (LNLEY)	
Bexley Heath (LSBEX)	Livingston Station (ESLVS)	
Bilston (CMBIL)	Low Moor (MYLOW)	
Binley (CMBIN)	Marylebone (WEWMAR)	
Bishopsgate (CLBIS)	Middlesbrough (NEMI)	
Blackheath (CMBLAC)	Mile End (LNMED)	
Brighouse (MYBRG)	Mitcham (LSMIT)	
Bristol North (SSNOR)	Monument (CLMON)	
Bromley (LSBRO)	Newbury (THNU)	
Cambridge Science Park (EASCI)	Newcastle Under Lyme (WMNEW)	
Castleford (MYCAS)	Norwich City (EANCC)	
Central (MRCEN)	Norwich West (EANCW)	
Chelmsley Wood (CMCHEL)	Ortons (EMORTON)	

Cowley (SMCO)	Paddington (WEWPAD)
Cricklewood (LWCRI)	Palmers Green (LNPGN)
Crownhill (WWCRWN)	Perth (ESPER)
Dundee Main (ESMAI)	Plymouth (WWPYTH)
Eastleigh (STEASTL)	Poplar (LNPOP)
Egham (LWEGH)	Portslade (SDPRTSL)
Enfield (LNENF)	Radcliffe (MRRAD)
Euston (CLEUS)	Reading (THRG)
Fulham (WRFULM)	Rugby (CMRUGB)
Gerrard St (Soho) (WEWSOH)	Shepherds Bush (LWSHE)
Gillingham (NDGIL)	Shipley (MYSHI)
Glenfield (EMGLNFI)	Shoreditch (CLSHO)
Golders Green (LWGOL)	Sittingbourne (NDSIT)
Greenock (WSGRE)	South Benfleet (EASBF)
Grimsby (SLGY)	South Harrow (LWSHAR)
Hackney (LNHAC)	Southend (EASND)
Halesowen (CMHALE)	St Albans (LNSTB)
Halifax (MYHAL)	Strood (NDSTR)
Hamilton (WSHAM)	Tilehurst (THTT)
Hammersmith (LWHAM)	Trafford (MRTRA)
Hemel Hempstead (SMHH)	Trentside (EMTRENT)

Ingrebourne (LNING)	Uxbridge (LWUXB)
Intake (SLIN)	Wallington (LSWAL)

Table A20.9: Proposed TAN groupings based on candidate competitive exchanges and existing TANs

TAN name	BT exchanges associated with TAN (red shows existing exchanges allocated to TANs)
Aberdeen	Aberdeen Central
Andover	Andover
Barnsley	Barnsley
Basingstoke	Basingstoke/Bounty
Bedford	Bedford
Belfast	Belfast/City; Belfast/Seymour
Birmingham	Birmingham Central; Birmingham Midland; Birmingham Perryfields (Bromsgrove); Erdington; Chelmsley Wood; Acocks Green; Blackheath; Halesowen
Bishops Stortford	Bishops Stortford, Ware
Brighton	Brighton Hove; Portslade
Bristol	Bedminster; Bristol Redcliffe; Bristol North
Cambridge	Cambridge Trunks; Cambridge Science Park
Cardiff/Newport	Cardiff; Newport (Gwent)
Carlisle	Carlisle
Chelmsford	Chelmsford Town
Coventry	Coventry Greyfriar; Leamington Spa; Binley
Crawley	Crawley
Croydon	Croydon; Beckenham; Beulah Hill; Bromley; Mitcham; Wallington
Darlington	Darlington
Derby	Derby
Doncaster	Doncaster; Balby
Dundee	Dundee Main
Edinburgh	Edinburgh Donaldson
Exeter	Exeter Castle
Falkirk	Falkirk
Gillingham	Gillingham; Strood; Sittingbourne
Glasgow/Clyde Valley	Glasgow Central; Glasgow Douglas
Gloucester	Gloucester
Greenock	Greenock

Grimsby	Grimsby
Guildford	Guildford/Martyr, Aldershot
Hamilton	Hamilton
Ipswich	Colchester Town; Ipswich Town;
Irvine	Irvine
Kendal	Kendal
Kettering	Kettering
Kingston	Kingston
Leeds	Bradford (2); Leeds (3); Keighley; Shipley; Low Moor; Halifax; Brighouse; Castleford
Leicester	Leicester Montfort; Leicester Central; Glenfield
Liverpool	Liverpool Central
Livingston	Livingston Station
London Central	BT Tower (West Block); Covent Garden, Faraday Te (Moorgate), South Kensington; Southbank; Whitehall; Gerrard St (Soho); Monument; Bishopsgate; Shoreditch; Kings Cross; Euston; Marylebone; Paddington; Kingsland Green; Hackney
London Docklands	Bermondsey; Stepney Green; Poplar; Mile End
London East	Hornchurch, Kidbrooke, Upton Park; Woodford; Bexley Heath; Ingrebourne; Leytonstone
London North	Colindale; Wembley; Cricklewood; Golders Green; Willesden; Kenton Road; South Harrow
London West	Ealing; Southall; Isleworth; Hammersmith; Shepherd's Bush; Fulham
Luton	Luton Ate/Tower Block
Maidstone	Maidstone; West Malling
Manchester	Bolton; Dial House (Manchester); Oldham; Pendleton; Trafford; Central; Woodley; Radcliffe
Middlesbrough	Middlesbrough
Milton Keynes	Milton Keynes
Newbury	Newbury
Newcastle	Newcastle Central; South Shields
Northampton	Northampton; Kingsthorpe
Norwich	Norwich City; Norwich West
Nottingham	Nottingham Longbow; Trentside
Oxford	Oxford City; Cowley
Perth	Perth
Peterborough	Peterborough Wentw; Ortons
Plymouth	Plymouth; Crownhill
Portsmouth/Southampton	Cosham; Southampton; Eastleigh; Woolston
Potters Bar	Potters Bar, Enfield, Palmers Green
Preston	Preston (Lancs)
Reading	Bracknell; Reading; Tilehurst

Rugby	Rugby
Salisbury	Salisbury
Sheffield	Chesterfield; Sheffield Cutler; Attercliffe; Intake
Slough	High Wycombe; Slough; Egham; Uxbridge
Southend	Southend; South Benfleet
Stoke	Stoke Trinity/Pott; Newcastle Under Lyme
Swindon	Swindon
Warrington	Ashton In Makerfield; Northwich; Warrington
Watford	Watford, Hemel Hempstead, St Albans
Wolverhampton	Walsall Central; Wolverhampton Central; Bilston
York	Malton

Table A20.10 Candidate competitive data centres

City Lifeline - Lifeline House	Savvis LO6
Colt London 3, WGC	Sentrum - Sutton
Computacenter Romford	Sentrum - Watford
Computacenter Salford Quays	Sentrum - Woking
Coreix Limited datacentre	SSE - Fareham
CyrusOne - London	Sungard London Technology Centre
Digital Realty Redhill	Tata Communications Cressex
Equinix LD1 - London City	Tata Communications Stratford
Equinix LD2 - London West	Telecity - Kilburn House
Equinix LD3 - Park Royal	Telecity - Meridian Gate
Equinix LD4 - Slough	Telecity - Williams House
Global Crossing London datacentre	Telecity - 6&7 Harbour Exchange
Global Switch London #1	Telecity - 8&9 Harbour Exchange
Global Switch London #2	Telecity - Bonnington House
Interoute - Hoddesdon	Telecity - Joule House
Interxion LON1	Telecity - Oliver's Yard
Interxion LON2	Telecity - Powergate
Iomart London	Telecity - Sovereign House
Level 3 Braham Street datacentre	Telehouse East
Level 3 London datacentre	Telehouse Metro
MDS Technologies - Crawley	Telehouse North

Navisite - Woking	Telehouse West
Next Generation Data Newport	TeliaSonera HEX/A
Node 4 - Derby	Telstra - Docklands
Node 4 - Leeds	The Bunker - Ash
Pulsant - Reading East	Docklands Data Centre Ltd - Tutis Point
Pulsant -Milton Keynes	Virtus LONDON1
Pulsant - Reading Central	Vital - Park Royal
Pulsant – Newbridge	Wildcard Networks IFL2
QiComm - Tutis Point	Wildcard Networks IFL3

Annex 21

Local and national competition: Our approach to geographic market definition

Introduction and regulatory framework

A21.1 In addition to specifying the services to be included within a market, discussed in Section 4 and Annexes 8 to 12 of this consultation, the EC regulatory framework also requires the geographic scope of the market to be specified. As with product market definition, the aim is for market definition to accurately capture the strength of competitive constraints, thereby ensuring that any regulation is targeted to areas and services where there are competition problems.

A21.2 The SMP Guidelines state that:

> "According to established case-law, the relevant geographic market comprises an area in which the undertakings concerned are involved in the supply and demand of the relevant products or services, in which area the conditions of competition are similar or sufficiently homogeneous and which can be distinguished from neighbouring areas in which the prevailing conditions of competition are appreciably different. The definition of the geographic market does not require the conditions of competition between traders or providers of services to be perfectly homogeneous. It is sufficient that they are similar or sufficiently homogeneous, and accordingly, only those areas in which the conditions of competition are 'heterogeneous' may not be considered to constitute a uniform market."[423]

A21.3 In addition to the SMP Guidelines we have had regard to the ERG's Common Position.[424] The ERG Common Position identifies criteria for the analysis of the homogeneity of competitive conditions in geographic markets.[425] It states that:

> "market definition should be based on the actual conditions of competition, reflected by the behaviour of the market players (e.g. pricing) and the effect of their behaviour on market structure (e.g. market shares). As is generally the case in ex ante regulation, the analysis of the criteria should also be forward-looking and should – as far as possible – take into account developments until the next review".[426]

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[423] See paragraph 56 of the SMP Guidelines.

[424] ERG Common Position on Geographic Aspects of Market Analysis (definition and remedies), October 2008. http://berec.europa.eu/doc/publications/erg_08_20_final_cp_geog_aspects_081016.pdf

[425] In so doing, it is noted in Section 4 of the ERG Common Position that the criteria it identifies "are those which are also of importance in an SMP analysis" (see Section 4).

[426] See Section 4 of the ERG Common Position.

A21.4 The purpose of this annex is to describe some of the main factors which determine how competition develops in different areas. We first discuss factors which tend to lead to local variations in competitive intensity in leased line markets, and then we discuss countervailing factors which tend to create homogeneity in competitive conditions in leased line markets across the country as a whole. If the former are sufficiently powerful, we may be able to identify distinct local markets in which competition can be sustainable and effective. On the other hand, if the latter predominate, we are more likely to define markets which are national in scope. However, appropriate regulation may be able to address some of the pressures for national markets, allowing competition to emerge in those areas where economic conditions are favourable. The value in understanding the factors which can hold back local competition is that it may allow us to design remedies which tackle these at source and are more effective as a result.

Local and national factors in geographic market definition

A21.5 As explained above and consistent with the ERG Common Position, we consider it appropriate to undertake geographic market definition relying primarily on an assessment of competitive conditions. In Section 4.1, we explain why, in our view, the presence of rival infrastructure is the main determinant of competition, with geographic variations in intensity of competition likely following variations in presence of rival infrastructure, and with rival infrastructure approximating the number of suppliers in an area able to compete with BT.

A21.6 Competitive conditions can be determined locally or nationally. Below, we identify and discuss factors affecting competitive conditions, some pointing towards local, others towards national determination of competitive conditions. Before discussing local and national factors, we explain that a CP's ability to provide leased lines sourcing one or more terminating segments from another CP is a prerequisite for competition to be determined locally.

A21.7 As a starting point it is instructive to consider the position if markets for leased lines were not regulated, and there was no pre-existing merchant market. In such conditions, CPs would not be able to source terminating segments from another CP. Leased lines are end-to-end services connecting sites in different locations, possibly many different ones where multiple sites need to be connected. Absent the possibility to source terminating segments from another CP, a CP would need to have its own network at all the locations the retail customer wants to connect, and these could be at sites across the UK. It is hard to see how local competition (for example, reflecting greater concentration of rival infrastructure and businesses) can be sustained in such conditions as only CPs with existing network in the proximity of most sites would be able to compete. Competition would be determined nationally with only CPs with an extensive geographic coverage able to compete for the provision of bundles of leased lines connecting sites in differing locations.

A21.8 The possibility of providing leased lines sourcing one or more terminating segments from another CP, either at regulated terms in markets where there is SMP, or on commercial terms, seems to be a prerequisite for effective competition locally. The availability of terminating segments from other CPs increases the ability of a CP to compete for leased lines connecting to sites in areas where they do not have infrastructure nearby.

A21.9 The scope for providing leased lines using terminating segments sourced from another CP depends on:

- the availability of regulated terminating segments (in accordance with the *modified Greenfield* approach we assume that SMP regulation applies outside but not inside the candidate market[427]); and

- the extent to which terminating segments can be purchased in the merchant market.[428]

A21.10 As terminating segments are available to a certain degree – OCPs are willing to provide terminating segments to other CPs (subject to network presence), and we note that in most of the UK BT is most likely obliged to provide terminating segments at regulated terms (as we find BT to have SMP) – we consider it appropriate to analyse competition at a local level, and only then to determine whether a wider geographic market can be defined.[429] In turn, we now discuss local and national factors affecting competition.

Factors promoting local competition

A21.11 In this section, we outline some of the reasons why local variations in competitive conditions might emerge in leased line markets and consider the factors which cause competition to develop more rapidly in some areas than in others. In the next section, we consider pressures in the opposite direction, which might tend to prevent local competition developing, and which tend towards national markets.

A21.12 We assume for the purposes of this discussion that the key hurdle in the way of local competition discussed in the previous section – the need to be able to provide an end-to-end circuit – has been overcome. Once there is the possibility to provide leased lines that partially rely on one or more terminating segments sourced from another CP – and thus local competition can exist – the question arises as to what determines which areas competition develops in and the intensity of competition in a given local area.

A21.13 The key factor determining the intensity of competition is the number of suppliers which have network in an area and are active in the supply of leased lines. In Section 4, we explain why we regard rival infrastructure as the main determinant of intensity of competition, and why we consider variations in intensity of competition to be, primarily, driven by variations in presence of rival infrastructure.

A21.14 The key factors determining the number of suppliers are the size of the local market and the costs of supplying it, that is the number of businesses demanding leased lines and how densely concentrated they are. We note in this regard that:

- The ability to exploit economies of scale and scope depends on the extent to which a CP can use the same local network to provide multiple services to multiple customers. By providing multiple services using the same duct network it can reduce its unit costs. It will clearly not be possible for services provided in

[427] So, where we consider/delineate the CLA we may consider that SMP regulation applies in the rest of UK.

[428] The extent to which the required segments can be purchased in the merchant market will depend first and foremost on OCPs having network infrastructure near/to sites that need to be connected.

[429] See for example the evidence of merchant market transactions in the WECLA set out in the BCMR 2013 Statement; see: http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/

differing areas to share the duct network over which services are delivered. This points to costs and competitive conditions being determined to a significant extent by local scale.

- The overall scale of the local market will determine the number of suppliers which can operate economically, with competition more likely to be sustainable in markets which are large enough for more than one CP to operate at a reasonably efficient scale. A larger local market is also more likely to be able to support an active merchant market.

- Where demand for leased lines is concentrated in a small area, the network extensions needed to connect to individual customers can be kept relatively short, reducing unit costs.

- Local specialisation in particular industries may lead to local variations in demand for leased lines so, for example, areas where firms in the financial services sector are located may have higher demand for some leased line products.

A21.15 We learned from responses to our Market Questionnaire, meetings with CPs and [✂ ✂] about CP approaches to investing in expansion of network infrastructure.

- While some CPs may consider pro-active expansion to an area (without having specific customers to connect to), for example, in anticipation of sales opportunities and growing demand, most CPs only consider network extension where this is needed for connecting to a business purchasing leased lines.

- Virgin Media has recently announced its plans ("Operation Lightning") to undertake a significant extension of its fibre network. [✂

✂][430]

- [✂

✂] [431]

A21.16 We note that CPs tend to develop the network infrastructure used for providing leased lines by incremental investments. One reason for this is that adding to an existing network is often the most cost-effective way to expand as it maximises usage of existing infrastructure. Incremental expansion thus allows better exploitation of economies of scope and scale in the existing network. Local networks tend to be contiguous and an area which is adjacent to a competitive area tends itself to be more competitive as a result. We refer to paragraphs A15.172 to A15.174 in Annex 15 for a description of our understanding of contiguity.

A21.17 The nature of investments in network infrastructure is one of the reasons why we consider competitive conditions to be more favourable in the London Periphery than

[430] [✂ ✂]

[431] [✂ ✂]

in CBDs. The proximity to and economic and physical links with the CLA mean that OCPs in the LP likely have stronger incentives to invest in network infrastructure.[432]

A21.18 As retail users want leased lines to connect to their sites, CPs that want to provide lines need to be able to connect to users' sites, using their own infrastructure or by sourcing a terminating segment from another CP.[433] Typically retail customers will have existing sites or will have committed to the location of sites prior to purchasing leased line services. When purchasing leased line services, these customers will seek to find a CP that can supply services to their existing sites. There may be some retail customers – for example, data centres or small media companies – for whom the availability of multiple network providers is of greater importance, up to the point of it being an important criterion of site selection. But once they have invested in a particular location, they will be unlikely to relocate to another area.

Factors tending to lead to homogeneous national competitive conditions

A21.19 In this section, we outline some of the factors which create pressures for competition to be homogeneous at the national level and which might prevent or hinder the development of local competition. These are important because, as should be clear from the previous section, competition is unlikely to be effective in all parts of the UK. Then, if competition cannot develop locally, the likelihood is that it may not develop at all. However, as noted at the start of this Annex, we may be able to design appropriate remedies to address the factors which would otherwise stymie local competition, and recognising and understanding these factors is likely to help us to do so more effectively.

A21.20 The following factors operate primarily at a national level and may tend to hinder the development of competition at a local level:

- Trends in demand and technological change, such as the decline in markets for legacy, TISBO services.
- Point-to-point provision being the norm for WDM-based services.
- CPs incurring greater incremental costs when providing leased lines using (one or more) terminating segments purchased from another CP.
- Customer preferences to purchase from a single national supplier and any costs associated with sourcing from multiple suppliers. A single contract, even a large multi-site one, may generate some incremental build but is unlikely to be sufficient to persuade a CP to invest widely where it does not already have network.

Trends in demand and technological change

A21.21 Trends in demand (increasing demand for bandwidth) and technological change likely have a similar bearing on supply, demand and competition in different parts of the UK. We note, in particular, the decline in use of legacy TISBO services

[432] The Towerhouse submission confirms that links between the centre of London and wider London area are strong.

[433] To put it another way, because demand-side substitution possibilities are so limited, CPs have to go where the demand is.

throughout the UK. CPs are reluctant to enter and compete for customers in a declining market, even where they have infrastructure in place which could potentially be used (as for example is the case in the CLA, where BT retains SMP in the low bandwidth TISBO market).

WDM services are (commonly) provided end-to-end

A21.22 WDM services are typically provided as end-to-end circuits on a single network, without interconnection. WDM interconnection is technically possible, but is costly and at present is not widely used, for reasons discussed in Section 11.

A21.23 End-to-end provision of WDM services requires CPs to have network infrastructure at both ends of the line and in between. Where a CP has network at only one end, the costs of interconnecting or network extension required will impair its ability to compete for provision of the line if another CP has network already present at both ends.

A21.24 As referred to above, BT has a much more extensive network and better geographic coverage in comparison to OCPs, in particular outside the major urban centres. As such, BT, and to a lesser extent Virgin Media, is better positioned to provide WDM services, in particular, where one or both ends of the service are located outside major urban centres. This also implies that competition can remain limited, even for services having one end in a geographic area where several CPs have infrastructure. If the area where rival infrastructure is concentrated is small, so that most circuits with one end in that area connect to a site outside it, competition is unlikely to be effective. As long as the OCPs with presence in this area do not have infrastructure at the other end, they could be restricted in their ability to compete.

Ability to provide services on-net

A21.25 OCPs have noted that, even in the presence of wholesale remedies, their ability to compete for provision of leased lines is impaired when they need to provide a line off-net, using a terminating segment sourced from another CP, as this tends to raise incremental costs. We note that transaction costs are a possible explanation for incremental costs being greater when providing a service off-net,[434] and that the cost difference between off-net and on-net will affect OCPs' decisions whether to purchase a terminating segment from another CP or instead undertake the network extension required for providing the service using their own infrastructure.[435]

[434] Another is that CPs' wholesale charges will often include an allowance for recovery of common costs in addition to incremental costs. The charge controls to which BT is subject allow it to recover a reasonable share of common costs through its wholesale leased line charges.

[435] Earlier we noted that interconnection is necessary for local competition to occur and that this will require regulation where there is SMP. Ineffective regulation may therefore stymie competition at the local level. Regulation which is both effective and retains some incentive for a CP to invest in network of its own will allow local competition to take place, and also facilitate its expansion over time, even if it does not become fully national in scope.

Multi-site demand

A21.26 Some retail users seek to purchase connectivity services linking multiple sites located in different parts of the UK – i.e. multi-site demand. Users can meet multi-site (potentially multi-service) demand in differing ways:

- They can purchase the services in a bundle from a single vertically-integrated CP.
- They can purchase the services in a bundle from a single integrator, which provides the bundle by purchasing and reselling services from differing CPs.
- They can purchase services from differing CPs, each of which may not have the coverage required for supplying the bundle on its own.

A21.27 The first option – purchasing from a single CP – is not consistent with intense competition at a local level as only CPs with a very extensive coverage (extending to the proximity of sites that need to be connected) can compete. CPs with less extensive coverage – in the proximity of some, but not all sites to be connected – will have an impaired ability to compete as the incremental costs they would incur in providing the bundle would be considerably greater than those incurred by CPs with network in proximity of most/all sites.

A21.28 The second and third options may facilitate competition at a local level as the integrators / retail users provide the bundle of services by sourcing services supplied to individual sites at the best possible terms. This will allow CPs with less extensive network, with network in the proximity of some, but not all, sites to compete.

A21.29 The BDRC end-user survey and the Market Questionnaire provide evidence and insights into the materiality and impact of multi-site demand.

- The BDRC end-user survey shows that 33% of end-users currently purchase, and 17% sometimes purchase connectivity services as part of a wider package.[436] This points to multi-site, multi-service demand being a major feature of leased lines markets, in particular, as large businesses with more extensive requirements are more likely to purchase services as part of a package.
- The BDRC end-user survey also provides insights to the views of retail users as to relying on one or multiple suppliers. While most businesses use only one supplier, 25% of businesses rely on more than one supplier (this is more prevalent for large businesses). [437] Reasons for relying on one supplier included ease of managing, quality of services, and better discounts; reasons for relying

[436] See Section 8 of the BDRC end-user survey. http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[437] See Section 8 of the BDRC end-user survey. http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

on multiple suppliers included value for money, resilience, being able to make use of CPs' specialising in different services.[438]

- The Market Questionnaire informed us on the views and experiences of CPs as sellers and buyers of leased lines.[439]
  - Some respondents indicated that they use several different suppliers, that this has not created any problems, and that this allows them to use competition between suppliers to improve the terms on which services can be purchased.
  - CPs were asked to list factors which were important to them when selecting suppliers. Some listed many different aspects of service provision as important, but nearly all included coverage/location and price.
  - One respondent [✂ ✂][440]
  - When asked about which operators were well placed to meet their needs, BT was almost always amongst those mentioned and this was often explicitly linked to the coverage of its network.
  - A number of respondents said that using multiple third-party suppliers led to additional costs for various reasons including multiple connection fees, reduced reliability, inconsistent SLAs and the need to integrate different systems.

A21.30 Multi-site demand may affect competition compared to the case where demand is for provision of services to individual sites.

- A CP's ability to compete for multi-site demand will depend on the extent to which the CP has network in the proximity of most/all sites to be connected. This is likely to provide an advantage to CPs with greater network coverage.
- The greater value of retail contracts involving multi-site demand could (possibly) increase the incentives of CPs to extend their networks – if network extension is the key to securing large contracts, the revenues could be more likely to exceed the additional costs.

A21.31 If retail users insisted on the same vertically integrated supplier in all areas where they require leased lines, there would be a tendency for competition to be national in scope. As it is, local competition can and does take place, but larger networks are still likely to have an advantage.

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[438] See Section 8 of the BDRC end-user survey. http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/annexes/BCMR_2014_report-bdrc.pdf

[439] CP responses to questions 11 to 14 in the Market Questionnaire.

[440] [✂ ✂]

A21.32 To see this, consider a retail user that wants its multi-site demand to be met, and preferably by a single supplier. CPs would then compete for the provision of a bundle of services. The ability of a CP to meet multi-site demand depends on the extent to which it has network in the proximity of sites that need to be connected.

- Where a CP has network in the proximity of a site, it can connect that site using its own network requiring limited network extension and thus at low incremental costs).[441]

- Where a CP does not have network in the proximity of a site, it can provide the service using its own network (requiring material network extension) or sourcing a terminating segment from another CP. Either way of providing the service is likely associated with more considerable incremental costs.

- The greater the proportion of services that need to be provided to a site where a CP does not have network nearby is, the greater will be the CP's incremental costs of providing the bundle, and thus the more impaired will be the CP's ability to provide the bundle on competitive terms.

A21.33 A CP whose duct network extends to most sites in the UK would be able to meet multi-site demand providing services over its own infrastructure requiring neither significant network extension nor purchasing services from other CPs. Consequently, such a CP would be able to provide bundles of services at relatively low incremental costs. A prevalence of multi-site deals with very wide coverage would tend to lead to competition between national networks.

A21.34 Demand from MNOs for leased line services to support backhaul, provides an example of multi-site demand. MNOs require leased line services to connect their mobile masts, which are often located in areas where the presence and density of rival infrastructure is limited, to their core networks. While MNOs could purchase lines on an individual basis, in practice, they tend to purchase services in large contracts from a single or perhaps two CPs. At the same time, locally-based network operators have not gained a large share of MNOs' backhaul purchase. We refer to Annex 11 for further discussion on MNO backhaul, and the extent to which existing remedies support effective competition for provision of backhaul services.

A21.35 Where multi-site demand is a major feature of leased lines markets, this may lead to broader geographic markets.

Our approach

A21.36 In light of the points discussed above, our approach is based on local determination of competitive conditions placing great weight on presence and density of rival infrastructure. We also acknowledge the potential importance of multi-site demand and other factors tending to lead to national markets and this is one reason why we only define separate markets where there are clear and sustainable differences in competitive conditions in a material area. Sustainability is crucial: competition must be robust enough to stand on its own feet once regulation is removed.

[441] We assume that a CP prefers to provide the service using its own network where it has network nearby.

Practical solutions to operationalise our approach

A21.37 In order to operationalise our approach, we had to address a number of practical issues, including:

- The choice of geographic building block – whether to use postcode sectors as in the 2013 BCMR;
- How to ensure that geographic market areas were sufficiently material to be capable of supporting sustainable and effective competition, taking account of CPs' approach to investments; and
- Whether to require (near) contiguity.

A21.38 Selection of the appropriate geographic unit involves a trade-off between granularity and practicality. An assessment of competitive conditions at the level of individual sites would be impractical and disproportionate in terms of data collection and analysis, whereas wider geographic units risk masking large variations in competitive conditions. We consider, having taken account of the criteria stated in the ERG Common Position, that postcode sectors remain the most appropriate geographic unit, with our reasons including:

- Postcode sectors are mutually exclusive and more granular than national;
- The network structure of all relevant operators and the services sold on the market can be mapped onto the geographic units; and
- Postcode sectors are small enough that competitive conditions within the sector are likely to be broadly similar in most cases but at the same time large enough that the burden on CPs and us, the relevant National Regulatory Authority, with regard to data delivery and analysis is reasonable. [442]

A21.39 CPs are unlikely to invest in an access infrastructure in an area just to serve a single postcode sector. They will aim to serve customers in a wider local area – including multiple, where possible neighbouring postcode sectors – to benefit from the available economies of scale and scope. This suggests that competitive conditions will be determined over a wider area than a single postcode sector. In addition, this is consistent with the pattern of OCP investments in network infrastructure observed over the past decades, where OCPs have tended to target urban areas, benefitting from the greater density of (potential) demand, and possibly from better utilisation of their network.

A21.40 We also place weight on (near) contiguity when defining geographic scope of markets. The relevance of contiguity to geographic market definition, and its application to the definition of the Central London Area as a geographic market are explained in paragraphs A15.172 to A15.174.

[442] In essence, our reasons remain those set out in the BCMR 2013 Statement: see in particular paragraphs 5.16 – 5.25. The decision to use postcode sectors in 2013 was taken after review of the detailed responses received to the 2013 BCMR consultation. We are not aware of any new factors which we should take into account and consequently we consider that postcode sectors remain the most appropriate geographic building block.

Annex 22

Profitability analysis

Rationale for profitability analysis

A22.1 This Annex presents our analysis of the profitability of BT and KCOM's provision of wholesale leased lines. We rely on this analysis in our assessment of competition and market power in relation to the wholesale markets identified in Sections 4, 5 and 6 of this review. Annex 13 explains the position and role of profitability analysis as part of a SMP assessment.

A22.2 The SMP Guidelines refer to the importance, when assessing market power, of considering a CP's power to raise prices without incurring a significant loss of sales or revenue. An unregulated CP with market power has, by definition, the ability and incentive to profitably raise prices above the competitive level. By contrast, a CP without market power will, constrained by competitors, customers and consumers, not be able to profitably raise and sustain prices above the competitive level. Where a CP's profits significantly, and for an extended time period, exceed the competitive benchmark, we consider this as an indicator of the CP in question having material market power.

A22.3 We recognise that caution is warranted when drawing inferences on market power based on profitability analysis:

- Measurement and interpretation of profitability (as explained later in this Annex) are subject to limitations and imperfections.
- Temporary above-normal profits can be consistent with competitive markets, for example, if such profits reflect the rewards for successful innovation.[443] In competitive markets, though, we expect profits to erode over time; hence, profitability which is persistently high is more likely to be an indicator of SMP.
- Profitability is affected by factors other than competitive conditions, for example, economic growth. At least in the short term, such factors can increase or decrease a CP's profitability while bearing no relation to underlying competitive conditions.

A22.4 In light of the reasons given above we consider that only profits that significantly and persistently exceed the competitive benchmark can form a basis for making market power inferences.

A22.5 We do not consider the reverse to be necessarily true. That is, where we find that profits do not consistently exceed the competitive level, we do not automatically regard this as evidence of a CP not having market power. A CP with significant market power can make normal or below-normal profits if it operates inefficiently, or – if subject to *ex ante* regulation – a charge control prevents above-normal profits being made.

[443] In fact, it is the presence of temporary above-normal profits that provides incentives for entry and expansion driving competition.

A22.6 Taking account of the above, we interpret profitability as follows:

- We do not make inferences about competitive conditions in markets where we find low levels of profitability and that were subject to price regulation in the period under review.

- We place some weight on profitability as an indicator of market power where profitability significantly and consistently exceeded the competitive benchmark.

A22.7 As explained in Annex 13, our market power determinations never rely on one indicator (for example, profitability) alone. In addition, we note that though profitability that persistently and significantly exceeds the competitive level can indicate market power, we do not regard this to be a necessary condition for finding a CP to have SMP.

Measurements of profitability and the competitive benchmark

A22.8 As in the previous review, we assess profitability by benchmarking a CP's return on capital employed (ROCE) against that CP's weighted average cost of capital (WACC).

- ROCE is the ratio of accounting profit to capital employed, with capital employed being the accounting value of the net assets used in producing an undertaking's output. Assets can be valued on either an Historical Cost Accounting (HCA) basis or a Current Cost Accounting (CCA) basis.[444] The latter is generally preferable as a measure of the value of the resources used to produce a service. Importantly, ROCE relates the return to the capital that was employed in producing the output on which the return was made.

- The WACC is determined by weighting an undertaking's costs of equity and debt by the proportions of equity and debt in that undertaking's financing.

A22.9 In the longer term, we expect that undertakings – at least in competitive markets – will achieve a return on capital employed that does not greatly exceed the minimum needed to reward providers of capital for the risk they bear. In other words, in competitive markets we expect ROCE to tend towards the WACC over time.

Financial data reported by BT and KCOM

A22.10 Under existing SMP regulation, BT and KCOM are obliged to publish the financial results – including turnover, return, operating costs, mean capital employed – of their sales of wholesale leased lines in the markets in which they were found to have SMP in the 2013 BCMR. BT publishes its financial results in its Regulatory Financial Statements (RFS), KCOM in its the Regulatory Financial Review (RFR).[445]

[444] Under the HCA convention, assets are valued at their original purchase cost. Under the CCA convention, they are valued at what it would cost to replace them with equivalent assets today.

[445] See http://www.kcomplc.com/regulatory-information/statistical-and-accounting-info/ for KCOM's regulatory accounts for the regulatory year ending 31 March 2014, and http://www.btplc.com/thegroup/RegulatoryandPublicaffairs/Financialstatements/index.htm for BT's regulatory accounts covering the regulatory years 2010/11 to 2013/14.

A22.11 BT and KCOM report operating costs on a Fully Allocated Cost (FAC) basis. FAC is an accounting measure of costs and includes the incremental costs of providing services plus an allocation of common costs. This means that ROCEs measured on an FAC basis will reflect the amount of common costs allocated to the service in question – allocating a greater share of common costs to one service would reduce its measured ROCE, for example.[446] This in turn means that, when interpreting ROCE data, we need to recognise that CPs have some discretion over the allocation of common costs – similar for allocation of common assets – and that there may be no uniquely correct way of doing so. A significant part of the FAC of BT's wholesale services is made up of common costs, and thus changes in the allocation of common costs can have a major impact on ROCEs reported for individual service types.

Data on BT's profitability

A22.12 BT reports financial data in its annual RFS for the markets in which it was found to have SMP in the relevant reporting period. In Table A22.1 we present BT's profitability for the four most recent years for which BT has reported financial data. There are a number of preliminary observations on the data available that we discuss in this section.

Mapping the profitability data to the market definitions proposed in this consultation

A22.13 BT reports profitability data for the markets in which it was found to have SMP in the previous review. In this review we are proposing some further changes to the markets defined, with the consequence that the available profitability data does not map precisely onto the market definitions proposed in this review. However, we consider that the available data does provide a reasonable basis to inform our SMP analysis:[447]

- Product markets
  - Profitability on CISBO can be inferred from the data for AISBO and MISBO. Given the far greater number of AISBO sales than MISBO the profitability figure for AISBO is the best guide to profitability for CISBO;
  - We also have profitability data for MISBO alone, which we refer to in our discussion of whether BT would have SMP in very high CISBO if a separate market for very high CISBO were to be defined.
- Geographical markets

[446] Similarly, the allocation of common assets will have a bearing on the capital employed in providing services, the denominator of ROCEs.

[447] If market definition and SMP findings change following a market review, then these changes will be reflected in the financial data that BT reports. Thus, for the financial years 2010/2011 and 2011/2012, BT reported figures for a national market for AISBO services. Following the changes in market definition in the 2013 BCMR, BT reports figures for separate markets for AISBO and MISBO services in the UK outside the WECLA, and for AISBO services in the WECLA.

- The "Rest of UK" market proposed in this review is identical to the "UK outside WECLA" used in 2013, so data are available for the proposed "Rest of UK" geographic market.

- In the London area, we do not have separate profitability data for our proposed CLA and LP markets, but only for the WECLA (which is the CLA and LP combined). However, we think the data for the WECLA is likely to correspond reasonably closely to the CLA (as the CLA forms the large majority of the WECLA) and we think it is also likely to provide some indication of profitability in the LP as well.

Asset valuation – treatment of holding gains and losses, and depreciated assets

A22.14 The ROCEs reported by BT are calculated on a CCA basis, with the return calculated by subtracting CCA operating costs from turnover.

A22.15 BT reports CCA operating costs prepared under the FCM convention. Under this convention: (i) changes in asset values are considered 'holding gains' if the asset price increases, or 'holding losses' if the asset price falls, and (ii) holding gains/losses and other one-off adjustments are treated as 'costs' in the financial year in which they occur. An implication of this convention is that variation in reported ROCEs may not reflect changes in competitive conditions as holding gains/losses and other one-off adjustments can vary for reasons not related to underlying competitive conditions.[448]

A22.16 For this reason, and because of some particularly sizeable adjustments in the relevant period, we presented two sets of profitability data in the 2013 BCMR Statement:

i) CCA figures from BT's regulatory financial statements, in order to reflect BT's reported ROCE; and

ii) adjusted figures based on the data from BT's regulatory accounts, but excluding all holding gains and losses and other one-off adjustments which resulted from changes in accounting methodology.

A22.17 In this review, we again assess BT's profitability based on reported ROCEs so including for holding gains/losses and other one-off adjustments as we consider those relevant to BT's profitability.449 Moreover, holding gains/losses and other one-off adjustments, at least in the years 2012/3 and 2013/14, were relatively small in comparison to BT's operating costs, and did not materially vary over time, so we have not presented adjusted figures in this consultation.[450]

[448] For example, because of occasional revisions to asset values and/or changes in accounting practices

[449] In the previous market review, we calculated adjusted ROCEs with holding gains/losses and one-off adjustments subtracted from the CCA operating costs. An alternative would be to smooth adjustments over time reducing the impact of significant one-off changes.

[450] As other adjustments were significant in the regulatory years 2010/11 and 2011/12, we considered it in the 2013 BCMR appropriate to establish adjusted ROCEs that would mitigate for the effect of one-off adjustments on profitability.

A22.18 BT reports operating costs on a FAC basis. They include a mark-up for common costs and the cost of capital. While common costs are relevant to economic profitability, especially so given their significance in leased lines markets, including a mark-up for common costs implies that ROCEs are sensitive to the choice of common cost allocation method and this can change over time.

A22.19 In markets where substantially or fully depreciated assets are used to provide services, asset depreciation can reduce the extent to which reliable inferences on market power can be made based on ROCEs. This is a particularly relevant consideration for the profitability analysis of low bandwidth TISBO services.

Changes in common cost allocation over time

A22.20 BT transferred significant costs from leased lines to other markets in the financial years 2011/12, 2012/13 and 2013/14. We understand these transfers involved a significant proportion of the costs of providing leased lines services, and that the effect of the transfers can have material, one-off changes in BT's profitability of providing leased lines. Accordingly the variations in profitability figures observed across these years reflect these changes.

Analysis of BT's profitability

A22.21 Table A22.1 presents BT's ROCEs for the leased lines markets in which BT was found to have SMP in previous market reviews for the regulatory years 2010/11 to 2013/14, and accounts for changes in the product and geographic markets for which BT reports data in its RFS.

Table A22.1 BT's reported ROCEs in wholesale leased lines markets in the financial years 2010/11 to 2013/2014

Market	2010/11	2011/12	2012/13	2013/14
Low bandwidth TISBO (up to and including 8Mbit/s) ***national***	14%	19%	21%	25%
AISBO ***National***	5%	14%	-	-
AISBO ***UK outside the WECLA***	-	-	30%	21%
AISBO ***WECLA***	-	-	70%	48%
MISBO ***UK outside the WECLA***	-	-	11%	32%

Source: RFS published by BT in 2012 and 2014, covering the financial years 2010/11 and 2011/12 (RFS 2012), and the financial years 2012/13 and 2013/14 (RFS 2014).

A22.22 For the purpose of charge controls we most recently determined BT's WACC to be 10.0% for BT Group, 8.6% for Openreach, and 10.8% for the Rest of BT.[451] In the 2013 BCMR we considered that the WACC applicable to the Rest of BT was the relevant one for the leased lines services covered by the proposed charge controls. This was based on an assessment of the cyclicality of demand for leased lines services and, to a lesser extent, an analysis of the underlying asset base.[452] The LLCC consultation document, to be published shortly will present updated estimates and analysis of BT's cost of capital. The role of the WACC in profitability analysis differs to that in charge controls. Our conclusion on profitability is not dependent on a very precise estimate of the WACC and will not be affected by our updated view on WACC to be published in the LLCC shortly.

A22.23 ROCEs relating to BT's provision of low bandwidth TISBO services have consistently and significantly exceeded BT's cost of capital and have been rising over time. However, the assets used in providing these services are depreciated to an appreciably greater extent than assets used in providing CISBO services. So, whilst the reported ROCEs are consistent with BT having SMP, in light of the above, we do not put great weight on these figures.

A22.24 ROCEs relating to provision of AISBO services in the UK have increased since 2010/11.[453] Whilst ROCEs on AISBO services nationwide did not (substantially) exceed the cost of capital in 2010/11 and 2011/12, ROCEs on AISBO services in UK outside the WECLA significantly exceeded BT's cost of capital in 2012/13 and 2013/14. The ROCEs on MISBO services outside the WECLA were also significantly above the WACC in 2013/14. The high ROCEs in the financial years 2012/13 and 2013/14 are consistent with BT having market power in the supply of CISBO services in the UK outside WECLA and the decline in 2014 is likely to reflect the effect of the current charge control. Moreover, a comparison with Figure 7.11 of the 2013 BCMR shows that ROCEs have been persistently high since at least 2006/07.[454]

A22.25 ROCEs relating to provision of AISBO services in the WECLA are only available for 2013 and 2014. The WECLA encompasses both the CLA and the LP, with around 75% AISBO services (lower bandwidth CISBO) supplied in the CLA. Whilst this implies that ROCEs reported are driven to a greater extent by profitability in the CLA, we consider that they can also be informative for profitability in the LP, particularly given the uniform pricing of BT's AISBO services. In both years, ROCEs significantly exceeded BT's cost of capital. The fact that they were also higher than in the UK outside the WECLA is likely to be due to the fact that charges are uniform

[451] Ofcom (2014), Annex 14 'Cost of Capital', Fixed access market reviews: Approach to setting LLU and WLR Charge Controls, final statement – Annexes. Strictly, the "Openreach" rate does not apply to the whole of Openreach but only to the copper access network assets and services it operates. http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/statement-june-2014/annexes.pdf

[452] BCMR 2013 Statement, paragraphs A14.7 and A14.118 - A14.130 at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/annexes8-17.pdf

[453] The separate 2013/14 figures for AISBO in the WECLA and in the UK outside the WECLA are both above the national market figures for 2010/11 and 2011/12.

[454] BCMR 2013 Statement, Figure 7.11 at http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/Sections6-7.pdf

but average costs in the WECLA are likely to be relatively low due to the high density of businesses in the area. Seen in isolation, the ROCEs reported are greater than would be expected in competitive markets. We discuss this as part of our SMP assessment for the CLA in Section 4.

A22.26 The LLCC consultation document will present more extensive analysis of BT profitability. We plan to carry out a more in-depth analysis of BT's profitability in wholesale leased line markets to inform our Statement.

Analysis of KCOM profitability

A22.27 In its annual RFR, KCOM reports financial figures – including returns, operating costs, mean capital employed and ROCEs – for the wholesale markets for low bandwidth TISBO and AISBO services in the Hull area in which it was found to have SMP in the previous review.[455,456] As market definition has not (materially) changed, comparison of reported figures over time is relatively straightforward. We consider that KCOM's profitability of providing low bandwidth TISBO and AISBO services can inform our assessment of KCOM's position in the (wholesale) markets for low bandwidth TISBO and CISBO services identified in this review.

A22.28 We proxy KCOM's cost of capital with BT's cost of capital, discussed above, as we have not recently estimated KCOM's cost of capital as part of our regulatory work. We consider that BT's cost of capital provides an appropriate proxy of KCOM's cost of capital as both CPs are involved in providing similar types of fixed telecommunications services. We take account of the fact that our estimate of KCOM's cost of capital is a proxy when making inferences based on KCOM's profitability. Only where KCOM's ROCEs significantly and persistently exceed the cost of capital, will we consider that profitability clearly suggests that KCOM has SMP.

A22.29 Table A22.2 (below) presents the ROCEs as reported by KCOM reported for both wholesale markets for the financial years 2011/12 to 2013/14.

[455] ROCEs only relate to KCOM's activities in the Hull area.
[456] See http://www.kcomplc.com/regulatory-information/statistical-and-accounting-info/ for KCOM's regulatory accounts for the year ending 31 March 2014.

Table A22.2: KCOM's ROCEs in wholesale leased lines markets in the financial years 2011/12 to 2013/14

	2011/12	2012/13	2013/14
Low bandwidth TISBO	13%	13%	13%
AISBO	13%	13%	13%

Source: KCOM RFR's 2012 and 2014 covering the financial years 2011/12 to 2013/14.

A22.30 KCOM's ROCE was equal to 13% in both wholesale markets and in each of the years considered. We note that this was the case, even though, in particular for AISBO services, the return was materially greater in the third year.[457]

A22.31 In the previous market review, we observed a similar pattern – KCOM's ROCEs were around 13% and did not vary across product markets and over time. We understood this pattern as being driven by KCOM's approach to allocation of common costs and its accounting practices.

A22.32 Observing no variation in KCOM's ROCEs across product markets and over time, and noting similar concerns regarding the extent to which returns and ROCEs reported by KCOM reflect economic profitability based on operational costs and revenues as in the previous review, we consider that the ROCEs reported by KCOM do not provide a reliable basis for making inferences as to any market power KCOM may have.

Annex 23

Benefits of passive remedies

Introduction

A23.1 This annex contains our assessment of the possible benefits associated with passive remedies, based on the April 2014 CFI responses,[458] responses to the November Consultation[459] and our own analysis. In those CFI and consultation responses, stakeholders expressed a range of views about how they considered passive remedies could support competition. We also discuss the forms of passive access and potential applications which could benefit from passive remedies in leased lines. Our assessment of the benefits of passive remedies feeds into our overall assessment of the case for passive remedies, which is summarised in Section 7.

A23.2 In the November 2014 Consultation, we said that competition based on passive remedies would expose more parts of the value chain to CPs' control than active remedies and make more elements of the network contestable and controllable by competitors to the SMP operator. We also said that by giving greater control of the underlying infrastructure to other CPs and so reducing the extent of reliance on co-operation of the underlying network owner, this could in theory increase the competitive pressure on costs, increase the scope and opportunity for innovation in networks and services, and allow CPs to differentiate the services offered to end users compared with competition based on active remedies.

A23.3 We also set out some initial considerations relating to the potential benefits identified by stakeholders in response to the CFI. We invited stakeholders to share with us their practical experience of the benefits arising from the direct use of passive infrastructure, either in the UK or in other countries where they operate. In particular, we were interested in understanding how this influenced their business, as well as competition and consumers in the relevant markets. We have summarised these in Annex 27.

A23.4 In light of responses to the November Consultation and our further analysis, we have now refined our consideration of the potential benefits of introducing passive remedies. In particular, we have carried out some additional analysis of the Statement of Requirements requests and the scale of potential costs savings from avoiding potential duplication of network monitoring elements and equipment. The remainder of the annex is structured around the following three broad categories of benefits that passive remedies could provide:

- dynamic efficiency in the form of greater scope for innovation and improvements in service quality. This part of our assessment draws in particular on the analysis set out in Annex 27 on the possible scope for innovation with passive remedies;

[458] We published the non-confidential responses to the CFI here - http://stakeholders.ofcom.org.uk/consultations/business-connectivity-market-review/?showResponses=true

[459] We published the non-confidential responses to the November Consultation here - http://stakeholders.ofcom.org.uk/consultations/bcmr-passives/?showResponses=true

- productive efficiency in the form of lower costs and prices over time as more of the cost stack is exposed to competitive pressure and as less equipment is used to deliver the service; and

- the potential to withdraw or relax some downstream regulation.

A23.5 We also discuss the forms of passive remedies and applications which may benefit from access to passive inputs.

A23.6 We first set out a summary of responses received to both the CFI and the November Consultation on each of these potential benefits, and then present our considerations and analysis of each. We note that the scale and scope of these potential benefits in most cases directly depends on the form and design of a remedy, so we then go on to discuss responses to the CFI and the November Consultation relating to this, and set out our corresponding analysis including our views on the forms of passive remedies and applications which may benefit from access to passive inputs.

A23.7 We recognise that passive remedies could also have negative impacts on dynamic efficiency and we discuss these in Annex 24.

Dynamic efficiency in the form of greater scope for innovation and improvements in service quality

Stakeholder responses to the CFI

A23.8 Those CFI respondents in favour of passive remedies considered that they would provide CPs with more control of the underlying infrastructure, offering a greater potential for innovation compared to active remedies. Respondents noted that with active remedies, BT controls the pace of innovation. CPs are dependent on BT introducing new products/features or for it to grant requests from CPs. There were concerns about BT's process for CP requests (the Statement of Requirements process or SoR Process).[460] Some respondents considered that requests are not handled in a timely manner and are unreasonably refused by BT.

A23.9 A further concern was that all new product/service developments introduced by BT are made available to all CPs simultaneously, making it difficult for CPs to compete and differentiate their services through innovation.

A23.10 CFI respondents identified various areas where passive remedies could facilitate innovation by allowing CPs to supply their own electronic equipment. These included:

- The ability for CPs to progress technology developments at their own pace and progress innovations of value to them and not to BT, offer innovative and flexible pricing.

- The potential to use passive remedies to create different network topologies as a move away from active products would reduce reliance upon interconnection and replication of BT's network architecture. Colt argued that duct and pole access

[460] See our analysis in Annex 27.

could provide the flexibility to deploy different network architectures[461] [✂ ✂].[462]

- Improvements in service quality: the ability to offer improved delivery and service upgrades and different approaches to fault detection and repair.

A23.11 In general, those who were in favour of passive remedies argued that passive access would provide CPs with the ability to compete and innovate in a range of ways such as network technologies, pricing innovations or innovations in quality of service. On the other hand, BT considered that passive remedies would not lead to any significant benefits which could not also be achieved from the use of active remedies.[463] Below we present a more detailed summary of stakeholder responses.

Product and services innovation

A23.12 UKCTA was of the view that the benefits of passive access stem from the ability to break free from constraints imposed by BT in terms of its product specifications, service quality, features, functionality, market segmentation (geographic and product) and pricing model. In terms of the advantages, UKCTA mentioned areas such as SLAs, lower latencies, innovative technologies, innovative and flexible pricing, network performance monitoring equipment, better quality of supply and better availabilities.[464]

A23.13 EE, Three and MBNL pointed out the constraints related to operators' ability to upgrade to the latest technologies given that CPs are dependent on the nature and speed of technology upgrades by BT. In particular, they noted that the fact that new developments are made available to all operators simultaneously undermines their incentive to compete and differentiate themselves through innovation. In their view, passive remedies would give CPs the ability to progress technology developments they value and at their own pace. For example, passive remedies would allow operators to deploy their own equipment and innovate in the electronics layer to better suit their customers' needs.

A23.14 EE, Three and MBNL further argued that the availability of better quality products in the market would put pressure on all operators, including Openreach, to innovate.[465] They also believed that passive remedies would allow CPs to introduce innovative and flexible pricing which responds to the demands of the relevant market.[466]

A23.15 Similarly, TalkTalk stated that dark fibre would give the choice to design, provide and configure the electronics layer which could allow CPs to innovate in many ways.[467] In particular, TalkTalk, [✂

[461] See Colt non-confidential response to the CFI, page 33-34.

[462] See Colt confidential response to the CFI, page 34.

[463] See BT non-confidential response to the CFI, page 18-19, 26-27.

[464] See UKCTA non-confidential response to the CFI, page 10 -11.

[465] See EE, Three and MBNL joint non-confidential response to the CFI, page 9.

[466] See EE, Three and MBNL joint non-confidential response to the CFI, page 9-10.

[467] See TalkTalk non-confidential response to the CFI, page 12.

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A23.16 While TalkTalk acknowledged that CPs could ask Openreach to develop the active products (e.g. by submitting SoRs), it considered this approach to be inferior to allowing CPs to innovate themselves. It believed that self-innovation has advantages such as the ability to differentiate from competitors, quicker development of innovations, or putting pressure on all CPs to innovate in order to win and retain customers.[469]

A23.17 TalkTalk also added that there are benefits to a greater choice of business model to provide services to customers that would allow a CP to, for example, choose the most cost effective approach depending on services demanded, need for innovation and customer density.[470]

A23.18 Vodafone noted the advantages such as the ability to progress development it values at its own pace as well as the ability to be a first mover with any development. It also pointed out the ability to better introduce technology in line with its demand.[471] In its response, Vodafone stressed that passive access would have an important role in ensuring the ubiquity of services across the UK and at the required capacity.[472]

A23.19 In the report commissioned by Vodafone on "Passive Access in Business Connectivity Market", Frontier Economics also set out its views on the benefits of passive access remedies over active remedies.[473] It saw benefits in product and

[468] For more detail please see [✂ ✂]

[469] See TalkTalk non-confidential response to the CFI, page 12-15.

[470] See TalkTalk non-confidential response to the CFI, page 18-20.

[471] See Vodafone non-confidential response to the CFI, page 20.

[472] See Vodafone non-confidential response to the CFI, page 19.

[473] See Frontier Economics report, section 2, pages 8-20.

price innovation. In particular, it said that allowing access to a dark fibre would increase the ability for CPs to innovate through the electronics they attach to the dark fibre so that they can both better meet their customers' demands and anticipate customer demands by introducing new capabilities even where there is no guaranteed demand in order to build a competitive advantage.[474] Frontier Economics added that a combination of Openreach's lack of incentives to develop innovative services and the cumbersome process for requesting new capabilities means that there is likely to be significant unmet need.[475]

A23.20 **[✂ ✂]** said that a passive remedy will allow the CP to utilise its technology of choice and to evolve that technology at its own rate and not be constrained by BT's technology adoption processes. It gave as an example the migration of Gigabit Passive Optical Network (GPON) to Time and Wavelength Division Multiplexed Passive Optical Network (TWDM PON). It added that the ability to run different technologies apart from Ethernet across fibre is a key reason why CPs currently undertake major civil works to allow installation of their own duct and fibre networks. The ability to utilise BT's infrastructure would minimise the requirement for civil work and would therefore minimise disruption to local communities.[476]

A23.21 It its response, Colt stated that with passive access CPs would not be dependent on BT to put in place various customer benefits relating to service innovation. In general, it stressed the overall benefits of having greater flexibility to offer customers varying commercial terms and pricing structures as a point of competitive differentiation. In particular, Colt pointed out the ability to develop and offer different service levels and other combinations of features in its product offerings. It admitted that the only constraint in this respect would be the extent of problems in relation to the passive elements purchased from BT, such as the duct itself. Colt added that CPs could compete by offering quicker changes to products or by scheduling maintenance downtime taking into account the specific needs of their customers. [477]

A23.22 In contrast, BT claimed that competition based on the use of active products already allows operators to differentiate their services and the SoR process enables CPs to request additional products.[478] BT questioned the technological innovation potential of passive remedies, arguing that the assertion that passive remedies would allow competing CPs to introduce other technologies faster or more effectively needs more careful consideration and does not stand up to scrutiny. BT believed that passive products would only lead to greater innovation in areas where passives are able to increase competition. However, it did not consider there to be a lack of competition within business connectivity markets and neither did it see the introduction of passive remedies being capable of leading to a step increase in competition.[479]

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[474] See Frontier Economics report, paragraph 58, page 18.

[475] See Frontier Economics report, paragraph 39-49, page 12-15.

[476] For more details see [✂ ✂]

[477] See Colt non-confidential response to the CFI, page 32-33.

[478] See BT non-confidential response to the CFI, page 26.

[479] See BT non-confidential response to the CFI, page 27.

A23.23 In addition, BT argued that it is an innovative company and has a strong track record of developing new products (at both the retail and upstream levels). It claimed that CPs directly benefit from this innovation by being able to purchase products on an EOI basis under the Undertakings from Openreach's network.[480]

A23.24 The majority of respondents who were in favour of passive remedies argued that they would enable them to expand their network reach and as such extend the geographic reach of infrastructure competition:

- Sky believed that passive remedies could allow CPs to expand network capacity in current on-net areas without repeated upgrade costs as well as invest and innovate to expand the scope of services offered, similar to the investment in LLU. It also said that similar to LLU, it should not be considered necessary to identify the sources of innovation resulting from passive remedies at this stage.[481]

- Colt noted [✂

✂][482]

- UKCTA members envisaged using passive remedies to extend the reach of their network geographically by allowing them to construct (for example) fibre networks in cities.[483]

A23.25 In this context, both BT and Virgin Media however noted the possibility that passives will only enhance competition in areas where competition already exists, rather than extending the geographic reach of competition. BT argued that infrastructure competition is currently possible based on active remedies and it is not clear that passive remedies would increase network-based competition overall. It stated that Ofcom should investigate whether passive remedies would actually extend competition to areas where there is none, or whether in fact this would only increase competition where it is already effective.[484]

A23.26 In the CFI we also asked the respondents about how valuable the innovation benefits of passive remedies would be and whether they would be sufficient to choose passive remedies if there was no overall cost advantage compared with active remedies (i.e. if the price of the passive remedy was exactly equal to the price of the active remedy less the cost of the network components that you would need to provide). We received several responses:

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[480] See BT non-confidential response to the CFI, page 27.

[481] See Sky non-confidential response to the CFI, paragraph 5.4-5.5, page 4.

[482] See Colt confidential response to the CFI, page 31 and Annex A.

[483] See UCKTA response to the CFI, page 10.

[484] See BT's non-confidential response to the CFI, page 24-25 and Virgin Media's non-confidential response to the CFI, page 7.

- Verizon considered [✂

✂][485]

- Colt was of the view that it and other CPs may use duct access even in cases where there would be no overall cost advantage compared to active remedies. Colt would consider duct access in the event that customers require on-net service delivery but are unable to get the same price and service from BT or where the risk of delivering off-net SLAs is greater than delivering on-net SLAs.[486]

- UKCTA said that the question is about whether there are other benefits that would remain even in the absence of the cost advantage. It emphasised that its members' customers sometimes pay their service provider to undertake significant new network construction, just for the benefit of receiving the service on-net. If network construction were cheaper, more customers would find it worthwhile to ask their CPs to undertake it. UKCTA noted however that a remedy applied in this manner, would effectively rule out a vast proportion of the potential dynamic benefits potentially on offer, particularly those that would result from CPs being able to sell in the market based on their own economic model rather than BT's.[487]

Improvements in service quality

A23.27 While recognising that CPs would be reliant upon Openreach service provision and fault repair, Vodafone was of the view there is much more that can be offered. As an example, it said that access to dark fibre and the ability to install ADVA boxes would allow it to undertake proactive fault management, which has not been agreed with Openreach through the SoR process.[488]

A23.28 Frontier Economics also identified benefits around improved quality. More specifically, the ability to diagnose and repair faults more readily, invest in equipment which lowers the propensity of lines to fault and compete on other dimensions of quality such as product characteristics or customer service.[489]

A23.29 Verizon [✂

✂]. [490]

[485] Verizon, confidential response to the CFI, question 17.

[486] See Colt non-confidential response to the CFI, page 38-39.

[487] See UCKTA response to the CFI, page 11.

[488] See Vodafone non-confidential response to the CFI, page 20.

[489] See Frontier Economics report, paragraph 39-49, page 12-15.

[490] See Verizon confidential response to the CFI, response to question 12, 13, 16.

A23.30 Colt claimed that passive remedies would provide service innovation in fault detection, as with more control, CPs will be better able to identify the origin of the fault and communicate promptly with its customer.[491]

A23.31 BT on the other hand pointed out the challenges associated with the use of passive remedies. It said that the introduction of passive remedies could make it more rather than less challenging to improve service levels.[492] In relation to duct access it said that not all stretches of duct would accommodate new sub-duct and the "tree" architecture of BT's infrastructure may be incompatible for use in networks with alternative basic designs such as rings.[493] BT also believed that there would be similar technical complexities associated with dark fibre, e.g. additional fibre and sub-duct may be needed or repeaters could be required beyond a certain distance.

A23.32 In addition, BT argued that dark fibre would not provide the same fault monitoring capabilities as active remedies, in terms of the speed with which faults are identified and subsequently repaired. As such, it views that dark fibre as a passive product would compromise its ability to maintain and deliver its minimum standards of QoS.[494] It also argued that passive remedies are likely to make fault finding and resolution longer, more complex and costly.[495]

Innovation in network design

A23.33 UCKTA members argued that duct access is of the greatest use when a CP wishes to configure its own topology or route. They noted that CPs in other jurisdictions (where the applicable remedy is available for this purpose), use duct access to construct metropolitan fibre networks by linking duct segments that already exist.[496]

A23.34 Vodafone stated that passive access could provide the ability for networks to be configured independently from BT's architecture and would avoid unnecessary duplication of BT's network design.[497] Vodafone saw network innovation benefits due to the fact that network could be configured optimally to their customer base.[498]

A23.35 Colt stated that a duct access remedy would allow the deployment of local fibre rings, instead of following BT's traditional tree and branch network architecture. Colt claimed that configuring its network in this way could deliver efficiency (because it allows more customers to be accessed from any given trench or cable length) as well as resilience benefits.[499]

A23.36 Colt argued that the evolving market may require changes to the structure and architecture of backhaul networks. It said that the ability for CPs to optimise

[491] See Colt non-confidential response to the CFI, page 32-33.

[492] See BT non-confidential response to the CFI, page 18.

[493] See BT non-confidential response to the CFI, page 22.

[494] See BT non-confidential response to the CFI, page 22-23.

[495] See BT non-confidential response to the CFI, page 26.

[496] See UCKTA non-confidential response to the CFI, page 9.

[497] See Vodafone non-confidential response, page 20.

[498] See Vodafone non-confidential response to the CFI, page 20.

[499] See Colt non-confidential response to the CFI, page 33.

backhaul services to meet their own needs is severely restricted under the current framework, due to the active backhaul services available for purchase from BT being limited in range, infrastructure type and location.[500] According to Colt, absence of passive access would further prevent any real innovation in network configuration and the benefits such innovation would bring, as it would force CPs to deploy their networks in a similar way to BT's legacy architecture and therefore prevent them from deploying alternative network infrastructures. Colt believed that if CPs had access to passive infrastructure for deploying leased lines, it would definitely change the way networks are deployed.[501]

A23.37 It further stated that [✂

✂].[502]

A23.38 Colt also believed that passive access would result in technology innovations and CPs could be using passive access to develop, trial and use new technologies.[503] It also gave description of [✂
✂][504]

A23.39 In terms of network innovation benefits, BT said that it was not clear how passive access would allow competing CPs the ability to configure networks in different ways. It said that BT's duct has been built using a particular architecture and if CPs wished to use alternative approaches they would need to build their own passive infrastructure. It did not think that an operator using ring architecture would be able significantly to recreate that with individual stretches of BT's own passive network. [505]

Stakeholder responses to the November Consultation

A23.40 In response to the November Consultation, most stakeholders argued that passive remedies would promote innovation and investment, while others argued that the risks to dynamic efficiency would be significant, which we discuss further in Annex 24). We first set out a summary of responses in support of dynamic benefits and then those raising concerns in relation to dynamic efficiency.

Responses in support of dynamic benefits

A23.41 TalkTalk believed that a dark fibre product would increase competition and innovation, through exposing more of the value chain to competition and allowing

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[500] See Colt non-confidential response to the CFI, page 38 and 33-34.

[501] See Colt non-confidential response to the CFI, page 34.

[502] Colt confidential response to the CFI, page 34.

[503] See Colt non-confidential response to the CFI, page 34.

[504] Colt confidential response, page 34.
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[505] See BT non-confidential response to the CFI, page 26.

CPs greater control of products than is possible using Openreach's active Ethernet products.[506]

A23.42 TalkTalk had three main comments on innovation. First, it did not consider that Ofcom needs to identify specific innovations that will occur as a result of passives but rather that there are potential innovations that *could* be brought to the market earlier by introducing dark fibre. Second, TalkTalk argued that allowing competitors to innovate will result in more and earlier innovations for several reasons. For example, rivals are able to gain first mover advantage and so there will be stronger incentives to innovate. In addition, it avoids coordination and transaction costs thereby allowing more innovation. Moreover, Openreach may reject requested innovations that would be pursued by competitors. Competition for innovation will increase the pressure on Openreach to innovate. Third, TalkTalk argued that Ofcom has focused on technology innovations and overlooked innovations related to pricing/new pricing structures (e.g. usage based tariffs and burstable speeds) as well as process and quality innovations (e.g. lower fault rate, more rapid repair).[507]

A23.43 In terms of quality of service, TalkTalk argued that the majority of faults occur in the active layer and so significant quality benefits may happen. It added that this was ignored by Ofcom's note that dark fibre remedies would not effectively address all of the quality concerns since most provisioning problems do not relate to the active layer.[508]

A23.44 Sky argued that unconstrained access to BT's ducts, poles and dark fibre, will enable CPs to deploy their own cable and/or active equipment to configure flexible and efficient networks which are significantly less constrained by BT's network topology. This, in turn, will enable the delivery of services that put CPs' customers first rather than bending customer requirements to fit around BT's fixed network topology, product specifications and pricing. As a result, this will bring greater product differentiation, choice, quality and lower prices to customers.[509]

A23.45 Sky added that service quality in particular can be expected to improve. Poor service performance has been persistent and BT has very limited incentives to improve. Access to passive infrastructure and investment in alternative infrastructure will give CPs greater control over service quality, and hence a further product characteristic upon which to compete with Openreach's active products. [510]

A23.46 Telefonica argued that greater connectivity, including flexibility of connectivity (not strictly bounded to BT Exchanges or Openreach defined connectivity products) will enable CPs (including BT) to evolve and deliver data services independent of active components. This could simplify Openreach's product portfolio and operational methods, being able to focus upon delivery and performance around the duct, fibre and access components of the network. It added that the UK mobile industry is moving forward very rapidly, with growing interest in new applications (e.g. broadcast), support for the emergency services via commercial mobile operators

[506] See TalkTalk non-confidential response to the November Consultation, page 1, paragraph 1.3.

[507] See TalkTalk non-confidential response to the November Consultation, page 12,13, paragraphs 4.7-4.9.

[508] See TalkTalk non-confidential response to the November Consultation, page 14, paragraph 4.14

[509] See Sky non-confidential response to the November Consultation, page 3, paragraph 3.5.

[510] See Sky non-confidential response to the November Consultation, page 3, paragraph 3.6.

(ESN), technologies such as Cloud RAN and further spectrum auctions (e.g. TDD bands), combined with the potential market consolidation, demand for fibre connectivity and differentiation of backhaul services and capability is emerging. Passive remedies could allow CPs to develop and deploy services and capabilities with less dependency on the traditional Openreach service and product development driven approach (SoR).[511]

A23.47 Vodafone said that fibre availability and the ability to bypass cumbersome BT SoR processes would spur innovation in fast growing parts of the market for instance very high speed backhaul services (10Gbps and above), Software Defined Networks, Carrier Ethernet Networks as a Service (Naas) which would allow customers to dynamically configure their services. Vodafone added that although Ethernet is today's favourite network technology, it is not certain what it will be in a decade or two. But forcing CPs down the active route means CPs are inherently locked into BT's technology choices which will ultimately stifle innovation when the next "big thing" comes along.[512]

A23.48 In addition, Vodafone believed that infrastructure control would allow CPs to minimise coordination with BT in service delivery, testing and fault management, which leads to a better quality of service.[513]

A23.49 EE, Three and MBNL argued that by imposing regulated access to Openreach's physical network – both dark fibre and ducts, Ofcom can foster effective competition in backhaul by enabling more extensive competition along more of the value chain. They added that greater competition in backhaul provision, created through passive remedies, would increase innovation by allowing CPs to configure and deploy their own equipment to better suit their customer's needs. The availability of better quality products in the market may also put pressure on all operators (including BT Openreach) to innovate, driving greater dynamic efficiency.[514]

A23.50 UKB Networks considered that remedies such as dark fibre would encourage innovations in a variety of products, including the innovative mobile and fixed wireless products and services it offers and continues to develop. These products are differentiated from those which BT and the resellers of BT's managed services offer today. They disagreed with our statement in the consultation that "even with duct access, some of the factors that affect Openreach's quality of service would also affect CPs" as this does not necessarily apply on a per customer connection basis, for example where the access network is built by the alternative CP not using BT's network. [515]

A23.51 Six Degrees Group mentioned that one of the primary benefits that may emerge is the ability of communication providers to innovate with products that utilise the passive solutions and the lead time associated with solution deployment as Openreach can hand over faster by avoiding the need for the active elements fit and test of the provisioning process. The Openreach product development cycle

[511] See Telefonica non-confidential response to the November Consultation, paragraph 9-11.

[512] See Vodafone non-confidential response to the November Consultation, page 18.

[513]See Vodafone non-confidential response to the November Consultation, page 18.

[514] See EE, Three and MBNL non-confidential response to the November Consultation.

[515] See UKB Networks non-confidential response to the November Consultation, page 2.

and statement of requirements (SoR) process mean that new products or variants on existing products are often extremely slow to reach the marketplace or not provided at all. This places operators who rely on Openreach in the position of not being able to offer the same product set nationwide, as they cannot replicate the services available from competitive carriers in some regions or the products they can develop where there is availability of passive products.[516]

A23.52 Six Degrees Group added that there are service benefits that can be offered to the customer for example circuit bearer upgrades would become the sole responsibility of the CP, rather than requiring Openreach and the CP to co-ordinate to upgrade both parts of the service, giving more flexibility to the customer regarding timing. Given the current state of network equipment the default underlying bearer speed is likely to rise, which opens the possibility of more flexible bandwidth products. Also there is scope for higher density handover of products at exchange sites leading to space savings in footprint. This is important to help ensure that footprints remain available to new entrants into exchange sites. Removing the active equipment would also help avoid situations such as the current introduction of the Openreach "2nd Vendor" project where CPs are reluctant to redevelop their OSS systems to support a new EAD implementation from BT that is primarily being introduced for security of supply.[517]

A23.53 Broadly INCA members favoured greater infrastructure competition in both the access and backhaul networks. Passive remedies offer an opportunity to facilitate infrastructure competition and improved services in rural areas where those building rural networks face the challenge of gaining access to affordable backhaul that meets their needs. It considered that companies like IFNL have put forward cogent arguments as to why lack of access to affordable backhaul holds back their ability to deploy Fibre to the Home (FTTH) in new building developments.[518]

A23.54 CityFibre said that it shared many of Ofcom's views on the potential benefits of passive infrastructure, in particular the dynamic efficiencies. [519] It said that whilst deeper access to BT's infrastructure may reduce the barriers to CP's investing further, investment will be at the service layer (through active components and systems) and not at an infrastructure layer (duct and fibre). It argued that investment in duct and fibre infrastructure is of higher critical importance to the longer-term well-being of the UK's digital infrastructure. CityFibre stressed that passive remedies potentially hinder investment in duct and fibre infrastructure in the short to mid-term.

A23.55 Cityfibre considered that availability of passive infrastructure transitions more components of the value chain to CPs, potentially allowing for CPs to reduce retail pricing to consumers. It warned, however, that care must be taken not to undermine the investment case for new duct and fibre build.[520]

[516] See Six Degrees non-confidential response to the November Consultation, page 4.

[517] See Six Degrees non-confidential response to the November Consultation, page 4.

[518] See INCA non-confidential response to the November Consultation, page 3.

[519] See CityFibre non-confidential response to the November Consultation, page 7.

[520] See CityFibre non-confidential response to the November Consultation, page 7.

A23.56 WarwickNet said that it already provides services via dark fibre and it considered that there are tremendous benefits over the equivalent managed Ethernet services (EAD, etc.) which include: [521]

- Ability to deploy passive WDM solutions on top of DF to deliver parallel and resilient services at no extra cost.
- Quick and easy to scale capacity.
- Removal of dependence on BT equipment that sometimes has technical limitations (such as frame size - though this isn't generally an issue with EAD).
- Removal of points of failure, for the CP this enables us to quickly identify a problem as being with the DF provider - for the DF provider though it can mean a more challenging troubleshooting process as they lack active equipment on the line.

A23.57 FCS mentioned that the more competition is allowed into the market by virtue of passive remedies, the more their members will be able to provide the bespoke services that their customers demand. FCS members need to have greater flexibility to offer new services and move away from the standard BT product set and service standards. It added that providers are looking for new ways to deliver high speed fibre services, as demonstrated by the joint project between Sky, Talk Talk and Cityfibre in York, which is being delivered with no Openreach involvement. Many independent smaller projects are being delivered by alternative network operators around the UK, offering greater flexibility for commercials and SLAs to meet customer requirements.[522]

A23.58 Level 3 agreed with Ofcom's preliminary thinking around potential benefits, including prospects for innovation. It added that there may be additional benefits such as the possible creation over time of a genuine carriers' carrier market for fibre- and wavelength-based access services which could enhance both the dynamic and productive efficiency elements.[523]

A23.59 The PAG argued that the current regulatory framework does not provide BT with strong incentives to innovate in the provision of active services.[524] As a result the

[521] See WarwickNet non-confidential response to the November Consultation, page 2.

[522] See FCS non-confidential response to the November Consultation, page 1.

[523] See Level 3 non-confidential response to the November Consultation, Q.2.

[524] Where BT has SMP:

- charge controls allow BT to make a reasonable return on relevant assets, subject to meeting efficiency targets, independently of the level of innovation;

- BT may be wary of introducing additional services, due to the risk that these products may be partial substitutes for existing products with relatively high margins;

- the relatively short duration of charge controls, driven by the market review process, and the process through which charge controls are set, where Ofcom does not actively scrutinise and approve BT's investment plans, means that BT's investments in innovation are likely to require a short pay-back period in order to increase BT's profitability;

capabilities of the services offered by Openreach tend to lag those offered by competitors in those areas where there is (limited) competing infrastructure. Allowing CPs control over more of the value chain can lead to better outcomes for end users as CPs would have more freedom to innovate, rather than relying on product specifications determined by BT. Product innovation can be on a number of dimensions: new products and enhancements to the capabilities of existing products; pricing; and quality. [525]

A23.60 The PAG added that the type of thriving infrastructure-based competition that has been able to develop on a commercial basis in central London, and has developed on a more widespread basis in other countries in countries that have implemented passive remedies by virtue of regulatory intervention, demonstrates that (when pricing incentives are set appropriately) CPs do not merely replicate pre-existing services and exploit arbitrage opportunities, but invest to deliver differentiated services that are designed to meet the varying needs of heterogeneous business customers. [526]

A23.61 Colt argued that Ofcom did not discuss Colt's approach to use duct access to build city fibre rings and whether it would offer tangible benefits in the UK market context. It added that a truly open and inquiring approach would have investigated the potential benefits of this model, firstly for different types of business customers in different regions, and for adjacent markets (such as mobile and residential broadband).[527]

A23.62 Colt said that it is able to offer specialist services to customers such as low-latency services, superior SLAs and advanced network monitoring services. It further added that these are available on-net but not off-net and that due to the lack of passive infrastructure access in the UK, the geographic availability of different grades of service is fixed in time and in place. They are available in Central London and parts of East London, and not elsewhere. Colt argued that Ofcom has not taken account of the possible demand for such services outside London.[528]

A23.63 Colt pointed out that there are many fibre not-spots in the UK and that there is some evidence to suggest that BT has deliberately avoided rolling out its FTTC network to certain areas (particularly business parks) to avoid leased lines market cannibalisation. It was of the view that BT has therefore created a major gap in the market. In other EU countries Colt specialises in exploiting these gaps, but is unable to do so in the UK. In other EU countries, Colt offers contended Fiber To

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- Openreach has little incentive to incur costs to offer additional services or capabilities that BT's downstream divisions will not make use of; and

- charge controls do not take account of improvements in wholesale service quality, encouraging BT to minimise costs by maintaining existing services even where additional functionality (for example improved network management capabilities) are available.

[525] See the PAG non-confidential response to the November Consultation. Cover sheet page 11 and Annex B (Frontier Report), section 1.3.

[526] See the PAG non-confidential response to the November Consultation, Annex A (Towerhouse Report), paragraph 2.22

[527] See Colt non-confidential response to the November Consultation, page 1.

[528] See Colt non-confidential response to the November Consultation, page 3.

The Office (FTTO) solutions over fibre rings to business parks that are cheaper (by far) than leased lines and better quality (by far) than residential grade FTTC.[529]

A23.64 Some respondents argued that although passive remedies would allow them to replicate services or technologies used on other networks, they would also open up the potential for future innovations not yet considered. For example, TalkTalk did not believe it was necessary to identify specific innovations that will occur as a result of passive remedies, as this would involve speculating on operator strategies and market outcomes.[530] Similarly, Vodafone argued that it is impossible to know how network technologies will evolve over the next decade, but relying on active remedies means CPs are inherently locked into BT's technology choices.[531]

Responses raising arguments against dynamic benefits

A23.65 BT, KCOM and Virgin did not agree with Ofcom's preliminary views on the potential benefits of passive remedies and stressed negative impacts on CPs and customers from a move to passive remedies. In terms of the dynamic efficiency benefits, BT and KCOM could not see any evidence that provision of passives would result in any material innovative service downstream of Openreach which could not be achieved by active services. [532, 533] Similarly, Virgin considered that if there are material incremental innovation benefits from access to passives (which they doubt) then these can also be garnered from an improved SoR process.[534]

A23.66 BT also doubted that passive remedies would lead to faster and/or greater levels of innovation by either CPs or Openreach. BT argued that passive products would reduce economies of scale and scope that Openreach is currently able to bring to product delivery, and risk chilling downstream CPs innovation incentives in the infrastructure and connectivity domains. Under a passive regime, CPs would face a smaller addressable market over which to recover the costs of innovation, and there is no evidence to suggest that time to market would be significantly reduced. Key hurdles such as standards development, equipment lead times and systems developments would remain.[535]

A23.67 In relation to the benefit of the supply of differentiated downstream service technical features, BT said that its active services are designed to allow a wide range of services downstream with very different technical features. BT added that if any downstream services hampered by the current range of Openreach Ethernet and optical services exist, then they are likely to be limited to highly niche customer markets and at sites which would likely be located in competitive footprints in any case.[536]

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[529] See Colt non-confidential response to the November Consultation, page 3.

[530] See TalkTalk non-confidential response to the November 2014 consultation, p. 12

[531] See Vodafone non-confidential response to the November 2014 consultation, p.18

[532] See KCOM non-confidential response to the November Consultation, page 1.

[533] See BT non-confidential response to the November Consultation, Annex 4, page 89.

[534] See Virgin Media non-confidential response to the November Consultation, page 25

[535] See BT non-confidential response to the November Consultation, Annex 4, page 107.

[536] See BT non-confidential response to the November Consultation, Annex 4, page 89-90.

A23.68 BT accepted that passive services would have some advantages for CPs including ability to scale up capacity more quickly and without reliance on BT equipment. However, it considered the benefit of greater speed of upgrade as minor in practice as CPs will typically plan upgrades in capacity and have excess capacity available at a point in time. It noted that removing their reliance on BT equipment also has adverse effects as it raises complex issues of monitoring and fault repair.[537]

A23.69 BT also disagreed with TalkTalk and Colt that active products limit their choice of layer 1, 2, and 3 protocols, arguing that Openreach's active products affect only layer 1 with CPs having freedom to choose their protocols at other layers.[538] BT doubted that there will be a serious possibility that new layer 1 processes or protocols, which are not in the Openreach portfolio, might arise such that dark fibre would be an attractive proposition for CPs.[539]

A23.70 BT was of the view that if C-RAN was the only identifiable example of potential innovation following the imposition of passive remedies then it is not sufficient justification to impose such a remedy.[540] BT noted that:

- C-RAN was just one of a range of mobile architecture solutions currently being considered by mobile operators;
- the Common Public Radio Interface (CPRI) discussed by Ofcom in the November Consultation is one of a range backhaul solutions being considered for C-RAN;
- CPRI is compatible with WDM and Ethernet services and therefore does not require a dark fibre remedy; and
- The potential economies of C-RAN could be achieved using active remedies.

A23.71 BT considered that there are potentially more efficient long term solutions based on active products which can be considered. It added that Openreach is in the process of assessing MNOs needs and actively discussing potential development options with vendors with international experience in this area.[541]

A23.72 BT argued that the introduction of passive remedies would not have a positive impact on service quality and that the greater complexity in provision which would arise would make the situation worse. It stressed the importance of line monitoring and fault repair saying that the removal of monitoring capability for Openreach would worsen fault repair.[542]

A23.73 BT argued that Openreach had kept pace with industry requirements and where for example it had not implemented certain services it had not been economic to do so.

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[537] See BT non-confidential response to the November Consultation, Annex 4 page 90**.**

[538] See BT non-confidential response to the November Consultation, page 96, Annex 4.

[539] See BT non-confidential response to the November Consultation, page 30.

[540] See BT non-confidential response to the November Consultation, page 67.See also Section 5 and Annex 1.

[541] See BT non-confidential response to the November Consultation, page 30-31. See also Annex 1.

[542] See BT non-confidential response to the November Consultation, page 67. See also Section 5 of its response**.**

It pointed out that it could be the case that one CP sees a solution which would suit its particular requirements but would require significant costs which would have to be recovered from the wider CP community. It further added that that Openreach has every incentive to provide innovative services through the EOI processes not merely from regulatory obligation but also critically BT itself is a major downstream player in direct competition with all other CPs throughout the UK. [543]

A23.74 BT admitted that the SoR process may have its limitations in terms of speed and not allowing First Mover Advantage. It argued, however, that there are inevitable tensions between CPs and Openreach as to who should bear development risk and also between CPs themselves some of whom may not want Openreach to develop something which will help their rivals. BT said that passive remedies would increase the potential for disputes in three ways:

- They put Openreach in direct competition with CPs who will arbitrage where commercially incentivised to do so and it will not be possible to remove such opportunities through changing active prices.
- Any loss of ability for Openreach to monitor where faults are occurring will potentially lead to litigation and disputes.
- The SoR process itself will come under severe strain.[544]

A23.75 BT said that as a consequence of passive remedies Openreach would be put into a very different commercial position if it were to be placed in direct competition with CPs for the provision of active services. Passive remedies would increase both the overall level of risk associated with innovation and change the balance between different players. BT identified three potential impacts on Openreach:[545]

- Given the uncertainty of demand, Openreach would have to consider it less likely that certain services which are borderline for development would be less viable to be taken up.
- To the extent CPs take passive services and are active in a merchant market, the transparency in the current processes will be put under severe strain. Openreach cannot be put in the position of taking risks of development and service upgrade for CPs to be allowed the options to self-supply but if that fails, then to free-ride on the developments by then purchasing active services which will be paid for by others.
- **[✂**

✂][546]

A23.76 In relation to Colt's point about the ability to build access rings, BT stressed that such a solution could not be considered as a simple extension of the current PIA

[543] See BT non-confidential response to the November Consultation, Annex 4 page 90-91.

[544] See BT non-confidential response to the November Consultation, Annex 4 page 112.

[545] See BT non-confidential response to the November Consultation, Annex 4 page 91-92.

[546] See BT confidential response to the November Consultation, Annex 4 page 96.

remedy beyond NGA to business services. BT said that it would require a complete new set of operational processes and reference offer. The current PIA offer is to supply a single CP with complete duct routing for NGA systems with little or no interconnection to competitive duct and which would follow exactly the same basic topology and system architecture as Openreach itself would use for NGA.[547]

A23.77 BT argued that for Colt to be able to build access rings in accordance with their access topology architecture they would need to be highly selective in the duct sections they use and they would have to interconnect their own duct build with the manholes/surface boxes on the ends of these sections. It added that Colt could never avoid own duct build altogether, and the interconnection between Colt's, and every other CP's duct infrastructure would occur at a very large number of random points. [548]

A23.78 In BT's view, Colt's proposal is potentially hugely more complex involving: multiple CPs; ad hoc short sections of duct; large scale duct interconnection; and the installation of systems to a completely different topology and system architecture to that which Openreach would use for itself. It also argued that this solution can only realistically address a small proportion of the overall business connectivity market. Colt and other CPs are already free to build their own duct to any customer with all the advantages of full vertical integration. This solution is only relevant to those sites where Colt, and other CPs, have currently decided it is uneconomic to build their own duct. But it does not replace the need for the CP to build, it only gives a marginal reduction in the amount of build that would be needed.[549]

Our analysis

A23.79 Below we consider the scope for passive remedies to give CPs the ability to use different technologies or offer different service levels and features from those available under BT's existing active remedies (i.e. deploy a different technology or network design) or do something very similar in technical terms, but to differentiate in other ways (e.g. offer improved service levels). This analysis draws on our assessment of the scope for innovation with passive remedies in Annex 27, particularly our analysis of the Openreach SoR process.

Product and service innovation

A23.80 Under the current framework, Openreach operates the SoR process which enables CPs to formally request the introduction of a new product or a change to an existing one. The SoR process in tandem with other obligations such as EOI and information sharing rules makes new products and developments simultaneously available to all CPs including BT. While this provides protection against the risk of Openreach discriminating in favour of downstream BT businesses, the concern is that it limits the scope for differentiation and therefore limits the incentive for innovation.

A23.81 In Annex 27, we provide an overview of the SoR process, and an assessment of its effectiveness in bringing new products and service features to market in a timely

[547] See BT non-confidential response to the November Consultation, page 118.

[548] See BT non-confidential response to the November Consultation, paragraph 35-36, page 95.

[549] See BT non-confidential response to the November Consultation, page 118.

fashion.[550] We have found that since 2006, just below one third of requests have been successfully developed, with the majority of the remainder either cancelled (usually at the initiator's request) or rejected by Openreach. Of those which have not been delivered, we consider that 27% (or 16% of the total number of SoR requests) could have been developed by CPs themselves with a passive remedy: duct access or dark fibre. We note that this does not mean that these services would necessarily have been developed; rather, it highlights the potential for passive remedies to give CPs the choice of whether to develop those services or not. It is possible that the development costs for an individual CP to develop a solution for its own network may be lower than those for Openreach to develop for the industry, making some requests viable.

A23.82 Our analysis also shows that some requests take several years to develop. Of the SoR requests that were developed between 2006 and 2014, on average, it took Openreach around 17 months from submission to delivery. In some cases, the development time has taken up to five years. In addition, ten requests were still in development, five of which had been in development for more than four years. While there is a significant variation between the type of developments, it is likely that the need to reach an agreement among several CPs, as well as making the development available to all CPs, means that the process results in increased development timescales. The lengths of these timelines are of potential concern especially since the market is developing rapidly.

A23.83 We recognise that this may simply reflect an incentive alignment problem either between BT and other CPs, or between CPs where BT is required to make any new functionality available to all downstream customers. BT argues that often the problem is that the downstream CPs do not want to pay for a new service or innovation that they want implemented, whereas the CPs argue that BT is unwilling to invest in new services. It is understandable that BT will be unwilling to invest in new technology or services when the downstream parties that are likely to gain the benefits will not underwrite the investment (e.g. through minimum purchase guarantees or similar arrangements). Similarly it is understandable that a downstream CP will not want to bear the risk of investing in a technology that will be immediately available to its competitors.

A23.84 While current regulations enable CPs to request additional products or capabilities, this may not always provide the flexibility CPs or end customers would want. The extent of innovation and service improvements seems to be limited because active products do not offer CPs complete end-to-end control, limiting CPs flexibility to differentiate their services. For example, in response to the CFI and our November Consultation, some stakeholders highlighted features which they do not have on BT's network, but they could implement if they had the scope to install their own electronics and/or fibre using passive remedies. We have summarised these features in tables A27.11 and A27.12 in Annex 27.

A23.85 Overall, we consider that availability of passive remedies is likely to increase innovation by allowing CPs to configure and deploy their own equipment to better suit their customers' needs. Passive remedies would allow CPs to make technology choices and upgrades independently of BT such as Ethernet functionality to deliver

[550] Please see further detail in Annex 27. Our analysis is based on the SoR dataset submitted by Openreach on 11/11/2014. Subsequent changes or updates to the SoR data are not reflected in our analysis.

lower latency or synchronisation, or different ways of managing their networks, such as Software Defined Networking. CPs could use and control their own choice of network equipment and introduce the features they want such as having more visibility of fault monitoring and repair.

A23.86 We note that BT, KCOM and Virgin doubted that there are any material benefits from access to passive remedies which could not be achieved by active services, including an improved SoR process. Although CPs could request that Openreach develop new active products or provide enhancements, we consider that passive remedies have the advantage of giving CPs the sole responsibility for such developments, rather than requiring Openreach and CPs to coordinate. In particular, the SoR process is designed to allow for a simultaneous availability to all CPs and while it addresses BT's ability and incentive to engage in discriminatory practices, it does not offer CPs a competitive advantage. Any amendments to the SoR process which would allow a degree of differentiation would likely need a relaxation of the EoI obligation. This in turn is likely to reduce the effectiveness of such arrangements and raise concerns around discrimination in favour of BT's downstream businesses. In addition, any improvements to the process would be unlikely to offer the flexibility available with passive remedies.

A23.87 We do not seek to take a view as to the specific innovations that would occur with passive remedies. Rather, we recognise that in principle access to passive inputs would give CPs the flexibility to differentiate, innovate and upgrade without being dependent on BT. While there is not one major technology or application which CPs use universally in their networks, and which is not provided by BT, we see that CPs have adopted a range of different approaches to technology choices and deployment options. The current development processes may constrain CPs choices at the time when the market is progressing rapidly. We recognise that a wide range of future innovations may emerge and that passive remedies would allow CPs greater flexibility to develop these faster. They could open pathways for developments without relying on BT. CPs would also have the opportunity to proceed faster with the developments or improvements of their choice.

A23.88 It is in this context that in the November Consultation we cited recent developments in Cloud Radio Access Networks (C-RAN). These provide an example of an emerging application that could arguably be deployed more quickly if CPs had access to passive remedies. In particular, as explained in Figure 1 in the November Consultation, C-RAN is not compatible with current Ethernet product range so a CP wishing to use it with active remedies would need to ask BT to develop a new wholesale product via the SoR process.

A23.89 We recognise BT's point that C-RAN "may not require dark fibre and is only one of several potential future development paths for mobile networks"[551] and that there are potentially more efficient long term solutions based on active products which can be considered. While the C-RAN technology may or may not be adopted, and may or may not need dark fibre, it provides an example of the way that passive remedies would provide CPs with more flexibility to consider if they want to invest in and deploy different technologies. For example, the deployment of LTE-Advanced networks means that demand for solutions alternative to those currently offered by Openreach to deliver high-capacity is likely to grow. With passive remedies, individual CPs could make their own decision about whether to deploy a

[551] See BT's non-confidential response to the November Consultation, page 7.

technology such as C-RAN and when to deploy it, independently of the views and development timescales of BT.

A23.90 TalkTalk argued that we overlooked innovations related to pricing/new pricing structures such as: usage based tariffs; burstable speeds; pre-upgrade; different contract terms; different minimum term; balance of connection and rentals.[552] In general, we do not consider that such benefits are unique to passive remedies. In general, if every CP shares the same basic input costs, then competitive pricing innovation could be based on the added value of the CP between the upstream input service and the downstream service.

A23.91 We recognise however that innovative service differentiation is a function of both technical characteristics and price. Access further upstream adds to the ability to control downstream product specification as well as the ability to have more control over downstream prices. As the recurring rental charges for passive remedies would be likely to constitute the most significant element of a CP's marginal costs, they may act as a constraint on downstream pricing. To the extent that passive access results in a lower per circuit recurring charge, this could create greater scope for CPs to adopt alternative pricing models.

A23.92 BT pointed out that as a result of passive remedies, Openreach may be in a different commercial position where it would be in direct competition with CPs for the provision of active services. However, we do not consider that this would increase the overall level of risk associated with innovation. Quite the contrary, we consider that increased competition in the active layer from CPs using passive remedies could actually incentivise BT to innovate in active circuits, in order to maintain active volumes .

A23.93 In relation to BT's argument that passive remedies would reduce economies of scale and scope that Openreach is currently able to bring to product delivery, and would risk reducing downstream CPs' innovation incentives in the infrastructure and connectivity domains, we expect that CPs would be able to compete in the active layer (including by introducing innovations) as a result of access to passive remedies. Many CPs are multi-national organisations with experience of operating active services. In addition, we understand that various CPs already take advantage of dark fibre available from other infrastructure providers such as Zayo or CityFibre. Therefore not having such active-specific innovation available from BT should not necessarily undermine competition in the active layer in the long term, or lead to adverse consequences for end users since other CPs would be able to invest in the active layer (and could do so either directly for themselves, or to wholesale to other CPs).

A23.94 We acknowledge BT's point that smaller CPs may not be able to consume passive inputs in the same way and at the same scale as larger CPs. To the extent that the economies of scale are important in the use of passive remedies, we recognise that this may lead to some market consolidation. We consider that the extent to which it happens is likely to be affected by the form of a remedy. In particular, the up-front costs incurred by competitors using duct access would generally be higher than the costs incurred when using dark fibre. As pointed out by Telefonica[553] duct requires CPs to have the processes, mechanisms and skills to install physical cables.

[552] See TalkTalk non-confidential response to the November Consultation, paragraph 4.9, page 13.

[553] See Telefonica, non-confidential response to the November Consultation, response to Q. 6.

Therefore we expect that the benefit from having access to ducts, may be limited to CPs who already have the right expertise, and may disadvantage smaller CPs who do not have such skills. In contrast, the cost of using dark fibre would be much lower offering the small scale CPs more scope to take advantage of passive inputs directly by deployment their own active components.

A23.95 As we set out in the November 2014 Consultation, compared with active remedies, passive remedies could give CPs greater flexibility to provide service upgrades and prioritise the developments they choose for their customers. We think that introducing passive access would 'unlock' increased innovation in the active layer, by allowing any downstream CP the opportunity to take on the risk and reward of investment through ownership of the active layer. In a competitive market, we would expect CPs to compete with each other to introduce new technologies to gain increased or new sources of revenue and a competitive edge. In doing so they would bear the costs, risks and rewards of their investments, without needing to agree the route to market with a dominant upstream provider. In our current view, passive remedies would allow CPs to be more responsive to end users' needs as they would have greater ability to progress at their own pace, for example in relation to upgrades and service reconfiguration, and this could potentially increase incentives to invest in innovation. This in turn would put pressure on all operators (including Openreach) to innovate, driving greater dynamic efficiency.

Improvements in service quality

A23.96 Some respondents considered that passive remedies would give them greater control over quality of service. The scale of potential improvements in this area depends on the specific form of the passive remedy. In general, however, we consider that both types of passive remedy would give CPs greater control of some aspects of quality, for example controlling when and how to upgrade and/or reconfigure services. CPs could offer differentiation within service levels around improved levels of customer service, improved resilience and/or faster repair times.

A23.97 A duct access remedy would also give CPs scope to offer better provisioning quality of service to the extent they are able to manage the provision of the fibre circuits better than BT. However, even with duct access, CPs would still be dependent on BT for the provision and repair of the passive components, so some of the factors that affect Openreach's quality of service would still apply. These factors include street works restrictions and wayleaves.

A23.98 For this reason, passive remedies would not effectively address all of the current concerns about BT's quality of service in relation to the provision of new leased line services. Our analysis indicates that these problems relate mainly to the difficulties that BT encounters in the provision of the underlying fibre circuits that support its active wholesale services rather than provisioning and commissioning of the active equipment. Thus to the extent that these issues persist, they would also be likely to be present with dark fibre and with duct access.

A23.99 In relation to fault repair, we agree with TalkTalk that there is some scope for improvement in service quality as most reported faults seem to occur in the active layer. This means that CPs could adopt more proactive fault management techniques (as argued by Vodafone and Colt) and minimise the requirement to coordinate with BT in fault management processes, with consequential improvement in efficiency and service quality. In addition, given that passive access offers the potential to reduce the level of duplication of electronic equipment, it

means that there is less scope for interaction between different sets of equipment which may limit the overall failure rate of the services.

A23.100 We note, however, that there will be a need for new processes to repair fibre faults, given that Openreach would not be able to monitor circuits. BT argued that this would increase the time taken to detect and to repair fibre faults. Whilst we acknowledge that new fault handling processes would be required and CPs would need to play a more active role in fault detection, we are not persuaded that fault handling processes for fibre faults would necessarily be less timely as a consequence. Moreover, as Openreach data indicates that a minority of fault reported to Openreach [✂][554] are fibre faults, potential improvements in handling faults that do not occur in the fibre could offset at least some of the additional overhead, if any, associated with resolution of fibre faults between CPs and Openreach.

A23.101 BT argued that there are potential operational challenges if Openreach has to deal with the introduction of a new dark fibre product at the same time as it is focused on a programme to improve Ethernet service delivery. In this context, we note that we propose to allow BT to recover additional development costs incurred as a result of introducing a passive remedy. We recognise however that there may be some interaction between the two and we would take account of this in assessing the proportionality of any proposed passive remedy. We also note that the exact nature and significance of this impact would depend on the form and design of a remedy as well as the extent to which there is an overlap in processes.

Innovations in network design

A23.102 As we said in the November Consultation, we recognise that there could be potential benefits from CPs having more control over the design and configuration of their networks, mainly associated with having a structure and architecture that more closely matches their own requirements. Such benefits may include greater flexibility to operate their networks more efficiently or deliver higher levels of reliability and resilience.

A23.103 In our view, the main benefits would be:

- Benefits stemming from control of the design of the fibre access network architecture, such as:
  - greater flexibility to adopt access network architectures that provide greater resilience at customer premises for example though the use of ring architectures or diversified routing;
  - greater flexibility to adopt alternative network architectures such as Passive Optical Networks (PONs); and
  - greater flexibility to deploy ultra-low latency connections that require optimisation of cable routing.
- Benefits stemming from control over the choice of network equipment, such as:

[554] [✂ ✂]

- reduced duplication of network elements compared with active remedies;

- greater flexibility over the choice of access network equipment which could in turn allow CPs to have full control over the specification of the equipment and the services and (service) features offered to end customers. They would also have full control of the operations and maintenance capabilities that support network monitoring, service assurance, fault diagnosis and service configuration features of services ; and

- greater flexibility about the location of circuit end-points stemming from the ability to specify terminal equipment suited to the environmental conditions.

A23.104 The overall scale of these benefits would depend on the form of any passive remedies we may impose. Duct access would provide the greatest scope to realise the network architecture related benefits because CPs would deploy their own access networks in BT's ducts. A dark fibre remedy would provide less scope to realise these benefits as CPs would be constrained to some extent by the architecture of BT's fibre access network. They would also need to use the SoR process to request network architectures that BT does not currently support such as rings. They would therefore have less scope to pursue these benefits independently of BT and other CPs.

A23.105 A duct access remedy would be better suited than dark fibre to the needs of CPs wishing to extend existing access networks to serve premises or areas that are uneconomic to self-build. It would more easily accommodate small scale extensions from street locations at the extremities of existing access networks and would provide greater flexibility for CPs to maintain their established access network architecture.

A23.106 Both duct access and dark fibre remedies would give CPs control over the choice of network equipment and therefore both would allow them to realise the other benefits.

A23.107 We consider that there would be some practical challenges associated with deploying networks in BT's ducts with different logical architectures to the tree-branch architecture used by BT. However, we acknowledge that Colt has successfully overcome similar challenges when using shared duct infrastructure in other countries.

A23.108 As BT has pointed out, its Duct and Pole Sharing Service would require some development if we were to implement a duct access remedy for wholesale leased lines. Our initial view is that the service could be adapted for leased line usage relatively easily given the flexible nature of the current service which provides for CPs to obtain details of BT's duct network and to develop their own network designs. In our view, the main challenges would be:

- industrialising the current manual operational processes to cope with higher volumes and to reduce process timescales;

- adapting the service to better accommodate leased lines usage patterns, for example developing new interconnection options suitable for more fragmented usage of BT ducts that had been envisaged for NGA network deployments.

Provisional conclusions on dynamic efficiency benefits

A23.109 As we set out above, competition in wholesale leased lines markets is currently based on BT's regulated set of end-to-end wholesale leased lines. While this regulation generates significant competition at the service level, the extent of innovation and service improvements is limited because the active products do not offer CPs complete end to end control. As the SMP provider, BT controls the nature of the network access services.

A23.110 The SoR process which enables CPs to formally request the introduction of a new product or a change to an existing one is designed to be a 'one size fits all' process. It makes it difficult for individual CPs to choose different technological and service options. Although these requirements aim to ensure that there is no discrimination between BT and other CPs, it is clear from the analysis set out in Annex 27 that this has a direct impact on the effectiveness of network access as a competition remedy.

A23.111 We are concerned that the SoR constrains some developments and the pace at which they are delivered. In particular, it limits scope for differentiation and innovation. Also, the product development process can take a long time as it involves a degree of consensus seeking between different CPs' requirements. In Annex 27, we provide details of SoR requests which have been either cancelled or rejected, that may have been able to have been pursued by CPs individually if passive remedies had been available. We also provide details of different technologies CPs have adopted with their own infrastructure that they may be able to use on the Openreach network if passive remedies are available. These examples are consistent with a demand by CPs for different services and solutions.[555]

A23.112 We consider that passive remedies would give competitors control over more elements of the network, providing CPs with more flexibility than they have now to make investment decisions and innovation choices independently of BT. In our view, greater competition in leased lines provision, created through passive remedies, could increase innovation by allowing CPs to configure and deploy their own active equipment to better suit their customer's needs. The availability of differentiated active products in the market would also put pressure on all operators (including Openreach) to innovate, driving greater dynamic efficiency. While we acknowledge that many of the developments could be delivered using the SOR process, we consider that passive remedies would go some way to addressing the underlying issue about the alignment of BT's incentives with those of OCPs.

A23.113 We believe that the key opportunities for innovation and competition from passive access lie in the active layer and that dark fibre therefore offers most of the innovation benefits of duct access. However, we also recognise that there could be potential innovation benefits from CPs having more control over the design and configuration of their networks, mainly associated with having a structure and architecture that more closely matches their own requirements. Such benefits may include the ability to operate their networks more efficiently or deliver higher levels of reliability and resilience. In this respect dark fibre and duct access provide

[555] While our assessment of benefits has been informed by the examples of specific or known developments, we recognise that a wide range of future innovations may emerge if passive remedies were introduced.

different scope for innovations with duct access allowing more flexibility in optimising network design.

A23.114 However, we consider that these additional potential benefits of duct access are more relevant to facilitating the deployment of fibre infrastructure by CPs, which may over time result in geographic expansion of alternative network infrastructure. Where this occurs, consumers may expect some combination of lower prices and innovative services. However, it is far from clear that CPs will be able to profitably utilise BT's duct outside of a narrow range of locations or circumstances and such expansion may not be sufficient to address the concerns around innovation. In comparison, dark fibre addresses more directly CPs' key concerns around having more flexibility to make investment decisions and innovation choices independently from BT. In addition, dark fibre offers the potential for a more rapid roll out of services as it is simpler for CPs to use.

Productive efficiency in the form of lower costs and prices

Stakeholder responses to the April 2014 CFI

A23.115 Those CFI respondents in favour of passive access argued that the availability of passive remedies could also stimulate competition by lowering barriers to entry for competitors investing in alternative infrastructure to BT and facilitate more effective competition throughout the value chain. Several stakeholders argued that passive remedies would allow CPs to extend their geographic reach and increase competition in areas of the country where currently there are a limited number of options. In contrast, however, BT doubted that passive remedies would extend the geographic reach of competition but rather enhance competition in areas where competition already exists.

A23.116 CFI respondents said that increased competition would in turn put pressure on Openreach to reduce its costs, which could feed into price reductions and more effective competition. Some MNOs argued that passive remedies would encourage more competition with BT Wholesale (BTW) in the provision of a cost effective, nationwide end-to-end mobile backhaul product, by reducing costs and lowering barriers to entry in that network segment.[556]

A23.117 CFI respondents also mentioned other possible productive efficiency benefits such as:

- making the aggregation of capacity more efficient;
- avoiding duplication of elements for network monitoring under active remedies;[557] and
- a pricing structure which better reflects an efficient level of costs.

A23.118 EE, Three and MBNL argued that the availability of passive products would promote competition and investment in Ethernet and provide an efficient means to

[556] See EE, Three and MBNL joint non-confidential response to the April 2014 CFI, page 9.

[557] This is because under the current arrangements there are typically two sets of equipment for the purpose of network monitoring, one installed by Openreach and one by CPs.

allow CPs to expand their network into new geographic areas. In particular, they considered that passive remedies would significantly reduce the cost of building new infrastructure which in turn would reduce barriers to entry in the local access network and facilitate more effective competition throughout the value chain.[558]

A23.119 EE, Three and MBNL further added that the largest single cost item in mobile backhaul is the cost of the local EAD circuits. Passive remedies would encourage more providers to compete with BTW in the provision of a cost effective, nationwide end-to-end mobile backhaul product, by reducing costs and lowering barriers to entry in that network segment.[559]

A23.120 EE, Three and MBNL argued that requiring BT to offer access to dark fibre would allow other operators greater control over the infrastructure elements of the network and make the aggregation of capacity more efficient.[560]

A23.121 UKCTA suggested that CPs would be able to realise a greater proportion of the option value of expansion, by lowering the cost of future customer acquisition leveraging off pre-existing network facilities. It noted that currently, market incentives are distorted due to the fact that, when a CP acquires a new customer, it pays BT for new facilities (via Excess Construction Charges) and the CPE. Yet BT retains the asset and benefits from the option value of that expenditure.[561]

A23.122 CPs such as Sky and TalkTalk argued that a passive remedy would allow CPs to expand capacity without repeated upgrade costs and innovate around the scope of the services offered,[562] and that they would allow more extensive competition along more of the value chain, leading to more innovation, lower costs, greater choice and reduced prices.[563]

A23.123 TalkTalk argued that the introduction of dark fibre will improve productive efficiency. It presented several factors in support of its view and believed that dark fibre would:[564]

- reduce net duplication of costs.
- be unlikely to encourage inefficient entry;
- minimise costs due to the effect of new entry and competition;
- likely lead to a small increase in scale economies. and
- possibly generate a small increase in scope economies (it considered that these could principally arise from duct/pole sharing).

[558] See EE, Three and MBNL joint non-confidential response to the CFI, page 9.

[559] See EE, Three and MBNL joint non-confidential response to the CFI, page 9.

[560] See EE, Three and MBNL non-confidential response to the CFI, page 11.

[561] See UKCTA non-confidential response to the CFI, page 11.

[562] See Sky non-confidential response to the CFI, page 4.

[563] See TalkTalk non-confidential response to the CFI, page 3.

[564] See TalkTalk non-confidential response to the CFI, page 14-16.

A23.124 Talk Talk also argued that introducing dark fibre (at a flat price) will reduce risk of various forms of anti-competitive pricing and gaming which harms consumers such as:[565]

- raising >1Gbps single-service Ethernet prices in order to reduce any price constraint on other MISBO services (e.g. OSA) whose price is not regulated;
- margin squeeze (between active wholesale products and retail);
- focusing price rises on externally purchased active products thereby effectively over-charging CPs;
- focusing price reductions on more competitive areas (such as low bandwidth where the products are homogeneous);and
- focusing price rises on growing products (to outperform the price cap) which exploits the prior year weighting used in the charge control.

A23.125 Frontier Economics suggested that "a move to a passive access charges control may be more effective in ensuring that the overall level of prices is in line with costs for a number of reasons:

- competition in the downstream markets should ensure that for these elements of the value chain margins reflect costs;
- forecasting unit costs (demand and cost forecasting) may be more straightforward for the relatively smaller set of passive products; and
- the scope for 'gaming' the price control may be more limited with a smaller set of simpler products."[566]

A23.126 In addition it argued that one of the benefits of passive access over active remedies is that competition forces suppliers to examine their cost structure to ensure that they are producing at the most efficient level. Based on its breakdown of EAD product costs it argued that if customers were offered wholesale passive access, between 30% and 60% of the cost stack (including the costs of access cards and Ethernet electronics) would be contestable, and rivals could compete by delivering these elements more efficiently than BT.[567]

A23.127 Vodafone believed that use of passive remedies could avoid duplication of elements for network monitoring under active remedies, potentially offering large cost benefits.[568]

A23.128 Colt said that the risk of duplication of investment is a reality with competition in general and also with mandating access to civil engineering infrastructure. It also

[565] See TalkTalk non-confidential response to the CFI, page 19.

[566] See Frontier Economics report, paragraph 36, page 11.

[567] See Frontier Economics report, paragraph 37, page 11-12.

[568] See Vodafone, non-confidential response to the CFI, page 20.

pointed out passive forms of access may even reduce duplication where for example, a CP deploys fibre where otherwise it would have to dig.[569]

Stakeholder responses to the November Consultation

Arguments for productive efficiency

A23.129 TalkTalk believed that competition will drive reduced costs. It argued that entrants may well be able to lower overall costs by operating more efficiently than BT (e.g. through lower cost equipment/installation/repair or innovations such as improved cost monitoring). It added that cost minimisation incentives on BT will be stronger with dark fibre remedies because the operator will retain the benefits of cost reduction (whether through higher profits of higher volumes). Although charge controls create some cost minimisation incentives, these are weakened by the fact that cost reductions are in time passed through in lower charges. TalkTalk also argued that dark fibre will result in less duplication of fixed costs because it involves a minor level of duplication of active layer costs that is likely to be offset by there being less self-build (of duct/fibre), which involves substantial fixed costs. It added that cost savings are also possible since a CP can integrate its existing equipment with the active layer equipment (e.g. Ethernet and lighting fibre). [570]

A23.130 Sky argued that regulated passive access to BT's infrastructure could address the limitations of the current active regime and provide significant benefits to businesses and consumers. It argued that promoting effective and sustainable competition across more of the value chain could lead to greater investment in alternative infrastructure and more innovation which in turn will result in higher levels of product differentiation, price competition, cost minimisation and service quality. It added that for purchasers of backhaul in particular, passive access will bring more effective competition and deliver solutions that are more efficient in keeping pace with the rapid growth in data consumption. In Sky's view, the success of LLU provides a clear example of the consumer and business benefits that can result from effective passive remedies and of the potential for future deregulation.[571]

A23.131 In Sky's view, passive remedies will lead to greater investment in alternative infrastructure and more innovation, which in turn will result in higher levels of product differentiation, price competition, cost minimisation and service quality. It added that for purchasers of backhaul in particular, passive access will bring more effective competition and deliver solutions that are more efficient in keeping pace with the rapid growth in data consumption.[572]

A23.132 Vodafone said that the introduction of passive remedies would have significant productivity benefits. Static and dynamic productivity enhancements would be possible as CPs can run services without the need to purchase Openreach Ethernet technology. Infrastructure control would also allow CPs to minimise the

[569] See Colt non-confidential response to the CFI, page 34-36.

[570] See TalkTalk non-confidential response to the November Consultation, page 14, paragraph 4.10.

[571] See Sky non-confidential response to the November Consultation, page 3, paragraph 3.1 to 3.3.

[572] See Sky non-confidential response to the November Consultation, page 3, paragraph 3.1, 3.2.

requirement to coordinate with BT in service delivery, testing and fault management processes, with consequential improvement in efficiency. [573]

A23.133 Telefonica argued [✂][574]

A23.134 Six Degrees mentioned that cost, power and space savings can be realised with the introduction of passive products. Currently multiple devices are often used at both ends of an active service, the Openreach demarcation device and a device provided by the communication provider, either in the customer premise as their CPE or in the aggregation node/exchange. These can be replaced by a single device at either end leading to easier provisioning and monitoring as well as reducing points of failure in the network. They added that reducing the utilisation of space and power in exchange Multi User Access (MUA) areas has an additional benefit of improving the availability of colocation for new entrants to the market.[575]

A23.135 The PAG mentioned if customers were offered services through dark fibre access, between 30% and 60% of the cost stack would be contestable, and rivals could compete by delivering these elements more efficiently than BT (infrastructure access would lead to competition in an even greater part of the value chain). It added that as BT has market power in an upstream market, it has little incentive to deliver services to competitors in downstream markets in a fashion that will minimise the overall end to end cost for those competitors as increasing the cost to competitors could increase the market level of prices and hence BT's overall margins in the downstream market. For example BT may choose to provide wholesale services in ways which require duplication of equipment or inefficient routing when competitors use these wholesale services to compete with BT's retail businesses.[576] In addition, more direct routing can allow CPs to deliver services more efficiently without being bound to BT's network structure and topology. The important feature of a fibre based network is that they can use passive components over long distances. This means that aggregation can occur at fewer points in the network.

Arguments against productive efficiency

A23.136 Those against passive remedies were concerned about the impact on productive efficiency and while it is likely to vary depending on the design, passive remedies will likely imply duplication of resources and additional costs which would have to be offset against highly uncertain benefits.

A23.137 BT considered that there are no obvious productive efficiencies available from the introduction of passive access and a number of reasons for considering that, on the contrary, costs may increase:

[573] Vodafone non-confidential response to the November 2014 Consultation, page 18.

[574]For more information see Telefonica confidential response to the November Consultation, paragraph 20 (page 5).

[575] See Six Degrees non-confidential response to the November 2014 Consultation, page 4.

[576] See PAG non-confidential response to the November 2014 Consultation. Cover sheer page 11 and Annex B (Frontier's Report), section 1.4.

- the existence of arbitrage would lead to less efficient utilisation of duct and fibre infrastructure;

- the planning, survey and implementation costs of allowing access in a greater number of variations would inevitably increase complexity and cost; and

- although this is highly sensitive to the exact form of any passive product, there is a significant risk that passive access would lead to network duplication, stranded assets and greater complexity in capacity management.[577]

A23.138 BT also said that benefits would largely be restricted to CPs in a position to take advantage of price arbitrage opportunities from passive remedies, generally large CPs focused on providing high bandwidth services in urban areas. Smaller CPs, customers outside densely populated areas and those using lower bandwidth circuits would face higher prices due to the requirement for BT to recover efficiently incurred common and fixed costs.[578] In addition, BT argued that Ofcom should assess quantitatively the cost of competition, including the extent to which assets would be duplicated and the resulting impact on customers.[579]

A23.139 The DotEcon report prepared for BT argued that passives could hinder BT's ability to manage capacity within its network (for example by choosing the route of fibres). It argued that together with increased uncertainty about demand from CPs (including whether this demand might be for active or passive products), there is likely to be a greater need to hold spare capacity and to build ahead of demand. It considered this would tend to reduce average rates of asset utilisation and increase unit costs, eventually impacting on prices paid by customers.[580]

A23.140 Virgin Media doubted that buyers of passive remedies will really be able to buy, install, monitor and maintain their electronics cheaper than BT. However, it added that if we were to introduce a passive remedy, we could at least ensure that it would deliver efficiency benefits by adopting value-based pricing such that it would only be attractive to purchasers who were more efficient that BT or who could deliver better services for their end-users (from whom they could presumably extract some benefit).[581]

A23.141 Referring to CPs comment that they may use duct and dark fibre to create or replicate their own network topologies in conjunction with their own network elements, Virgin Media said it would result in CPs networks being compromised of a mixture of their own infrastructure elements and passive inputs from BT, which would give rise to increased management and operational overheads and inefficiencies.[582] **[✂**

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[577] See BT non-confidential response to the November Consultation, page 67.See also Section 5**.**

[578] See BT non-confidential response to the November Consultation, page 10-11. BT clarified that by arbitrage it is referring to the situation where a purchaser of passive access products is able to take advantage of differences in relative costs and prices to undercut a portion of the prices for active products (which are based on averaged costs) with no economically efficient market expansion.

[579] See BT non-confidential response to the November Consultation, page 44.

[580] DotEcon, *Business Connectivity Market Review: Passive Remedies*, page vi, 25-27. Submitted as an Annex to BT's response to the November Consultation.

[581] See Virgin Media non-confidential response to the November Consultation, page 25.

[582] See Virgin Media's non-confidential response to the November Consultation, page 13.

✂.][583]

Our consideration

A23.142 We consider that there are two key issues to consider in relation to productive efficiency and price reductions resulting from passive remedies. The first relates to the prospect of genuine competition on the merits, and the benefits this may have in the form of lower costs (and therefore ultimately, prices). The second relates to potential arbitrage opportunities created by the interaction of passive access products with the current active pricing structure, which may result in price reductions for some downstream services relative to today but which are not necessarily driven by cost-efficiencies. Here we focus on the former, while we discuss the implications of the arbitrage opportunities in Annex 24.

A23.143 Several stakeholders argued that competition based on passive remedies would make more elements of the network contestable for competitors to BT compared with active remedies, potentially reducing the total cost of delivery. This may allow competitors to take advantage of opportunities to make additional efficiencies over BT, for example in relation to equipment used for making the aggregation of capacity more efficient according to their own individual network requirements. It may also allow them to take advantage of additional efficiencies over what can be achieved under the active regime, such as alternative aggregation of capacity and avoiding potential duplication of network monitoring elements. Therefore to the extent that this increased competition within the value chain leads to increased productive efficiency gains, passive remedies could drive lower downstream prices than might occur with active remedies alone.

A23.144 In addition, given the cost of BT's Operational Support Systems (OSS) system upgrades which may impact even around 60-70 systems when implementing complex developments, CPs may have scope to make additional efficiencies which may translate into much lower systems costs.[584]

A23.145 This in turn may lead to smaller projects with niche demand becoming more viable when compared to today. The availability of passive remedies could also reduce BT's own costs of introducing new technology/developments by being able to avoid some of the coordination and transaction costs associated with the SoR process.

A23.146 Moreover, passive access offers the potential to reduce the level of duplication of electronic equipment, which is a feature of the current active leased line products. In other words, with a passive remedy it is possible to use less active equipment to deliver the same leased line service. Since our November 2014 Consultation, we have analysed this issue in more detail and consider that there are potential cost savings available resulting from removing some of this duplication. In what follows, we set out our analysis and findings:

[583] See Telefonica non-confidential response to the November 2014 Consultation, page 5.

[584] See [✂

✂]

- First, we explain the potential for passive remedies to use less equipment compared to active remedies. We also identify the types of leased line circuits where we expect this benefit to occur.

- Second, we estimate the cost savings that are likely to arise – both within the time period of this review and in the longer term. We calculate this by estimating the reduction in the equipment cost for those leased line circuits likely to switch to passive solutions.

Passive remedies use less equipment for Ethernet access services

A23.147 Figure below illustrates the equipment used to provide a typical Ethernet access circuit using an active product and a passive product. In our illustration this is an EAD 1Gbit/s circuit that connects a customer site to a network site located either in a BT exchange or a CP site. With active remedies, connections of this type are typically provided using Openreach's EAD and EAD LA products depending on the location of the network site.

Figure A23.1: Equipment saved by passive remedies (EAD customer-to-network circuit) [585]

Source: Ofcom analysis

Notes: CP – communications provider, OR – Openreach, S – short range optical interface, L – long range optical interface

A23.148 Figure A23.1 shows that with an active remedy, Openreach and typically also the purchasing CP install equipment at both ends of the circuit:

- Openreach installs Network Terminating Equipment (NTE) at the customer premises and a Network Terminating Unit (NTU) at the BT exchange/CP PoP. This is shown in the boxes labelled OR1 and OR2 in Figure A23.1. These two pieces of equipment are configured with long-range optical interfaces, marked (L)

[585] We recognise that some access circuits have EAD connections with a main link. This does not affect our analysis as the main link connection is only fibre and no additional equipment or services are used to form the main link.

in the diagram to enable data transmission over the distance between the customer site and the BT exchange/CP PoP.

- The purchasing CP will normally add its own equipment, both at the customer premises and at the BT exchange/CP PoP. At the customer site, the CP will typically add a router or other Customer Premise Equipment (CPE) to provide the service e.g. a VPN to the end customer. The CP will also install equipment at the BT exchange or CP PoP for onward transmission. This equipment, labelled CP1 and CP2 in Figure A23.1, is equipped with short-range optical interfaces (marked as 'S' in Figure A23.1) as it is directly connected to the Openreach equipment.

A23.149 With a passive remedy, Openreach would not provide any terminating equipment and the CP would normally be able to operate the circuit with the same equipment it deploys in the active scenario, provided it is equipped with long-range optical interfaces rather than short-range optical interfaces as illustrated in Figure A23.1.

A23.150 Based on the analysis above, Table A23.2 summarises the equipment that is likely to be saved under passive remedies. We assume the long reach interfaces for the Openreach and CP equipment are equivalent.

Table A23.2: Equipment savings per circuit

	Equipment	Description	Number of units saved
Customer site	OR1	NTE	1
	S	1Gbit/s short range optical interface	2
Network site[586]	OR2	Head-end common equipment	1 per 15 circuits[587]
	NTU	Network Terminating Unit	1
	S	1Gbit/s short range optical SFP	2

Source: Ofcom analysis

A23.151 Based on the analysis above, we consider that equipment costs may be reduced if the CP uses passive access rather than purchases a 1 Gbit/s EAD circuit. We also note that using less equipment would lead to additional savings in related costs. For example, using less equipment also saves on electrical power and accommodation costs. It can also lead to lower costs associated with system developments as there

[586] We recognise that alarm monitoring equipment may also be saved consisting of a broadband monitoring line and router which supports up to four head-end units. We believe the savings from these items will be relatively small and consequently we have excluded it from our estimates.

[587] BT uses head-end equipment comprising equipment chassis and power supply that supports the Network Terminating Units for up to 15 EAD circuits.

is no intermediate EAD equipment (OR1 and OR2 above, Figure A23.1) to incur development costs.[588]

A23.152 We have also considered whether the equipment savings identified in our illustration above are representative of Ethernet circuits more generally, based on the following analysis for the different types of circuits:

- **Other EAD circuit configurations**: EAD services are deployed in a range of configurations (including end-to-end services between customer sites and backhaul segments between BT exchanges and CP PoPs), bandwidths and circuit length options. Although the equipment used will vary according to the configuration, the equipment deployed by CPs will typically be capable of operating the circuit with suitable long range optical interfaces and therefore the equipment savings will be similar to our illustration.

- **Other leased line technologies in the CISBO market:**[589] We consider that passive remedies may not generate comparable equipment savings for WDM services because CPs using passive remedies would need to deploy additional equipment comparable to that used by Openreach for its OSA/OSEA services in order to provide WDM services. There may be potential for equipment savings for the other technologies in the CISBO market. However, we have not considered this in detail given they are relatively a small proportion of CISBO circuits.[590]

Estimation of productive efficiency benefit

A23.153 We have estimated the potential savings from CPs adopting passive solutions relative to Openreach's active products. In order to estimate the potential savings, we need to estimate both the cost saving per active circuit and the volume of active circuits that are likely to switch to passives.

Potential cost saving per circuit

A23.154 We have estimated the potential savings in equipment cost per circuit. We have obtained the cost of the relevant equipment from Openreach. Our analysis is based on Openreach's forecast of equipment costs in 2018/2019.[591,592]

A23.155 Table A23.3 presents the estimated cost saving per EAD 1 Gbit/s circuit for customer-to-network connections. For each type of equipment saved, the table

[588] Changes to Openreach's active products, lead to significant costs for Openreach associated with system developments. In addition, for a CP to adopt that product change it will also incur costs for developing its systems. We recognise that Openreach would incur development cost to introduce passive products; however, in the long run it would save the ongoing costs of developing active products.

[589] We do not consider potential equipment savings for TI technologies as it is a legacy product with very few new connections.

[590] EAD and EAD LA represent above [✂] of CISBO circuits, while other technologies represent less than [✂] collectively.

[591] BT response to 4th notice s.135, QA4, dated 11 November 2014.

[592] We assume that the cost of the optical interface is the same for Openreach and CPs. We recognize that CPs may pay higher prices for Optical Interfaces as Openreach may benefit from bulk discounts. However, we do not think that this will have a material impact on our estimates.

shows the number of equipment units saved per circuit and the cost per unit. We assume that one common head-end unit will be saved per 15 circuits. This is conservative as we assume that all the common head-end equipment is operating at full capacity. If utilisation is below 15 circuits on average, then the potential saving per circuit would be higher. Our analysis shows that passive access to dark fibre would be likely to save equipment with a value of [✂ ✂] per EAD 1Gbit/s circuit.

Table A23.3: Potential cost saving per circuit (2018/2019)

Equipment Description	Units saved per circuit	Cost per unit (£)	Saving per circuit (£)
NTE (OR1)	1	[✂ ✂]	[✂ ✂]
Headend common equipment (OR2)	1 per 15 circuits	[✂ ✂]	[✂ ✂]
NTU	1	[✂ ✂]	[✂ ✂]
1Gbit/s short reach optical SFP (S)	4	[✂ ✂]	[✂ ✂]
Total cost savings per circuit			[✂ ✂]

Source: Ofcom analysis

A23.156 We recognise that the potential equipment saved varies depending on the network configuration. The cost savings calculated above relate to customer-to-network connections (i.e. EAD LA and some EAD circuits). Other types of access circuits and backhaul connections may be slightly different as explained earlier in paragraph A23.152. However, our calculations show this leads to relatively small differences in cost savings per circuit (plus or minus [✂ ✂]).[593]

Total savings for the potential volume of passive circuits

A23.157 We estimate the potential total savings based on the potential volume of circuits that may switch to passive remedies. We only consider the circuits outside the CLA region where we propose to implement passive remedies.

A23.158 The extent to which new or existing leased lines are switched to passive products will depend on the price of any passive product as well as the terms of access and migration. This analysis considers the potential switching in light of our proposed pricing approach for passive products (i.e. EAD 1Gbit/s minus approach - see Annex 26 on pricing approach for dark fibre).

[593] Cost savings per circuit are around [✂ ✂] for EAD customer-to-customer links and [✂ ✂] for EAD network-to-network links.

A23.159 In the short-term, we assume that only new EAD circuits at and above 1Gbit/s are likely to switch to passives. This is because, under our proposed pricing approach, dark fibre will be made available at a price that is consistent with that of the EAD 1Gbit/s circuits. Therefore, it is in general only likely to be economic to substitute leased line circuits at and above 1Gbit/s with dark fibre based circuits. We also assume that new connections, rather than existing connections, are most likely to switch to passives in the short-term. For existing circuits, as we discuss in the June 2015 LLCC Consultation, migrations are likely to occur over a longer time period.

A23.160 Based on these assumptions, Table A23.4 shows our estimate of the potential cost savings in the short-run. We forecast the volume of new EAD and EAD LA 1Gbit/s connections outside the CLA to be [✂ ✂] circuits in 2018/2019. Assuming that this base can potentially switch to passives this can lead to potential savings in equipment cost of up to £3.5 - £7 million for 2018/19 alone.[594] This estimate is conservative as it does not take into account any related savings in power and accommodation.

Table A23.4: Estimate of potential savings for EAD1Gbit/s new connection, 2018/19

	Volume (ccts)	Total potential cost savings (£)
EAD	[✂ ✂]	[✂ ✂]
EAD LA	[✂ ✂]	[✂ ✂]
Total	[✂ ✂]	[✂ ✂]

Source: Ofcom analysis

A23.161 In the long-term, if all active circuits were to switch to passive solutions as contracts expire and demand for bandwidth grows, then the potential for efficiency savings is greater. This provides us with an upper bound estimate of migration volumes. We estimate the total volume of EAD, EAD LA and WES [595] circuits at 10Mbit/s, 100Mbits/s and 1Gbit/s to reach [✂ ✂] circuits in 2018/2019. In the long-run, this can lead to potential equipment savings up to £60 - £120 million.[596] Those estimates may be even higher given the potential for additional savings for higher bandwidths as well as other Ethernet technologies.

A23.162 Finally, in relation to the argument that passive access would require duplication of assets, we note that it is not necessarily, per se, inefficient in its own right. Infrastructure-based competition has the greatest level of fixed-cost duplication

[594] This is calculated based on the cost savings per circuit in Table A23.3.

[595] We apply the cost savings for EAD connection to WES circuits because we assume that in the absence of passive remedies WES connections will migrate to EAD in the long-run.

[596] The calculation is based on a cost saving of [✂ ✂] per circuits for 10 Mbit/s and 100 Mbit/s connections. Cost savings for these circuits are slightly lower than the cost saving per 1Gbit/s circuits presented in Table 10 [✂ ✂]. This is because i) we assume the two units of short reach Optical interface for Openreach equipment are not saved and ii) the price of short reach interface for 10 Mbit/s and 100 Mbit/s circuits is different from 1Gbit/s circuits [✂ ✂].

(which could result in productive inefficiencies), but also potentially provides the greatest scope for dynamic benefits (since CPs will have the opportunity to control more of the value chain). Therefore where self-build occurs and competes successfully, it would tend to suggest any productive inefficiencies which occur are outweighed by other factors (i.e. the market can bear such duplication). In relation to BT's point that Ofcom should assess quantitatively the cost of competition, including the extent to which assets would be duplicated and the resulting impact on customers, we are mindful of the fact that productive efficiency considerations may only provide part of the picture. We therefore consider that it is important and more informative to consider efficiency overall of the proposed remedy.

A23.163 In this context we note that some stakeholders have argued that passive remedies could reduce the barriers to entry for those competitors investing in alternative infrastructure to BT, leading to an increase in the geographic reach of competition (relative to the position if these CPs had to self-build entirely). However, we consider that this is not unique to passive remedies, as active remedies also lower barriers to entry relative to self-build.

A23.164 That said, we recognise BT's and Virgin Media's arguments that passive remedies could lead to increased duplication and additional costs relative to an active-only regime, which could create productive inefficiencies (albeit potentially a lesser degree of duplication relative to full self-build). We also recognise that to the extent that passive remedies significantly reduced utilisation of BT's existing infrastructure, there could potentially be reduced economies of scale, leading to higher unit costs. Further, we note that the availability of passive remedies may affect how BT runs and manages its network (including in relation to how BT manages its capacity).

A23.165 We consider that the design of the remedy will affect the risk that increased duplication and reduced utilisation of BT's existing infrastructure reduce economies of scale. For example:

- Form of passive remedy: as identified by BT, we consider that duplication is likely to be higher with duct access than dark fibre, and would also make less use of BT's existing infrastructure (which may lead to a reduction in economies of scale). Conversely, dark fibre may better utilise BT's existing infrastructure and reduce duplication of fixed assets, reducing the risk to productive efficiencies;

- Pricing: providing the passive remedy is priced appropriately (including compatibility with the active pricing structure), CPs should in general only purchase passive access where they have cost advantages and/or the other benefits of passives outweigh any cost disadvantages (relative to active access, if available). However, if the passive price is "too low", this could over-incentivise take-up and lead to inefficient duplication of fixed assets relative to an active-only regime.

- Migration terms: we discuss the role that migration may have in stranding assets in Annex 24.

- Scope for reservation of existing capacity: the process by which existing capacity is allocated (as well as any process for expanding capacity) may affect BT's incentives to build and hold excess capacity in advance of demand.[597]

Provisional conclusion

A23.166 We consider that competition based on passive remedies would make more elements of the network contestable for competitors to BT compared with active remedies, potentially reducing the total cost of delivery. Passive remedies may allow competitors to aggregate capacity and avoid potential duplication of network monitoring elements and equipment, which could drive lower downstream prices than might occur with active remedies alone.

A23.167 In particular, our analysis shows that the use of dark fibre or duct access could allow CPs to deliver the same service at a lower cost than with active circuits, as less equipment, power and accommodation costs are required. As set out above, access to dark fibre would be likely to save equipment with a value of [✂ ✂] per EAD 1Gbit/s circuit. We also estimate that the total savings based on the potential volume of circuits that may switch to passive remedies could lead to a significant cost saving of up to £3.5 - £7 million in the short-term and £60 -£120 million in the long-term. In addition, given the high cost of BT's system upgrades associated with new developments, CPs may have more scope to realise additional cost saving opportunities. This in turn may lead to smaller developments with niche demand becoming more viable when compared to today.

A23.168 While we recognise that there is a risk that passive remedies could lead to increased duplication and additional costs relative to an active-only regime, which could create productive inefficiencies, we consider that the cost savings opportunities we have identified are likely to outweigh this effect, particularly in relation to dark fibre.

Potential to withdraw or relax downstream regulation

A23.169 A passive remedy would take some time to implement and for the industry to prepare to consume it. Therefore, as discussed in more detail at Section 7, we consider that it would be necessary to impose passive remedies alongside active remedies for the purpose of this charge control period. However, in the longer term, if the availability of passive inputs allows CPs to replicate BT's downstream services, there may be less (or no) need to impose regulation of active remedies downstream.

Stakeholder responses to the CFI

A23.170 Some CFI respondents argued that the introduction of passive remedies could lead to the withdrawal of downstream regulation over time, reducing the overall regulatory burden. Some cited local loop unbundling (LLU) as an example of how the introduction of a passive product led to the withdrawal of downstream regulation.

A23.171 Frontier Economics argued that passive access means that regulation further downstream can be withdrawn over time. It also said that an effective dark fibre

[597] We have discussed this point in more detail in the November Consultation, paragraph 5.7 – 5.9.

access regime could significantly reduce the need for CPs to submit SORs, for BT to assess these and for Ofcom to intervene in case of disputes. In illustrating its point, Frontier Economics referred to the competition in the provision of LLU. Overall, it was of the view that introducing passive access could reduce some of the regulatory overhead associated with intervention in complex active markets, with the focus being concentrated on the much simple pricing, processes and interfaces required for an effective dark fibre remedy.[598]

A23.172 TalkTalk noted that introducing dark fibre may lead to a reduction in regulation of Ethernet services and less administrative burden as a result of dark fibre based competition.[599]

A23.173 Conversely, BT argued that passive remedies would represent a significantly more intrusive form of regulation and would conflict with Ofcom's core policy principle of pursuing the least intrusive regulatory measures. BT further highlighted the complexities associated with employing regulation at multiple levels of the supply chain. This is in particular in relation to the coordination of passive remedies alongside the pre-existing active remedies, which it views will detract regulatory focus from a particular set of remedies and will also stretch resources. BT warned that this will significantly increase the risk of regulatory failure.[600]

A23.174 BT also argued that if passive remedies are considered appropriate then that logically casts serious doubt on the ongoing need for active remedies. It added that if both co-exist then it is likely that the markets in which active remedies will be further constrained and distorted (for example in relation to what is feasible and efficient in relation to on-going bandwidth gradients).[601]

Stakeholder responses to the November Consultation

A23.175 TalkTalk argued that introducing dark fibre has the potential in the medium to long term to reduce certain costs of regulation if the active product becomes unregulated. It added that regulation of active products (compared to passives) is complex and can increase scope for regulatory error. The wide variety and constant variations in active services results in Ofcom being involved in detailed and prescriptive regulation on an ex ante basis and leads to complex disputes on an ex post basis. In contrast, dark fibre, which has a limited number of variants is far less complex and so is less costly to design and enforce and less prone to error. It will also be more stable and predictable.[602]

A23.176 TalkTalk agreed with many of the benefits outlined in our consultation though they consider that we have overlooked some and/or underplayed the advantages.[603] TalkTalk argued that passive remedies will reduce the opportunity for BT to engage in anti-competitive price discrimination such as focusing price rises on products used more by external customers and gaming the current year weighting method

[598] See Frontier Economics report, paragraphs 60- 64, 68, page 18-20.

[599] See TalkTalk non-confidential response to the CFI, page 21-22.

[600] See BT non-confidential response to the CFI, page 19.

[601] See BT non-confidential response to the CFI, page 19.

[602] See TalkTalk non-confidential response to the November Consultation, page 15, paragraph 4.16.

[603] See TalkTalk non-confidential response to the November Consultation, page 12, paragraph 4.2.

that is used to monitor charge control compliance. We note that TalkTalk's comments are focussing on the benefits from the introduction of dark fibre.[604]

A23.177 In Virgin Media's view, the benefit of any removal of regulation (if it happens) will occur so far into the future as to make it irrelevant to any weighing of the costs and benefits of the introduction of passive remedies. This is given a) the likely timescale necessary to introduce any passive remedy and b) the likely desire on the part of CPs that active remedies continue into the foreseeable future. It added that as we do not intend to have a 'passives' only option, maintaining both active and passive remedies during that transitionary period would be a considerable regulatory burden.[605]

A23.178 In Sky's view, the availability of passive access will enable CPs to provide alternatives to Openreach's active products and over time competition and greater choice will reduce the reliance on these products. As a result, passive remedies could lead to the gradual removal of regulation downstream at the active layer.[606]

A23.179 Six Degrees Group agreed that there is the potential that a regulated passive product could lead to reduction in regulation of some active products where the introduction of passive products leads to sufficient competition in the active space. However it noted that there will need to be at least a period of simultaneous regulation in order to assess the impacts without harming the existing market in the event of unforeseen outcomes. [607]

A23.180 CityFibre broadly agreed with Ofcom's comments on the regulatory implication in paragraphs 4.34 to 4.40 of the November Consultation. However, CityFibre felt strongly that the regulatory system must take into consideration the emergence and support of infrastructure competition. The structure of price regulation and charge controls for both active and potential passive remedies must not undermine the investment case for third party infrastructures – in fact CityFibre would go further and stated that regulatory conditions imposed on BT should positively encourage investment in competitive infrastructure, including the introduction of 'pricing floors'. [608]

A23.181 The PAG mentioned that passive remedies could allow for more stable and predictable regulation in the long run even if there is increased complexity in the short run due to the need to regulate active and passive access in parallel. Passive remedies could decrease the scope for regulatory error as there are a limited number of variants of dark fibre and infrastructure access and the rate of technical evolution is slower in the passive infrastructure than active components. For

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[604] See TalkTalk non-confidential response to the November Consultation, page 14, paragraphs 4.15. TalkTalk also argued that there are a variety of effects that will both increase and reduce demand but overall they consider that demand will increase. TalkTalk also argued that Ofcom has overlooked the economic benefit that with dark fibre, prices will be rebalanced to reflect cost so customers will make better and more efficient choices of bandwidth. (See TalkTalk non-confidential response to the November Consultation, page 14, paragraphs 4.12, 4.13]. We present the arguments on price rebalancing in more details in the Annex on costs and risks.

[605] See Virgin Media non-confidential response to the November Consultation, page 25.

[606] See Sky non-confidential response to the November Consultation, page 3, paragraph 3.7

[607] See Six Degrees non-confidential response to the November Consultation, page 4.

[608] See CityFibre non-confidential response to the November Consultation, page 8.

example, forecasts of passive service volumes, which should be largely independent of the technology used to provide services, should be more robust. Gradually, as the use of passive remedies becomes more significant and established, then some active remedies could be withdrawn. LLU offers a text book example of how passive remedies over time can lead to the withdrawal of the active layer. [609] In its additional submission, while the PAG stressed the need for both active and passive remedies to coexist, it also said that they may create the potential for reducing regulation in the long term (in areas where take-up is strong). It also added that some forms of passive access may take longer to implement.[610]

A23.182 BT argued that the level of regulatory intervention which might be needed to sustain competition based on passive remedies, or a mixture of passive and active remedies, would be, more intrusive and onerous than the current active remedies. In the meantime, co-existence of different remedies would create distortions. In BT's view, a removal of downstream (active) regulation could be harmful unless an alternative is shown to be better and does not provide a duplicate remedy to the same SMP. It also said that deregulation can only be considered as a benefit in the context of firm criteria on how and when such regulation would be withdrawn. [611][✂

✂][612]

A23.183 BT also argued that since not all CPs would be in a position to use passives, it is likely that passive and active remedies would co-exist indefinitely. It added that any deregulatory benefit is highly uncertain and negligible in the short to medium term. Even if active-based regulation could be withdrawn in the long term, Ofcom would still need to set against this uncertain benefit the cost of an increase in regulation in the near term. BT claimed that progress over the last three years suggests active product deregulation is now appropriate.[613]

A23.184 A DotEcon report submitted by BT argued that existing active access products are already being used by CPs and would need to continue alongside any new passive access products for the foreseeable future. DotEcon was of the view that any winding back of active access products could only happen in the long run after some future market review. DotEcon said that as a matter of broad principle, parallel access remedies result in a compounding of risks as CPs will treat parallel access products as substitutes, choosing whichever is most cost-effective. However, the setting of access prices is always subject to potential error, with risks of under- and over-pricing creating risk for infrastructure investment incentives.[614]

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[609] See PAG non-confidential response to the November Consultation. Cover sheet, Page 11 and Annex B (Frontier's report) section 1.5

[610] See the PAG non-confidential submission dated 13 March, pages 5-6.

[611] See BT non-confidential response to the November Consultation, page 29.

[612] See BT confidential response to the November Consultation, page 71 and also see section 3.

[613] See BT non-confidential response to the November Consultation, page 12-13.

[614] DotEcon, *Business Connectivity Market Review: Passive Remedies*, page iv, 7. Submitted as an Annex to BT's response to the November Consultation.

Our consideration

A23.185 In principle, our preference would be not to regulate concurrently at multiple levels of the value chain indefinitely. Theoretically, the availability of passive inputs should allow CPs to replicate BT's downstream services and provide their own leased line services. In light of the above, it is therefore important to consider the extent to which at some point in the future it would be possible not to rely on regulation at the active level.

A23.186 If passive remedies were introduced, a period of transition is likely to follow in which passive access products would be implemented. It would take BT several months to launch any passive products. In addition, BT, CPs and end-users of leased lines would need time to adjust to any changes brought about by the introduction of passive remedies, including developing business processes to take advantage of passive inputs and migrating services and processes from current products.

A23.187 Once in place, passive access products should allow CPs to rely less on BT's wholesale leased line services and hence sustain effective competition downstream, and, over time, there may be less (or no) need to impose active remedies. Indeed, as pointed out by some stakeholders,[615] we would expect that CPs would not need to use BT's SoR processes where they can replicate active leased lines. As set out above, passive remedies are also likely to avoid some of the coordination and transaction costs and as such reduce the overall burden on BT.

A23.188 However, in this context we note that the active remedies are well established and CPs currently depend on BT's regulated wholesale services in all locations in which BT has SMP in the relevant markets, for all applications, including mobile backhaul. While respondents expressed significant interest in passive remedies, it is very difficult to judge the extent of demand as this would be very much driven by the terms and conditions of access, including form of a passive remedy, product design, its scope and price.

A23.189 The speed with which CPs might migrate from active remedies to passive inputs may vary depending, among other things, on the form of passive remedy. We consider that the scope and timescales of any deregulation are more uncertain with duct access given the greater investment required. In particular, duct access requires CPs to deploy their own access networks and is attractive to CPs who can leverage economies of scale. It therefore presents a much higher barrier to usage when compared to dark fibre and is likely to have much slower take-up.[616] In contrast dark fibre provides a more direct substitution to wholesale leased lines.

A23.190 In addition, the timescale to move to passive inputs would differ between existing and new circuits:

- For existing circuits, CPs would need to consider the duration of contractual commitments, early termination charges and the potential of disruption for their customers. The differences between the respective prices would therefore play a large part in determining how quickly the industry would use them. Where the

[615] See TalkTalk and Vodafone non-confidential responses to the November Consultation, page 13 and 18 respectively.

[616] [✂ ✂]

overall economics of proposition offer some savings when compared with early termination charges, the CPs would have strong incentives to migrate.

- For new circuits, we would expect that CPs should be able to take advantage of passive inputs sooner. We are conscious however that some CPs have signed long-term contracts based on active products which means that they are unlikely to move demand to passive inputs before their contracts expire.[617]

A23.191 In summary, if we were to impose passive remedies, CPs are likely to start using them to fulfil requirements for new services. CPs may be able to replace existing installations of BT's wholesale leased lines only gradually, as and when their users request upgrades or changes.

A23.192 In relation to BT and Virgin's argument that maintaining both passive and active remedies would be a considerable regulatory burden, we recognise that there is likely to be a need for coexistence on a short to medium term basis. However, we expect that opportunities to rely less on active regulation would emerge beyond that period. Although we cannot fetter our discretion for future market reviews, we think that, in principle, the introduction of passive remedies should provide scope for deregulation in the long term.

A23.193 As to parallels drawn with the introduction of LLU by some respondents, we note that the existing set of LLU services was developed and refined by BT and industry over a number of years, involving significant time and investment. As the broadband and voice markets developed and competition from LLU became established in many geographic areas, it has enabled a significant degree of deregulation in the downstream Wholesale Broadband Access (WBA) market.[618]

A23.194 However, in contrast to LLU, which was introduced to primarily support the development of consumer broadband services from a relatively low base, the current situation in the leased lines markets is different. Therefore, we need to be mindful that any evolution from the current regulatory regime to one where competition based on passive remedies is sustainable and effective may take a longer period than in the case of LLU.

Provisional conclusions

A23.195 We consider that where passive remedies lead to sufficiently vigorous competition, there would be less need to impose active remedies. Therefore, we would expect that passive remedies could also lead to the withdrawal of downstream regulation over time, reducing the overall regulatory burden.

A23.196 The feasibility and timescale of any withdrawal is also likely to vary by geography and be dependent on the form of the passive remedy. We consider that the scope

[617] [✂

✂]

[618] http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/statement-june-2014/volume1.pdf

and timescales of any deregulation are more uncertain with duct access given the greater investment required. In addition, we also recognise that CPs may be likely to prioritise their focus more on using duct access to fill “gaps” in the market to deploy access network. With dark fibre we might expect to observe more of a one-to-one relationship between active circuits and a dark fibre remedy and therefore more likelihood for a timely transition to passive inputs.

Forms of passive remedies and allowed use

A23.197 In considering options which may include passive remedies we are also looking at a range of issues relating to their form and potential uses which could benefit from having access to passive inputs. In practice, the nature and scale of benefits that could be delivered by passive remedies as well as the scale of potential costs would be dependent on the type of applications they are used to supply as well as the form of passive remedy. These would determine how and where passive remedies are used, and the ultimate impact on competition and consumers. For this reason, our assessment of whether to impose passive remedies takes into account the form and allowed uses of passive remedies.

A23.198 In the April CFI we asked for views on which passives were suitable for use in leased lines markets, in the event that we decide to impose passive remedies. In response, the majority of stakeholders identified dark fibre and duct access as suitable for leased lines. We have also asked about applications for which CPs could use each of the types of passive remedy. CPs had differing preferences for the passive product solution but in general they favoured duct access for network deployment purposes and dark fibre for longer point-to-point links. While preferences between the two depended on the intended use, most respondents' interest was focused on dark fibre (particularly for mobile and fixed backhaul).

A23.199 Subsequently, in our November Consultation, we discussed the type of applications for which passive remedies could be used. In particular, we asked stakeholders if they agreed with our initial view that mobile backhaul and fixed broadband backhaul are likely to be the primary applications with significant demand for passive remedies. In addition, we set out our initial views that most of the potential benefits of passive remedies appear to be associated with control of the electronic equipment used to provide leased lines and consequently dark fibre appears to offer most of the benefits of duct access. We asked stakeholders' input on benefits which duct access might offer over dark fibre and vice versa and whether they consider there is a case for having both remedies.

A23.200 Below we provide summaries of the responses we received to both consultations.

Stakeholder responses to the CFI

A23.201 Verizon said [✂

✂] [619]

A23.202 Vodafone stated that all passive remedies are worth consideration, but expressed a preference for dark fibre.[620] It thought that dark fibre avoids many of the practical

[619] Verizon confidential response to the CFI, Q. 12.

[620] See Vodafone non-confidential response to the CFI, page 13

issues associated with duct access, and can be readily implemented using existing systems and processes developed for EAD. Vodafone said that it would use the passive inputs to extend from its network points to base station sites, its network points to BT local exchange sites and its network sites to connect to end customer sites.[621]

A23.203 EE, Three and MBNL also expressed a preference for dark fibre.[622] They considered that passive remedies would encourage more providers to compete with BTW in the provision of a cost effective, nationwide end-to-end mobile backhaul product, by reducing costs and lowering barriers to entry in that network segment.[623] [✂

✂][624]

A23.204 TalkTalk said that it is a significant purchaser of wholesale business connectivity products (predominantly Ethernet) both for LLU backhaul for its broadband network and to provide leased lines for business customers. It considered that for its use dark fibre would be the most suitable remedy. TalkTalk added that dark fibre does not have high scale economies and therefore, its viability is not dependent on high density of use. It said that the use of other passive remedies such as duct/pole access may be more concentrated in areas of higher demand since (depending on how these products are priced) they may have high scale economies.[625]

A23.205 TalkTalk also noted that if duct and pole access were permitted for Business Connectivity Market, it would allow (at least in theory) economies of scope between these two applications in the same way that BT is able to achieve scope economies from its use of duct/poles – for instance, it can and does use the same duct/poles to carry fibre for VULA and BCM. The magnitude of the benefit will depend on the uptake of duct/pole access for each of VULA and BCM and the overlap in term of which ducts/pole are used.[626]

A23.206 **[✂ ✂]** said that a passive remedy could be used in the core, aggregation and access segments of the network. It considered that dark fibre will provide the most suitable solution. While wavelength unbundling could be used, **[✂ ✂]** thought that it will only be commercially viable when replacing high bandwidth legacy applications. **[✂ ✂]** also added that duct access could prove a useful and viable remedy but noted that the restrictions to its use would need reviewing.[627]

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[621] See Vodafone non-confidential response to the CFI, page 15.

[622] See EE, Three and MBNL joint non-confidential response to the CFI, page 8.

[623] See EE, Three and MBNL joint non-confidential response to the CFI, page 9.

[624] See EE,MBNL, Three, confidential response to the CFI, page 11.

[625] See TalkTalk non-confidential response to the CFI, page 3 and 19.

[626] See TalkTalk non-confidential response to the CFI, page 16. It also noted that it does not need to be the same operators providing services in the VULA and BCM markets for scope economies to be achieved since a merchant market could operate whereby, for instance, one operator could use duct sharing to deploy fibre that it uses for BCM products and then provide (say) dark fibre to another operator which uses it to provide VULA products. It also said that the economies of scope for dark fibre are likely to be small.

[627] [✂ ✂]

A23.207 Colt saw merits in both PIA and dark fibre. It considered that duct access is the right remedy for Colt to build local rings as it provides the benefit of multiple fibres as well as flexibility for CPs to choose the different routes they need their ring to follow. It added that with a workable duct access offer, operators can decide not to precisely follow BT's topology but to use one part BT's path via a given duct and then dig to join another duct and hence create very different topology. Colt said that duct access would give the opportunity for CPs to build their network in a technically and economically efficient way.[628] In terms of dark fibre, [✂ ✂]. [629]

A23.208 Sky considered that passive remedies could potentially be used for a variety of applications in addition to LLU backhaul. It viewed duct access as most applicable where CPs needed to connect to exchanges that are small, but a significant distance away from its nearest point of presence, while dark fibre would be preferable for longer point-to-point links, where duct would be more complicated or costly due to duct limitations.[630]

A23.209 UKCTA viewed duct access and dark fibre as the most important forms of passive access for CPs, but noted that members have yet to express a view on wavelength unbundling.[631] In terms of use, UKCTA saw that dark fibre and duct access could be applied in different circumstances. Dark fibre is of greatest use in providing a point-to-point connection between two locations, where suitable infrastructure already exists and is typically a more efficient method of serving longer distance connections (such as a fibre ring inside a city and another fibre ring in a business park outside the city), whereas duct access could be used when a CP wishes to configure its own topology or route.[632]

Stakeholder responses to the November Consultation

Applications with demand for passive remedies

A23.210 We asked the following question:

> *Question 5: Do you agree with our initial view that mobile backhaul and fixed broadband backhaul are likely to be the primary applications with significant demand for passive remedies?*

A23.211 In its response, Telefonica said that mobile backhaul and fixed broadband backhaul are the main areas utilising higher bandwidth fibre based access services from BT. It was of the view that the broad usage of Openreach infrastructure for all manner of

[628] See Colt non-confidential response to the CFI, page 30.

[629] See Colt confidential response to the CFI, page 31.

[630] See Sky non-confidential response to the CFI, page 4

[631] See UKCTA non-confidential response to the CFI, page 9. It shared its initial indications that it could provide a substitute for dark fibre in some situations (perhaps where no spare fibre is available) but it is unclear what the other costs and benefits might be when compared with dark fibre.

[632] UKCTA non-confidential response, p. 9. UCKTA also noted that CPs in jurisdictions where the applicable remedy is available for this purpose, use duct access to construct metropolitan fibre networks by linking duct segments that already exist.

connectivity means it could be seen as unfair to limit passive remedies to specific applications.[633]

A23.212 The FCS members considered that mobile and fixed backhaul are of prime interest in terms of demand for passive remedies but noted that research by the FSB has shown that over 70% of small businesses predict an increase in reliance on the internet and almost half would welcome an increase in the availability of bespoke telecoms and IT packages.[634]

A23.213 Virgin Media also agreed that mobile backhaul and fixed broadband backhaul are likely to be the primary applications with significant demand for passive remedies adding that purchasers of high capacity backhaul are hopeful that they will be able to reduce their costs (through taking advantage of an arbitrage opportunity).[635]

A23.214 INCA was also of the view that mobile backhaul and fixed broadband backhaul are likely to be the primary applications with significant demand for passive remedies. It anticipated that passive access will help develop the market for high speed fixed (http) and wireless networks.[636]

A23.215 Six Degrees Group said that mobile/fixed backhaul would provide a large bulk of deployment due to the scale of the networks involved in these areas. In terms of its use, Six Degrees Group said it would primarily utilise these circuits to provide business connectivity to its customers, as a replacement for the existing EAD product set. In addition, it would also look to utilise it to provide backhaul for its deployments in BT exchanges.[637]

A23.216 UKBN agreed that mobile and fixed broadband backhaul are important and perhaps primary applications for passive remedies, particularly dark fibre, and it pointed out that this would include backhaul for fixed wireless services such as those provided by Relish.[638]

A23.217 Commenting on the primary applications with significant demand for passive remedies, Bit Commons said there is a longer term gain in creating conditions for a pro-competitive market to progress and supply FTTP to every home and business. In the short term the supplying of fibre only access to multi-dwelling units, business parks and multi-tenanted business units could grow significantly.[639]

A23.218 In Sky's view the usage cases considered by Ofcom in the Consultation such as mobile and LLU backhaul, business grade broadband and unlocking residential

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[633] See Telefonica non-confidential response to the November Consultation, page 6-7.

[634] See FCS non-confidential response to the November Consultation, page 3.

[635] See Virgin Media non-confidential response to the November Consultation, page 26.

[636] See INCA non-confidential response to the November Consultation, page 4.

[637] See Six Degrees Group non-confidential response to the November Consultation, page 5.

[638] See UKBN non-confidential response to the November Consultation, page 3. In June 2014, the UKB Group entered the UK market for residential and business broadband with the launch of broadband services under the Relish brand in central London. Relish offers a range of products including residential broadband, business broadband, and mobile broadband based on UKB's licensed 4G LTE spectrum, as well as Dedicated Business Internet using point to point microwave technology.

[639] See Bit Commons non-confidential response to the November Consultation, page 4.

FTTP services represent opportunities to maximise any investment using passive remedies. It added that while some applications and resulting benefits of passive remedies can be forecast today, it is not possible to identify them all because future uses and efficiencies will only become apparent once CPs have has the opportunity to invest and innovate around regulated passive access products.[640]

A23.219 In relation to usage cases for regulated passive access, Sky made a number of additional comments[641]:

- The economics for the FTTP network deployment are challenging and in order to make it more economically viable access to cost efficient methods of delivering fibre to each neighbourhood and the flexibility to use the use FTTP network to satisfy all end users would be required. FTTP networks give opportunity to provide multiple services such as residential, business grade, broadband and leased lines, backhaul and whole broadband services to other CPs. Sky argued that passive access to infrastructure unconstrained by the end product offered would allow it to maximise the value of the FTTP network deployment and unlock the investment in viable alternative access networks.

- Passive access, in particular dark fibre would likely increase the scope for LLU operators to access cost efficient backhaul that is sufficiently flexible to rapidly respond to the changing requirements of their customers. It would allow for a choice in technology or transport topology. This is, Sky said, in contrast with a FTTP deployment which seeks to reduce connection cost by installing cables carrying multiple fibres into unused ducts that pass premises in anticipation of future orders.

- Mixed usage of dark fibre and duct access can provide a cost efficient opportunity to extend the reach of FTTP networks. Where CPs are required to install new cables, duct and pole access will be preferred to dark fibre as it would provide more flexibility to control the cost of an FTTP deployment. Outside the FTTP serving area, access to dark fibre alongside duct and pole access can facilitate cost efficient deployment to premises including business, multiple dwelling units, mobile mast sites and remote FTTP areas too small to be served by a local POP.

A23.220 Level 3 said that although mobile backhaul and fixed broadband backhaul are likely to be the applications with significant demand, any passive remedy should not be restricted in its use as many CPs would be very interested in making use of passive remedies for business connectivity.[642] [✂

] ✂[643]

A23.221 CityFibre said that as a provider of dark fibre products to CPs, it may wish to explore the potential to extend the geographic coverage of its fibre networks by access to BT ducts and poles. It believed that passive remedies for unrestricted duct access are most relevant in geographic areas where BT have expanded or

[640] See Sky non-confidential response to the November Consultation, page 6.

[641] See Sky non-confidential response to the November Consultation, page 9-12.

[642] See Level 3 non-confidential response to the November Consultation, page 5.

[643] See Level 3 confidential response to the November Consultation, page 5.

upgraded its network using state aid i.e. broadly the rural areas where BT has benefited from BDUK funding.[644]

A23.222 The PAG considered that Ofcom's focus should be on setting appropriate conditions for the availability of passive remedies, rather than second-guessing how those remedies will be used. It believed that passive access will promote all types of network investment. This will include, for example, fibre-to-the-premises deployments (such as fixed broadband backhaul), mobile backhaul and potentially many other applications. The PAG considered that the market innovations that will result from investment in passive access cannot be known and identified in advance and that an attempt to quantify the value of innovation *ex ante* (or design remedies or usage restrictions to reflect where demand is likely to lie) will be futile.[645]

A23.223 Colt disagreed with Ofcom's view that mobile and fixed backhaul are the primary applications with significant demand for passive remedies. It said that Ofcom's discussion mostly ignored Colt's earlier submission describing its approach to use duct access to build city fibre rings and whether it would offer tangible benefits in the UK market context. While Colt acknowledged that duct access would require greater changes to cost allocation and pricing mechanisms than dark fibre, it believed that excluding duct access as a remedy is another lost opportunity for the UK.[646]

A23.224 It argued that the construction of new fibre networks covering broad areas such as city centres and outlying business parks would be the primary application of passive remedies. Once in place, the fibre network can be used for any purpose including business connectivity and fixed/mobile backhaul.[647]

A23.225 Colt argued that the business model it advocates is not subject to the criticism levelled against passive access in the past, that it is a straightforward arbitrage. The reason is that the creation of a new fibre network is not directly substitutional with any BT downstream product as they have different:

- technical characteristics in that they are able to offer different features and levels of performance (e.g. for higher-end markets offering low latency and network monitoring, and lower end markets involving contended services);
- service characteristics in that they are able to offer their on-net SLA (superior by far to the offnet SLA where the service level is constrained by the underlying inputs from Openreach);
- geographic characteristics in that Colt plans to target geographic markets that are untouched by other operators (particularly business parks) – just as they do in continental Europe;

[644] See CityFibre non-response to the November Consultation, page 9.

[645] See the PAG non-confidential response to the November Consultation, page 12-13.

[646] See Colt non-confidential response to the November Consultation, page 1.

[647] See Colt non-confidential response to the November Consultation, page 5.

- economic characteristics in that ring architecture allows incremental expansion in a way that a tree and branch architecture does not.[648]

A23.226 In relation to applications with significant demand for passive remedies, [✂ ✂] said that there could be demand for backhaul from access aggregation points to the core. It argued, however, that the BCMR needs to create an environment in which the market can determine how best to service businesses without being overly prescriptive in how. [649]

A23.227 WarwickNet said that its biggest problem is lack of viable mid-mile backhaul at 10Gbit/s from BT.[650] It added that it has increasing number of requests for 10Gbit/s on the customer access side and noted a lack of EAD 10Gbit/s product.[651]

A23.228 Vodafone considered that backhaul is likely to be a large user of passive remedies, however it also thought that many business customers require high bandwidth connectivity (classed as AI).[652]

A23.229 GTC said that its use of passive remedies would be focused on the construction of infrastructure for new homes. GTC explained that it does not purchase access connections from third parties (because it self-constructs a GPON access segment to an optical line terminal (OLT) and only purchases backhaul. GTC requires a backhaul connection from its GPON access network to the nearest point of presence where traffic can be aggregated across a number of sites. It can then be backhauled further to GTC's core network. It said that a requirement for passive backhaul services to new developments would be straightforward to consider under the BCMR on an analogous basis to mobile backhaul. [653]

A23.230 In terms of the applications with significant demand for passive remedies, Hyperoptic noted that there is significant demand within London and the UK for 'high-speed' broadband. If available, Hyperoptic would make use of dark fibre and/or duct access to offer a differentiated 1 Gig FTTB solution to more homes than can be done using existing active products given their high operating costs.[654]

Benefits that duct access might offer over dark fibre and vice versa

A23.231 We asked the following question:

Question 6: What benefits might duct access offer over dark fibre and vice versa? Is there a case for having both remedies?

[648] See Colt non-confidential response to the November Consultation, page 5-6.

[649] See [✂ ✂]

[650] It further explained that it does not follow the traditional model of taking space in BT exchanges (thus has no access to the EBD). WarwickNet's POPs are very distributed (typically located at each business park it serves), and if Virgin Media's backhaul is not available, the backhaul with BT is costly especially over 1Gbit/s.

[651] See WarwickNet non-confidential response to the November Consultation, page 3.

[652] See Vodafone non-confidential response to the November Consultation, page19.

[653] See GTC non-confidential response to the November Consultation, Legal Annex, page 2.

[654] See Hyperoptic non-confidential response to the November Consultation, page 2.

A23.232 Sky was in favour of having all forms of passive access available as it considered they are complementary remedies. In particular it said that with unconstrained access to BT's ducts, poles and dark fibre, CPs will be able to deploy their own cable or active equipment to configure flexible and efficient networks which are significantly less constrained by BT's topology. It further claimed that such wide access would maximise the benefits.[655]

A23.233 Level 3 expressed support for both duct and fibre and possibly a hybrid of the two. To the extent that duct space was not available due to congestion or the state of repair of the infrastructure, then a dark fibre option would be a suitable alternative. It saw additional benefit from duct access in the ability to avoid issues it encounters with BT in relation to capacity management & fibre planning. It admitted, however, the prospect of added complexity when CPs seek access to Openreach's chambers to deploy their own fibre systems, including BT's reluctance to recover redundant or unused cables so as to create space for its competitors suggesting regular spot check audits to measure compliance. Level 3 said that dark fibre, while less attractive than a duct or duct/fibre hybrid model, would still offer some tangible improvements over the current situation.[656]

A23.234 Telefonica considered that dark fibre would be more effective and accelerate adoption compared to the very market specific/labour intensive duct access products (assuming that PIA mechanisms for utilisation would apply). It acknowledged that duct access requires the CP to have the process, mechanisms and skills to survey, select and facilitate installation of physical cables, the burden of actually achieving this may be limited to CPs who already have the capability, and may prevent new entrants and/or CPs who do not have such skills. Dark fibre products could enable the deployment of CP's own active components using Openreach processes for active services.[657] [✂

✂].[658]

A23.235 Colt argued that duct access and dark fibre are complements and that the value of each is enhanced by the existence of the other. It said that the full range of benefits from passive remedies requires that both are available. It explained that typically, when building fibre networks it uses duct access to construct the fibre ring and dark fibre to connect the fibre rings where they are not adjacent.[659] Colt said that dark fibre cannot generally be used to construct fibre rings unless all the routes required already exist. If they already exist, there is mostly likely no case for constructing new network. It stated that dark fibre cannot be used for strategic network expansion in the same way that duct access can.[660]

A23.236 Colt referred to Ofcom statement that "(…) the incremental benefits offered by duct access appear relatively small, particularly in the context of backhaul for the fixed

[655] See Sky non-confidential response to the November Consultation, page 1-3.

[656] See Level 3 non-confidential response to the November Consultation, page 6.

[657] See Telefonica non-confidential response to the November Consultation, page 6-7.

[658] See Telefonica confidential response to the November Consultation, page 7-8.

[659] See Colt non-confidential response to the November Consultation, page 6.

[660] See Colt non-confidential response to the November Consultation, page 6.

access and mobile applications that appear to be of most interest" and said that it does not believe this is the most important, significant or transformative use of passive remedies. Colt further added that Ofcom cannot make the assertion that duct access offers only minor incremental benefits without at least making a reference to the benefits that Colt claimed for fibre networks constructed using duct access.[661]

A23.237 The PAG argued that duct and dark fibre are complementary and there is likely to be demand for both in different scenarios. It added that concurrent access to both remedies will lead to the best competitive outcomes and is consistent with the regulatory approach taken in the UK (in other markets) and elsewhere in Europe:

- Duct offers, for example, the ability for CPs to configure their active network to reflect demands from different customers; significant flexibility and adaptability; economies of scope and the opportunity for cost-effective network expansion.

- Dark fibre's benefits include less duplication of infrastructure in use cases where a service can be effectively delivered using an existing BT fibre route; being potentially simpler and quicker to use; and enabling faster delivery of solutions to customers than would be the case using duct access.[662]

A23.238 The FCS stressed that some CPs may wish to install their own fibre in existing ducts, others to "rent" existing dark fibre installations. It considered that the variety of service requirements of the business community call for a variety of solutions.[663]

A23.239 In response to the question on benefits duct access might offer over dark fibre and vice versa, [✂ ✂] said that there is a case for both remedies and that the remedies in the BCMR need to be as broad and open as to allow the market to address how to serve specific businesses and buildings. Duct access affords the market to create competition in dark fibre i.e. operators could take sub-duct and lease fibre accordingly and therefore is the most required remedy; dark fibre remedies allow the market to accelerate service of businesses by avoiding the need to have to negotiate sub-duct access. [✂ ✂] suggested that Ofcom may wish to consider a step further which is to have a remedy requiring the provision of wavelengths on existing fibre which affords operators the ability to share the burden of the business rates liability on a strand of lit fibre which is a substantial economic factor in considering building infrastructure.[664]

A23.240 GTC favoured dark fibre as a remedy and considered that duct access does not offer any benefits over dark fibre (at least for GTC's purposes). It therefore saw no purpose in both remedies being made available.[665] GTC said that a dark fibre access remedy should be suitable for use for the purpose of connecting new local networks constructed by OCPs (either from pure housing developments, or from

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[661] See Colt non-confidential response to the November Consultation, page 6.

[662] See the PAG see non-confidential response to the November Consultation, page 13. This view was reinforced by a report prepared for the PAG by Towerhouse LLP, page 14-16.

[663] See FCS non-confidential response to the November Consultation, page 3.

[664] See [✂ ✂]

[665] See GTC non-confidential response to the November Consultation, page 32. GTC discussed the limitation of the PIA remedy, see pages 29-30.

mixed-use developments) to core backhaul networks. It envisaged its use of the dark fibre in a point-to-point topology either:

- as 'Aggregation Backhaul' that GTC will typically run at speeds of up to 1Gbps, in a similar way to the EAD circuits that GTC currently purchases; or
- as 'Access Backhaul' that will form part of PONs currently running at speeds of up to 2.5Gbps.[666]

A23.241 Hyperoptic said that the remedy must ensure access is to both the dark fibre and the duct infrastructure. However, it said that if Openreach is obliged to provide access to dark fibre wherever requested with cost based pricing then duct access (above and beyond what is already offered by PIA) may not be necessary.[667]

A23.242 INCA noted that some existing providers of dark fibre may be able to extend their networks using BT's ducts and poles if demand is there. However it noted that few companies have taken up the existing PIA product, in part because of caveats on the conditions for its use.[668]

A23.243 In terms of benefits of duct access over dark fibre, while Six Degrees Group could see a benefit in flexibility for duct access, at this stage it would be unlikely to utilise a duct access remedy. It viewed dark fibre as a more standardised product, which would better fit into its product and support processes. This would also more closely mirror the existing active product T2R processes within Openreach (as from an engineering point of view it would likely appear as an EAD circuit without the active equipment on each end). Although it admitted it would like to see both remedies to be able to maximise innovation, if it had to commit to a single one, it would be dark fibre.[669]

A23.244 In relation to benefits duct access might offer over dark fibre, UKBN said for increasing capacity in its backhaul network, dark fibre would be its favoured remedy. [✂

✂][670] UKBN considered that

[666] See GTC non-confidential response to the November Consultation, page 27.

[667] See Hyperoptic non-confidential response to the November Consultation, page 1.

[668] See INCA non-confidential response to the November Consultation, page 4.

[669] See Six Degrees non-confidential response to the November Consultation, page 5-6.

[670] See UKBN confidential response to the November Consultation, page 1 and 4.

there is a risk of imposing a remedy only of duct access as take-up of this service might be comparatively low due to the complexities involved and it therefore might not be deployed on a widespread basis and would not be adequate for the backhaul market.

A23.245 UKBN also said it would prefer to have both remedies available as they are not necessarily a substitute for each other and that such remedies would be used by different operators for different purposes. For example, duct access would likely be used in the access network or for short connecting sections, whereas dark fibre would likely be used for longer circuits or by operators without the scale or business model for infrastructure build.[671]

A23.246 WarwickNet was of the view that duct access and dark fibre have a place:[672]

- PIA with duct access is perfect for 'local' solutions, within a 1km circumference of a provider POP. It said that within business parks it expects to be able to connect new customers to fibre with PIA in under two weeks.

- On longer mid-mile backhaul PIA scales quite badly and leasing of Dark Fibre is preferable.

A23.247 Vodafone saw that there is a need for both dark fibre and duct access as these inputs are complementary in nature. The density of its customer base will determine the viability of either dark fibre or duct access at a given location. Local deployments of duct access in the business market may well require dark fibre for backhaul connectivity to its wider network. It noted its recent announcement of entry into the fixed consumer broadband market and said it would want to share infrastructure between customer types without restriction. [673]

A23.248 Vodafone further added that duct access would enable CPs to deploy significant amounts of fibre hence ensuring sufficient fibre availability in support of high demand for bandwidth and could overcome BT's current point-to-point active service architecture by deploying local rings. The provision of dark fibre allows more immediate roll out of services by the CP and would be a better solution where customer density is not expected to be high enough to implement a fuller local network solution.[674]

A23.249 Virgin Media considered that it is premature at the present time to consider the question on benefits which duct access might offer over dark fibre and vice versa and whether there is a case for having both remedies. It stressed that the fundamental question is whether it is appropriate to impose a passive remedy per se.[675]

[671] See UKBN non-confidential response to the November Consultation, page 4.

[672] See WarwickNet non-confidential response to the November Consultation, page 3.

[673] See Vodafone non-confidential response to the November Consultation, page17.

[674] See Vodafone non-confidential response to the November Consultation, page19.

[675] See Virgin Media non-confidential response to the November Consultation, page 26.

Provisional conclusions

A23.250 Although CPs had differing needs, the responses to the November Consultation make it clear that there is an appetite to use passive remedies for a wide range of applications in the business connectivity market, and not only for mobile and fixed backhaul. Therefore, we consider that the benefits from having control over the choice of electronic equipment and a greater responsiveness to the end users' needs including differentiation in their product offering are likely to be realised across all market segments.

A23.251 As such, our preference would be not to restrict the use of passive inputs for any specific applications within the business connectivity market. Although, as we discuss in Annex 24, the restrictions in the use of passive remedies could help minimise some of the unintended consequences of introducing them such as disruption to common cost recovery, they could also significantly reduce the usefulness of a remedy. In particular, any restrictions may not allow CPs to maximise the scale and scope efficiencies of their investment and as such undermine the business case for using passive remedies. In addition, any usage restrictions would limit the scale of potential to relax downstream regulation given that active remedies are used across a range of applications.

A23.252 The type and scale of the benefits that could be delivered using passive inputs are not only dependent on the applications they are used to supply, but also on the form of a remedy. In terms of the form of passive remedies, although CPs had differing needs, stakeholders identified both dark fibre and duct access as suitable for a range of applications in business connectivity market. We recognise that dark fibre and duct access could be used and preferred in different circumstances. CPs indicated that duct access may be preferable where they need to connect multiple fibres over relatively short distances, while dark fibre would be preferable for longer point-to-point links.

A23.253 In the analysis we set out above under different categories of benefits that passive remedies could provide, we have considered how these vary as between dark fibre and duct access. At a high level:

- With dark fibre, the most significant element which would fall under the CP's control is the electronic boxes which operate the fibre optic cable. This could give opportunities to innovate in this element of the network with alternative technical standards, line speeds, monitoring and new features at the discretion and risk of the competitive entrant.

- Duct access provides access at a deeper level of the value chain and in addition to the potential for innovations at the active layer, it could expose the choice of the fibre and blowing of the fibres as well as give more scope for different architectures or configurations. It also allows deploying access networks to serve customers.

A23.254 In relation to addressing CPs' concerns around having more flexibility to make investment decisions and innovation choices independently of BT, we consider that dark fibre offers similar benefits to duct access. Both provide a greater control over the choice of electronic equipment and a greater responsiveness to the end users' needs as well as allow CPs to differentiate their product offerings. In theory, duct access could give CPs greater scope to offer better provisioning of service to the extent they are able to manage the provision of the fibre circuits better than BT. However, based on our analysis on BT's quality of service, even with duct access,

some of the factors that affect Openreach's quality of service such as street works restrictions and way leaves would also affect CPs. Overall, it is not clear to us that in practice duct access delivers a significant degree of innovation potential over that which could be realised through access to dark fibre.

A23.255 We acknowledge, however, that there could be potential benefits from CPs having more control over the design and configuration of their networks. While the overall scale of this benefit would depend on the form of any passive remedy, duct access allows for more flexibility in optimising design and could offer more potential for the CPs footprint expansion. As such, dark fibre and duct access could achieve different aims with duct access allowing for a network deployment. The key benefit in this scenario seems to lie in improving the case for investment in areas where it is uneconomic to self-build. To the extent that cost of duct access is lower than the cost of self-build otherwise required in a specific location, it would reduce CPs' overall investment required in deploying network. Where this investment occurs, consumers may expect some combination of lower prices and innovative services.

A23.256 However, as we set out above, we consider that the additional benefits of duct access cited by CPs are more relevant to encouraging investment in fibre infrastructure generally, rather than to addressing specific competition problems in the business connectivity market. In this respect, we consider that dark fibre has the advantage of offering a more rapid roll out of services by the CP with the potential for wider take up than duct access, leading to greater potential benefits. Duct access by contrast requires CPs to deploy their own access networks in BT ducts and therefore presents a much higher barrier to usage.[676] In addition, we consider that CPs will be only able to profitably utilise BT's duct within a narrow range of locations. We therefore would anticipate higher take-up of a dark fibre remedy than duct access.

Summary of provisional conclusions

A23.257 Based on our analysis, we conclude provisionally that:

- By reducing reliance on BT's processes, passive remedies would offer CPs more scope to realise dynamic efficiencies when compared to active remedies alone, both in the form of technical solutions and features, enabled by independent choice of equipment, and in the form of greater responsiveness to end-users' needs, enabled by more direct control over operational activities such as upgrades and configuration of services;

- in relation to productive efficiencies, passive remedies could provide CPs with opportunities to reduce duplication of equipment, reducing overall equipment costs and lead to lower prices; and

- passive remedies could allow us to simplify regulation in future.

A23.258 We consider that the flexibility offered by passive remedies could incentivise CPs to deliver a range of innovative services. Although it may be possible for BT to deliver

[676] In contrast, we consider that dark fibre has the advantage of ensuring a smoother and quicker transition to passives if it is based on existing operational processes used for the provision of active services making it simpler for CPs to use. Dark fibre, therefore, offers the potential for more rapid roll out of services by the CP.

some innovations in the form of solutions based on active remedies, we consider that passive remedies provide greater dynamic efficiency benefits by allowing each CP to decide independently whether, how and when to proceed with such developments, rather than requiring Openreach and CPs to coordinate.

A23.259 In our view, the key opportunities for innovation and competition from passive access lie at the active layer. To the extent that CPs aim to have a greater control of the electronic equipment used to provide leased lines to differentiate their offerings, both dark fibre and duct access offer similar benefits. However, we consider that dark fibre offers the potential of allowing a more rapid roll out of services by CPs.

Annex 24

Impacts and risks of passive remedies

Introduction

A24.1 This section sets out our consideration of the broad categories of potential impacts and risks associated with the introduction of passive remedies based on the responses from stakeholders and our own analysis.

A24.2 In the November Consultation, we set out two broad categories of potential adverse impacts and risks associated with the introduction of passive remedies.

A24.3 The first related to the potential impact on dynamic efficiency, including investment incentives of BT and other CPs. In particular, we noted it would be important to consider the extent of existing passive infrastructure investment by BT and other CPs, as well as the potential impact of passive remedies on their incentives to invest in the future.

A24.4 The second related to allocative efficiency and distributional impacts arising from the implications for common cost recovery and rebalancing of prices. In particular, we noted that BT could seek to increase some of its charges if we impose passive remedies, given the relatively significant contribution which BT's sales of high-bandwidth wholesale leased lines currently make to recovery of its common costs. In setting controls on BT's charges we generally ensure that BT has an opportunity to recover its efficiently incurred costs, including common costs, and so we noted that if we were to impose passive remedies, we would take care not to undermine that opportunity. Therefore, if BT's revenues from high-bandwidth wholesale leased lines were to reduce as a result of our imposition of passive remedies, its charges for other services may need to rise. The overall impact on the pattern of BT's charges would depend on the design and scope of any passive remedies we may impose. We also noted that the impacts of any increases may not be confined to leased lines prices, and could potentially include prices of wholesale services used to support voice and broadband services sold primarily to residential consumers.

A24.5 In light of responses to the November Consultation and our own further analysis, we have now refined our consideration of the potential impacts and risks associated with the introduction of passive remedies. These include the potential impact on:

- Dynamic efficiency, including investment incentives for BT and other CPs;
- Allocative efficiency and distributional impacts arising from the implications for common cost recovery and rebalancing of prices;
- Productive efficiency, including the potential loss of economies of scale; and
- The structure of competition in the market.

A24.6 We also note that introducing passive remedies is likely to incur at least some implementation costs, which could have an impact.

A24.7 We now set out a summary of responses received to both the CFI and the November Consultation on each of these potential impacts, and set out our preliminary view and analysis of each. We recognise that the scale and scope of

these potential risks will be directly affected by the remedy design (including scope, pricing etc)[677], and so also discuss these potential interactions.

Dynamic efficiency, including investment incentives

Responses to the April 2014 CFI

A24.8 In response to the April 2014 CFI, some stakeholders commented on the potential impact of passive remedies on investment incentives (and therefore dynamic efficiency) in relation to:

- The investments made under the current regulatory regime that may be stranded by a change to a different regime;
- The risk that passive remedies may undermine CPs' incentives to invest in their own infrastructure; and
- The risk that passive remedies may generate 'inefficient' investment.

A24.9 BT considered that the introduction of passive access products could lead to 'cherry picking' whereby CPs would use passive remedies to only offer more lucrative services, such as high-bandwidth leased lines for businesses or mobile backhaul. It believed that this would undermine its ability to price discriminate across different bandwidths, and this would adversely impact on dynamic efficiency through distorting investment incentives for all CPs. Virgin Media also recognised the risk of cherry picking (noting that the areas with most commercial opportunity were least in need of competition driven by regulation), and more generally argued that if structured in an inappropriate manner, passive remedies could undermine genuine network investment.[678]

A24.10 In relation to BT's investment incentives, BT said that a passive remedy would violate Ofcom's "fair bet" principle by expropriating BT's spare capacity currently available for future growth.[679]

A24.11 BT also argued that as the spare capacity within BT's network was built to account for future demand, passive remedies (if imposed) would allow other operators to use this, in particular where demand is high. BT stated that this would mean its investments would not be able to accommodate future growth and where there is less demand BT would have to bear the cost of the resulting excess capacity.[680]

A24.12 Some other CFI respondents stressed that if passive remedies were designed and priced appropriately, this should not undermine genuine network investment as this

[677] We note that GTC also argued that the scope for any risks to be significant depends on the scope of the remedy, with tightly defined remedies aimed at a specific market failure lowering the risk. See GTC non-confidential response to the November Consultation, page 26.

[678] Virgin Media non-confidential response to the April 2014 CFI, page 7.

[679] See BT non-confidential response to the CFI, pages 19, and 24 to 25. The 'fair bet' concept seeks to provide BT with an opportunity to recover its efficiently incurred costs. This gives BT the scope to invest with a forward-looking view of demand and bear the benefits or costs of that investment, depending on whether its predictions underestimate or overestimate growth opportunities, in order to maintain investment incentives. Therefore it is important for promoting dynamic efficiency.

[680] See BT non-confidential response to the CFI, paragraph 100, page 24.

would limit potential inefficient investment arising from differences between passive and active prices. In particular, UKCTA argued that the arbitrage and cost recovery risks have been solved in other countries[681], and along with Vodafone argued that setting passive prices in line with existing regulatory costing principles (including a contribution to common costs) would not appear to be detrimental to BT's cost recovery and investment incentives. Vodafone also argued that such an approach should not fundamentally alter expected returns on competing networks.[682] Additionally, TalkTalk argued that the risk of stranded assets is low.[683]

Responses to the November Consultation

A24.13 In response to the November Consultation, some stakeholders raised concerns about the potential impact of passive remedies on dynamic efficiency, while others argued that any risks to dynamic efficiency would be manageable (with some arguing passives could actually promote investment, which we discuss further in Annex 23).

A24.14 We first set out a summary of general responses in relation to dynamic efficiency, and then set out responses specific to the potential arbitrage opportunities which passives could introduce (which could pose a risk to investment incentives). We then set out responses which cover the potential impact on the investment incentives of BT and separately those of other CPs.

General comments on dynamic efficiency

A24.15 The DotEcon report commissioned by BT argued that we must consider the impact of passive remedies on investment incentives of both BT and other CPs. It stated that genuine infrastructure investment provides clear benefits over passive-based competition,[684] and argued there are good reasons to expect passive remedies to depress infrastructure investment incentives:[685]

i) By creating parallel interventions in the same value chain, with different access products being potential substitutes, the risks of depressing infrastructure investment incentives through at least one of those products being under-priced is exacerbated. Pricing of active and passive products cannot be expected to be sufficiently well coordinated to avoid this risk.

ii) Entry based on passives may not be efficient (see further below) and could be particularly attractive in geographic areas with emergent infrastructure-based competition, and thereby depress such investment.

[681] See UKCTA non-confidential response to the CFI, page 3.

[682] See Vodafone non-confidential response to the CFI, page 21.

[683] See TalkTalk non-confidential response to the CFI, page 18.

[684] For example, DotEcon referred to the WECLA where it argued that multiple networks provide possibilities for enhanced resilience and service differentiation (e.g. low latency) for niche customers.

[685] DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, pages vii, 7 and 30 to 32.

A24.16 The PAG stated that the dynamic efficiency risks are not new and have been raised each time a new remedy has been considered, adding that they are a question of how passive remedies are introduced – not whether they should be introduced.[686]

A24.17 Telefonica argued that when looking at mobile coverage and capability into the future, fibre availability and economic reach in many parts of the country remains a challenge and so the on-going provision of new fibre infrastructure needs to be encouraged. It stated that BT should still have appropriate incentives to invest further in areas of the country not presently covered, and consideration is needed to assess the revenues and competition that may ensue in areas where such investments are made.[687] Similarly, WarwickNet argued that it is important that passive remedies are priced appropriately to not dissuade investment in new duct where required.[688]

Scope for arbitrage opportunities and resulting risk to BT's cost recovery

A24.18 BT argued that there would be significant scope for arbitrage opportunities in the event passive remedies were introduced (irrespective of the pricing approach) [✂

✂].[689]

A24.19 However, several other respondents to the November Consultation argued that the scale of arbitrage opportunities and the resulting risk to BT's common cost recovery would likely be limited (or at least be manageable).

A24.20 For example, in relation to the arbitrage risk, Colt argued that cherry picking is true of any remedy where the price is wrong, and that the risks, while theoretically plausible, are resolvable (noting that passive remedies have played a role in business connectivity regulation in other countries). It also argued that in markets where passive remedies have been implemented they have not resulted in inefficiencies that are visibly serious such that they justify a high level of caution.[690] Sky also argued that although there is a risk of cherry-picking, the scope to do so is relatively immaterial and is small when compared to the wider long term benefits that passive inputs could provide.[691]

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[686] See PAG non-confidential response to the November Consultation, page 11.

[687] Telefonica non-confidential response to the November Consultation, paragraph 24.

[688] See WarwickNet non-confidential response to question 3 of the November Consultation.

[689] [✂

✂]

[690] Colt's non-confidential response to the November Consultation, page 5.

[691] Sky's non-confidential response to the November Consultation, paragraphs 1.4 and 5.13.

A24.21 TalkTalk noted that the form of passive remedy would affect the arbitrage opportunities and risk to BT's ability to recover its common costs. TalkTalk argued these risks do not arise with dark fibre since:[692]

a) Bandwidth gradient-based arbitrage would not be possible: as BT would have both the ability and incentive to rebalance its active pricing structure to remove this opportunity;[693]

b) Arbitrage based on BT's current geographic-averaging of active prices would not be possible: dark fibre can be priced in a consistent way with the active pricing structure,[694] which will avoid opportunities for a CP to take advantage of active prices being higher than incremental costs in particular areas as a result of BT currently averaging its active prices.[695] TalkTalk noted this risk is greater for duct access, but considered it could be addressed by BT geographically de-averaging its active prices to reflect differences in density/utilisation (and therefore costs).[696]

c) Aggregation opportunities are limited with dark fibre: while an entrant would be able to take advantage of the ability of a unit of duct access to provide many active circuits (and thereby exploit the opportunity to add additional customers at a low marginal passive cost), this type of entry cannot occur for dark fibre since a dark fibre can only be used to provide a single active circuit.[697]

BT's investment incentives

A24.22 BT argued that the framework established for Openreach in 2005 supported major investment by BT and others (such as Virgin), and considered that any material change from the existing framework (including passive remedies) would put this at risk.[698] In particular, it stated that passive remedies would have implications for Openreach's incentives to invest in new active services and the resources it allocates to current systems and processes:

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[692] TalkTalk non-confidential response to the November Consultation, paragraphs 1.4, and 3.1 to 3.37.

[693] TalkTalk also argued that this rebalancing would limit any threat to common cost recovery, since BT would be able to recover a similar amount of common costs irrespective of whether a circuit is sold as dark fibre or as an active circuit.

[694] E.g. on a per-circuit and geographically uniform basis. TalkTalk also argued that pricing on a per circuit basis (rather than per metre) removes the possibility of entrants focussing on shorter circuits.

[695] For example, TalkTalk stated this could occur if a CP uses passives for shorter circuits (where the active prices are the same irrespective of length) and/or in areas where the unit passive cost is lower (due, say, to high utilisation of passive).

[696] TalkTalk repeated its view that arbitrage opportunities based on active price averaging (i.e. by focussing on urban areas or shorter circuits) would not arise, assuming that the dark fibre price structure mirrors the active price structure (i.e. fixed amount per circuit that is same across all areas it is available). TalkTalk comments on BT response to the November Consultation, February 2015, page 3.

[697] i.e. multiple active circuits cannot be substituted by a single dark fibre. TalkTalk stated that a dark fibre circuit could only substitute multiple active circuits if there were two circuits that shared exactly the same start and end points (e.g. from office A to exchange B), which would not occur for its use since each active circuit it purchases has different start/end points.

[698] See BT non-confidential response to the November Consultation, page 40.

a) the role that Openreach plays in the development of active products would need to change. Passive remedies would cause the boundary between CPs and Openreach investment to become extremely confused. [✂

✂]. BT noted the role Openreach plays in taking the upfront investment risks and in working through the prioritisation and standardisation of requirements from CPs.[699]

b) the introduction of passive remedies would lead to reduced volumes of active products, which in turn would reduce the incentives of Openreach (and other infrastructure providers) to innovate with respect to their networks and active services. This will result in adverse impacts on customers (and end users) of such products.[700]

A24.23 BT also raised concerns about the risk of stranded investments in the event that passive remedies were introduced, which could undermine its investment incentives. Although it noted that it is difficult to be precise without detailed passive remedy proposals, it stated that if CPs were able to migrate from active service to dark fibre, BT would significantly under-recover the costs of existing equipment and would be exposed to greater financial risk. BT said that the Openreach model both for WLA/WLR and BCMR services has to date been one of conscious investment in an active and integrated fibre service layer to meet known demand, and with sufficient reserved capacity for future growth of such active services. Truly 'spare' capacity has not, and could not have been, built to allow for the possible duplication of CP networks using Openreach duct access or to account for different patterns of use of dark fibre use in selective and ad hoc sections of Openreach's network. BT also argued that CP network architecture could also lead to stranding of assets, for example if CPs choose to bypass an existing Openreach plant which has been designed and dimensioned for active services.[701]

A24.24 BT also raised concerns about whether the risks of stranding investment made under the existing regime could be controlled or minimised through setting appropriate passive (and active) prices. In particular, it argued that it would be highly complex, as identifying all stranded (pre-existing) assets/costs is likely to be difficult (for example, Openreach may not have historically designed its network in the same way had it known that it was to be used for dark fibre). As well as pre-existing assets, BT argued we would also need to consider to what extent future investment (based on a view of future demand for passives) was stranded if demand turns out to be different (i.e. linked to the risk of forecasting error).[702]

A24.25 However, many other respondents argued that the impact on BT's investment incentives could be more limited than argued by BT.

[699] See BT non-confidential response to the November Consultation, pages 39-40.

[700] See BT non-confidential response to the November Consultation, page 45.

[701] See BT non-confidential response to the November Consultation, pages 37 and 43.

[702] See BT non-confidential response to the November Consultation, page 42

A24.26 In relation to the risk of passive remedies to BT's ability to recover its common costs, Level 3, the PAG, TalkTalk, Vodafone and Sky argued that the risk should be manageable/would appear to be limited:

a) The PAG argued that basing both the active and passive access pricing regime on BT's regulatory costing system (and reflecting FAC) should provide BT with the expectation that it can recover a proportionate share of fixed and common costs from BCMR services.[703] TalkTalk also argued that BT would be able to maintain the same level of common cost recovery by rebalancing its active prices.[704]

b) Sky argued that the issue of BT's ability to recover its common costs relates to uncertainty in demand forecasts and risks of errors, and so because of this, BT could equally over-recover its common costs. In addition, Sky noted that this is a regular issue that Ofcom faces when setting cost based charges in all markets, and so is not unique to this review. It also argued this is likely to be a short term risk, as in the long term the demand for passive products will become established and more stable, so the common cost allocation to product baskets (and overall recovery) will be less prone to error.[705]

c) Level 3 argued that while extracts from BT's RFS show relatively large values for common cost recoveries in recent years, there is considerable scope for BT to make efficiency gains, particularly during the early years of a passive remedy regime (as it will take several years in practice for CPs to take full advantage of new passive-based opportunities). Therefore any risks to BT's ability to recover its costs should be manageable.[706] Similarly, Vodafone argued that the transition to passive remedies will be manageable and probably span two (if not more) market reviews (noting that it does not envisage a wholesale migration of its existing installed base, since it will be restricted by end customer contracts[707]), and so will not result in the collapse of the cost apportionment and cost recovery systems in place within BT.[708] [709]

A24.27 In relation to the risk of stranded assets as a result of the introduction of passive remedies, the Frontier Economics report for PAG noted there are a range of assets that could be stranded (such as BT investment in active equipment), but argued that the scope for stranded active equipment is relatively low. This is because of the relatively short economic lives of electronic equipment (due to technological

[703] Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, page 28.

[704] TalkTalk's non-confidential response to the November Consultation, paragraph 3.34.

[705] Sky's non-confidential response to the November Consultation, paragraphs 5.2-5..

[706] Level 3's non-confidential response to the November Consultation, page 4.

[707] Vodafone stated that a migration option would be required, however.

[708] It stated that this view was based on: the Frontier Economics report "Passive access in the business connectivity market June 2014" in Vodafone's response to the CFI, which included a review of BT's capability to recover appropriate costs; the Frontier Economics report "BT profitability and price regulation" which shows BT's SMP services recovering £4.9bn in excess of reasonable returns over an 8 year time period; and the Frontier Economics report "Costing and pricing for passive access remedies" prepared for PAG which looks at costs and prices in a move to a passive regime.

[709] Vodafone's non-confidential response to the November Consultation, paragraphs 37-38.

advances), and since the contract terms and the relatively high one off costs of migrating existing services to passive links mean that migration of existing circuits is unlikely to be a significant driver of demand for passives (rather it will be driven by demand for new circuits, including capacity upgrades).[710]

A24.28 Similarly, TalkTalk argued that in practice introducing dark fibre is very unlikely to materially discourage future investment (providing its price reflects BT's costs), since the level of stranding will be very low. It stated this is because it will not strand BT's duct/fibre investment, and so the only assets that might be stranded are those in the active layer (i.e. electronics), but these are likely to be minimal.[711] Telefonica also stated that migration from existing active services to passive solutions would be expected to re-apply existing passive components.[712] GTC also did not consider there to be a significant risk of stranded assets (although its arguments related specifically to its own proposed use, rather than the use of passives more broadly).[713]

A24.29 Referring to BT's argument that passive remedies will violate the 'fair bet' principle by expropriating spare capacity (set out in response to the CFI), TalkTalk agreed with Ofcom that it is not clear that this is the case. It argued that since passive and active prices are based on costs incurred (including a return on capital employed), BT will be remunerated for the investment it has made. TalkTalk said that it is not aware of any of the other countries where passive remedies are available experiencing difficulties such as: inability to recover common costs; inefficient pricing structures; lack of investment in infrastructure; excessive regulatory burden; or, lack of widespread availability.[714] In relation to BT's fair bet argument, Bit Commons also argued that it needs to be placed alongside an analysis of who has been paying for any excess capacity, and noted the impact of public investment in extending BT's fibre capacity.[715] A confidential respondent [✂ ✂] also noted that there are substantial parts of BT's infrastructure that has been paid for by other parties (e.g. through ECCs or through the Broadband Delivery UK project).[716]

A24.30 Six Degrees Group argued that the impacts of passive remedies on investment, while dependent on the final commercial model, are likely to be minimised by the

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[710] See Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, page 28.

[711] TalkTalk non-confidential response to the November Consultation, page 16. TalkTalk stated that it understands that BT recovers the costs of electronics in the rental charge (with the costs depreciated over their useful life). Given the typical contract duration is 3 years, TalkTalk argued that this means that little if any of the active equipment cost could be unrecovered. Further, given that an immediate shift to dark fibre is unlikely at the end of contracts, it said that BT will be able to recover the vast majority of its costs. Lastly, it argued that BT retrieves the equipment and therefore it will have some re---use or resale value. TalkTalk also stated its view that there would be no stranding of infrastructure assets in its response to BT's response, stating that there would be no difference in the use of infrastructure under dark fibre and active. TalkTalk comments on BT response to the November Consultation, February 2015, page 3.

[712] Telefonica non-confidential response to the November Consultation, paragraph 20.

[713] See GTC non-confidential response to the November Consultation, page 26.

[714] See TalkTalk non-confidential response to the November Consultation, page 19.

[715] See Bit Commons non-confidential response to the November Consultation, pages 3 to 4.

[716] [✂ ✂]

extent to which the passive products and topologies mirror the existing structure of products and network layout. In its view, the risk of the fair-bet being violated does not constitute a significant justification for the withholding of passive products, assuming that the pricing is set at a level which is on a par with existing active products, as the underlying infrastructure would be consumed if an active product was ordered in place of the passive solution.[717]

A24.31 Finally, in relation to the impact on investment in active services, UKB Networks and Relish however argued that introducing passive remedies "is more likely to incentivise BT to invest than complacency brought about by continuing dominance of the retail market".[718]

Investment incentives of other CPs

A24.32 Some respondents raised concerns that introducing passive remedies could undermine their incentives to invest in their own infrastructure.

A24.33 In particular, Virgin Media argued that incentives to deploy new infrastructure would be diminished for both existing owners of network assets and CPs purchasing inputs from them. Specifically, it stated that there is evidence of a trade-off between access regulation and investment incentives in telecommunications which has long been recognised. It argued that the role of access regulation with respect to infrastructure investment by entrants is inherently uncertain, since it reduces barriers to entry but also reduces incentives to build new infrastructure since it can be rented at regulated prices. However, it argued that access regulation can undermine incentives to invest in infrastructure by entrants as well as the incumbent.[719] [720]

A24.34 INCA argued that the investment and cost recovery needs of companies building alternative infrastructure need to be taken into account in pricing or charge controls, and not just BT's recovery of common costs.[721]

A24.35 CityFibre (as a provider of passive infrastructure to CPs) also raised concerns that passive remedies in the same geographic areas as its own offering are likely to reduce its share of passive connections, and could undermine its investment case (if the regulated price is set below its own passive products). It argued that reduced market share and/or revenues in its current geographic markets could lead to stranded investments and part built networks, while negative impacts to its business case may reduce incentives for future rollout (thus limiting efficient infrastructure competition in further geographic markets).[722]

[717] See Six Degrees Group non-confidential response to the November Consultation, page 5.

[718] See UKB Networks and Relish non-confidential response to the November Consultation, page 2.

[719] Virgin Media referred to the following in support of this view: Michal Grajek and Lars-Hendrik Roller; Regulation and Investment in Network Industries: Evidence from European Telecoms. Journal of Law and Economics, 55 (February 2012).

[720] See Virgin Media non-confidential response to the November Consultation, pages 6 to 7 and 10

[721] INCA's non-confidential response to the November Consultation, page 4.

[722] See CityFibre non-confidential response to the November Consultation, page 8.

A24.36 KCOM expressed its concerns that mandating passive remedies could undermine incentives to invest and have a negative impact on infrastructure investments already made.[723] It argued that at a national level it is able to commercially offer passive access products such as dark fibre and other providers are doing the same (it referred to CityFibre as an example of this). It was concerned that a requirement to offer the same product on regulated basis may hamper the ability of others to compete successfully in this market, and for other providers to deploy solutions themselves in order to meet particular demand. KCOM acknowledged that Ofcom has identified the risk that passive remedies may undermine CPs' incentives to invest in their own infrastructure but argued that Ofcom needs to take a wider view and consider the impact on existing and planned infrastructure build which is already or soon will be providing the capability to meet demands for passive access.[724] Similarly, BT stated that there are a number of current CPs which own and operate their own basic infrastructure and that the introduction of passive remedies would impact the business case for further infrastructure investment. It argued that Ofcom must take into account the resulting adverse impact on the case for future infrastructure investment as well as significant adverse impact on dynamic efficiency.[725]

A24.37 However, other stakeholders argued that the impact on other operators is likely to be more limited (or at least, manageable). For example, TalkTalk argued that the impact on other operators that invest in infrastructure (e.g. COLT, Virgin) is likely to be limited for a number of reasons:

i) Dark fibre is likely to be used more in areas where competition is weakest, as unlike duct access there is no benefit for a user of dark fibre to focus on high density areas where alternative infrastructure operators have invested;

ii) Operators using passive products will continue to pay a similar price for the underlying duct/fibre infrastructure as under the current regulation – the key difference will be rebalanced active prices; and

iii) COLT has actively supported the introduction of passive access.[726]

A24.38 Talk Talk also argued that a change in the regulatory approach to introduce dark fibre has been a foreseeable possibility for many years, and so could have been factored into the investment plans of BT and other CPs.[727]

A24.39 Frontier Economics (in its report for the PAG) argued that the risk of infrastructure investment by non-BT CPs being stranded did not appear to be material as:

- a number of CPs who have significant investments in passive infrastructure (e.g. COLT) have responded to Ofcom consultations arguing for passive access, which would not be the case if they believed that passive access would strand their existing investments; and

[723] See KCOM non-confidential response to the November Consultation, page 4.

[724] See KCOM non-confidential response to the November Consultation, page 3.

[725] See BT non-confidential response to the November Consultation, page 44

[726] See TalkTalk non-confidential response to the November Consultation, pages 16 to 17.

[727] See TalkTalk non-confidential response to the November Consultation, page 17.

- investments in infrastructure by competitors should have largely been on the basis of sustainable cost advantages. As such the investment by CPs in infrastructure should not be predicated on any particular access regime.[728]

Our provisional view

A24.40 Passive remedies could potentially have both positive and negative effects on dynamic efficiency. We discuss the potential positive impact in Annex 23, and so here we consider the potential negative impact. We then discuss the overall balance between these potential positive and negative impacts in Section 7.

A24.41 Introducing a new remedy could potentially have a negative impact on dynamic efficiency, and in particular on investment incentives for both BT and other infrastructure-building CPs. This is because it would provide regulated wholesale access at a different point of the value chain, and so could – subject to its design – affect the incentives to invest upstream of the passive remedy (i.e. in self-build infrastructure) and downstream of the passive remedy (i.e. in active services). As such, we need to consider the potential impact on dynamic efficiency, and seek to minimise any potential distortion to investment incentives (this was also argued by Telefonica and WarwickNet, see paragraph A24.17).

A24.42 In particular, competition is largely currently based on upstream self-build infrastructure and downstream active services, but both duct access and dark fibre would allow other CPs to provide their own active layer using BT's passive infrastructure to compete in the provision of downstream active services without necessarily incurring the full sunk costs associated with self-build. Further, duct access may also potentially allow other CPs to deploy their own fibre to their own network design/configuration where BT duct is available (subject to the specific design of the duct remedy). As such, both types of passive remedy potentially provide an alternative to self-build infrastructure, and so depending on the specific design, both could potentially:

a) undermine existing investments made by other CPs in their own infrastructure: introducing passive remedies could change the downstream competitive environment relative to what was expected when they invested in their own infrastructure (e.g. by facilitating increased competition in active services). This could have the effect of stranding previous investments and undermining the business case of the initial investment (for example, if it resulted in different prices, market shares etc than was anticipated); and/or

b) affect their future incentives to invest: the availability of passive access as an alternative to self-build may reduce their incentives to build their own infrastructure (i.e. it could affect their build/buy decisions). In addition,if previous investments have been significantly undermined by regulatory changes (e.g. that resulted in the stranding of assets), the perceived regulatory uncertainty/instability over time may have a negative impact on future investment incentives.

A24.43 Similarly, use of passive access rather than active services from BT could make less use of BT's existing infrastructure and assets (with duct access using less than

[728] See Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, pages 28 to 29.

dark fibre), and so could affect the return BT makes from these existing assets. Given our general approach to regulation (i.e. to promote dynamic efficiency by seeking (where appropriate and relevant) to provide BT with an opportunity to recover its efficiently incurred costs, including a reasonable rate of return), if such regulatory uncertainty/instability significantly undermined BT's previous investments it could also ultimately affect BT's incentives to make further investments in the future.

A24.44 However, the scale and scope of these potential effects will depend on the specific design of any passive remedy (including both price and non-price terms). Therefore, while we recognise that introducing passive remedies could potentially lead to investments made under the current regulatory regime being stranded and so may distort CPs' investment incentives, that is not to say that we should (or indeed would have to) retain the status quo indefinitely. Rather, to the extent this were the case, we would want to be mindful of how we introduced passive remedies so as not to unduly distort future investment incentives. In addition, we note that similar considerations arise when considering how to implement any access remedy (including active remedies), so we do not see this potential concern as being particularly unique to the question of whether or how we might impose passive access remedies. Rather, it is an area we may need to consider as part of our overall analysis.

A24.45 In order to consider the potential implications further, we first consider the potential impact on BT's investment incentives, before then considering the impact on the investment incentives of other infrastructure operators.

Potential impact on BT's investment incentives

A24.46 A key consideration in terms of the potential impact on BT's investment incentives is whether it unfairly undermines BT's ability to recover its efficiently incurred costs (including a return on capital employed), as if this were the case, it would likely weaken BT's incentives to invest in the future. This is not unusual, as this is the case for the active charge control where although we seek to reduce prices, we do so in a way which provides BT with an opportunity to recover its efficiently incurred costs (as also recognised by Sky, see paragraph A24.26). Therefore providing any passive remedy is priced in a way such that BT has an opportunity to recover its efficiently incurred costs including a return on capital employed (and this is done on a consistent basis with any active control, if considered appropriate[729]), it should not undermine BT's investment incentives.[730] Such an approach would also mean that

[729] In this regard, we also note that the PAG has argued that basing both the active and passive pricing regime on BT's regulatory costing system should provide BT with the expectation that it can recover a proportionate share of fixed and common costs (see paragraph A24.26). We note DotEcon's concerns about the complexity in ensuring consistency between active and passive pricing (see paragraph A24.15), but consider this can be reduced through the design of any passive remedy, such that the risk is limited. We discuss this further below.

[730] On this basis, it is also not clear to us why a CP using spare capacity and paying a passive access charge which satisfies this principle (within the wider regulatory regime) would necessarily undermine BT's opportunity to recover its efficiently incurred costs or the "fair bet" principle (as argued by BT, see paragraph A24.10 and A24.23). TalkTalk also agreed with this view, as summarised in paragraph A24.29. We recognise BitCommons' argument that who has paid for any excess capacity is relevant to BT's fair bet concerns (with confidential respondent [✂ ✂] also noting that parts of BT's infrastructure has been paid for by other parties), and agree that the opportunity to recover its

passive remedies would be consistent with the incentive properties of charge controls (including incentives to "beat" the control, increase efficiency etc).

A24.47 We consider that the scope for arbitrage opportunities is likely to pose the biggest risk to BT's recovery of its costs, as it potentially provides scope for CPs to use passive access in order to target those active services which currently make the greatest contribution to BT's common cost recovery, whilst leaving BT to provide the less profitable services. Therefore to the extent that certain design options may leave scope for "cherry picking", this could reduce BT's opportunity for cost recovery and therefore affect its investment incentives if not appropriately adjusted for (i.e. within any active and/or passive charge control). We note that BT has argued that the scope for arbitrage opportunities is significant (see paragraph A24.18), while other CPs have argued that they are likely to be more limited (see paragraph A24.20 onwards).

A24.48 Potential arbitrage opportunities exist as a result of BT's current active pricing structure, and occur in relation to three main dimensions:

a) Density of network usage;

b) Circuit length; and

c) The pricing of bandwidth (i.e. the bandwidth gradient).

A24.49 However, the extent to which these could occur will depend upon the design of any passive remedy (indeed, Colt has argued that cherry picking is true of any remedy where the price is wrong). As well as the potential arbitrage risks, we recognise that to the extent that the introduction of passive access resulted in CPs switching from BT's active services to passive circuits, it could potentially result in some assets becoming stranded directly as a result of a new remedy being introduced (as argued by BT, see paragraph A24.23). If such stranded assets were not appropriately taken into account in setting the price for BT's remaining services, it could lead to perceived regulatory instability/uncertainty which could reduce BT's incentives to invest in infrastructure in the future.

A24.50 We now discuss how each of these may undermine BT's ability to recover its common costs in the event that passive remedies were introduced, and how the specific design of any active and/or passive remedies may be able to reduce the risk.

Density of network usage

A24.51 BT's active prices are generally geographically averaged, meaning that equivalent circuits are sold for equivalent prices regardless of location (i.e. circuit prices are geographically uniform). However, there are marked differences in the intensity of usage of the network by geographical area, with some parts supporting many circuits and very high bandwidths, while others are utilised comparatively lightly. As a result, profitability will tend to vary by area, with areas with a high volume of circuits generating a higher contribution to common cost recovery.

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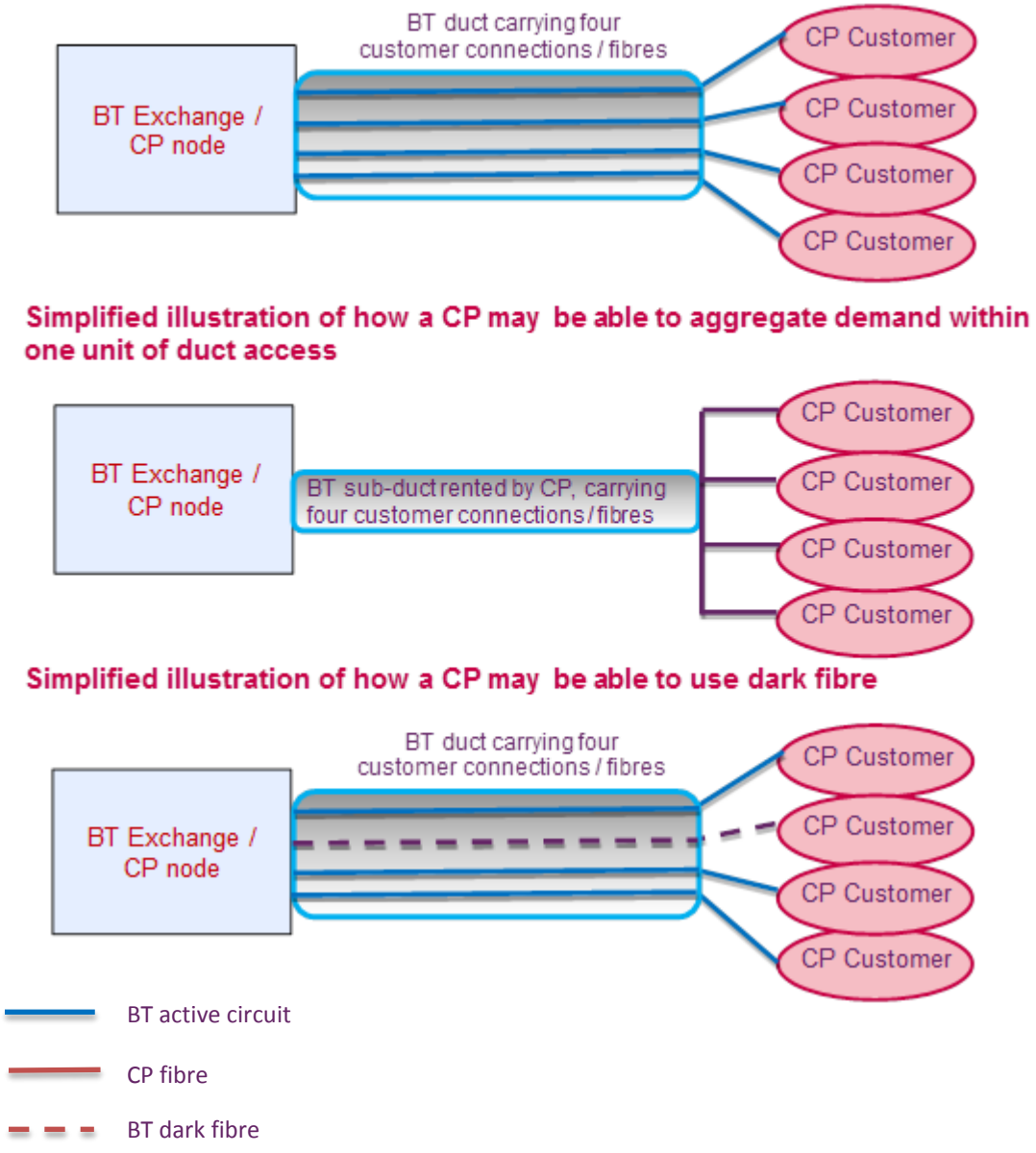
efficiently incurred costs is relevant for BT's own investments (for example, ECCs are outside of the current active charge control basket).

A24.52 This geographic concentration of value leads to a situation where a competitor using a passive access product priced on the basis of a share of geographically averaged cost will have the opportunity to target the provision of services in locations with above average utilisation. This appears to be of particular risk for duct access, where a CP would be able to purchase a unit of duct access (e.g. a sub duct) in high density areas and potentially be in a position to deploy its own fibre to supply multiple active circuits. In other words, a CP could effectively aggregate multiple active circuits into a single unit of duct access. For example, in the simplified illustration in Figure A24.1 below, BT would be providing four active circuits. However, a CP would be able to provide all four circuits itself by purchasing one unit of duct access and deploying the necessary fibre. As a result, BT could potentially lose four active circuits and replace it with one unit of duct access (assuming a CP can win all the active circuits).

Figure A24.1: Simplified illustration of the potential density-based arbitrage opportunities between duct and dark fibre



A24.53 This means BT could lose multiple active circuits in high density areas, significantly reducing the contribution to common costs from these areas (the greater the density of use, the greater this risk as the number of active circuits BT could lose to a single unit of duct access would be higher[731]). This could result in BT needing to geographically de-average its active prices to reflect density of network use in order to reduce the arbitrage opportunities and maintain its common cost recovery (this was a view echoed by TalkTalk, see paragraph A24.21).[732] Therefore this is something we would need to be mindful of in designing an active charge control. However, this risk may not be able to be fully eliminated by de-averaging the active price (due to the complexity in identifying the scale and scope of entry based on density-based arbitrage), and so a risk to BT's investment incentives may persist.

A24.54 In addition to changing the active pricing, the approach to pricing of any duct access remedy may reduce the scope and scale of this risk. In particular, setting geographically de-averaged passive access prices which reflect variations in network utilisation and contributions to common cost recovery is one way in which we could seek to reduce the scope for density-based arbitrage opportunities. For example, this could result in higher passive prices in high density areas, reflecting the greater contribution to common costs these areas currently make to BT's common cost recovery, with lower passive prices in low density areas. However, given the likely large geographic variability in the utilisation of BT's network, the ability to do this effectively while still ensuring the regime is manageable is likely to be limited, resulting in a crude proxy for utilisation at best. As such, while it may be possible to reduce the scale and scope for such opportunities, it is unlikely to remove the risk entirely and so this is something we would need to mindful of in designing any charge control for active services and/or duct access. This would be likely to add significant complexity to any charge control in order to provide BT with an opportunity to recover its efficiently incurred costs so that its investment incentives are not undermined.

A24.55 Conversely, this arbitrage risk appears to be lower for dark fibre as the need for a fibre for each circuit provided plus the existing availability of active aggregation services means the relationship between existing active circuits and dark fibre is likely to be much closer to one-to-one (subject to the specific access points permitted). This was a view echoed by TalkTalk (see paragraph A24.21). In other words, if a CP wants to provide a circuit using dark fibre instead of buying the active circuit from BT, it will still likely require one dark fibre for each active circuit it replaces (as illustrated in Figure A24.1 above). This is particularly true as many of the aggregation opportunities are likely to have been exhausted using the existing active aggregation services. Therefore it would seem plausible that dark fibre pricing could more closely replicate the active pricing structure compared to duct access, subject to the specific access points which are available. As a result, the scope for CPs to be able to specifically target high density areas to exploit the higher profitability is likely to be more limited. Therefore the risk to BT's common cost recovery (and ultimately, its investment incentives) is also likely to be more limited with dark fibre than could be the case with duct access.

[731] We note that the unit of sub-duct is likely to be greater (i.e. wider in diameter) than the duct access allocated to an individual active circuit, but nonetheless there would still be a potential risk to cost recovery as a result of this aggregation.

[732] We note that this de-averaging is likely to lead to (potentially significant) price increases in the lower density areas, and this may have distributional/allocative efficiency implications. We discuss the implications of potential active price rebalancing as a result of passive remedies further below.

Circuit length

A24.56 Some of BT's active services are priced on a constant per circuit basis, irrespective of the actual circuit length.[733] However, longer circuits are likely to have higher actual costs of provision. Therefore shorter circuits will tend to make a greater contribution to common cost recovery relative to their cost of provision than longer circuits, and therefore have a greater margin which could be targeted by CPs using passive access (all else equal).

A24.57 Duct access potentially provides an opportunity for other CPs to exploit this variation. In particular, if duct access is priced on a per-metre basis, CPs could target shorter circuits and deploy their own fibre in BT's duct to replace the existing active service. This inconsistency between the active and passive pricing approach would have the effect of reducing the contribution to common costs from these circuits, while BT continues to provide the longer active circuits which make a smaller contribution. As a result, all else equal, BT may not be able to recover its common costs if its active prices were unadjusted, which could have adverse effects for its investment incentives.

A24.58 One way to address this risk might be for BT to vary its active pricing structure such that the prices for all active circuits are also distance-dependent, as this should significantly reduce the risk of circuit length based arbitrage opportunities.[734] Therefore this is something we would need to be mindful of in designing any active charge control.

A24.59 As an alternative, we could potentially seek to reduce this risk by pricing duct access on a per circuit basis rather than on a distance-based approach, so it replicates the active pricing approach. This would reduce the risk, as a CP would pay the same for passive access irrespective of the circuit length and so there would be no opportunity to exploit length-based profitability variations in active services. However, it seems highly unlikely that it would be practical to price duct on a per circuit basis, given once a CP has access to a sub duct it can put as many fibres (and therefore supply as many active services) as will fit. Therefore it would likely require significant monitoring to ensure CPs were paying the correct amount in duct access according to the number of active circuits it was supplying.

A24.60 As such, given duct access would likely need to be priced on a distance-basis, we consider that circuit length arbitrage risks are likely to persist with duct access unless BT adjusted its active prices for those services which are currently priced per circuit to be distance-dependent.

A24.61 We consider that dark fibre priced on a distance-dependent basis would raise similar concerns as duct access priced on this basis, as CPs could target the higher

[733] The main exception to this is in relation to the MainLink product, which is distance-dependent. We also note that while this holds within product type (e.g. all 100Mbit/s EAD circuits are priced the same irrespective of length), there are variations in prices between services which are at least in part distance related (e.g. EADLA circuits tend to be shorter (and lower priced) than EAD circuits), and some circuit types have a distance-based limit (e.g. over a certain circuit length (which varies by bandwidth), an EAD Extended Reach circuit is required instead of an EAD).

[734] As with the density of network usage concern above, this would potentially lead to significant price increases for some active customers (in this case, those with longer circuits), which may have undesirable consequences.

margin on shorter active circuits. However, unlike duct access, we consider that pricing dark fibre on a per circuit basis is likely to be much more practical, given a fibre is needed for each active circuit provided (i.e. the likely one-to-one substitution between an active circuit and a dark fibre, as discussed above). By pricing on a per circuit basis, the dark fibre price could reflect the existing distance-independent pricing within active circuit types. Further, depending on whether a single dark fibre product was introduced or it included variants (for example, an EAD LA and an EAD variant), it could also potentially reflect at least some existing distance-dependent pricing differentials between active product types. This would reduce the risk of arbitrage based on circuit length as there would be greater consistency between the active and passive pricing approach, and so this risk to BT's investment incentives (and therefore dynamic efficiency) would not exist.

The pricing of bandwidth (the bandwidth gradient)

A24.62 The current active pricing structure generally involves higher bandwidth services making a greater contribution to the recovery of common costs than lower bandwidth services when measured on a per circuit basis. In other words, the 'bandwidth gradient' (i.e. the change in price charged when moving to a higher capacity circuit) exceeds the gradient of the incremental cost in relation to bandwidth.

A24.63 If passive access is made available to competitors at a price which reflects a share of the average costs (of duct and/or dark fibre), a competitor using that access would be expected to target the services with the greatest contribution to common costs because it will be more profitable to recover a (relatively) fixed access charge from services where the available margin is greatest. This is the case irrespective of whether the duct or dark fibre is priced on a per circuit or distance-dependent basis as either way, CPs will still be able to use the passive access to target the higher margin active services. Therefore the ability to limit this arbitrage risk to BT's common cost recovery it is likely to be limited to:

a) rebalancing the active pricing structure – this would have the effect of reducing the margins on higher bandwidth services (and increasing the margins on other services) to reduce the scope for CPs to target those circuits currently making the greatest contribution to common costs. This would be the case for both duct access and dark fibre, and so facilitating this sort of rebalancing (e.g. within any active charge control) should reduce the risk to BT's common cost recovery and therefore its investment incentives;[735] and/or:

b) the absolute level at which the passive price is set – all else equal, the higher the passive access price, the narrower the scope for CPs to target circuits making the greatest contribution to BT's common cost recovery. For example, at one extreme, if the passive price was set such that both the duct access and/or the dark fibre made the same contribution to common cost recovery as the highest active service, there would be very limited scope for CPs to exploit the bandwidth gradient (although we note that depending on how the passive price was set, the density and/or circuit length concerns above could still be relevant). Therefore setting a higher passive access price could reduce the scope for arbitrage based

[735] We discuss the potential impact of this type of price rebalancing further below.

on the current bandwidth gradient, and therefore reduce the risk to BT's common cost recovery.[736]

Risk of stranded assets

A24.64 We recognise that BT has raised concerns about the risk of stranded investments (see paragraph A24.23), but we consider this risk is likely to be limited (or at the very least, manageable), a view echoed by GTC, the PAG, TalkTalk and Telefonica (see paragraphs A24.27 to A24.28).

A24.65 Firstly, we consider that the scale and scope of the risk of stranded assets will be affected by the form of any passive remedy. In particular we would likely expect the risk of stranded assets to be greater under a duct access remedy than dark fibre. This is because it reuses less of BT's existing fixed infrastructure, and so if take-up of duct access to supply existing circuits was high, it could undermine the investments by BT in laying fibre to date. This is illustrated in Figure A24.1 above, where if a CP used duct access to replace the four existing active circuits supplied by BT, the fibre deployed by BT could be stranded. This compares to the situation where a CP uses dark fibre instead, which reuses more of the same infrastructure already supplying the existing active circuits (i.e. it utilises the existing BT fibre as well as the duct).

A24.66 We recognise that it is not only fixed (passive) infrastructure investment which has the potential to be stranded, as there could also be active-specific investment (e.g. in the electronic boxes at each end of the leased line) which could become stranded. However we consider that this risk is likely to be relatively limited as again, we consider that the remedy design could potentially reduce this risk. For example, we would expect the risk of such assets becoming stranded to be higher if migration from active circuits to passive access was permitted within-contract, since we would expect BT to recover such circuit-specific costs across its contract period. However, once this period has expired it is not clear the extent to which such assets would be stranded. We also note the arguments in the Frontier Economics report for the PAG (see paragraph A24.27) that electronic equipment has relatively short economic lives and that contract terms and migration costs mean demand for passives will be driven by demand for new circuits rather than migrations, both of which will reduce the risk of active-specific asset stranding.

A24.67 Secondly, and in any event, we would seek to approach any pricing of both passive, and active remedies (if appropriate) in a manner which provided BT with an opportunity to recover its efficiently incurred costs. Further, this could include, where appropriate, an estimation of the efficiently incurred costs which may become stranded as a result of the new remedy, so as not to distort future investment signals. While we recognise BT's arguments that it may be complex to identify all stranded costs (see paragraph A24.24), we consider that the design of our remedies could potentially reduce this complexity (for example, a dark fibre remedy could potentially limit the risk of stranded assets relative to duct as the duct and fibre would still be used in the provision of the remedy, and so the risk is likely to be

[736] However, this would also likely have the effect of limiting the use the passive remedy to only providing those active services with a greater contribution to common cost than the passive price (as it would not be economic to provide those active services with a lower contribution using duct or dark fibre). Therefore adopting this sort of approach would involve a trade-off, which we discuss further in Annex 26.

focused in the active layer). We would also note that our focus would be those genuinely stranded within this review period as a direct result of passive remedies (we would not, for example, be concerned about assets which are already fully depreciated (e.g. circuit-specific electronics for circuits which are out of contract period) or continue to be utilised within the passive regime (e.g. existing ducts)). Therefore we consider the risk of stranded investment undermining BT's future infrastructure investment incentives is likely to be limited.

A24.68 Overall, we recognise that there is a potential risk to BT's ability to recover its common costs as a result of passive remedies (which could undermine its investment incentives), but there are also certain design features which may be able to reduce the risk. In particular, broadly speaking, the greater level of consistency between active and passive products which can be achieved (in terms of topology, use of existing assets, pricing etc), the lower the risks to BT's common cost recovery and ultimately its investment incentives (a view echoed by Six Degrees Group, see paragraph A24.30).

A24.69 In light of this, we consider this risk is greatest with duct access given it provides greater arbitrage opportunities than dark fibre, and a potentially greater risk of stranded assets. While certain design elements (such as pricing) might be able to reduce the scale and scope of the risk to BT's common cost recovery, it is still likely to persist to some degree as there are limitations to the extent to which it can replicate the active pricing structure. In addition, this risk is likely to be much less predictable, given the limitations to which the design can reduce the arbitrage risks (as usage of duct access will likely vary geographically and according to specific circuit lengths), meaning the risk to BT's ability to recover its efficiently incurred costs (and the ability to manage this within any charge control) is likely to be greater. Therefore, we consider that the risk to dynamic efficiency may be greater with duct access.

A24.70 Conversely we consider this risk is likely to be more manageable with dark fibre, and its design is likely to result in more predictable usage which would allow us to adjust any charge control (active and/or passive) to allow for any remaining risk, such that BT still has an opportunity to recover its efficiently incurred costs. Therefore we consider the risks to dynamic efficiency are likely to be more limited.

Potential impact on incentives to invest in active circuits

A24.71 We note that BT has also argued that its incentives to invest in active circuits could be undermined if passive remedies were introduced (see paragraph A24.22). However, we consider that as with physical infrastructure discussed above, it is not clear passive remedies should necessarily disincentivise BT from investing in actives (even if there are lower active volumes), providing any active control permits BT to recover the costs of such investment.

A24.72 For example, we note UKB Network's argument that increased competition in the active layer from CPs using passive remedies could actually incentivise BT to innovate in active circuits, in order to maintain active volumes (see paragraph A24.31). In addition, depending on the non-discrimination requirements (which we discuss in Section 9), the availability of passive remedies could potentially reduce the costs of introducing new technology/developments incurred by BT, as it could introduce developments in active products that it wanted and do so on its own timescale without necessarily needing industry consultation etc. In any event, if passive access is available, it is not clear that if BT stopped investing in active circuits it would raise significant concerns in the long term since other CPs would be

able to invest in the active layer themselves (and could do so either directly for themselves, or to wholesale to other CPs).

A24.73 Nonetheless, we would need to consider this risk as part of the implementation design for any passive remedy, and consider whether it is necessary and appropriate to address it in some way through the remedies imposed.

A24.74 [✂

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Potential impact on the investment incentives of other infrastructure operators

A24.75 As described above, passive remedies are likely to provide CPs with an alternative way to compete in the provision of leased line services – upstream from existing active services but downstream from self-build infrastructure. This may provide a greater opportunity for infrastructure investment by some CPs by providing a lower cost alternative to self-build in some areas (and so reducing the barriers to entry/entry costs). This may have the effect of making investments commercially viable in areas where self-build competition is currently not (we note that some CPs have argued that passive remedies could increase their incentives to invest, which we discuss in Annex 23). In this scenario, a passive access remedy which reduces the costs for further rollout could be more of a complement to a CP's existing infrastructure, leading to increased infrastructure investment overall (and thus may not act to undermine their investment incentives). Passive access is also likely to increase investment in the active layer relative to an active-only regime (where active investment is dependent upon CPs with their own infrastructure), as more CPs are able to invest in (and control) the electronics themselves without investing in their own network infrastructure first (we discuss these potential positive effects for dynamic efficiency in Annex 23).

A24.76 However, there is a potential trade-off (as recognised by Virgin Media, see paragraph A24.33). Although passive access potentially reduces the barriers to entry, introducing such an intermediate form of access on regulated terms could undermine existing investments made by other CPs in their own infrastructure, and/or affect their future incentives to invest in areas which may be commercially viable (as argued by Virgin, BT, CityFibre and KCOM, see paragraphs A24.33 to A24.36).

A24.77 Firstly, passive access may allow CPs to replicate some of the benefits of self-build infrastructure (such as control over electronics, increased flexibility, etc) without the sunk investment. As such, it may provide a lower cost alternative to self-build while still delivering many of the benefits, and so as a result could reduce the incentive for future infrastructure investment where it might otherwise have been built. For example, at an extreme, if passive access replicated all of the benefits of self-build, it would seem likely that a CP would choose the entry option which minimised costs,

and so (subject to the passive price) self-build investment incentives could be reduced.[737]

A24.78 While this risk is likely to depend on the benefits which the passive remedy can deliver relative to self-build and the specific benefits of self-build a CP is seeking to optimise, it is possible that there will still be additional benefits of self-build over and above passive access which may still incentivise infrastructure investment. However, given passive remedies are further upstream than actives, it is likely to close the gap between the benefits delivered by regulated services and by self-build relative to an active-only regime (the scale of this will depend on the specific form of remedy).Therefore there is a risk that for some investments where the incremental benefits of self-build over and above the passive remedy are relatively small, the incentives to self-build will be undermined relative to an active-only regime (where the incremental benefits could have been more significant). As a result, this would reduce infrastructure investment (potentially in areas where it may have been commercially viable in the absence of passive remedies), forgoing these additional benefits of self-build as well as the potential dynamic efficiency gains it could have delivered.

A24.79 Secondly, by providing CPs with regulated access to alternative ways to compete in the provision of leased lines services, passive access may have an impact on the downstream competitive environment, because more of the value chain would be exposed to competition. This is likely to increase the scale and scope of downstream competition relative to the world without passive access, reducing their market share as well as potentially leading to downstream price rebalancing (we discuss this further below).[738] As a result, there is a risk of undermining the returns from CPs' existing investments (relative to expectations when they invested) and lead to a stranding of some assets (as argued by BT, CityFibre and KCOM (see paragraphs A24.35 to A24.36))[739] as well as weakening the business case for future investments. The scale of this effect is likely to be affected by the extent to which passive access is able to replicate the benefits of self-build infrastructure, and in particular whether any advantages of providing services using alternative infrastructure persist such that it has a competitive advantage against passive-based providers.

[737] The impact on dynamic efficiency of this extreme outcome is unclear, as while undermining this investment may not be desirable for other reasons (e.g. it could be considered a regulatory distortion if self-build infrastructure investment would have occurred anyway), if the remedy delivered identical benefits to self-build then the dynamic efficiency gains could still potentially be achieved but for a lower static cost (i.e. lower duplication).

[738] While relevant to the returns on existing investments, we also note that a change in competitive conditions (including downstream prices) is not unique to the availability of passive remedies as such changes could equally occur in an active-only regime. Indeed, BT could potentially respond to self-build competition by changing its active pricing structure (subject to any constraints from the active control), even without the introduction of passives. We note that the PAG argued that infrastructure investments should not be predicated on particular access regimes (see paragraph A24.39).

[739] Our understanding is that many infrastructure investments are often in response to specific demand, and so it is not clear that the initial investment would necessarily be at risk in the event that passive remedies were introduced (although the changes in the competitive environment going forward that could result relative to expectations when the investments were made could potentially affect the initial business case).

A24.80 As a result we consider that the net impact of passive remedies on existing and future infrastructure investment incentives of other CPs is unclear and could be finely balanced. Indeed, we note some CPs with their own infrastructure such as CityFibre and Virgin have argued against passive remedies on the basis it reduces their incentives to deploy new infrastructure (see paragraph A24.33 and A24.35), while others (such as Colt) have argued in support of the introduction of passive remedies. However, we note that the trade-off between these effects will likely depend on the benefits of self-build a CP is seeking to take advantage of (and the extent to which the passive remedy replicates these), and will also likely be affected by the design of any passive remedy. Therefore we now discuss how the design could potentially mitigate (or indeed exacerbate) the risks, while being mindful of the different advantages of self-build which could exist.

A24.81 We consider the form and pricing of any passive remedy is likely to be particularly important in considering the scale and scope of this risk to existing infrastructure investment.

A24.82 The form of passive remedy will affect the extent to which passive access can replicate the benefits associated with self-build as well as the likely impact on downstream competitive conditions. In relation to the former, we recognise it will depend upon the benefits of self-build a CP is seeking to gain, but nonetheless consider this risk to investment to be greatest for duct access. This is because it may provide a lower cost way for CPs to extend existing networks by removing duplication of ducts (which is a significant component of the self-build cost stack) while still delivering many of the benefits of self-build. Therefore while duct access could open up additional investment by CPs in laying fibre and operating their own services where they might not otherwise have done so (i.e. where the costs of self-build, and in particular duct digging, were prohibitive), it is could also undermine investments which would otherwise have been commercially viable. This is particularly likely to be the case if the additional benefits from owning the duct itself are more limited.

A24.83 In comparison, while we recognise that dark fibre could also reduce incentives for CPs to build their own infrastructure (particularly where BT fibre already exists), this would predominantly be where the benefits of self-build infrastructure investment are focused in control over the electronics (rather than the network itself). However, it would seem less likely that a CP would self-build solely to be in a position to use its own electronic equipment (given the high sunk costs involved). Rather, we would expect there to be additional benefits of self-build to justify such investment (e.g. resilience, network design benefits etc). Therefore it is not clear that the fact that dark fibre would allow a CP to use its own electronic equipment would significantly undermine investments made in infrastructure where there are additional benefits of doing so.

A24.84 Notwithstanding the above, while we recognise that regulated dark fibre and duct access may both provide a lower cost alternative to self-build, they would both be based on BT's network topology and may be subject to specific restrictions reflecting the market they are imposed in and the competition concern they are seeking to address (e.g. the remedy could apply for the provision of terminating segments only). Therefore to the extent that there are additional benefits of self-build over and above the passive remedy (e.g. related to network design and ownership, such as flexibility or resilience), it is not clear that either passive remedy will act as a perfect substitute to self-build, and so CPs may still have an incentive to invest in their own infrastructure to achieve these benefits.

A24.85 In relation to the impact on downstream competitive conditions, we recognise that duct access would still require significant investment (i.e. in laying fibre), while the use of dark fibre would likely require significantly lower levels. Therefore we might expect the impact on downstream competitive conditions to be lower with duct access (for example, since we might expect lower take-up of duct access). However, we recognise that duct access may provide alternative CPs with greater scope for differentiation than dark fibre (i.e. in relation to network design as well as electronics) and also allow CPs to roll out fibre to areas where BT does not currently have fibre. As such, it is likely to put CPs which use duct access in more direct competition with infrastructure-owning operators and so could potentially erode any competitive advantage they may have from self-build.

A24.86 Further, the density-based arbitrage opportunities in relation to duct access (set out above) could make its use particularly attractive in higher-density areas, which are also those geographic areas that are more likely to have emergent infrastructure based competition (as noted by DotEcon, see paragraph A24.15). We also recognise TalkTalk's argument that dark fibre offers limited benefits from focusing on high density areas (see paragraph A24.37), and so this may limit the extent to which CPs using dark fibre will specifically target high-density areas where alternative infrastructure operators are more likely to have invested (relative to duct access).

A24.87 Therefore overall we consider the risk to investment incentives is likely to be higher for duct access than dark fibre as it is likely to replicate more of the benefits of self-build but for a lower cost and with greater incentive to target high density areas. However, we recognise that there may still be a risk with dark fibre, particularly if the majority of the benefits of self-build are in control over the electronics and so can be largely replicated with dark fibre access, since the lower investment required relative to duct access and self-build is likely to lead to greater take-up (and so a greater impact on downstream competitive conditions).

A24.88 In relation to pricing, the relativity between self-build costs and regulated passive pricing will affect the efficiency of the build-buy decision of CPs as well as the likely scale and scope of take-up of any passive remedy (and therefore the downstream competitive conditions faced by any CP with its own infrastructure). For example, all else equal, a lower passive access price will likely lead to higher take-up of the passive remedy as more active services are likely to be able to be economically supplied using passive access (this could be as a result of genuine efficient competition based on passive access, or alternatively based on the arbitrage opportunities discussed above[740]). Further, if the price of regulated access is "too low" relative to self-build costs (i.e. it is not cost-reflective), it may undermine incentives to self-build in areas where it would have been commercially viable to do so and where it would offer additional benefits over and above the passive remedy. As a result, it may lead to higher levels of take-up of regulated services and lower infrastructure investment than may be efficient. This increased competition in downstream active circuits may also affect the returns a CP with its own infrastructure can expect from its investments (existing or future), as it may gain a smaller downstream market share and/or the prices may be lower than expected in a world without passive access (we discuss the potential rebalancing of active prices which could occur if passive remedies are introduced further below).

[740] Given the greater arbitrage opportunities for duct access than dark fibre, we consider this risk is likely to be greater for the former.

A24.89 However, while regulated passive access may provide an alternative to self-build, we would only expect CPs to build their own infrastructure where it is efficient to do so and/or the benefits of doing so outweigh the costs relative to the regulated alternative(s). This is the case irrespective of whether actives and/or passive remedies are imposed, or there is no regulated access. Therefore we consider that providing any passive price is consistent with the idea of providing efficient build-buy incentives (by this we mean it is not below cost and on a consistent basis with any active pricing so as not to create significant arbitrage opportunities), it should help reduce the risks to efficient investment incentives.[741] As a result, even if some investment incentives are undermined relative to an active-only regime, we do not consider that this should significantly undermine dynamic efficiency (i.e. efficient investment incentives should persist). For example:

a) to the extent that a CP can self-build at a lower cost than the regulated access, it will still have an incentive to do so, and so many of the dynamic efficiencies can still be achieved;

b) to the extent that self-build has higher costs than passive access but also significant additional benefits, CPs should still have an incentive to invest where the benefits outweigh the additional costs (even if this is over a longer time horizon). As such, the dynamic efficiency gains could still occur; and

c) where the passive remedy matches all the benefits of self-build but for a lower cost, this type of investment is more likely to be undermined by regulated passive access. However, given it would not provide additional dynamic efficiencies, self-build in this scenario is more likely to be inefficient (providing the passive price is not below cost).

A24.90 In light of the effect the pricing approach for passives (and its relativity to access prices) will have on investment incentives and ultimately dynamic efficiency, we take this factor into account in our pricing analysis in Annex 26.

Provisional conclusions on the risk to dynamic efficiency

A24.91 Overall, passive remedies could affect investment incentives in various ways, and we recognise that they could undermine incentives for further infrastructure investment by both BT and other CPs. However, as described above, the scale of this risk will depend upon the design of any passive remedy.

A24.92 In relation to the risks to BT's investment incentives, we consider that (broadly speaking and all else equal), the greater the level of consistency/compatibility which can be achieved between the passive and active remedies (both price and non-price), the lower the risk relative to an active-only regime. However, we recognise that there are likely to be variations in the extent to which the arbitrage opportunities

[741] We note that CityFibre raised concerns about the impact on competitive infrastructure providers of regulation of BT in leased line markets, including that BT had used the flexibility within the Ethernet charge control to make anti-competitive price reductions for high bandwidths services that were undermining other CPs incentives to make efficient investments in fibre infrastructure. Since these concerns are relevant irrespective of whether passive remedies are introduced, we discuss these issues further in Section 8 where we explain our proposal to impose an active charge control. Therefore in considering passive remedies here, we assume that the identified risks of imposing an active charge control on investment incentives have been considered and addressed (as considered appropriate).

can be mitigated (for example, as discussed above, it is likely to be more complex for duct access than dark fibre[742], meaning the former is likely to pose a greater risk), and so the design features of any passive remedy will be important in determining the scale of risk to investment.

A24.93 In relation to the risk to other CPs' investment incentives, we consider that as well as the general design features, the extent to which the passive remedy fully replicates the benefits of self-build will affect the scale of risk. As such, while passive remedies may undermine some investment relative to an actives-only regime (particularly if it replicates the benefits of self-build), providing the passive remedy is designed appropriately (including in relation to form and price), it is not clear that this should have significant adverse effects for overall dynamic efficiency. In particular, we consider that the pricing approach for passive access would be likely to affect the extent of this risk, and that, in general a higher price would be likely to reduce the risk. We discuss this in detail in Annex 26.

A24.94 As a result, we consider that a passive remedy can be designed such that the risks to dynamic efficiency will not be significant. We are therefore mindful of this when considering the the non-pricing design aspects in Annex 25 and in Section 9, and the pricing approach in Annex 26, as well as the overall assessment and proposed form of passive remedy in Section 7.

Allocative efficiency and distributional impacts arising from the implications for common cost recovery and rebalancing of prices

Stakeholder views – responses to the CFI

A24.95 Several respondents to the CFI recognised that passive remedies could potentially lead to BT reallocating its common costs between services and a changed pattern of common cost recovery. However, views on the impact of this rebalancing and the risk to BT's cost recovery were mixed.

A24.96 BT argued that the risk of cherry picking would undermine its ability to price discriminate across different bandwidths which could likely shrink the overall market and reduce net welfare, as well as lead to BT's common costs being shifted from being recovered from already competitive areas to areas where there is less competition (or other regulated markets).[743] Virgin Media also noted the risks of CPs cherry picking areas with the most commercial opportunity, which it argued are the areas least in need of regulatory driven competition (often with existing infrastructure competition in place).[744]

A24.97 Conversely, several other CPs questioned the efficiency of BT's existing active pricing structure, and argued that BT could respond to passive remedies by rebalancing the prices of active services such that it was still able to recover its costs (and that such an outcome could be welfare enhancing).

[742] This is due to the potentially greater scope for increased aggregation/density advantages with duct as well as the greater difficulty to price it on a consistent basis with active circuits.

[743] See BT con-confidential response to the CFI, paragraph 72.

[744] Virgin Media's non-confidential response to the CFI, page 7.

A24.98 In particular, Colt[745], EE, Three and MBNL[746], Sky[747], TalkTalk[748], and UKCTA[749] argued that there should be no presumption that BT's current pricing structure is efficient (with some claiming there is limited evidence to support its efficiency), and so any disruption to this may not actually be a "cost" or force an inefficient pattern of cost recovery on active services. For example:

a) Colt argued that the benefits of the current pricing structure remain unsubstantiated (except in a theoretical sense), and may well be over-stated.[750]

b) TalkTalk stated that the existing active pricing gradient would only optimise welfare if the price elasticity of lower bandwidth products was significantly (about 25 times) more than higher bandwidth products (in line with the existing price differentials), and stated there is no evidence to support this. TalkTalk also argued there is evidence that the current structure is not efficient, noting a range of potential reasons why BT would adopt a steep pricing gradient to increase profits but which would reduce welfare. This included to allow Openreach to set higher prices for non-regulated high bandwidth services (given the constraint from regulated services); to game the prior year weighting in the active control (since volume growth is fastest in high bandwidth products); and to price anti-competitively.[751] TalkTalk argued that for each of these examples it is easy for Openreach to identify the prices that increase profits (i.e. faster growing products and products used more by external customers), which contrasts with the difficulties of identifying profit maximising prices which meet Ramsey principles. TalkTalk also argued that it cannot be ruled out that BT has set a steep pricing gradient for erroneous or "non-rational" reasons.[752] [753]

c) Vodafone argued that while BT's prices will reflect customers' willingness to pay to a degree, there is little reason to believe that the active prices are allocatively efficient since BT's incentives are to profit maximise (which can lead to outcomes which reduce overall demand and hinder the development of competitive downstream markets). Further, it noted that revenues from all EAD rental services are above FAC, which it argued shows that these prices are not efficient

[745] Colt's non-confidential response to the CFI, pages 11 to 12.

[746] Non-confidential combined response of EE, Three and MBNL to the CFI, page 10.

[747] Sky's non-confidential response to the CFI, paragraphs 4.1 to 4.6.

[748] TalkTalk's non-confidential response to the CFI, paragraphs 2.21 to 2.25.

[749] UKCTA's non-confidential response to the CFI, page 2.

[750] Colt's non-confidential response to the CFI, pages 11 to 12.

[751] In particular, TalkTalk stated that a steep bandwidth gradient could be used to distort competition, for example by raising relative prices on higher bandwidth products that are used more by external customers (it argued that sub-caps in the charge control cannot fully mitigate this behaviour) and/or lower prices for low bandwidth products where competition is stronger (due to the homogenous nature of the product). It also argued that the gradient could be a form of regulatory gaming, in order to discourage the introduction of passive remedies.

[752] For example, TalkTalk argued that BT may have chosen a steep price gradient in the past and stuck with it in the future, noting that BT has a history of setting high prices for services they perceive as high value (e.g. IPStream/WBC backhaul, higher care levels (e.g. quicker repair) and WLR used for business consumers are or were at one stage priced significantly above their incremental cost difference).

[753] TalkTalk's non-confidential response to the CFI, paragraphs 2.21 to 2.25.

in a Ramsey sense, and competition from passive access would tend to lead to a reduction in all prices.[754]

d) Sky noted that the incremental price is not cost reflective, and so argued that the pricing premium (and profitability) of higher bandwidth products should be assessed to consider whether it may result in economic harm, given the forecast demand for 10Gbit/s circuits. In particular, Sky referred to the fact that even BT's lowest estimate of ROCE is higher than its cost of capital, and stated that if this continued it could be evidence of excessive pricing which could have negative effects (including inefficiently high consumer prices, low quality of broadband, and unnecessary costs and disruption as CPs undertake multiple backhaul upgrades to respond to demand rather than anticipate it).[755]

A24.99 Some stakeholders argued that the scale and impact of any price rebalancing is likely to be more limited. For example, TalkTalk argued that while some CPs who purchase active products may be adversely affected since they might see some unanticipated price rises (which will reduce profits), the net impact would be very limited. Firstly, it argued there may not be a need for an absolute price rise for low bandwidth products, since: BT's prices are substantially above cost already (e.g. from the RFS 12/13 prices would need to fall by 34% in order that prices meet FAC); costs are falling by 5% to 10% each year due to reducing equipment costs, efficiency and higher volume resulting in scale economies; and the rebalancing may occur over a number of years (a point also made by Colt[756]). Secondly, it argued that CPs will in some cases be able to pass on the price rises in their contracts with customers either during the term of a contract or when a contract renews (which is typically every 3 to 5 years). Thirdly, it stated that CPs affected by increased low bandwidth prices will enjoy reduced high bandwidth prices. Finally, TalkTalk also noted that rebalancing has been done in other markets (e.g. calls versus access, business vs residential line rental, high bandwidth wholesale broadband) and stated that it is not aware of any material disruption that resulted.[757] Similarly UKCTA also noted that there has never been any concern about the disruptive effects of LLU on BT's ability to price efficiently or its ability to recover common costs.[758]

A24.100 Vodafone argued (supported by a detailed submission from Frontier Economics) that while the introduction of effective passive access would limit BT's ability to price discriminate in downstream markets, any losses in allocative efficiency resulting from consequent rebalancing of tariffs would be offset by the dynamic efficiency gains from increased competition. Vodafone also argued that consistency between passive and active pricing would ensure that competition at the active level would be driven by efficiency rather than regulatory arbitrage (we discuss the pricing options in Annex 26).[759] Similarly, UKCTA argued that the compatibility of passive and active remedies have evidently been solved in other markets (e.g. their

[754] Vodafone's non-confidential response to the CFI, pages 14 and 20 to 21.

[755] Sky's non-confidential response to the CFI, paragraphs 4.1 to 4.6.

[756] Colt's non-confidential response to the CFI, page 20.

[757] TalkTalk's non-confidential response to the CFI, paragraphs 2.55 to 2.57.

[758] UKCTA's non-confidential response to the CFI, page 2.

[759] Vodafone's non-confidential response to the CFI, pages 14 and 20 to 21.

coexistence in Market 6[760] does not appear to have caused any fundamental arbitrage or cost recovery problems in practice).[761]

A24.101 Finally, EE, Three and MBNL stated that Ofcom seems to rely on distributional factors in weighting impacts on consumers of low versus high bandwidth services, but in other contexts, Ofcom has specifically stated that dealing with equity concerns is not the role of the regulator, who should be more concerned with promoting competition and efficiency.[762] Whilst they noted that there may not necessarily be a direct read across between these regulatory decisions, they considered that there is a need for consistency in regulatory assessments.[763]

Stakeholder views – responses to the November 2014 Consultation

A24.102 In the November Consultation, we asked the following question:

Question 4: What are your views about the potential impact of passive remedies on the pattern of common cost recovery and the associated distributional impacts?

A24.103 Responses to this question broadly fall into the following categories:

a) The efficiency (or otherwise) or BT's current active pricing structure;

b) The potential impact of any price rebalancing; and

c) The illustrative example of the impact on common cost recovery set out in the November Consultation.

A24.104 We now set out a summary of responses received from stakeholders on each of these areas, before setting out our provisional view of the potential impact of passive remedies on allocative efficiency in light of responses to both the CFI and the November Consultation on this issue.

BT's current active pricing structure

A24.105 BT argued that the existing bandwidth gradient is an efficient way to recover common costs, and such pricing flexibility has been provided under previous charge controls for good economic reasons.[764] This view was reinforced by a DotEcon report submitted by BT, which argued that the use of a broad basket approach to provide flexibility to BT over the active pricing structure is a deliberate decision by Ofcom (due to the greater level of demand and cost information available to BT), and is one which has been reconfirmed over a number of market reviews. It stated that this leads to a more efficient pricing structure, by providing flexibility for Openreach to recover common costs reflecting demand conditions and to facilitate the migration of customers from legacy to new products. It also stated that to the

[760] Note, this has now become Market 4.

[761] UKCTA's non-confidential response to the CFI, page 2.

[762] Specifically, they stated that in the 2011 MTR review (and in the subsequent appeal processes) Ofcom argued that promoting equity should not be its primary concern when setting charge controls and that charge controls were "a highly inefficient tool" for pursuing "social" outcomes.

[763] Non-confidential combined response of EE, Three and MBNL to the CFI, page 10.

[764] BT's non-confidential response to the November Consultation, paragraph 2.23.

extent that there are concerns that flexibility could lead to anti-competitive prices, Ofcom has used various sub-caps to reduce this risk while retaining some of the advantages of flexibility (and noted that no specific evidence has been submitted to suggest that this approach has been deficient or that BT is using its flexibility to price anti-competitively). Given the current pricing structure has been justified by Ofcom and is the result of a long history of regulatory decisions, DotEcon stated it was appropriate to consider the current pricing structure as being efficient.[765]

A24.106 However, other stakeholders argued that whilst under certain specific conditions a regulated monopolist would have incentives to price in a Ramsey way which maximised end user demand (and allocative efficiency), it is not clear that the current active pricing structure follows these principles. For example, the PAG argued that this might be the case if BT were a downstream monopoly, as its incentive to maximise revenues under an overall price cap would then be aligned with maximising demand in that downstream market. However, it argued that since BT is not a monopoly supplier to end users (but a supplier with upstream market power competing with wholesale customers in downstream markets), its profit maximising behaviour may take into account downstream margins and market share when setting wholesale prices. Additionally, the PAG argued that the basket charge control may distort BT's incentives since its optimal prices will be affected by the substitutability of services outside the basket as well as end users' willingness to pay (given that pricing for regulated services may affect profits from non-price regulated services which are partial substitutes[766]). In any event, the PAG argued that wholesale price discrimination would be an inefficient way to achieve this outcome, as BT has no control of the use that its wholesale products are put to.[767]

A24.107 TalkTalk also argued that BT does not appear to have the incentive or ability to price discriminate in a way which maximises allocative efficiency. In support of this view, TalkTalk referred to its own response to the CFI (summarised above), as well as the Vodafone/Frontier submission, which it stated provided clear evidence that the pricing gradient was highly likely to be inefficient. In particular, it noted that common costs recovered from 10Gbit/s circuits is 25 times more than that recovered from 10Mbit/s circuits, and argued that this would only be efficient if the retail price elasticity of the latter was 25 times that of the former which it considered to be implausible (and noted no market wide elasticity evidence is provided to support such a contention). It also argued that Ramsey pricing is not BT's only

[765] DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, pages vi and 9 to 16.

[766] In particular, the PAG argued that BT may have incentives to increase the prices of those regulated services which are partial substitutes for unregulated ones (e.g. VULA or certain MISBO services) in order to maximise the profitability of the unregulated services. For example, the PAG argued that the high tariff gradient for regulated 1 Gbit/s services may reflect BT's incentive to maximise profits for unregulated MISBO services as some purchasers may have a choice between buying MISBO services or high bandwidth AISBO services (and so increases in high bandwidth AISBO prices may allow the prices for MISBO services to be increased without prompting substitution). As such the overall revenue effect of prices increases in high bandwidth services may be proportionately greater than an equivalent (in charge control terms) increase in lower bandwidth.

[767] Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, pages 25 to 26 and 50.

profit-maximising incentive[768], and there is no evidence BT has the elasticity and usage data and evidence necessary to implement it. TalkTalk also argued that there are no effective regulatory constraints on 'strategic' pricing, stating that the existing sub-caps only slow the rate at which prices change (rather than prevent anti-competitive pricing).[769]

A24.108 Vodafone also raised questions around the efficiency of the current active pricing structure, noting that the flexibility afforded to BT in allocating common cost recovery across products inherently severs any link with cost causation and allows BT the opportunity to "beat the cap" (by loading costs approximately scaled to bandwidth in the knowledge that growth is likely to be greatest in high bandwidth products). Vodafone argued that while this may be to BT's benefit, it is not clear that it is to the benefit of consumers and businesses (as pricing decisions could be taken to suppress demand if BT so wished).[770]

A24.109 Colt argued that unless there are powerful reasons why the existing wholesale price controls are unequivocally welfare optimising, the presumption should be in favour of the form of intervention that gives competitors the greater scope for differentiation, exploiting any economies of scale, scope or density that the competitor can find.[771]

A24.110 TalkTalk also provided comments on BT's response to the November Consultation, and queried DotEcon's arguments that the current bandwidth gradient is relatively efficient. It argued that DotEcon had not set out any economic reasoning or factual evidence as to why this was the case, and seemed to instead infer that because Ofcom delegated BT pricing flexibility then Ofcom must have considered that such flexibility is welfare enhancing (which it considered to be a circular argument). TalkTalk also argued that DotEcon's argument that sub-caps will mitigate any anti-competitive pricing is not correct, since at best they only slow the rate at which BT can adopt anti-competitive prices (they do not eliminate pre-existing anti-competitive prices or prevent anti-competitive prices being introduced).[772]

A24.111 Finally, GTC stated that BT's price gradient is inefficient as EAD is not viable for new housing developments (since the potential revenues are too low relative to the cost of an EAD line), meaning it restricts competition for the provision of these services.[773]

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[768] TalkTalk referred to other profit maximising incentives BT may have, including to set higher prices for products used externally and where competition is weak, and to set a gradient which allows it to raise the prices (and therefore profit) of unregulated MISBO services and exploit the charge control.

[769] TalkTalk non-confidential response to the November Consultation, paragraphs 3.22 to 3.30.

[770] Vodafone's non-confidential response to the November Consultation, paragraph 47.

[771] Colt's non-confidential response to the November Consultation, page 2.

[772] TalkTalk comments on BT response to the November Consultation, February 2015, paragraphs 4.1 to 4.5.

[773] GTC's non-confidential response to the November Consultation, paragraphs 6.8 to 6.9 and 6.45 (and section 3.2 of the non-confidential Economic Annex).

The potential impact of any price rebalancing

A24.112 In response to the November Consultation, BT, KCOM and Virgin raised concerns about the potential impact of price rebalancing that would likely occur in the event that passive remedies were introduced.

A24.113 BT argued that the existing bandwidth gradient would not be sustainable as users of high bandwidth circuits migrate to passives, and so Openreach would need to make substantial price changes to active products – essentially removing or reducing the effects of cost averaging – in the event that passive remedies were introduced to ensure common cost recovery. This, it argued, would have significant adverse, unpredictable and highly disruptive distributional impacts, leading to active prices increasing in certain market segments (including for smaller operators and their customers as well as those end customers who tend to purchase lower bandwidth circuits[774] and/or outside of metropolitan hotspots).[775] It also argued that the corporate market would suffer relative to fixed and mobile backhaul, where contracts are fixed and there are more lower bandwidth circuits. BT stated that these price changes would adversely impact a large group of customers reliant on active products (disproportionately placing disruptive pricing adjustments on low bandwidth users) and distort competition in the markets for supplying these customers. Conversely, it argued that comparatively few CPs would be in a position to benefit from passive remedies. Further, BT argued that higher active prices would reduce demand, further exacerbating these effects.[776]

A24.114 On the basis of its view that the current pricing structure is efficient and the current flexibility afforded to BT delivers benefits (as summarised above), DotEcon (in its report for BT) argued that it is reasonable to assume that indirectly reducing flexibility (via the introduction of passives) would be detrimental. It argued this is the case on the basis that there would be an efficiency cost resulting from lost consumer surplus due to the price rebalancing if the current pricing structure is reasonably efficient.[777] It further argued that a view that the current structure is not reasonably efficient (e.g. if there were anti-competitive concerns) would imply a failure of the current system (which could be changed), rather than an argument for passives, per se. In addition, DotEcon argued that there may be wider reaching impacts on prices in other markets if BT cannot recover common costs through increasing the price of low bandwidth services (given their greater price sensitivity and the availability of substitutes (including residential broadband) at the lower

[774] [✂ ✂]

[775] BT also argued that in the case of duct access, the active bandwidth gradient would be reduced and de-averaging by distance (and possibly density and geography) would likely be required. BT's non-confidential response to the November Consultation, paragraph 8.28.

[776] BT's non-confidential response to the November Consultation, paragraphs 1.10, 2.17, 2.23, 6.53, and 10.20 to 10.21, and DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, pages v and 19.

[777] In particular, it argued that the gains from some customers paying less will be outweighed by the loss from other customers paying more, and higher prices for low bandwidth circuits may be particularly concerning given that there are a greater number of low bandwidth circuits.

end). However, it noted that the scale of these effects will depend on the exact form and pricing structure of the passive remedy (we discuss the impact of pricing in Annex 26).[778]

A24.115 KCOM also stated that it supported our intention to explore the implications for common cost recovery, and argued that this could have a significant impact on providers who have invested heavily in BT's current portfolio of regulated active services and could face a significant adjustment to their cost base.[779]

A24.116 Virgin Media argued that price rebalancing would give rise to a number of negative effects, including: making lower bandwidth services much more expensive; reducing switching from legacy TI products and therefore creating a technology "drag" in the market generally; skew incentives for businesses to take different technology solutions such as superfast broadband potentially creating an unbridgeable division between business broadband and dedicated data circuits.[780]

A24.117 We also note that Virgin argued that it would be unlikely that common costs could be easily absorbed by other services outside of the Business Connectivity market since these services are subject to their own charge control (which runs to a different time period than the LLCC) and the pricing of GEA is likely to be constrained by the margin squeeze condition (whereby BT may not wish to make compensating changes in order to recover displaced common costs from GEA[781]).[782] In this regard, TalkTalk argued that the mechanism by which reduced common cost recovery in leased lines would lead to increased contribution from other markets is unclear, as assuming BT continues with its current cost attribution methodology, it is not possible for the common duct cost recovery from MPF/WLR to increase.[783]

A24.118 However, several other respondents including the PAG, Sky, TalkTalk and Vodafone also argued that the scale of potential rebalancing (and therefore its impact) could be more limited, or indeed potentially manageable through the design of the passive remedy.

A24.119 The PAG[784] acknowledged that passive remedies may lead to BT changing its pattern of cost recovery (and so could have distributional or efficiency implications), but noted this type of disruption is common when new parts of the value chain are opened to competition. Further, as summarised above, the PAG argued there is no evidence that BT's existing pricing reflects efficient price discrimination, and so argued there is no reason to withhold passive access in order to preserve BT's

[778] DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, pages 19 and 21 to 22.

[779] KCOM's non-confidential response to the November Consultation, page 4.

[780] Virgin Media's non-confidential response to the November Consultation, page 20.

[781] Virgin provided the following examples: adjusting retail pricing upwards, or removing "high profile" inclusive offers on BT Sport channels.

[782] Virgin Media's non-confidential response to the November Consultation, page 19.

[783] TalkTalk non-confidential response to the November Consultation, paragraph 3.36.

[784] The PAG's non-confidential response to the November Consultation, paragraph 16 and pages 11 to 12, and Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, pages 26 to 27.

current pricing decisions (this view was echoed by TalkTalk[785]). Instead, the PAG argued that the scale of potential rebalancing and its distributional impact is likely to be limited, while still allowing BT to recover its costs.

A24.120 Firstly, the PAG argued that an appropriately designed remedies and pricing regime would allow BT to rebalance its system of cost recovery in an orderly way and to recover a similar proportion of its costs from fibre-based services (minimising the impact on other services).

A24.121 Secondly, it argued that in practice, the impact of price rebalancing (and therefore distributional effects) for most users would likely be limited, given demand is already concentrated on lower bandwidth services (reflecting the fact that such sharp gradients reduce demand for higher bandwidth services relative to what would be the case in competitive markets). This means any price increase will be spread across a large number of customers and so should be small. The Frontier Report submitted as part of the PAG response also argued that the impact on low bandwidth customers would be small because: even in the absence of passive remedies unit costs are decreasing rapidly over time as a result of increased demand and charge control-driven reductions in BT's (previously very high) returns on these services; and the productive efficiency and innovation benefits of passive access should increase the number of alternatives for these users which could offset the impact of any price rises on overall demand. As such, it argued there is limited evidence that any distributional effects would be significant. Similarly, TalkTalk argued that the level of disruption to consumers as a result of price increases is very limited[786] since there is unlikely to be any price rise relative to the current price level for the following reasons:

a) current prices are above costs and unit costs are falling by about 5% a year (due to scale economies, operating efficiencies and falling equipment costs), which will offset any price increases required in the future. Relatedly, Bit Commons stated that the impact of any rebalancing could be reduced given future efficiency savings BT could make, and also argued that a merged EE/BT would reduce the impact as BT's common costs could be balanced across the new combined group (particularly given that one rationale for the merger is cost savings)[787];

b) customers on low bandwidth circuits will have the opportunity to upgrade (e.g. to 100Mbit/s or 1Gbit/s) for very little premium; and

c) there will be no material geographic effects from dark fibre since it is likely to be used across the UK (and in fact, may be used more in less competitive areas where there is no infrastructure competition, meaning that the areas that will enjoy the most benefit will be those where competition is weakest today).[788]

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[785] Similarly, TalkTalk argued that while BT should be able to recover its (efficiently incurred) common costs through regulated charges, there is no particular benefit from allowing BT to maintain any particular pattern of common cost recovery (unless it is clearly shown to be efficient). TalkTalk non-confidential response to the November Consultation, paragraph 3.32.

[786] TalkTalk also argued that unlike residential services, there are no 'vulnerable' customers in business connectivity markets which need protecting.

[787] The Bit Commons Limited's non-confidential response to the November Consultation, page 1.

[788] TalkTalk non-confidential response to the November Consultation, paragraphs 4.29 to 4.34.

A24.122 Thirdly, the PAG argued that in assessing the distributional impacts, any increase in prices must be balanced against potential price reductions for other (high bandwidth) services which may support downstream services used by UK consumers (such as mobile telephony and fixed broadband), and the cost savings of which will tend to be passed on to due to the competitive nature of the relevant downstream markets. Similarly, UKB Networks and Relish argued that any adverse impact of rebalancing on the pricing of BT products such as WLR and LLU will be offset by the benefits to customers of improved access to competitive services underpinned by unconstrained backhaul capacity.[789] Relatedly, TalkTalk argued that the fact that some consumers lose and some consumers gain is of little economic relevance – it is the aggregate impact that is of most importance (although in any case, argued that the distributional effects are minor).

A24.123 Fourthly, the PAG argued there will be long-term benefits of greater competition in the market for business connectivity (e.g. better quality), and flow-on impacts for UK consumers (including those customers that may pay higher prices in the short term).

A24.124 Finally, the PAG argued that the benefits of passive remedies create the potential for significant market growth, which could see unit cost reductions for all users. Vodafone also argued that passive access provides an opportunity for overall market growth rather than purely as a substitute, and referred to the market indicators of increasing bandwidth demand, new services and applications, and ongoing and advanced connectivity needs in support of this view.[790]

A24.125 Related to this, Sky argued that the potential temporary harm that may arise from higher prices for lower bandwidth services is likely to be small compared to the benefits of a more efficient bandwidth pricing structure and the dynamic efficiencies that will ultimately deliver lower prices and better products for consumers of those services. In particular, Sky referred to its response to the CFI where it set out concerns that the current active pricing structure means higher bandwidth prices are not reflective of the cost of provision, and so argued that passive-based competition and the resulting rebalancing of prices may be efficient (e.g. by leading to prices which are more likely to reflect costs).[791] Similarly, Level 3 argued that introducing passive remedies would create a strong incentive for BT to more closely align its prices for higher bandwidth services with cost, and that this would drive significant consumer benefit. It also noted that NGA networks use IP switching which has an inherently much flatter cost structure than TDM, and so argued that flattening the active price levels will be compatible with pricing trends for the switched services that typically consume them. Therefore it did not consider this to be an undesirable consequence of passive remedies.[792]

A24.126 TalkTalk[793] and the Frontier Report submitted as part of the PAG response[794] noted that price rebalancing has previously occurred in other markets (with the latter

[789] UKB Networks and Relish's non-confidential response to the November Consultation, page 3.

[790] For example, it referred to the increasing data usage by 4G mobile customers, and the growth in higher bandwidth leased line connections and take-up of SFBB. Vodafone's non-confidential response to the November Consultation, paragraph 44.

[791] Sky's non-confidential response to the November Consultation, paragraphs 5.8 to 5.11.

[792] Level 3's non-confidential response to the November Consultation, pages 4 to 5.

[793] TalkTalk non-confidential response to the November Consultation, paragraph 4.32.

noting some rebalancing has occurred as a result of previous changes in regulation[795]), and TalkTalk stated it was not aware of any material disruption that resulted. Further, the Frontier Report argued the previous examples showed that the overall benefits of increased competition far outweighed any adverse effects on particular customer groups of increases in the price of some services. Relatedly, FCS stated that it understands that a mix of active and passive remedies in other countries has not been shown to have any detrimental effect on common costs or downstream pricing.[796]

A24.127 Vodafone however argued that introducing passives may not have any distributional effect. It argued that BT has been over-recovering costs in wholesale business connectivity markets (recovering well in excess of the regulated WACC[797]), and the gap is not being closed.[798] As a result of this analysis, it considered there is a greater risk from the ongoing over-recovery from active services, and argued that regulated active prices could be substantially lowered from today's levels while simultaneously introducing passive remedies without endangering common cost recovery. As such, it considered that the potentially disadvantageous distributional effects discussed in the consultation simply do not arise, and so do not need to be considered.[799]

A24.128 In relation to the type of rebalancing that may occur, Bit Commons argued that the need for geographic de-averaged pricing should be resisted, given the level and scale of state funding in BT's passive infrastructure compared to BT's total outlays.[800] Relatedly, Sky argued that even in the absence of passive remedies, demand for high bandwidth active products will continue to increase such that a rebalancing of active product prices would occur anyway, in order to avoid over-recovery of those common costs.[801] Similarly, Telefonica also noted that as demand for data speed inevitably grows (with minimal increase in BT's operational burden), consideration is needed of the impact on cost recovery in the absence of passive remedies, and the accelerated demand for higher priced 'bandwidth gradient' driven charges.[802]

A24.129 UK Broadband Networks and Relish argued that the issue of common cost recovery should not preclude BT from offering passive access as it should be possible to

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[794] Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, page 29.

[795] For example, between line rental and call tariffs following full liberalisation, or the rebalancing of ADSL prices following large scale roll out of LLU. TalkTalk referred to rebalancing between calls and access, business and residential line rental, and high bandwidth wholesale broadband.

[796] FCS's non-confidential response to the November Consultation, page 3.

[797] For example, Vodafone stated that in the last financial year, Ethernet products over-recovered (based on WACC) an excess of £250M profit.

[798] It referred to the November 2013 Frontier Economics report commissioned by Vodafone which looked at the returns that BT makes across its SMP services. It stated that it updated the numbers in November 2014 to include 2013/14, whereby a further £600M of excess recovery occurred.

[799] Vodafone's non-confidential response to the November Consultation, paragraphs 48 to 52.

[800] The Bit Commons Limited's non-confidential response to the November Consultation, page 4.

[801] Sky's non-confidential response to the November Consultation, paragraph 5.10.

[802] Telefonica non-confidential response to the November Consultation, paragraph 20.

introduce a flatter pricing structure whilst spreading common costs appropriately across all products. They noted that other operators are able to offer dark fibre products on a profitable basis without cross subsidising against other products, and so did not consider that BT (which to a large extent has had much longer to recover its sunk costs and has considerable advantage in terms of scale and scope) is unable to do the same.[803]

A24.130 TalkTalk provided comments on BT's response to the November Consultation, and stated that BT has not evidenced its claim that rebalancing would have significant adverse and disruptive distributional impacts. In particular, it argued that BT does not explain whether these price changes will be disruptive by considering the actual likely price increase (which will depend on cost and price reductions, due to the charge control glidepath) and the time period over which it might occur. TalkTalk also argued against BT's claims that smaller CPs will lose out, instead arguing that they may gain since they will have passive-based wholesalers (such as Vodafone and TalkTalk) who are able to provide innovative and more attractive active services to them.[804]

The illustrative example of the impact on common cost recovery and BT's active pricing structure set out in the November Consultation

A24.131 Both BT and Virgin identified difficulties and complexities in estimating the potential impact of passive remedies on BT's common cost recovery, and raised concerns that the illustrative example in the November Consultation understated the scale of the potential effect. However, other stakeholders (including BitCommons, TalkTalk, and Vodafone) raised concerns that the illustrative scenarios of the potential impact of passive remedies on BT's common cost recovery (and resulting impact on prices) presented in the November Consultation were an overstatement. We consider these arguments further in the June 2015 LLCC Consultation, where we also provide a revised illustration of the scale of the potential impact of passive remedies on BT's active pricing structure.

Our provisional view

BT's current active pricing structure

A24.132 In a large multi-service telecommunications network, there are many cost elements which are shared (i.e. common) across a variety of different wholesale and retail services. When setting a charge control for regulated services, we typically aim to ensure that BT's charges for the regulated services reflect BT's incremental costs of provision of that service, plus a mark-up for common costs and its cost of capital. In order to estimate the costs for the regulated services, we start with the service costs reported in BT's Regulatory Financial Statements (RFS). These service costs are reported on a fully allocated cost (FAC) basis, which essentially include both the incremental costs of a service as well as a contribution to common costs.

A24.133 Within the existing BCMR charge controls imposed on active leased line services, we provide some flexibility for BT in how it recovers its costs. That is, we do not

[803] UKB Networks and Relish's non-confidential response to the November Consultation, page 3.

[804] TalkTalk comments on BT response to the November Consultation, February 2015, paragraphs 5.1 to 5.2.

require BT to set the price of each service at the FAC of each service. Instead, Ofcom typically sets a charge control for a broader basket of services such that it expects BT's charges for the overall basket to be at FAC, including a return on capital, by the end of the charge control. BT then sets the charges for individual services within this broader constraint on the overall basket of services. This is because we recognise that there can be benefits in allowing some flexibility in cost recovery, for example:

a) It is more likely to result in charges which allow BT to recover its costs, particularly fixed and common costs, in an efficient way which maximises consumption. This is important in the case of wholesale leased lines because their provision is characterised by high fixed and common costs and low marginal costs. As such, simply setting all charges equal to FAC may result in a lower level of output than with a more flexible charging structure;[805]

b) Higher mark-ups on some services than others can be used to provide efficient migration signals between an old service and/or technology and a new replacement; and

c) Flexibility allows BT to respond to changing demand conditions and any changes in costs, so as to re-optimise its charges. This is particularly useful when demand is changing rapidly within the market review period.[806]

A24.134 However, we also recognised that BT may have incentives to exploit this flexibility to distort competition, and imposed sub-caps to limit its flexibility in areas where we identified that it has an incentive to change the pricing structure to favour its downstream operations.

A24.135 The consequence of this flexibility is that some services (particularly higher bandwidth Ethernet circuits) contribute more to common cost recovery on a per circuit basis than others, as a consequence of the 'bandwidth gradient'. Although absolute contributions to common costs increase with bandwidth, there is a reduction in the average price per unit of bandwidth as bandwidth increases (i.e. the average price per Mbit/s decreases). A positive gradient that declines in bandwidth allows the marginal price of bandwidth to get closer to its marginal cost (relative to a gradient that reflected average costs), and it increases demand for low bandwidth circuits (relative to the situation where the gradient reflected only the incremental costs of bandwidth and fixed and common costs were recovered equally from circuits of all bandwidths).

A24.136 In the 2013 BCMR, we did not identify any strategic incentives on Openreach to price the different bandwidth products in an unduly discriminatory and/or anti-competitive way. We also noted that an upward sloping bandwidth gradient accompanied by decreasing average costs could be an efficient way to recover common costs given the high fixed and common costs (and low marginal costs) which characterise Ethernet services. We therefore considered it appropriate to

[805] i.e. costs do not normally increase in direct proportion to bandwidth, and so setting all charges equal to FAC could mean spreading the fixed and common costs evenly across all products so that charges for lower bandwidth products are increased while they are reduced for higher bandwidths, the net effect of which could be a lower level of total output.

[806] BCMR 2013, paragraphs 18.10 to 18.13.

allow Openreach flexibility to determine the most appropriate structure of prices, subject to meeting the charge control conditions.[807]

A24.137 While BT has argued that the existing bandwidth gradient is an efficient way to recover common costs (see paragraph A24.105), we note that many respondents to the November Consultation have questioned the efficiency of BT's current pricing structure (including Colt, EE, GTC, MBNL, the PAG, Sky, TalkTalk, Three, UKCTA and Vodafone, see paragraph A24.98 and paragraph A24.106 onwards). In particular, several argued there is no evidence that the current structure is actually efficient. In addition, while some respondents acknowledged there may be a theoretical argument that active prices may reflect Ramsey principles, many questioned whether maximising downstream demand was BT's only incentive in setting active prices, and suggested that responding to other incentives was undermining the efficiency of the current pricing structure. For example, respondents referred to the following factors which may affect BT's incentives:

a) Downstream margins and market shares – given BT competes with wholesale customers in downstream markets, its profit maximising behaviour may take these factors into account;

b) Substitutability (and therefore profitability) of services outside of the charge control baskets – as optimal prices will be affected by this as well as willingness to pay, since prices for charge controlled services may affect the prices that can be charged for partially substitutable services that are outside of the charge control basket[808];

c) Extent of competition – for example, if the products sold externally differ significantly to internal consumption or there are particular products where competition from alternative products/infrastructure operators is weaker, BT's profit maximising incentives may be to price strategically; and

d) Ability to optimise returns in the active charge control – given BT is constrained by the active charge control, it may have an incentive to set prices which maximise returns within the overall constraint rather than reflect demand (e.g. to take advantage of the prior year weightings used, given the trends in volumes).

A24.138 From a practical perspective, TalkTalk also noted the complexities involved in identifying profit maximising prices which meet Ramsey principles, and questioned whether BT has the data and evidence necessary to implement them (see paragraph A24.98 and A24.107).[809]

A24.139 We remain of the view that in principle, BT has an incentive to maximise demand/output within the constraints of existing charge controls (and has better information on customer responses to prices to do this than Ofcom), and so, subject

[807] BCMR 2013, Annex 12, paragraphs 165 to 181.

[808] Note, considering substitutability could be consistent with an efficient pricing structure in some circumstances.

[809] We note some respondents also stated that BT appears to be earning a ROCE in excess of its cost of capital within the existing charge control and that this could illustrate that prices are not allocatively efficient. However, we do not consider this issue further here, as this is a consideration for the active control, and is not relevant to (nor is it affected by) the decision to implement passive remedies or not.

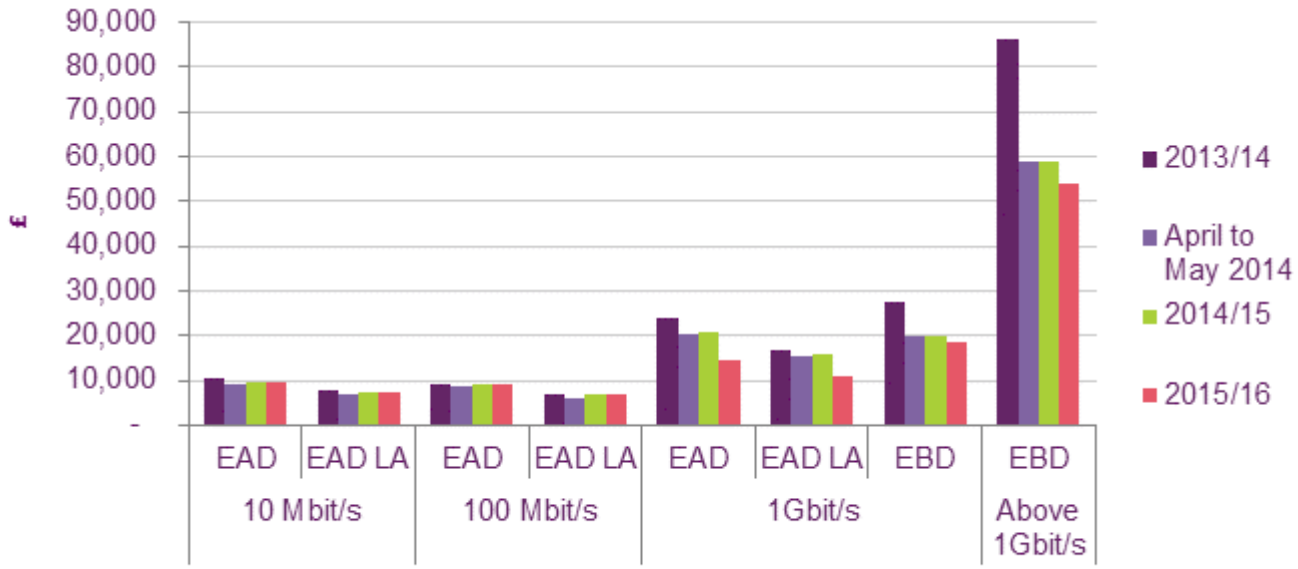
to charge control constraints, should have incentives to recover costs in a reasonably efficient way. We also recognise that the existing structure may (broadly speaking) exhibit some of these characteristics/benefits, particularly relative to an average contribution/flat bandwidth gradient.

A24.140 However, we also recognise (as we have done previously) that pricing is complex, and pricing efficiency may not be the only incentive that BT has. In particular, BT may have incentives to set prices in line with other motivations (as set out above). Some motivations may still be considered desirable, for example, we have previously noted that incentives to provide efficient migration signals between old and new technology can be beneficial. Other motivations may however be less desirable, for example any potential strategic or anti-competitive incentives (as noted above, although we have previously sought to address anti-competitive incentives where they have been identified in the active charge control[810]). Disentangling the different factors and their effects on BT's pricing is difficult.

A24.141 In addition, we also recognise that there is not necessarily a single unique pricing structure which can demonstrate these general efficiency characteristics – indeed, we note that BT has been using its pricing flexibility in this review period to reduce the gradient of the active pricing structure. In particular, while it still exhibits a positive gradient that declines with bandwidth, it has become less steep. This is illustrated in Figure A24.2 which shows that lower bandwidth circuits have experienced more modest price reductions (with static prices planned for 2015/16) while high bandwidth circuits (i.e. 1Gbit/s and above) have generally experienced much greater price reductions – effectively we observe a rebalancing of prices over time which has reduced the bandwidth gradient. While part of this rebalancing may be driven by a need to comply with the charge control, there may be other factors (such as those described above) also at play.

[810] We note TalkTalk's argument that sub-caps may not fully mitigate anti-competitive pricing (see paragraph A24.110). However, we have introduced sub-caps where we consider they are likely to be effective at preventing anti-competitive price changes, and consider that if a CP identified specific prices which are anti-competitive and could not be addressed by sub-caps, we could consider alternative solutions (for example, starting charge adjustments, or ensure prices reflect LRIC differentials).

Figure A24.2: Average three year (external) contract price for selected active products



Prices from published Openreach pricelist, based on three year rental plus connection charge. 2015/16 prices reflect announced price changes as at 30 April 2015. EBD is based on Band A prices, and for EBD above 1Gbit/s the price is based on UK excluding FlexZone. April to May 2014 prices included as EAD connection charges included a £548 ECC Fixed Fee to fund an ECC exemption of £2,800 from 1 June 2014.

A24.142 These price changes also illustrate the potential for factors other than Ramsey principles to be influencing BT's pricing. For example, we note that the 10Mbit/s EAD and EAD LA circuits are priced above 100Mbit/s, which would not appear consistent with a positive bandwidth gradient (and instead, potentially illustrates the role that migration incentives may have in BT's pricing). Additionally, we note that BT has chosen to concentrate price reductions in the last two years on 1Gbit/s services in particular (and to some degree, the services above). While this may reflect the market elasticity of demand for these services, it also potentially illustrates a desire for BT to migrate customers to higher bandwidths in order to increase revenues (in particular, we understand that there is a relatively low incremental cost differential between 100Mbit/s and 1Gbit/s circuits, and so this is likely to be outweighed by the incremental revenue gained by any circuit BT successfully upgrades, even with a price reduction on the latter).

A24.143 Overall, we do not seek to take a view as to whether the current active pricing structure is definitively "efficient" or otherwise, not least given it would likely be a very complex process to determine this (given the detailed information and data that would be required, as well as the complex range of factors that may be at play which would need disentangling). Rather, we recognise that in principle (and all else equal) a gradient with these characteristics is likely to be more allocatively efficient relative to a flat gradient (i.e. one with a flat charge for common cost recovery) for the reasons set out above. Therefore there may be efficiency justifications to limit the impact on the current pricing structure (and gradient). However, given other potential pricing motivations as well as the potential scope for wider benefits from passives, this need not mean that the current structure should be maintained indefinitely or that any price changes should be prevented (as DotEcon seem to suggest, on the basis that the current structure has been permitted over several market reviews, see paragraph A24.105). Rather, there is likely to be a trade-off.

A24.144 As a result, we focus on the potential impact of passive remedies on the current active pricing structure and the effect of any potential change, so we can then assess this impact (along with the other costs/risks) relative to the benefits of passives, to inform our overall assessment of passives. In particular, consistent with the idea of allocative efficiency, we consider the potential for distributional effects as a result of any price rebalancing that could occur, and any impact on total circuit volumes.

A24.145 We now first discuss the implications of passive remedies for common cost recovery within the BCMR markets with the current active pricing structure, before then discussing the potential implications for the pattern of cost recovery (i.e. prices) for active circuits as well as whether it has the potential to impact other BT services.

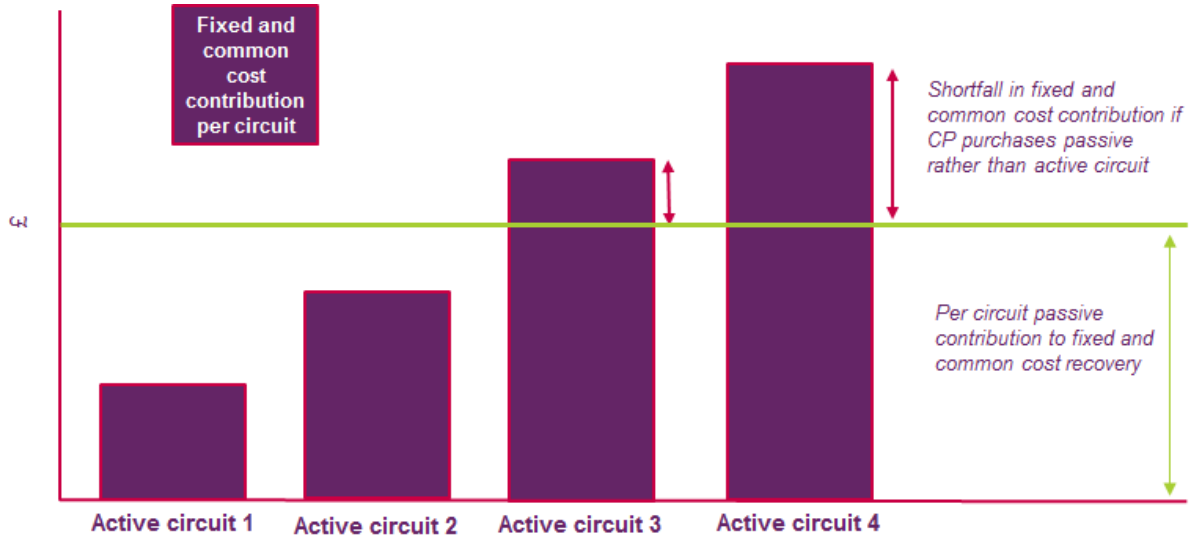
Potential impact of passive remedies on BT's common cost recovery if active prices are unchanged

A24.146 Where passive access is introduced in markets with an established set of active wholesale products, such as wholesale leased lines, there is likely to be an effect on the pattern of common cost recovery (and therefore prices). In particular, where passive remedies are used to compete with BT, BT may see a reduction in volumes of its active products with a loss of associated contribution to fixed and common costs. Depending on the active pricing structure (and in particular, the degree of variability in contribution to fixed and common costs between different circuit types), this loss from the active circuit may or may not be fully offset by the contribution from passive access.

A24.147 Given the current active pricing structure (in particular, the bandwidth gradient and geographic averaging), a passive remedy could potentially create opportunities for CPs to undercut BT's prices on some of the higher margin services (e.g. target the bandwidth and, in the case of duct access, geographic arbitrage opportunities discussed above) as well as genuine competition on the merits. As a result, BT could potentially lose a greater contribution to fixed and common costs from the active circuit than it makes up from the passive access that replaces it. Therefore although highly dependent on volumes and pace of uptake, the loss of active circuits could have implications for BT's opportunity to recover its common costs if active prices were unchanged.

A24.148 To illustrate this effect, consider the simplified diagram in Figure A24.3 below (we abstract here from the design of passive remedy for simplicity). Imagine BT only provides four active circuit types, and sets the pricing structure such that each makes a different contribution to fixed and common cost recovery (but overall costs are recovered in aggregate). This results in different margins across different product types. Introducing a passive remedy which makes a constant per circuit contribution to cost recovery at a level illustrated by the green line would mean that CPs are likely to have an incentive to target those circuits which currently make a greater contribution (i.e. margin), and so will likely provide Active circuits 3 and 4 (while they are unlikely to supply Active circuit 1 or 2). If BT continued to try to maintain this pattern of cost recovery, it is likely to lose Active circuits 3 and 4, which would result in an under-recovery of fixed and common costs since it would lose a greater contribution from the active circuit than it makes up for from the passive product (illustrated by the red arrows).

Figure A24.3: Simplified illustration of the potential risk to cost recovery



A24.149 We note that the impact on volumes and resulting scale of common cost at risk if active prices remain unchanged will be affected by a range of factors, including:

a) The form of passive remedy – as discussed above, we consider the arbitrage opportunities are likely to be greater for duct access than for dark fibre, and therefore all else equal, we consider the risk to BT's common cost recovery of maintaining the existing active pricing structure (including any potential risk of stranded assets) is also likely to be greater.

b) The scope of the passive remedy – if there are any geographic limitations to the use of passive access, this will likely have the effect of reducing the extent of use of the passive remedy itself, and therefore reduce the substitution of active circuits.

c) Pricing of passive remedy – this is important as this will affect the offsetting contribution to fixed and common costs that the passive remedy will make as well as the scope for arbitrage opportunities under the current active pricing structure. Therefore the basis for pricing, including its consistency with the active pricing approach (e.g. whether it is distance or circuit based) will affect the scale of cost recovery at risk if active prices remain unchanged.

A24.150 As set out above, when regulating BT's wholesale service our general approach is to seek to provide BT with an opportunity to recover its efficiently incurred costs, including common costs. As a result, if we were to introduce passive remedies, we would seek to continue to provide such an opportunity, including in this market review period. While the design of the passive remedy may be able to limit the scale of common cost recovery at risk if BT's active pricing structure remains unchanged, we do not think it is possible to design a remedy that has no impact at all. Therefore we would need to be mindful of the potential need to make an adjustment to any active charge control that is imposed in order to continue to provide an opportunity for BT to recover its efficiently incurred costs.

A24.151 Firstly, we would seek to ensure the cost forecast in the active charge control was appropriate in the presence of passive remedies, and in particular, that the forecast fixed and common costs to be recovered from active circuits was appropriate and reasonable. This would likely require an understanding of potential cannibalisation

of active circuits by the passive remedy as well as the pattern of cost recovery across different circuits and the passive remedy (including the breakdown of costs between fixed and variable components). Therefore the ability to do this effectively will likely be affected by the design of the passive remedy[811], and so this is something we would need to be mindful of when determining the appropriateness of an active charge control, as well as its design and that of any passive remedy implemented. We discuss the interactions between the availability of passive remedies and the active charge control further in the June 2015 LLCC Consultation.

A24.152 Secondly, on the basis that the level of costs forecast for the active control are appropriate, we recognise that prices are likely to need to adjust to facilitate a rebalancing of the pattern of that cost recovery so that there would not be a net loss of contribution to common costs. We would in the first instance likely seek to give BT an opportunity to recover its efficiently incurred costs via a rebalancing of active prices from the current structure within any active charge control.[812] However, as we noted in the November Consultation, this adjustment to prices could potentially have an effect on other markets. We now discuss the potential impact on each of these areas below.

A24.153 Following the preliminary illustration set out in the November Consultation, we have also sought to illustrate the potential scale of common cost recovery at risk if BT's active pricing structure is unchanged, as well as the potential scale of active rebalancing that may be required as a result. We refer to these estimates in general terms further below where relevant and appropriate, but we consider it further in the June 2015 LLCC Consultation given its interdependency with the active charge control.

Potential changes to BT's existing active pricing as a result of passive remedies

A24.154 In light of the above, price increases for certain services (on a product and/or geographic dimension) are likely to be required relative to the situation if passive remedies were not introduced, in order to take account of the effect of passive access on demand for, and cost recovery from, active products. Such a rebalancing of active prices would likely reduce the arbitrage opportunities available from the introduction of passive remedies, and therefore support competition on the merits. Therefore we would seek to adjust any active charge control to allow this, both to allow BT to respond to competition based on passive access (e.g. in order to reduce the arbitrage opportunities), and to support common cost recovery overall.

A24.155 We consider that a price rebalancing of downstream active services could potentially manifest itself in three ways:

[811] For example, we consider that estimating the effect on active volumes in this review period of a duct or dark fibre remedy priced on a distance-dependent basis is likely to be much more complex and less predictable than considering a dark fibre remedy priced on a per circuit basis. Therefore the ability to reasonably adjust any active charge control to reflect the availability of passives such that BT has an opportunity to recover its efficiently incurred cost is also likely to be more complex.

[812] If an active charge control is implemented, we could potentially allow for this rebalancing via detailed cost modelling, or facilitate it by maintaining wide baskets with limited (if any) sub-caps/additional restrictions (subject to any strategic/anti-competitive concerns with the basket). If an active charge control is not implemented, then BT will already have flexibility over its active prices.

- price reductions for active services where BT faces competition from CPs using passive access (likely to be higher value/bandwidth services);

- compensatory price increases for active products where BT does not face passive-based competition (likely to be lower value/bandwidth services, as argued by Virgin Media see paragraph A24.116); and/or

- geographic de-averaging/rebalancing of active prices, to reflect the different circuit lengths and possibly customer densities in order to reduce the associated arbitrage opportunities discussed above (as such, this is more likely to occur with duct access than dark fibre, where such arbitrage opportunities are potentially more limited, depending on the specific remedy design).

A24.156 This view of the potential broad directional changes in active prices appears to be broadly supported by BT, who suggested a similar potential rebalancing of active prices (see paragraph A24.113). The availability of passive access over time may therefore tend to produce a flatter structure than we observe today in charges for active services, (with differences between circuits more closely reflecting incremental cost differences), and on a potentially geographically de-averaged basis. The scale of this rebalancing will be directly affected by the scale of cost recovery at risk if active prices remain unchanged, and therefore we consider will be directly affected by the design of passive remedies in a similar way to that discussed above in paragraph A24.149.

A24.157 As a result, through active price rebalancing (alongside careful design of any passive remedy and appropriate adjustments to any active charge control, if appropriate), we consider it should be possible to largely mitigate the risk to BT's common cost recovery. However, such a rebalancing will result in a redistribution in the pattern of common cost recovery, and so the key risk in relation to allocative efficiency is in relation to the distributional impact of this price rebalancing and what impact this may have on overall output.

Impact of price rebalancing

A24.158 In relation to the distributional impact, this rebalancing will likely create winners and losers among CPs (and end customers) depending on the mix of services typically purchased and the scope for switching to passive-based services. However, importantly, the distributional impact will depend on the counterfactual. In particular, the appropriate comparison is the world with passive remedies and without at the same point in time (i.e. relative to today's prices is not the correct comparison). In this regard, we note that BT has had flexibility in previous charge controls, and appears to have tended to slightly reduce/flatten the bandwidth gradient over time (as discussed above). We also note that some stakeholders have argued that as demand for bandwidth increases, per-circuit price rebalancing will need to occur anyway in order to avoid over-recovery of costs. Therefore if this pattern continues, by the time that passive remedies could be introduced we may observe a flatter gradient in active prices than we observe today, and so the per-circuit impact of dark fibre may not be as stark relative to future prices as it may appear relative to today's pricing structure (although we note that BT may not continue this pattern).

A24.159 Nonetheless, some active circuits (expected to be low bandwidth) will likely have higher prices if passives are introduced compared to a world where they are not. This could therefore have a negative impact on CPs who have invested on the basis of BT's current portfolio of regulated active services (as argued by KCOM, see paragraph A24.115), and could raise distributional concerns (as argued by BT,

see paragraph A24.113).[813] BT has argued that a large group of customers dependent on active products would suffer from this while relatively few CPs would benefit (as set out in paragraph A24.113). In addition, we also note that if substantial, such rebalancing could potentially exacerbate the common cost recovery concerns if higher prices significantly reduce lower bandwidth volumes.[814]

A24.160 We acknowledge that volumes are concentrated in the lower bandwidths which are likely to be those that face the greater price increases (relative to if passives weren't introduced) which could suggest a greater volume of circuits (and therefore potentially customers) being adversely affected. However, the ultimate impact on these customers will depend on the scale of rebalancing that is required, which is ultimately dependent on the design of any passive remedy (including its form and price, as discussed above). Therefore we consider that the scale of rebalancing (and the resulting impact on lower bandwidth users) can potentially be managed through the passive remedy design. We also note that such rebalancing will potentially occur within the context of an active charge control (as currently proposed), and so subject to the scale of the 'X' in the control, nominal price increases may not be necessary. Further, the greater volumes at lower bandwidth is also likely to mean that the impact of price rebalancing on a per circuit basis is more limited, given the greater number of circuits affected. Some of these users may also benefit from the availability of passives in the longer term given the general trends in bandwidth (meaning they can upgrade capacity for a lower incremental cost).

A24.161 We also note that some stakeholders have put forward additional arguments for why the scale and net impact of any price rebalancing is likely to be more limited and could potentially occur without an absolute real terms increase (see paragraphs A24.99 onwards and A24.118 onwards):

- Consistency in pricing should ensure that competition is driven by efficiency rather than arbitrage;
- Users of high bandwidth circuits which experience price reductions will pass on the cost savings to end customers due to the competitive nature of downstream markets (e.g. backhaul cost savings will be passed on in lower retail broadband and/or mobile prices);
- Even CPs which lose in the short term as a result of passives will benefit in the longer term from the dynamic benefits that passive remedies will deliver (in terms of innovation, availability of alternatives to Openreach etc, greater competition). This will ultimately deliver lower prices and better services; and

[813] For the reasons set out above, we focus here on the potential impact of such a change in prices, and do not simply consider that any change from today's pricing structure must result in allocative efficiency losses (as argued by DotEcon, see paragraph A24.114).

[814] For example, attempting to recover significantly more common costs from lower bandwidth services could alter the purchase decisions of businesses between different technologies, and if substantial, could lead to end user migration to VULA and/or EFM at the lower-bandwidth end of the market (as argued by [✂ ✂] and Virgin, see paragraph [✂ ✂] and paragraph A24.116 respectively).

- Passives may increase total market demand relative to actives only in the longer term, which could lead to unit cost reductions for all users.[815]

A24.162 Some stakeholders also referred to the fact that rebalancing has occurred in other markets, and the fact that passives have been introduced in other countries in support of their view that any disruption/detrimental effect is likely to be limited (see paragraph A24.126).

A24.163 In addition, while we note that such rebalancing may exacerbate the common cost recovery concerns if higher prices on lower bandwidth services lead to CPs ceasing the purchase of business connectivity services (and moving to alternative technologies), we consider that the risk of this is likely to be manageable. In particular, we note that prices for lower bandwidth services may still not be higher in nominal terms relative to today even with rebalancing (subject to the passive remedy design and x in the active charge control), and note that BT has in 2015/16 maintained the existing nominal prices for low bandwidth circuits despite concerns about migration to VULA and/or EFM at the lower end of the bandwidth gradient (and so we might expect BT to continue to focus price reductions towards higher bandwidth circuits even in the absence of passive remedies). As such, on the basis that the scale of rebalancing is manageable (through the design of the passive remedy), we consider the volume effect for lower bandwidth circuits may not be significant relative to an active-only regime.

A24.164 Further, while some CPs will likely face higher prices than in the world without passive remedies, we recognise that other CPs (and end users) will likely benefit as a result of this price rebalancing. In particular, CPs who purchase higher bandwidth circuits (or will do so in the future given the price rebalancing that is likely to occur) may face lower prices than they might have done in the absence of passives and/or the potential for higher quality/bandwidth for the same cost relative to an active-only regime. In the long term, this could potentially lead to increased volumes at higher bandwidths relative to an actives-only regime. However, this will depend upon the pricing level of the passive remedy, as well as the scale of price reductions which would have otherwise been imposed.

A24.165 Therefore all of these effects need to be considered in the round as the overall net effect is likely to be finely balanced, and will be affected by the overall design of any passive remedy, as described above.

Potential implications of passive remedies for other markets

A24.166 The introduction of passive remedies may also have implications for the common costs recovered from other markets. If there is a significant impact in the long term such that usage of wholesale active leased lines sold by BT falls relative to other products, proportionately more common costs may need to be recovered from other

[815] Note, some CPs also argued the impact would be limited as prices are already above costs and efficiencies mean unit costs are expected to decline over time, but although we agree that this may offset the potential price increases, we consider that it does not mitigate the fact that prices are likely to be higher for some products than would be the case if passives were not introduced.

(non-BCMR) services, including wholesale access services (such as Wholesale Line Rental (WLR), LLU and Integrated Services Digital Network (ISDN) lines[816]).

A24.167 However this effect depends on a fall in usage of services within the BCMR relative to other services, and so for there to be a significant impact in other markets, passive remedies would need to have a significant effect on volumes. This could occur, for example, if there is scope for aggregation with a passive remedy which is not possible under the active regime, which leads to a substantial reduction in absolute volumes in the business connectivity markets. However, the risk of this occurring will depend to some extent on the design of any passive remedy, and in particular, the form.

A24.168 In particular, it seems unlikely that usage would significantly reduce with dark fibre (largely irrespective of how it is priced), as it would appear to offer more limited opportunities for aggregation beyond those which already exist and are available with existing active aggregation products (as discussed above). As such, we might expect to observe more of a one-to-one relationship between active circuits and a dark fibre remedy. Given this, and the general trend we observe for increased volumes in the active forecasts, it is not clear that the introduction of dark fibre would significantly reduce usage of BT circuits, such that more common costs needed to be recovered from other markets.

A24.169 Conversely, duct access would appear to offer greater scope for aggregation and a reduction in usage, although the materiality of any reduction in usage is difficult to predict. In particular, we recognise that in the short term CPs may focus more on using duct access to fill “gaps” in the market (rather than duplicate (and therefore cannibalise) fibre where it already exists). But in the longer term, there are potentially greater risks of a reduction in the usage of BT circuits as CPs may use duct access to expand their own network to areas where BT already has leased line circuits (although we note that significant switching costs will exist with duct access). However, this is difficult to quantify, as it is likely to depend on a range of factors, including the specific requirements of individual CPs.

A24.170 We recognise that DotEcon has argued that there may be an impact on prices in other markets if BT cannot recover common costs through increasing the price of low bandwidth circuits as a result of their greater price sensitivity and the availability of substitutes (as set out in paragraph A24.114). However, for the reasons set out above, we consider this would only be the case if usage of wholesale active leased lines sold by BT falls relative to other products.

[816] These wholesale services are used by CPs to provide retail telephony and broadband services to consumers and businesses. We reviewed these services in our FAMR. The latest FAMR statement was published in 2014, see http://stakeholders.ofcom.org.uk/telecoms/ga-scheme/specific-conditions-entitlement/market-power/fixed-access-market-reviews-2014/statement/. There are two main LLU services: Metallic Path Facility (MPF) commonly called full unbundling and Shared Metallic Path Facility (SMPF). MPF gives CPs access to all frequencies on a copper line to provide voice and broadband services. SMPF gives CPS access to a subset of frequencies that can be used to provide broadband services. There are also two main ISDN services: ISDN 2 which provides two 64kbit/s channels that can be used for switched voice and data services and ISDN 30 which provides 30 64/kbit/s channels.

Provisional conclusions on the risk to allocative efficiency

A24.171 We recognise that introducing a passive remedy is likely to have an impact on BT's current pattern of cost recovery (and therefore ultimately, the active pricing structure), which could raise distributional concerns. However, we consider that through a combination of careful design of any passive remedy and appropriate adjustments to any active charge control (if appropriate), it should be possible to limit the scale of active price rebalancing necessary as a result of introducing passive remedies. This would reduce the distributional effect by limiting upward price changes for lower bandwidth circuits (and therefore the risk of negative total volume effects), while also mitigating the risk to BT's common cost recovery. The June 2015 LLCC Consultation will provide further illustrative analysis on the potential scale of rebalancing our proposed dark fibre remedy may require, (as well as how we will seek to provide BT with an opportunity to recover its efficiently incurred common costs in the event passives are introduced).

A24.172 We are therefore mindful of the potential distributional impacts of passive remedies when we assess the different pricing options in Annex 26, as well as the overall assessment and proposed form of passive remedy in Section 7.

Productive efficiency

Stakeholder views

Responses to the November Consultation

A24.173 Some CPs (including BT and Virgin Media) argued that the introduction of passive remedies will likely result in duplication of resources and additional costs, leading to productive inefficiencies (including poorer management and utilisation of BT's infrastructure). We discuss these further in Annex 23, alongside the potential cost savings other CPs have identified in relation to the use of passive remedies.

A24.174 In addition to the comments on overall costs, some stakeholders commented on the risk of inefficient entry as a result of passive remedies (which could lead to productive inefficiencies). The DotEcon report commissioned by BT argued that because of practical limitations in setting sufficiently geographically differentiated prices, entry based on passive products may not always be efficient and could be particularly attractive in geographic areas with emergent infrastructure-based competition.[817] BT argued that any assessment of the risk of inefficient entry using passives needs to include the extent to which additional costs are incurred, especially where customer demand is not increased but substituted from existing actives.[818]

A24.175 However, PAG (including the Frontier Report it commissioned) argued that if regulated prices are set appropriately (with consistency between passive and active prices, in line with BT's regulatory costing system), build/buy decisions should be appropriate and CPs would choose between different forms of access in a way which reduces the overall cost of provision and allows innovation. CPs would

[817] DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015,, pages vii, 7 and 30 to 32.

[818] BT non-confidential response to the November Consultation, page 44.

choose deeper level access: if they can provide equipment or carry out activities more efficiently than BT; where unbundling allows services to be delivered without duplicated or redundant network components; or which allows greater innovation which is not possible with high level network access.[819] In this regard, Frontier Economics noted that while current active prices show varying margins, it is likely that active prices would move into line with dark fibre pricing, at which point investment decisions should reflect productive efficiency considerations. It further said that any short term inconsistencies in prices between active services and passive services following the introduction of passive remedies should not distort build or buy decisions as competitors would base these decisions on expectations of post-entry pricing.[820]

Our provisional view

A24.176 In relation to the risk that passive remedies may generate 'inefficient' entry and investment (as argued by DotEcon and BT, see paragraph A24.174), we consider that it would depend on the specific design of any passive remedy and the specific "efficiency" being considered. The key risk for inefficient entry appears to be related to the pricing of passive access, both in absolute terms and relative to active prices.

A24.177 The absolute price level could distort build/buy decisions of CPs, with a passive price which is "too high" potentially leading to inefficient infrastructure build, while a passive price which is "too low" (for example, below cost) could lead to inefficient use of passives (as well as risk BT's common cost recovery, as discussed above). Both of these could lead to productive inefficiencies in the relevant markets. However, we note that this risk does not seem unique to passive remedies, since similar concerns around distorting build/buy decisions by the absolute price level exist with active services.

A24.178 Similarly, the relativity of passive prices to actives could potentially raise a concern in relation to the efficiency of entry, as if not set appropriately, it could result in inefficient investment signals between different levels of the value chain with the incentives to enter using active and/or passive remedies (and/or self-build) potentially being distorted. For example, if the passive remedy price is 'too high' relative to the active price, this could disincentivise take-up of passive remedies (potentially forgoing dynamic benefits); while if the passive price is 'too low' relative to the active price, this could simply create arbitrage opportunities and over incentivise take-up of passive remedies (potentially leading to productive inefficiencies, due to duplication of fixed assets).

A24.179 However, we consider that if passive prices are set appropriately and on a consistent basis with active prices (to the extent feasible), the risk of inefficient entry and distorted build/buy decisions should be more limited (and in any event not significantly higher than the case with regulated active prices). In particular, this should allow CPs to make efficient choices between different forms of access (as argued by the PAG, see paragraph A24.175).

[819] Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, page 6.

[820] See Frontier report prepared for the PAG's response to the November 2014 Consultation, "Costing and pricing of passive access remedies", January 2015, page 27.

Provisional conclusions on the risk to productive efficiency

A24.180 Overall, we consider that the risk of productive inefficiencies as a result of passive remedies (relative to an active-only regime) is ultimately likely to be affected by their design, and in particular, the approach to pricing. We therefore take the risk to productive efficiency into account when assessing the pricing options, as discussed in Annex 26, as well as the overall assessment and proposed form of passive remedy in Section 7.

Structure of competition

Stakeholder views

Responses to the November Consultation

A24.181 BT argued that the introduction of passive remedies would cause irreversible damage to competition, and cause it to become more consolidated. It stated that the current diverse market structure meets the diverse nature of business connectivity demand and a more consolidated industry would not be an improvement in competitive terms. It argued that smaller CPs are unlikely to have the economies of scale to be able to exploit dark fibre's lack of a bandwidth gradient. BT was concerned that widespread use of dark fibre would lead to smaller CPs being priced out the market and no longer able to provide the specialist services they currently do.[821]

A24.182 BT also argued that passive access would make the industry dependent on on-going regulation. It stated that the introduction of passive remedies would effectively be irreversible and once CPs had integrated the use of passive remedies into their networks, their investment would have been sunk. It further argued that as market structure and competition changes in this way it would become impossible to test the counterfactual of their withdrawal for the purposes of future market reviews. BT considered that this would be even more the case to the extent that active regulation is withdrawn on the basis of passive product take up and further infrastructure investment-based competition has been dis-incentivised by the use of passive products. It said that the market structure and therefore basis of competition could become dependent on passive access as a regulatory remedy.[822]

A24.183 BT also argued that passive remedies may make retail switching more difficult. For example, BT argued that if passive remedies were based on longer term arrangements (especially where new infrastructure build was required) it is likely that the circuits provided to end users would be based on longer term upstream passive arrangements. This would mean, it argued, that retail markets are likely to migrate to longer term arrangements (or customers be incentivised to sign up for longer term deals).[823]

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[821] BT non-confidential response to the November Consultation, pages 40 to 41.

[822] BT non-confidential response to the November Consultation, page 41. See also DotEcon's views on the irreversibility of a decision to introduce passive remedies in DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, pages 9-10.

[823] BT non-confidential response to the November Consultation, page 41.

Our provisional view

A24.184 To the extent that economies of scale are important in the use of passive remedies, we recognise that there is potentially a risk that the downstream market could become more consolidated relative to today. We consider this risk is likely to be greater for duct access than dark fibre, given the greater investment required in the former. In particular, the additional investment required by CPs for dark fibre is relatively low compared to the current active products, and is mainly confined to different circuit interfaces (we note that such equipment is manufactured globally and is already readily available).

A24.185 However, that is not to suggest that we will necessarily see smaller CPs exit the market (as argued by BT), even with duct access. In particular, even in the absence of economies of scale, smaller CPs may still want to purchase regulated passive access, particularly if they are currently providing more specialist services as it would increase the flexibility they have over the services they provide. In addition, we consider that passive access could potentially lead to increased wholesale competition upstream, meaning smaller CPs may actually be able to buy an active service from alternative (passive-based) suppliers to continue providing services in the event they did not want to purchase passive access from BT. This could work much like the market today where non-BT infrastructure operators offer active services to downstream CPs (as well as dark fibre). Therefore it is not clear that smaller CPs will necessarily be priced out of the downstream market, even in the event that they themselves lack the economies of scale required to utilise passive access directly.

A24.186 In relation to BT's arguments that the industry may become dependent on on-going regulation, it is not clear to us that this risk is necessarily greater with passive remedies relative to the existing active-based regulation (which CPs are currently largely dependent on, with the exception of some geographic areas). As discussed above, the impact of a passive remedy on non-BT infrastructure investment can to some degree be mitigated by its design, and therefore to the extent infrastructure-based competition is viable and sufficiently occurs, we would anticipate being in a position to deregulate where appropriate (as we have proposed in the CLA, as discussed in Section 7). Further we frequently need to assess markets in the absence of regulation (including where passive remedies exist, such as the WLA market), and while it can be complicated by the presence of remedies it does not prevent deregulation where it is considered appropriate and necessary (e.g. in the WBA market).

A24.187 While it may not be desirable for competition if passive remedies lead to longer term contracts and reduce switching (as argued by BT), we note that longer term contracts (including discounts) already exist under the active regime. We also understand that variability in contract lengths (including where new build is required) is also apparent in the offerings of non-BT infrastructure operators. Therefore (subject to the specific design of the passive remedy) we consider there is likely to remain some commercial scope to vary such terms in response to the market even in the event of new infrastructure build, and so it is difficult to see at this stage that this should be a particular concern in relation to passive remedies.

Provisional conclusions on the risk to the structure of competition

A24.188 We recognise the possibility that there may be some changes to the market structure and competitive environment (for example, we could see the emergence of passive-based wholesale competitors and alternative, more differentiated

offerings), but we do not think that there is a high likelihood of a large impact or that the impact would be to reduce competition.

Implementation costs

Stakeholder views

Responses to the November Consultation

A24.189 BT argued that the direct costs of implementing any new passive products would be considerable. It argued that implementing passive remedies would be a significant undertaking technically, operationally and financially, and there would need to be a lengthy implementation period during which both Openreach and CPs would need to make significant investments in process and systems changes, particularly if high order volumes were anticipated. BT noted that the scale of costs would be affected by the remedy specification and anticipated volumes. For example, it argued that a single remedy (duct or dark fibre) would be costly and time consuming to implement and would be likely to require multiple systems releases, but if both duct and dark fibre access were imposed then the degree of process/systems change required would be higher still. Nonetheless, BT gave the following examples of some potential changes it would need to implement:

a) Changes to the quote, billing and inventory systems.

b) Changes to the fault diagnosis and repair processes: while passing responsibility to the CP for fault testing, diagnosis and call-off of Openreach engineering resource is possible, it raises challenges which would require major change (e.g. redefinition of responsibilities of stakeholders), coordination (if multiple CPs consume passive remedies with differing electronics and network management systems) and investment (e.g. in restructuring of systems and re-engineering of processes).[824]

c) There would also be a need for Openreach to reconsider the requirements and priority of other 'active' systems developments in the light of scale of changes required to introduce passive services.[825]

A24.190 DotEcon report commissioned by BT argued that the implementation costs associated with changing Openreach's business processes would likely be incurred regardless of whether demand for passives is actually realised, and many transition costs could not be recovered if there was little demand for passives (or if passive remedies were subsequently unwound).[826] KCOM also argued that there is a considerable risk regarding whether there is actual demand for passive products

[824] We note BT also argued that such changes to fault diagnosis and repair could have a negative impact on quality of service, for example by causing supplier boundary issues and disputes, a lack of clarity in fault diagnosis and more engineer call-outs being required (see BT non-confidential response to the November Consultation, page 34). However, other CPs argued passive remedies could improve quality, and so we discuss the interactions between passives and quality of service further in Annexes 23 and 25.

[825] See BT non-confidential response to the November Consultation, pages 33 to 34 and 55 to 59.

[826] DotEcon report prepared for BT's response to the November 2014 Consultation, "Business Connectivity Market Review: Passive Remedies", 5 January 2015, page 27.

which cannot be met in other ways or by other providers. It considered there to be a real risk that there may not be sufficient demand materialising, and so development of a suitable product might generate costs that could not be directly covered from the sale of passive access.[827]

A24.191 BT also argued that while it is important that passive remedies are only applied in response to an SMP finding, limiting passive remedies to SMP markets would be a major issue requiring considerable thought and analysis as the practical and logistical problems would be immense.[828] Virgin Media also argued that it would be extremely costly and very difficult to enforce passive remedies due to the rudimentary nature of such access, highlighting the difficulty of enforcement when its use extends across competitive and non-competitive areas.[829]

A24.192 TalkTalk argued that the burden for dark fibre is in practice minimal, for instance:[830]

i) there will be a small additional cost to Ofcom to monitor and review (triennially) the regulation of dark fibre remedies (probably averaging less than £100k *additional* cost per year

ii) BT will incur a small cost to develop, operationalise and manage dark fibre products. In the case of dark fibre, the cost will be small since the product is a sub-set of the Ethernet product. There may also be a small cost to BT to operationally comply with the regulation.

iii) Over the longer term, if regulated access to dark fibre products enabled regulation of active products to be removed, there would be reductions in the overall cost of regulation since regulation of dark fibre is likely to be much less complex and onerous that the regulation of active remedies.

Our provisional view

A24.193 We recognise that introducing a new remedy would likely result in BT incurring associated development and implementation costs. As a result, it would seem reasonable to seek to provide BT with an opportunity to recover efficiently incurred implementation costs, just as we do with other efficiently incurred costs (including investment, as discussed above). We discuss where and how these costs may be recovered in the June 2015 LLCC Consultation.

A24.194 In any event, we note that the scale of implementation costs is highly dependent upon the design of any passive remedy. For example, if a dark fibre remedy which largely mapped the existing active circuits was introduced, we would expect the implementation costs to be significantly lower than a completely new (BCMR-specific) duct remedy, as it is likely that many of the existing processes could be re-used (as noted by TalkTalk). We are therefore mindful of the implementation costs while designing the passive remedy (see Section 9).

[827] KCOM's non-confidential response to the November Consultation, page 4.

[828] BT non-confidential response to the November Consultation, page 55.

[829] See Virgin Media's non-confidential response to the November Consultation, pages 21 to 22.

[830] TalkTalk non-confidential response to the November Consultation, page 19.

A24.195 We recognise that enforcing any passive remedy effectively will be affected by its scope, which is directly related to the market definition and SMP findings. We discuss this in Section 9.

Provisional conclusions on implementation costs

A24.196 Overall we recognise that there are likely to be implementation costs incurred by BT as a result of introducing a new remedy, and that these need to be considered as part of the overall assessment. However, there are likely to be ways to limit the scale of these costs, such that they are unlikely to be significant. We will set out in the June 2015 LLCC Consultation the magnitude of these costs, and how we will provide BT with an opportunity to recover them.

Summary of provisional conclusions on impacts and risks of passive remedies

A24.197 In Table A24.1 below, we present a summary of the impacts and risks of introducing passive remedies discussed above.

Table A24.1: Summary of the impacts and risks of introducing passive remedies

	Description	Scale and scope of risk
Dynamic efficiency	The introduction of a new upstream remedy could reduce the investment incentives of BT and non-BT infrastructure operators relative to an active-only regime, by affecting future build-buy decisions and undermining returns on existing investments. However, the remedy could promote investment in the use of passive access.	Highly dependent on i) the design of any passive remedy, and ii) the extent to which the passive remedy replicates the benefits of self-build.
Allocative efficiency and distributional impacts	Passive remedies are likely to result in some rebalancing of active prices, which is likely to create winners and losers among different customers depending on services typically purchased. This could create distributional concerns.	It is unlikely that a passive remedy could be introduced in a way which would have no distributional effects, but its design is likely to be able to reduce any negative impacts while also minimising the risk to BT's common cost recovery.
Productive efficiency	The existence of passive remedies (and any coexistence with active remedies) could distort the investment signals at different levels of the value chain, leading to inefficient entry.	If passive prices can be set appropriately (both in absolute terms, and relative to active prices if remedies coexist), it is not clear that the risk of inefficient entry would be significant.
Structure of competition in the market	To the extent that economies of scale and long term commitments are more important to a CPs ability to utilise passive remedies than actives, it has been suggested that introducing the former could result in market consolidation, with smaller CPs exiting the market and reducing the extent of competition.	While the remedy may have an impact on the downstream market, providing it is fit for purpose we consider it unlikely that this impact will be large, and in any event it is not clear that this will necessarily be for the worst, given the greater opportunities that passives may open up.
Implementation costs	BT will likely incur some costs as part of developing and implementing a new remedy.	It seems these are unlikely to be significant, particularly since there are likely to be ways to limit them.

A24.198 As this illustrates, we consider that while introducing passive remedies potentially poses some risks, the scale and scope of these risks is likely to be affected by the specific design of any remedy. As such, we consider that it is likely to be feasible (and practical) to design a passive remedy which significantly reduces these potential risks. For example, many of the risks identified above are likely to be significantly lower with a dark fibre remedy than duct access for the reasons we have set out (although other design elements are also important). Further, we recognise that there are also potential benefits of passive remedies (as discussed in Annex 23) which need to be traded off against these potential risks (among other relevant considerations), and we discuss our view of this overall trade-off in Section 7.

A24.199 We consider the interactions between the risks of passive remedies and the specific design features further in Annex 26 (in relation to pricing) and Annex 25 (in relation to other design features) as well as in our overall assessment in Sections 7 and 9, where we explain the extent to which the specific package of remedies we propose will mitigate the risks identified in this annex.

Annex 25

Design of the dark fibre remedy

Introduction

A25.1 In this annex we discuss non-price aspects of design of the dark fibre remedy in two parts:

- in Part 1 we summarise stakeholders' responses to both the April 2014 CFI and to the November Consultation on all matters relating to non-price aspects of the design of dark fibre. They include the technical and operational aspects, the potential scope of a passive remedy, non-discrimination arrangements, supply of new infrastructure and implementation timescales; and
- in Part 2 we provide our views on stakeholders' responses regarding technical and operational aspects of the potential provision of a regulated dark fibre access product.

A25.2 We take account of both parts of this annex in our assessment of Section 9 of the dark fibre remedy we propose for CISBO markets in which BT has SMP.

Part 1: Summary of stakeholders' responses to consultations in relation to non-price design aspects of passive remedies

A25.3 In the April 2014 CFI we sought initial views from stakeholders on a range of topics, including the scope of any passive remedy as well as technical and operational challenges associated with the deployment and use of passive remedies and how these might be addressed.

A25.4 In the November Consultation, we discussed scope and design choices for passive remedies. Stakeholders provided further views on high-level considerations in relation to:

- product and geographic scope of any passive remedies and its impact on their usefulness and benefits;
- arrangements for construction of new infrastructure;
- appropriate form of non-discrimination obligation for passive remedies; and
- implementation arrangements.

Technical and operational aspects

A25.5 In the April 2014 CFI, we asked the following question to stakeholders:

> "What are the technical and operational challenges associated with deploying and using passive remedies and how might these be addressed?"

Stakeholder responses to the April 2014 CFI

A25.6 UKCTA considered it important that the remedy should be "architecture agnostic", allowing access-seekers to construct networks that are not dependent on BT's pre-existing network architecture.[831]

A25.7 Vodafone suggested that dark fibre could be readily implemented using the existing framework of systems and process that are already in place for EAD.[832]

A25.8 TalkTalk also believed that the dark fibre product could reflect the duct/fibre components of the existing active product, such as route restrictions, availability checking, the provisioning and fault repair process, SLA/SLG arrangements and Excess Construction Charges (ECCs). TalkTalk noted that the only new and different elements of the dark fibre product would be the arrangements for fault monitoring and a management interface for fault reporting and repair, as well as specified optical performance standards and SLAs. TalkTalk also suggested that the regulatory obligations can reflect those for AISBO products, although without the EOI requirement.[833]

A25.9 Colt proposed that an efficient passive access offer needs to allow deployment in all network segments and it should not be restricted to what BT defined as access and backhaul segments. Colt was of the view that the less restrictive the offer, the more network innovations can be expected. In addition, Colt suggested including business grade SLAs of 4 hours for fault repairs and 35 day delivery lead time.[834]

A25.10 Both Colt[835] and UKCTA[836] suggested the implementation of an online tool showing maps of passive infrastructure and associated points of access in order to facilitate take-up and increase demand. UKCTA noted that passive access is supported by such a tool internationally. It expected that the obligation on BT to provide passive access is to be accompanied by the requirement to develop a similar tool.[837]

Stakeholder responses to the November Consultation

A25.11 Several respondents also commented on the technical and operational aspects of passive remedies in their responses to the November Consultation.

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[831] See UKCTA non-confidential response to the CFI, page 9. UKCTA further clarified that this requirements would not necessarily imply that the access provider would (by default) be required to provide access in which it does not hold SMP in the applicable downstream market. It suggested that defining a cut off in such a way that the access provider is not obliged to provide duct or dark fibre over very long distances could be an example of how to approach this issue.

[832] See Vodafone non-confidential response to the CFI, page 15.

[833] See TalkTalk non-confidential response to the CFI, page 20.

[834] See Colt non-confidential response to the CFI, page 41.

[835] See Colt non-confidential response to the CFI, page 42.

[836] See UKCTA non-confidential response to the CFI, page 10.

[837] See UKCTA non-confidential response to the CFI, page 10.

A25.12 Sky argued that Ofcom must ensure sufficient transparency of product availability and specification, fair and reasonable cost orientated pricing, and flexibility of use. For example, it is important that:[838]

- CPs have direct access to BT network records systems for ducts, poles and cables;
- There is a space reservation scheme to ensure customer premises connection;
- There is a process for exchanging excess copper capacity for fibre where passive infrastructure is exhausted; and
- The cost allocation methodology where passive infrastructure upgrades are needed is fair and reasonable.

A25.13 The use of existing arrangements for the supply of dark fibre was suggested by Bit Commons,[839] Six Degrees Group,[840] Telefónica[841] and GTC.[842]

A25.14 GTC considered that it would be straightforward for BT to supply dark fibre given that it would follow the arrangements currently used for EAD services. GTC added that installing additional fibre in BT shared ducts is simpler than providing dedicated sub-duct access, as blown fibre requires less duct than the type of sub-duct that is offered under the WLA PIA remedy.[843]

A25.15 GTC suggested that ordering point-to-point dark fibre products could be done via the "eCo" portal as is the current method for EAD. For such products, GTC suggested a CP could access the "eCo" portal and either enter the postcodes or coordinates for the BT fibre demarcation points either end of the requested service. The construction costs of new build should be paid by the requesting CP and BT could levy ECCs on top of its installation fees if it is to extend its network infrastructure to reach a requested demarcation point.[844]

A25.16 GTC also argued that it is critical for BT to provide documentation on the handover to dark fibre which includes Optical Time Domain Reflectometry (OTDR) tests providing service measurements for use in fault detection testing. In regards to fault repair, GTC suggested that CPs should be permitted to perform fault detection and analysis initially to see if the fault is within their own network. GTC noted that this would be facilitated by the inclusion of OTDR in the handover documentation (as aforementioned). According to GTC, responsibility for faults within BT's network should be assumed by BT itself and are to be repaired within reasonable timescales

[838] See Sky non-confidential response to the November Consultation, page 5-6.

[839] See Bit Commons non-confidential response to the November Consultation, page 4

[840] See Six Degrees Group non-confidential response to the November Consultation, page 6

[841] See Telefónica non-confidential response to the November Consultation, page 7.

[842] See GTC non-confidential response to the November Consultation, page 25.

[843] See GTC non-confidential response to the November Consultation, page 18.

[844] See GTC non-confidential response to the November Consultation, page 25

that are reflective of the fact that multiple households will have been inconvenienced.[845]

A25.17 GTC, in its supplementary response to the Consultation, suggested that if Ofcom were to mandate a varied connectivity solution derived from the existing EAD remedy, either on a continued active basis or passive (so-called 'boxless') basis, the following practical issues would need to be addressed:

- the existing ordering processes for EAD should be applied to any passive variant;
- the time to provision a “boxless EAD” should be slightly shorter than for the active EAD service because the installation and testing of the equipment will not be required. Additionally, GTC suggested that details of fibre and fibre pair performance (i.e. length and attenuation) should be provided at handover. Furthermore, GTC said that in instances where BT has no infrastructure present to the site boundary, BT should facilitate CPs digging between their site and BT’s network by installing a handover chamber to reduce ECCs;
- interconnection at the site end of any passive link should involve BT breaking into and leaving fibre in the access-seeker’s chamber. The access-seeker can then connect to BT’s fibre using its own joint. GTC also said that the termination arrangement at the local exchange end of the connection, should be in line with BT’s external Cabelink product;
- the main link vs EAD LA pricing structure should not be applied to the passive remedy, as it penalises access-seekers who cannot align with BT’s existing network topology;
- BT should support any dark fibre remedy end-to-end. The CP who leases dark fibre from BT should conduct OTDR testing to ascertain the location of faults before it reports them to BT for repair. GTC considered that the levels of service support should exceed those for the current EAD service, as there would be no active electronics and BT would know the location of the fault once reported; and
- no periodic maintenance should be required. Instead, GTC suggested that pre-agreed maintenance windows could be used for diversionary works, similar to the existing EAD service.[846]

A25.18 TalkTalk disagreed with BT’s view that providing additional dark fibre will be complex, arguing that it is no more complex than the arrangements required for active products. [847]

A25.19 Vodafone said that it submitted a Statement of Requirements (SoR) to Openreach requesting the supply of dark fibre. It set out its detailed requirement for dark fibre which included the following features:

- dark fibre direct customer connectivity;

[845] See GTC non-confidential response to the November Consultation, page 25.

[846] See GTC, non-confidential supplementary response provided on 20 March 2015, page 8-9.

[847] See TalkTalk non-confidential response to the November Consultation, page 21.

- no restrictions to be imposed on the nature of the equipment, customers or services which are to be connected to the dark fibre;
- one or two fibre options;
- distance availability aligned with technical capabilities available from electronics vendors (& should not be restrained by restrictions on current active products);
- resilient routing where possible;
- collection of the fibre should be at a) local exchange, b) CP location, c) joint box or d) any relevant agreeable location;
- route maps for standalone survey and advanced order management process (AOMP);
- pricing options should include indefeasible rights of use (IRUs);
- dark fibre direct customer connectivity should have a minimum contract term of no more than 12 months;
- Service Level Agreements on provision and repair, with SLGs for late provision and repair;
- the ability to migrate free of penalty to dark fibre from active services, whether WES/WEES/BES, EAD-LA, EAD, EAD-ER, TDM-A, OSA, regardless of term option xviii) moves and shifts permitted of either end (but not both A and B at same time on same order);
- no restrictions on use or on CP's ability to sublease capacity to OCPs; and
- updated testing approach to accommodate new dark fibre product.[848]

Comments about supply of new infrastructure

A25.20 A further design consideration relating to the scope of passive remedies is the arrangements that would apply when new infrastructure is required. In the November 2014 Consultation we discussed situations in which new infrastructure would be required, acknowledging that they appear to be comparable with the situations where new infrastructure is required for wholesale leased lines.

A25.21 Our initial view was that the same arrangements which are used for wholesale leased lines should apply to dark fibre. We also said that the wholesale leased line arrangements are likely to provide a good starting point for consideration of the arrangements that would be appropriate for a duct access remedy. Several stakeholders commented on this in their responses to the November 2014 Consultation.

A25.22 Telefónica said that the current practice for leased lines for locations not currently served is to apply BT's ECCs. New infrastructure in the common parts of BT's network (such as new fibre flexibility points) and work to repair blockages and

[848] See Vodafone non-confidential response to the November Consultation, page 17.

damage are not charged as ECCs. Such an approach would seem pragmatic for passives remedies, as long as equivalence of charges is maintained and monitored for passive and access components, with ECCs being based on fair and equitable basis.[849]

A25.23 A number of other CPs were also of the view that ECC arrangements could be applied to passive remedies. In particular:

- Vodafone suggested that the current ECC arrangements could be used for new network requirements under the passive remedy;[850]
- TalkTalk was of the view that extending infrastructure should follow the existing arrangements for Ethernet (for example, levying ECCs);[851]
- [✂ ✂][852]
- FCS agreed that infrastructure arrangements for dark fibre are likely to be similar to those for wholesale leased lines;[853]
- WarwickNet said that the current ECC arrangements (as per EAD) are appropriate for network extensions;[854]

A25.24 [✂ ✂] acknowledged that all of the scenarios outlined in the consultation are likely to be applicable, however, it noted that the applicability of the scenarios is dependent upon circumstances present in the area in which it requires new build. For example, [✂ ✂] stated that it may be optimum for it to build duct to a BT splice point in a given area, while in another outsourcing the build to BT and paying an ECC may be a better option to pursue. In the latter instance however, [✂ ✂] raised the issue that the first mover would incur the cost of the build and BT could potentially earn an economic rent on an asset that it did not fund whilst providing duct access on terms which are comparatively advantageous to the first mover's competitors (given that they will not have been required to pay BT any ECC for that infrastructure). [✂ ✂] argued that the only way to avoid this issue is for the entity paying the ECC to be granted ownership of the new infrastructure in order for it to benefit from the economic rent based upon sharing access to that duct with other parties in the future.[855]

A25.25 The Passives Access Group (PAG) commented that there is a range of solutions that could be implemented for the supply of new infrastructure, and it did not consider that the choice between solutions would impose any significant issues

[849] See Telefónica non-confidential response to the November Consultation, page 7.

[850] See Vodafone non-confidential response to the November Consultation, page 19.

[851] See TalkTalk non-confidential response to the November Consultation, page 21.

[852] See [✂ ✂]

[853] See FCS non-confidential response to the November Consultation, page 3.

[854] See WarwickNet non-confidential response to the November Consultation, page 4.

[855] See [✂ ✂]

towards implementation. The PAG stated that the most appropriate solution could be discussed between Ofcom, BT and industry (including itself).[856]

A25.26 In its additional response of 13 March 2015, the PAG members said that some potential for a properly designed 'dark fibre with new build' obligation to enable CPs to design their own network topologies, including where network segments do not currently exist, provided that Ofcom makes the remedy available on that basis. The PAG argued that unless this arrangement enables CPs to request new dark fibre on a segment-by-segment basis and on CP-selected routes, then it will offer very few additional opportunities for innovation compared to the existing active remedy.

A25.27 Furthermore, the PAG said that if new build for dark fibre simply mirrored the existing obligation:

a) CPs would not be able to use combinations of own fibre segments and BT's dark fibre segments to deliver a service as efficiently as possible given CP's existing investments;

b) CPs would have no control over the network route in order to offer customers a network topology that best serves their needs;

c) CPs would be unable to reuse network capacity, such as redeploying certain dark fibre segments to serve different routes to reflect changes in customer requirements; and

d) It would not facilitate efficient network expansion. The PAG noted that it understood that dark fibre would be provided as a replacement for a single leased line on a point-to-point basis.[857]

A25.28 In order to approximate the benefits of duct access, the PAG said that it is essential for any dark fibre remedy to be provided on a segment-by-segment basis and that the new build requirement would need to provide network extensions to specific customer access points where duct/dark fibre is non-existent. It also argued that the new build requirement should obligate that BT break out of existing duct/dark fibre routes mid-way in order to establish new network routes and topologies by CP request.[858]

A25.29 BT considered that the consultation did not fully depict the complexity of the interaction of passive remedies with new infrastructure build and noted that the approach for any individual passive product depends upon the availability of other passive products. BT also deemed that the proposal of using current wholesale leased line arrangements for dark fibre, essentially based on the ECC regime and for them to act as a starter for duct access, does not reflect the realities of operating parallel active and passive regulated remedies.[859]

A25.30 In relation to a dark fibre remedy, BT noted that current industry discussions suggest that CPs who wish for dark fibre are looking for access to a greater number

[856] See the PAG non-confidential response to the November Consultation, page 13 – 14.

[857] See the PAG non-confidential additional submission of 13 March 2015, page 10-11.

[858] See the PAG non-confidential additional submission of 13 March 2015, page 11.

[859] See BT non-confidential response to the November Consultation, page 52

of flexibility points in the network than would traditionally be available using EAD products. It argued it would place additional investment demands on certain parts of the network than would be required if only active products were provided, also leading to stranded assets elsewhere in the network. BT viewed that the regime would need to ensure that these costs were faced by those purchasing passive products.[860]

Product and geographic scope of dark fibre

Stakeholder responses to the CFI

A25.31 In the CFI, we asked stakeholders the following question:

> "Would the presence of physical infrastructure belonging to other CPs affect usage of passive remedies? For example would you expect passive remedies to be used only or mainly in areas where only BT has passive infrastructure of would you also expect passive remedies to be used in areas where other CPs have passive infrastructure?"

A25.32 Vodafone said that it expected passive access by BT would be nationally available. It did not consider that the presence of other CPs' physical infrastructure should limit the application of a passive remedy imposed on BT. Vodafone noted that to date such infrastructure has failed to dampen BT's SMP in downstream services.[861]

A25.33 Verizon [✂

✂] [862]

A25.34 UKCTA said that the presence of alternative infrastructure would be a determining factor for the demand for passive infrastructure from BT. However, it noted that due to BT's ubiquitous network coverage it expected BT to be the main provider of infrastructure even in areas where there is competitive, alternative infrastructure present. UKCTA also noted that its members use each others' passive facilities via duct sharing, dark fibre access and fibre swaps.[863]

A25.35 Colt [✂

✂].[864] Colt also stated that it would not consider using passive access available from third parties where it has its own infrastructure. In its view, there might therefore be scope for geographic delineation in the scope of passive remedies. Colt said that the geographic scope should not necessarily be the same as the existing WECLA, as it noted that digging is too costly for it to justify

[860] See BT non-confidential response to the November Consultation, page 54

[861] See Vodafone non-confidential response to the CFI, page 19.

[862] See Verizon confidential response to the CFI, page 9.

[863] See UKCTA non-confidential response to the CFI responses, page 10.

[864] See Colt confidential response to the CFI, page 31.

offering connectivity to the majority of off-net sites in West London. However, Colt noted that decisions to build/buy would be different if passive access were available.[865]

A25.36 BT was of the view that if nationwide provision of passives became mandatory under the relevant remedy, CPs would use the remedy regardless of the presence of alternative competing physical passive infrastructures. However, BT also questioned the basis on which passives would be introduced in areas where alternatives to BT's network are available.[866]

A25.37 TalkTalk [✂

✂][867]

A25.38 Virgin Media raised concerns that the creation of widespread infrastructure access through passive remedies could, if structured in an inappropriate manner, undermine genuine network investment.[868] In expressing the concerns around the potential to undermine investment in network infrastructure, Virgin Media stressed that it was not suggesting that passive remedies may not have a place within the regulated environment. For example, a more targeted approach could be taken, potentially applying a geographically differentiated approach to the implementation of the remedy (across a national market, but in recognition of differing competitive conditions in different areas of that market). This would allow for the protection of genuine investment or investment potential whilst providing an ability to compete, by lowering barriers to entry, in areas where competitive entry (through network build) would not be viable. Such an approach would also help to allay concerns regarding the application of uniform pricing of a passive remedy undermining the bandwidth gradient applied to regulated products, which Virgin Media recognises as a relevant issue that would need to be considered, not only in the context of the effect on BT's pricing, but also on competition in the market for on-net supply more generally.[869]

A25.39 KCOM saw no need to impose remedies for passive access products in the Hull area. It noted that it has not received any formal expressions of demand for passive infrastructure access to its network in the Hull area to date.[870]

Stakeholder responses to the November Consultation

A25.40 In the November Consultation, we asked stakeholders the following question:

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[865] See Colt non-confidential response to the CFI, page 31.

[866] See BT non-confidential response to the CFI, page 25.

[867] See TalkTalk confidential response to the CFI, page 4.

[868] See Virgin Media non-confidential response to the CFI, page 6.

[869] See Virgin Media non-confidential response to the CFI, page 7.

[870] See KCOM non-confidential response to the CFI responses, page 8.

"If passive remedies were restricted to particular product types or geographic areas how might this affect the usefulness and benefits of the passive remedy?"

A25.41 The majority of stakeholders held the view that restrictions on the application of passive remedies by product type and/or geographic area would impact upon the benefits and use of passives. Many stakeholders proposed arguments for the potential impacts restrictions could bring.

A25.42 [✂ ✂] argued that while the WECLA could potentially be the only geographic area that is to be considered exempt, discrimination by product type or geographic area provides the ability to distort the remedies. As an example of such distortion, [✂ ✂] noted that there is already product-based discrimination in the PIA remedy (i.e. providing point-to-point connectivity) which has the effect of barring the market from anything useful.[871]

A25.43 Bit Commons disliked the idea of restricting passive remedies, and noted that Ofcom must prepare for a pro-competitive switch to all fibre access networks.[872]

A25.44 Six Degrees Group would be concerned if SMP restrictions on passive access would mean that it would not be available nationwide. It hoped that Openreach would choose to provide passive access imposed in SMP areas on a national basis. It also noted that the presence of competition in locations where BT does not have SMP should allow products based on passive access to be delivered using passive access from providers other than BT, as is seen in certain cases at present. An outcome in which CPs were given the tools to innovate but the applications of new developments were to be limited seemed counterintuitive to Six Degrees Group. It expected that at minimum, any service that can be currently provided with EAD/EBD should be permitted.[873]

A25.45 TalkTalk considered that the obligation to provide dark fibre should be imposed in all product and geographic markets where BT has SMP, in order to effectively address BT's dominance and improve competition, innovation and efficiency. It saw no reason to restrict the introduction of dark fibre to areas where SMP is stronger, stating that the benefits of dark fibre exist even in markets with relatively weak SMP.[874]

A25.46 Vodafone also did not support the notion of restricting passives by product type, and stated that doing so would ruin opportunities for innovation, market growth and new market development.[875] [✂

[871] See [✂ ✂]

[872] See Bit Commons non-confidential response to the November Consultation, page 4.

[873] See Six Degrees Group non-confidential response to the November Consultation, page 6

[874] See TalkTalk non-confidential response to the November Consultation, page 20

[875] See Vodafone non-confidential response to the November Consultation, page 17

✂][876]

A25.47 The Independent Networks Cooperative Association (INCA)[877] said that passive remedies were strongly supported by its members who are building networks in rural areas. However, it noted CityFibre's argument that passive remedies could undermine investment cases for it and other CPs in fibre infrastructure in urban areas, if passives are introduced too soon or poorly considered. In light of this, INCA noted that some form of geographic segmentation would be worth pursuing.[878]

A25.48 In relation to product markets, GTC requested a dark fibre access remedy suitable for connecting new local networks constructed by CPs to core backhaul networks. Its use of dark fibre would be for point-to-point topologies for either 'aggregation' backhaul (to be run at a typical speed of 1Gbps similar to the EAD circuits currently purchased by GTC) or 'access' backhaul (intended to form part of PONs currently running at speeds of up to 2.5Gbps). Without access to dark fibre for both 'access' and 'aggregation' for these purposes, GTC said it would have significantly less flexibility to design optimum network architecture, and would not be able to pass on all of the significant benefits to consumers in new homes that it believes they are entitled to.[879]

A25.49 Commenting on the geographic scope of a remedy, GTC argued that if dark fibre is excluded from markets where BT or KCOM have SMP, it will be less able to deploy its FTTP networks economically. It added that in non-SMP areas few CPs have POPS close enough to offer GTC cost-effective connectivity in all cases. Furthermore, GTC argued that restrictions on reach and scope of the remedy will reduce the potential for economies of scale to be generated among CPs, as it would require CPs to design systems based upon differing interconnectivity approaches in different parts of the country.[880]

A25.50 The Federation of Communication Services (FCS) acknowledged Ofcom's consideration of geographic areas for the purposes of considering SMP and the potential geographic restrictions on passives that would seek to increase competition in such areas. The FCS noted that it hoped that areas without SMP would be able to offer benefits similar to those from passive remedies, via the natural competition that already exists. The FCS also suggested that the aim should be to create a national default position of open access to infrastructure. In areas where SMP exists, the FCS stated that the regulatory mechanism should be a rent

[876] See Vodafone confidential response to the November Consultation, page 17-18.

[877] INCA is an association representing the non-incumbent builders and operators of next generation network digital networks. Its membership is a mix of large companies (such as Vodafone and Sky) and new entrants (for example CityFibre, Hyperoptic and UK Broadband).

[878] See INCA non-confidential response to the November Consultation, page 2.

[879] See GTC non-confidential response to the November Consultation, page 27.

[880] See GTC non-confidential response to the November Consultation, page 27- 28.

cap on the amount that the infrastructure owner can charge for third party access.[881]

A25.51 Sky was of the view that to unlock fully the potential benefits of passive access, passive remedies should be unconstrained in terms of geography and downstream application as well as any contractual restrictions of the purchase, packaging, selling of the product.[882] Sky also said that an unconstrained dark fibre passive remedy would provide LLU Operators (LLUOs) with flexibility in choice of technology and transport topology without the inefficiency of deploying additional fibre cables. A dark fibre remedy that accommodates termination within a cable chamber, could be used as a component of LLU backhaul in combination with a third-party dark fibre provider. This would maximise the flexibility of the dark fibre remedy and offer the LLUOs an opportunity to consume the lowest cost fibre available for each segment of a backhaul route.[883]

A25.52 Telefónica said that when considering the current demands for data connectivity there is a blurring of access between fixed broadband, public/private WiFi, Femtocells, small cells and wide area cellular connectivity all using variants of Openreach's products underpinned via fibre/duct passive components. As such the case for restricting passives to certain product/application types is questionable and would disadvantage CPs wishing to run and operate converged offerings via a common infrastructure.[884]

A25.53 Virgin Media stressed that it is against an introduction of passive remedies and said that the implication of Ofcom finding a variation in competitive conditions by both geography and product type would be that any passive remedy would only apply in certain geographic areas and to certain products. It argued that whilst, in theory, this may mitigate some of the risks of distortion of investment incentives and disruption to competitive dynamics, it considered that in practice it would be very difficult and extremely costly to enforce. For example, fixed and mobile backhaul connectivity solution tends to cover (relatively) long distances – quite possibly extending across competitive and non-competitive areas.

A25.54 Virgin Media said that it is not clear how such conditions would be reflected in the enforcement of any remedy. It considered that identifying, monitoring and enforcing the downstream uses to which passive inputs would be extremely difficult and costly. For example, without (potentially formally) requiring purchasing CPs to self-verify the uses to which they are putting passive inputs, it would in effect be impossible to establish those uses.[885]

A25.55 Virgin Media also questioned the value of a 'partial' application as it considered it is likely that the greatest benefit would be derived from a passive remedy where it was able to be used in the provision of a broad spread of products and across a wide range of geographic areas (and thus enable purchasing CPs to realise economies of scale, in both consolidating use of passive inputs and, for example, in purchasing

[881] See FCS non-confidential response to the November Consultation, page 3.

[882] See Sky non-confidential response to the November Consultation, page 4.

[883] See Sky non-confidential response to the November Consultation, page 11.

[884] See Telefónica non-confidential response to the November Consultation, page 7.

[885] See Virgin Media non-confidential response to the November Consultation, page 21-22.

their own active electronics to create downstream products). It believed that the likely limited scope of any passive remedy in the UK business connectivity markets would not deliver sufficient benefits or be particularly useful and argued that its implementation and the enforcement of legitimate usage of it would be complex and costly.[886]

A25.56 Level 3 said that in order for it to make significant use of any passive remedy, it would need to be able to use the infrastructure to deliver existing products including Ethernet Private Line and Wavelength services as well as to provide more efficient Ethernet aggregation and backhaul solutions. It argued that if this was not the case, then it may be placed at a material disadvantage to MNOs and LLU operators if they are themselves able to use the remedy in order to deliver their core products and services. In order to future-proof the development of innovative new products and to anticipate the increasing market convergence that is underway, Level 3 urged against service restrictions.[887]

A25.57 Hyperoptic said that any restriction regards the product types offered to CPs or the geographic areas opened are likely to impact a CP's business case for adoption. It was of the view that remedies should be available without restrictions for use by any legitimate service provider.[888]

A25.58 UK Broadband Networks (UKBN) said that recognising difference in market conditions, there may be some justification for excluding some areas from new passive remedies. However, it was against restricting the remedies to certain product types. UKBN noted that the PIA remedy has been widely criticised for placing restrictions on its use (preventing its use for leased lines or mobile backhaul). It noted that BT itself is subject to no such restrictions in its use of its passive infrastructure and it can only be damaging to competition, service differentiation and innovation if any usage restrictions are placed on BT's wholesale customers and retail competitors.[889]

A25.59 Although CityFibre was against the introduction of passive remedies, arguing that it may introduce risks and uncertainty that undermine investment in infrastructure, [890] it noted that, as a provider of dark fibre products to CPs, it may wish to explore the potential to extend the geographic coverage of its fibre networks by gaining access to BT's ducts and poles. In such circumstances, CityFibre argued that access should not be restricted. In addition, CityFibre noted that passive remedies for unrestricted duct access are most relevant in areas where BT has used public funding to expand or upgrade its network. CityFibre stated that such funding has already undermined the case for investment in alternative infrastructure in these areas.[891]

A25.60 WarwickNet said that CPs would want passive access from BT to be made available in areas where there is no other alternative, and especially where there is

[886] Virgin Media non-confidential response to the November Consultation, page 22.

[887] See Level 3 non-confidential response to the November Consultation, page 6.

[888] See Hyperoptic non-confidential response to the November Consultation, page 2-3.

[889] See UKB Networks non-confidential response to the November Consultation, page 4.

[890] See CityFibre non-confidential response to the November Consultation, page 3.

[891] See CityFibre non-confidential response to the November Consultation, page 9.

no other provider (for example, Virgin Media).[892] With regards to product restrictions for dark fibre, WarwickNet suggested that it could be restricted to provider backhaul (POP to POP). WarwickNet stated that this would force providers to either use PIA or EAD for customer access from their POP.[893]

A25.61 The PAG argued that inappropriate restrictions by product type or geographic area would significantly impact upon the success of passives and would protect the current market from creative disruption. In addition, the PAG considered that restrictions would impact upon the wider benefit of innovation.[894]

A25.62 The Towerhouse report (prepared for the PAG) argued that it would be inappropriate for any passive remedies to be highly constrained by reference to the purpose for which, or the areas within BT's network footprint in which, they can be used. The experience with PIA – for example in relation to its non-permitted use for wireless access services – suggests that any limitations will be interpreted narrowly by BT and it is therefore important that Ofcom avoid ambiguity about the scope of any passive remedy.[895]

A25.63 In its additional response of 13 March 2015, the PAG members further stressed that too granular an approach to carving out particular submarkets or permitting such pockets to overshadow the implementation of an SMP based remedy for the whole market needs to be considered very carefully, taking into account any possible detriments to the likely reduction in overall benefits to competition.[896]

A25.64 BT commented on the potential applications for passive remedies arguing that Ofcom should not try to 'pick winners' from the provision of passive services. If it were possible to design a passive remedy so that there were no or very limited price arbitrage possibilities, then the only uses would be where there was a genuine innovation opportunity relative to what could be provided by active services. BT did not think that Ofcom will be in a good position to spot these opportunities.[897]

A25.65 BT argued that it would also not be possible to mandate a more intrusive passive remedy in markets which are found to be competitive or prospectively competitive (such as markets within the WECLA). It added that any remedy would need to be targeted at addressing a specific issue arising from SMP and therefore related to that market or set of products where the SMP issue arises. Therefore, BT stressed, if a justification for introducing passive access in relation to a specific use or application only was identified, then it is important that an appropriate and robust form of ring fencing was implemented to limit passive use to that particular use or application. Such ring fencing would be important to ensure no wider adverse impacts through, for example, arbitrage in other segments.[898]

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[892] See WarwickNet non-confidential response to the November Consultation, page 3.

[893] See WarwickNet non-confidential response to the November Consultation, page 4.

[894] See the PAG non-confidential response to the November Consultation, page 13.

[895] See Towerhouse non-confidential report prepared for the PAG, page 23. See additional comments page 24-29.

[896] See the PAG non-confidential additional submission of 13 March 2015, page 4.

[897] See BT non-confidential response to the November Consultation, page 50.

[898] See BT non-confidential response to the November Consultation, page 70.

A25.66 BT highlighted these complexities in the context of 4G "fronthaul" and backhaul. For example, MNOs requiring dark fibre for CPRI to implement Cloud RAN would need to build hub sites to house the servers used for the processing requirements of the mobile stations attached to them. If dark fibre is only available in certain parts of a region covered by the hub (such as rural locations where BT might be identified to have SMP), a mix of technologies (either alternatives to dark fibre for CPRI or alternatives to CPRI itself) may be needed to carry out the processing. However, BT noted that in terms of running a network it is generally preferable to use a single technology. This might imply a mixture of cloud RAN and current technology for processing, that is, some processing would be done in the base stations (as per Cloud RAN) and some at the hub site (as per today). There may be ways to make this work, but much of the cost savings of bringing all the processing to the hub site would be lost. It thought that there is likely little point in using CPRI for a limited set of locations.[899]

Non-discrimination arrangements

A25.67 In the November Consultation we said that if we were to introduce a passive remedy, our preference would be to require BT to provide it on an EOI basis if possible. However, we also considered that, given the established processes for the current set of services and the fact that many of these services use passive infrastructure, any requirement for BT to consume a passive input for these services would involve re-engineering many of its business processes and we therefore considered that it was unlikely to be proportionate.

A25.68 We also said that we would also need to consider whether it would be appropriate to complement an EOI obligation with a no undue discrimination obligation to address any potential concerns regarding BT's ability to discriminate between its passive and active products, particularly if it chose to consume one form above the other.

Stakeholder responses to the November Consultation

A25.69 In the November Consultation we asked stakeholders the following question:

> "Do you agree with our initial views about the non-discrimination arrangements for passive remedies?"

A25.70 The majority of stakeholders who are in favour of passive remedies agreed with our initial view on non-discrimination arrangements.

A25.71 Telefónica expressed its preference for EOI. It also recognised that the overlap with existing on-going active services would be challenging and costly if there was a requirement for BT to consume passive remedies. Given this, Telefónica would not wish to see a disruption in the on-going provision of existing services due to the delivery and consumption of passives, likewise, care is needed to ensure no undue discrimination applies between active and passive products, and also BT's self-consumption of these capabilities.[900]

[899] See BT non-confidential response to the November Consultation, page 70 – 71.

[900] See Telefónica non-confidential response to the November Consultation, page 8.

A25.72 Six Degrees Group favoured EOI, although noted that a more pragmatic arrangement may be required given that the remedy could cover the existing base of products. It also suggested that it should be periodically reviewed to ensure that the non-discrimination arrangements do not provide BT with a competitive advantage.[901]

A25.73 FCS said that it would welcome any new passive remedies being provided on an EOI basis, but noted that a no undue discrimination obligation may be more practicable in some circumstances.[902]

A25.74 GTC also favoured EOI to be able to compete with BT in the provision of access infrastructure to new developments. It stated that EOI is necessary in areas where BT has incentives and the ability to withhold access or discriminate in other means. Therefore, the assessment of whether the regulatory costs of EOI outweigh the risks depends on an assessment of the risks in the specific market. GTC also stated that provided that BT is required to supply a properly specified dark fibre product, a 'no undue discrimination' obligation may be sufficient.[903]

A25.75 Bit Commons felt that the majority of options have been discussed for non-discrimination arrangement. It noted that BT's takeover of EE may present the opportunity to create non-discrimination arrangements where trading with EE is on the same basis all other CPs, including BT Retail. It added that volume, particularly the number of customers served or capable of being served in an area, should be a consideration in preventing cherry picking.[904]

A25.76 TalkTalk supported Ofcom's preliminary view for BT to provide dark fibre on an EOI basis for new supply only if possible, should a passive remedy be introduced.[905] TalkTalk believed that EOI would reduce the likelihood for BT to discriminate in ways which will degrade the service it provides to its competitors, such as slower provisioning, more faults and substandard reporting. In addition, TalkTalk indicated agreement with Ofcom as it noted that EOI for new supply would limit the incurred costs associated with implementation.[906]

A25.77 TalkTalk also stated that EOI must not be viewed as the solution to all forms of discrimination, noting that:[907]

- Ofcom should recognise that EOI does not protect against price discriminations (such as margin squeeze). TalkTalk noted that the wholesale charge for dark fibre is effectively a notional internal transfer charge.

- EOI will not prevent all forms of non-pricing discrimination. For example, it argued that EOI would provide little or no protection against BT favouring its downstream operations by setting favourable pricing structures, designing investments better

[901] See Six Degrees Group non-confidential response to the November Consultation, page 6.

[902] See FCS non-confidential response to the November Consultation, page 4.

[903] See GTC, non-confidential response, response to the November Consultation, page 25.

[904] See Bit Commons non-confidential response to the November Consultation, page 4.

[905] See the November Consultation, page 39, paragraph 6.32.

[906] See TalkTalk non-confidential response to the November Consultation, page 20 - 21

[907] See TalkTalk non-confidential response to the November Consultation, page 20-21.

suited to its own commercial plans than to those of its competitors, favouring product developments that meet its own interests and notifying its downstream contingent in advance of price and product changes. TalkTalk argued that there is a high risk for BT to discriminate in such ways, as there is no strong separation proposed on Openreach between its sale of dark fibre and its sale of active products. TalkTalk stressed that the imposition of obligations that prohibit and discourage such discrimination are required.

- EOI needs to avoid situations in which BT use different variants of dark fibre from those used by other CPs. TalkTalk noted that use of different product variants for voice and broadband (BT use WLR and SMPF whilst its on-net competitors use MPF) has undermined EOI principles and increased BT's ability to engage in non-pricing forms of discrimination.

A25.78 Vodafone was of the view that an enforceable EOI approach is the only way to ensure a level plain field between BT's customer-facing entities and other CPs.[908]

A25.79 Level 3 agreed with Ofcom's preliminary view that any passive remedy should be introduced on an EOI basis.[909] It also said it would anticipate that there would also be an overriding 'no undue discrimination' requirement and expected there to be appropriate record keeping in order to validate compliance.[910] [✂

✂][911]

A25.80 [✂

✂][912]

A25.81 UK Broadband Networks was of the view that any new passive remedy should be provided on an EOI basis. It also noted that in light of a planned acquisition by BT of EE, the conflict of interest between BT's wholesale business and its downstream retail business would be heightened and BT's market power would be strengthened. This would increase the importance of an EOI remedy.[913]

[908] See Vodafone non-confidential response to the November Consultation, page 19.

[909] See Level 3 non-confidential response to the November Consultation, page 7.

[910] See Level 3 non-confidential response to the November Consultation, page 7.

[911] See Level 3 confidential response to the November Consultation, page 8.

[912] See Level 3 confidential response to the November Consultation, page 10.

[913] See UK Broadband Networks non-confidential response to the November Consultation, page 4.

A25.82 Virgin Media stressed the need for adequate protection, especially if active and passive remedies are to co-exist. It said that Ofcom is rightly concerned that an asymmetry in regulatory approach between active and passive remedies could lead to BT Group being able to favour one remedy over the other to the detriment of wider competition. Equally, as passive access forms a part of the supply of an active product, the imposition of strict EOI obligations could require BT to consume a passive remedy as an input for the provision of active services, which Ofcom believes is disproportionate. Virgin Media argued that the complexity of trying to design a new layer of passive regulation to sit alongside active regulation is yet another example of the high regulatory cost of this remedy, suggesting that this high cost is not justified by potential (but unclear and unrealised) benefits.[914]

A25.83 WarwickNet agreed with our initial views of the consultation on non-discrimination arrangements for passive remedies.[915]

A25.84 The PAG supported Ofcom's view to consider a requirement for a non-discrimination obligation to address concerns of BT discriminating between its active and passive products.[916] It viewed EOI as the most effective form of non-discrimination and suggested that it should be adopted for both duct access and dark fibre, unless a detailed assessment showed that EOI would create disproportionate implementation issues. The PAG also agreed that Ofcom will need to consider a non-discrimination requirement between BT's passive and active services.[917]

A25.85 In regards to the risk that BT discriminates in its provisioning of active and passive services, Towerhouse noted that Ofcom has prior experience in addressing such concerns. The report referenced Ofcom's Fixed Access Market Review 2014 as demonstrating Ofcom's ability to address the issue of discrimination between the terms on which different and alternative wholesale services are offered. As such, Towerhouse viewed that this experience can be transferred to the concurrent regulation of passive and active products. Towerhouse also noted that a range of non-discrimination models have been applied in other countries. In light of this, it considered that, while EOI has additional costs and would be expected to deliver superior outcomes for CPs, both EOI and no-undue discrimination arrangements would be workable in the UK.[918]

A25.86 BT said that it agreed with Ofcom that it would be disproportionate to require it to consume any mandated passive remedies on an EOI basis. If Openreach was required to sell to itself on EOI basis, it would require a fundamental and company-wide re-structuring which, it argued, would effectively overturn the Undertakings given in 2005. Furthermore, BT stated that every dark fibre would consume a duct service, which would be an upstream input and suggested that both could be considered as inputs to active services. BT argued that re-organising the approach would indicate the creation of new interfaces and systems across the value chain

[914] See Virgin Media non- confidential response to the November Consultation, page 27.

[915] See WarwickNet non-confidential response to the November Consultation, page 4.

[916] See the PAG non-confidential response to the November Consultation, page 14.

[917] See the PAG non-confidential response to the November Consultation, page 14. See also further considerations in the Towerhouse non-confidential report prepared for the PAG, pages 36-40.

[918] See Towerhouse non-confidential report prepared for the PAG, page 39-40.

and would also lead to greater costs and hence consumer prices.[919] Given its overall disagreement with passive remedies, BT agreed with Ofcom that requiring its downstream divisions to purchase passive products on an EOI basis is unfeasible. However, BT argued that its downstream divisions should be permitted to consume whatever upstream passive services are available and should do so free from any regulations or restrictions.[920]

Implementation arrangements

Stakeholder responses to the November Consultation

A25.87 In response to the November Consultation stakeholders provided their views around implementation arrangements. Below we set out the detail of their responses.

A25.88 Virgin Media said that previous experience suggests that introducing a new type of remedy brings with it a significant need for management, oversight and intervention by both the regulator and industry. The challenges will be technical, operational and administrative. It further added that any implementation period is unlikely to be short. It would need to allow not only for the design and launch of the product, but also the necessary changes to regulatory arrangements. It said that Ofcom must be mindful of the fact that any benefits that are derived from such a move will be tempered to an appreciable extent by the considerable practical and logistical challenges presented by its introduction.[921]

A25.89 Level 3 anticipated that in relation to a possible duct remedy that contractual negotiation of specific commercial terms would be required in addition to appropriate pricing and adoption of appropriate common civil procedures. It referred to a precedent of the introduction of the then new PPC portfolio (including pricing and contract terms) within a period of 14 weeks. This timescale, it said, while challenging was well supported by CPs and except for the pricing which was subsequently disputed, all other terms were successfully agreed. Level 3 considered that a similar approach could be adopted in relation to a possible dark fibre remedy. It believed that this could prove even more straightforward in relation to the commercial terms and in view of an already common approach to the engineering aspects, and it considered that a new reference offer could be launched in somewhat less than 3 months from initiation.[922] Level 3 urged Ofcom to consider a suitable compensation regime in cases where BT fails to deliver what can be reasonably expected and oversight by the OTA of all practical and procedural aspects of a fibre solution.[923]

A25.90 The PAG argued that the implementation challenges of passive remedies are similar to, and no more difficult to overcome, than those that Ofcom has previously dealt with when setting SMP conditions in the past.[924] A report prepared for the

[919] See BT non-confidential response to the November Consultation, page 71.

[920] See BT non-confidential response to the November Consultation, page 72.

[921] See Virgin Media non- confidential response to the November Consultation, page 23

[922] See Level 3 non-confidential response to the November Consultation, page 8-9

[923] See Level 3 non-confidential response to the November Consultation, page 6.

[924] See the PAG non-confidential response to the November Consultation, page 5.

PAG by Towerhouse noted that the appropriate implementation period for passive remedies will depend upon the extent to which:

- the existing duct access procedures and systems can be applied to the business connectivity market; and
- the ease with which existing arrangements for Ethernet, or similar services, can be applied to dark fibre.[925]

A25.91 In the context of implementing dark fibre, Towerhouse argued that the only additional complexity it offers, relative to active remedies, is the need for physical access to the fibre end points. However, it did not consider that it should be too complex or onerous for BT to design and implement a dark fibre product based upon a combination of:

- a reduced Ethernet offering without the active elements; and
- access to BT infrastructure to the extent that is required to install the active equipment.[926]

A25.92 In its additional submission, the PAG said that a dark fibre remedy could be developed and industrialised with very few changes to existing BT processes (and those mostly around repair processes). Its preference was therefore for Ofcom to require a product to be made available as soon as possible, with the acknowledgement that a level of regulatory supervision and refining of the product may be required over time. The PAG also stressed that a clear indication of the likely legal framework and implementation timeframes is necessary for the PAG members to develop solid and extensive business plans.[927]

A25.93 BT agreed with Ofcom's preliminary assessment that implementing passive remedies would be a significant undertaking requiring a lengthy implementation period. It said that both Openreach and CPs would need to make significant investments in process and systems changes, particularly if high order volumes were anticipated.[928]

A25.94 While noting that it disagrees with the need for mandating passive remedies, BT argued that it should be entitled to fully recover the costs it incurs. BT suggested that a detailed assessment of the operational and implementation costs would need to be commissioned, as was done for PIA, to ensure that the resulting cost estimates were properly taken into account in the evaluation of options. It said that the introduction of passive remedies would also create transitional costs given that BT's current network is optimised for the provision of active products. Changing this would in itself create costs over a potentially significant period of time, during which infrastructure investment would need to be re-optimised to provide the new set of passive products, whilst at the same time continuing to supply active products.[929]

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[925] See Towerhouse non-confidential report prepared for the PAG, page 45.

[926] See Towerhouse non-confidential report prepared for the PAG, page 46.

[927] See the PAG non-confidential additional submission of 13 March 2015, page 2.

[928] See BT non-confidential response to the November Consultation, page 56.

[929] See BT non-confidential response to the November Consultation, page 55.

A25.95 BT noted that the complexities of implementation would also be driven by the specification of the remedy imposed. A single remedy (duct or dark fibre) would be costly and time consuming to implement and would be likely to require multiple systems releases. It added that having both duct and dark fibre would require a higher degree of process/systems changes. Similarly, if CPs were to demand access points which did not have a parallel in current active services this would increase complexity.[930]

A25.96 BT referred to the experience during the introduction of PIA noting that it required extensive engagement by Ofcom, Openreach and CPs both before the remedy was introduced and after the SMP regulation was formalised. It argued that BCMR passive remedies would be more complex and entail greater Openreach involvement, and this would require far more negotiation and much more detailed reference offers. In particular, the very detailed decisions that would need to be taken with regard to fault repair systems and service quality measures would be far more complex than those involved in the PIA process.[931]

A25.97 BT has also identified additional issues which would need to be addressed as part of any implementation of passive remedies:

- The introduction of passives (particularly dark fibre) would raise the issue of whether products were required to enable migrations both from actives to passives and from passives back to actives. Relevant scenarios would need to be identified and network solutions developed to allow movement between different fault reporting and management processes/systems, and for different jumpering and jointing scenarios to be developed and implemented.

- There would also be a need to restructure the SoR and industry engagement processes. CPs purchasing passive products would be competing with those continuing to use Openreach active products, and some degree of separation and confidentiality between the two groups of CPs would be necessary to avoid competitive distortions. Ofcom would need to ensure that revised processes were used fairly and appropriately.[932]

A25.98 BT argued that the magnitude of the systems and process issues would depend on the specification of the remedies and anticipated volumes. It considered that this would not be achievable without a major reinvestment to restructure systems, re-engineer processes and redefine responsibilities on both sides. BT also said that if multiple CPs consumed passive services with multiple different electronic devices and network management systems, it would require specifying standards/interfaces to be adopted by all CPs to feed Openreach physical layer data from their systems back into Openreach systems - essentially a reversal of the existing systems and processes as they operate today.

A25.99 BT noted that Openreach would need to reconsider the requirements and priority of other ‘active’ systems developments in the light of the scale of the changes required

[930] See BT non-confidential response to the November Consultation, page 56.

[931] See BT non-confidential response to the November Consultation, page 56 – 57.

[932] See BT non-confidential response to the November Consultation, page 58.

to introduce passive services. BT also stated that changes would have to be made to Openreach's quotation, billing and inventory systems.[933]

Part 2: Our consideration of technical and operational aspects of dark fibre access

A25.100 In Section 9 we have set out our views on the scope and design of a dark fibre remedy. In this part of the Annex we discuss some of the more detailed technical and operational aspects of the proposed dark fibre remedy arising from our analysis and our review of stakeholders responses to the CFI and the November Consultation, namely:

- distance limits;
- use of dark fibre for CPs' access network extensions;
- handover locations;
- arrangements concerning provision of new infrastructure;
- provisioning processes;
- repair processes;
- service migration processes; and
- infrastructure discovery.

Distance limits

A25.101 We have identified a risk that if a dark fibre remedy were imposed without distance limitations then it might undermine existing infrastructure investments in the competitive market for core conveyance. In view of this, we consider it appropriate to propose a distance limit for the dark fibre remedy as an additional safeguard.

A25.102 With the current active remedies, we do not impose explicit distance limitations, but the risk of use for core conveyance is minimised by BT's specifications for its wholesale services. BT specifies distance limits for most of its Ethernet services, and its main backhaul product EBD is only available between specified locations.

A25.103 Regulated dark fibre access would be inherently more flexible in terms of circuit lengths and circuit end-points and, absent other restrictions, could more readily be used to provide core conveyance. For example, if there were no distance restrictions, a CP could use the dark fibre service to provide a long distance link between London and Birmingham.

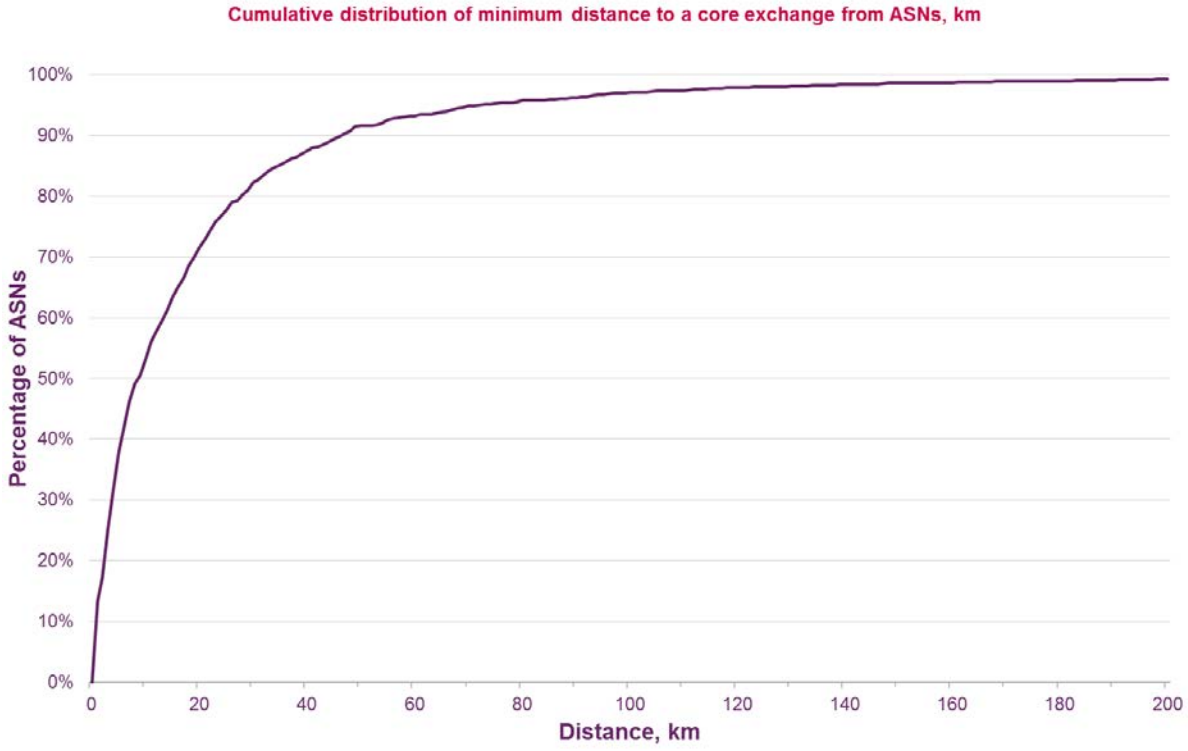
A25.104 Our current view is that an appropriate distance limit is one that is sufficiently long to allow a CP to provide access circuits and backhaul connections to the nearest competitive core nodes. Beyond this limit, CPs would either provide their own core connectivity or purchase such connectivity in a competitive core market.

[933] See BT non-confidential response to the November Consultation, page 57.

A25.105 In order to assess the distance necessary to provide backhaul circuits, we have analysed the distribution of distances between BT's ASNs and the nearest core node. BT's ASNs represent the exchanges where BT aggregates significant traffic. Although other CPs may choose different aggregation locations, BT's ASNs are likely to represent a useful proxy for such backhaul locations, as they will tend to be located in areas of significant population.

A25.106 Our analysis, summarised in the figure below, finds that the majority of ASNs are within 20km of a core node and that 90% are within 50 km. This suggests that a dark fibre remedy with a distance limit of 50km would be sufficient to serve the vast majority of backhaul needs.

Figure A25.1: Distance of ASNs from competitive core nodes



Source: Ofcom analysis

A25.107 We also note that a 50km distance limit would be sufficient to meet access requirements, as it exceeds the minimum straight-line distances of BT's EAD services. We therefore propose a distance limit of 50km, measured on a straight line basis between the circuit ends.

Use for access network extensions

A25.108 The responses to the April 2014 CFI and the November Consultation reflect differing views about how regulated dark fibre access might be used. These can be categorised into two broad scenarios of use:

- 'Dark leased line' - a dark fibre service that might be used by CPs in a very similar manner to BT's existing active wholesale products. CPs would order access segments, backhaul segments and short range end-to-end connections, much as they do now to provide connectivity between nodes in their networks and connectivity to end-user premises; and

- ‘Access network extension’ – CPs might use dark fibre to extend their existing access networks, in configurations ranging from small extensions (e.g. to provide connectivity from an existing access network flexibility point to an end-user premise) to potentially larger schemes to extend an access network to a group of premises.

A25.109 These two scenarios differ significantly. In a ‘dark leased line’ scenario, BT would provide circuits using its existing fibre network architecture, augmenting capacity as required and, where necessary, extending its infrastructure to connect premises that are not currently connected, in the same way it does currently in providing active services. For example, BT currently makes such connections via its exchanges, in a tree-and-branch architecture, and would likely to continue to do so in providing dark fibre in the ‘dark leased line’ scenario.

A25.110 In contrast, in an ‘access network extension’ scenario, BT may need to deploy fibre in configurations which are not consistent with the current design of its network architecture, in order to extend CPs’ networks in a manner consistent with their network designs.[934] Consequently, the ‘access network extension’ scenario might be considered a full-service infrastructure model in which BT would allow CPs to use its duct infrastructure, but would configure and deploy the fibre to order on CPs’ behalf. Such an approach could be more relevant to promoting investment in fibre infrastructure generally than to addressing specific competition problems in leased lines markets.

A25.111 Our current view is that it is unlikely to be proportionate to impose regulatory requirements on BT which would require it to change the architecture of its physical infrastructure in order to address the competition problems that we have identified, and so we do not propose to do so.

Handover locations

A25.112 BT’s wholesale leased line services are typically terminated at end-user premises, in part because of the power and environmental requirements of the Network Terminating Equipment (NTE). Dark fibre access could provide more flexibility for services to be terminated at different locations for several reasons:

- CPs rather than BT would select the NTE and could therefore select equipment suitable for alternative locations (e.g. equipment suitable for installation in street furniture);

- dark fibre could be terminated on passive components, such as passive optical splitters which would be suitable for outdoor locations; and

- the termination could be a fibre splice with a CP’s fibre network.

A25.113 As we discussed in the November Consultation, the last arrangement could enable a different approach to be adopted for network extensions. In the case of locations not currently served by BT’s access network, particularly those requiring a significant amount of new duct construction, CPs may prefer to construct their own infrastructure and retain ownership of it, rather than pay ECCs to BT to extend its

[934] These network extensions would typically comprise relatively short segments providing connectivity from flexibility points in CPs’ access networks to end-users’ premises.

network. In such cases the dark fibre circuit could be handed over at an intermediate point, such as a footway box.

A25.114 In view of these considerations we propose that BT should be required to terminate dark fibre access segments in joint boxes, manholes and other external structures, as well as in end-user premises. We have specified this requirement in the proposed Dark Fibre Access condition as set out in Annex 6.

New infrastructure arrangements

A25.115 A further design consideration is the arrangements that would apply when new infrastructure is required. New infrastructure would be required in three distinct situations:

- congestion – where there is no spare capacity available, new infrastructure would need to be built. For example, additional fibres may need to be deployed to relieve a congested flexibility point or new duct may need to be constructed to relieve a congested section of duct;

- blockages and damage – where duct is blocked or damaged, remedial work (such as repair of a broken duct) would be needed to allow the duct to be used; and

- network extensions – at locations not currently served by BT, new ducts/poles and fibre would be required to provide service.

A25.116 For wholesale leased lines, BT's current practice is to provide service to any location upon request, including locations that are not currently served by its network. In cases where new infrastructure is required to fulfil an order for a leased line, BT levies ECCs for any extension to its access network that is specific to an individual customer i.e. the final leg of its duct and fibre network that serves an individual premise. For fibre-based wholesale Ethernet services this generally equates to fibre between the serving fibre flexibility point (analogous to a Distribution Point in BT's copper access network) and the customer's premises, and duct that serves an individual customer premise. New infrastructure in the common parts of BT's network (such as the installation of a new fibre flexibility point) and work to repair blockages and damage are not charged as ECCs even when undertaken to fulfil a customer order. These common infrastructure costs are capitalised and recovered from connection and rental charges over time.

A25.117 We note that respondents broadly agreed with our suggestion in the November Consultation that these arrangements appeared to be suitable for a passive remedy and that it would be desirable for the arrangements to be the same as for the active remedies in order to:

- enable CPs to deliver comparable outcomes to wholesale leased lines and to compete effectively with them;

- ensure that any differences in the arrangements for active and passive remedies are not unduly discriminatory; and

- minimise the risk that differences between the arrangements adopted for wholesale leased lines and passive remedies artificially incentivise CPs to use one type of remedy over another.

A25.118 In view of these considerations, our view is that the existing charging arrangements for network extensions would provide the most suitable solution for the dark fibre service.

A25.119 For the avoidance of doubt, we consider that, where construction of new infrastructure is required which is not specific to an individual customer, for example to increase capacity or to repair broken duct, we consider that the arrangements should not differ between active access and dark fibre access.

Provisioning processes

A25.120 We agree with various stakeholders that, given the similarities between dark fibre circuits and wholesale leased lines, the existing operational processes used for the provision of active services such as EAD should be suitable for the provisioning of a dark fibre service with minimal adaptation. This should allow development costs to be minimised and would also enable CPs to roll out services based on dark fibre as soon as possible.

A25.121 The systems and processes currently in place for the provision of EAD are summarised below:[935]

i) *Pre-order enquiry and order placement:* The CP makes a pre-order enquiry with Openreach before submitting an order for EAD. The order submission is automatically validated by Openreach, which then informs the CP of whether the order is rejected or acknowledged. Order placement takes place at Day 0.

ii) *Pre-network review and site survey:* Openreach conduct a pre-network review, which involves processes such as reserving the desired route, determining the planning requirements and dependencies, and the identification of any additional costs. The pre-network review also determines the need for rod and tube testing of fibre. Openreach also perform a site survey and order the alarm circuits[936] for fault monitoring purposes. Upon completion of the surveillance work, the access solution is determined (which includes any requirement of wayleaves, any requirement of rod & tube testing, the main link distance and provision of any indicative ECC and/or TRC charges). This survey phase is to be completed at Day 6.

iii) *Planning:* The electronics are ordered and any requirements identified after the pre-network and site surveys (such as wayleaves and rod& tube testing) are planned and initiated. Once the relevant requirements have been addressed, Openreach commit to the order and issue a target completion date (CCD), any details of delay and confirms the location of the NTE.[937] Orders are to be committed at Day 14 of the process.

[935] We note that Openreach is currently redesigning the entire process for the provision of EAD.

[936] These are copper pairs that are attached to either end of the EAD fibre link. The copper pairs are accompanied by a broadband router (also provisioned by Openreach) which is connected to the EAD equipment to allow Openreach to remotely monitor faults along the fibre.

[937] NTE is the equipment that an operator places at the end-customer's premises. It demarcates the termination of the operator's network and the start of the customer's network. We note that the Ethernet Services Group view the NTE location to be the location of fibre handover at each end (including in-span options) under the dark fibre remedy.

iv) *Network build*: As per the order requirements, Openreach schedule and allocate the necessary field operations. If new build is required, civil engineering work for digging is arranged. Openreach then build the network fibre. The build is complete once the equipment is delivered and subsequently installed by Openreach. The timing of build completion is to be in accordance with the agreed CCD.

v) *Fit and test to completion*: This is the final stage of the process and involves a fit and test of electronics and alarm circuits.[938] If successful, the electronics and circuits are commissioned and Openreach tests the service to complete the process and the order. Billing arrangements are then initiated.

A25.122 We recognise that Openreach's systems and processes may require a degree of modification to account for the fact that the dark fibre would not require Openreach to provide and install equipment at either end of the fibre. We consider that the following components of the current processes for supplying new infrastructure for EAD would not be required:

- dark fibre would not require alarm circuits, removing the need for the ordering and appointment processes that are currently in place. Similarly, the subsequent testing and commissioning of alarm circuits would also not be required; and

- there would be no need for Openreach to order or manage the delivery of electronics as it is the CP who would be installing its own active equipment at either end of the fibre link. As with alarm circuits, there would be no need for Openreach to fit and test any equipment. This means that the dark fibre remedy would only require Openreach to fit and test the fibre.[939]

A25.123 These variations may mean that there is scope to shorten provisioning lead times for dark fibre services compared with comparable active service. If this is the case, then we would expect that the SLA/SLG arrangements for provisioning would reflect this. In this context, we note that the handover of completed circuits may differ in some respects from wholesale leased lines, for example in relation to the information supplied by BT to CPs and the method used to identify circuits. However, our initial view is that these differences would be relatively minor and could be agreed by BT and CPs as part of the implementation process.

Repair processes

A25.124 As pointed out by stakeholders, a dark fibre service would require different arrangements in relation to the fault reporting and repair processes since CPs, rather than BT, would be operating the network equipment which facilitates monitoring and fault diagnosis.

A25.125 In relation to BT's concerns about the complexity of designing such a process, whilst we acknowledge that the process would differ significantly from the repair processes for active services, we do not consider that this would present an insurmountable barrier. In particular, we note that commercial dark fibre services

[938] Further testing work is undertaken should Openreach detect faults with the equipment.

[939] Openreach will only need to fit the box for the termination of fibre. It is the CP's responsibility to then extend the fibre from the box to their equipment in the exchange, if needed (this may require an Openreach engineer to connect the fibre to the equipment at the entry point).

are well established in the UK and in other countries. Although there may be some practical challenges, we are confident that workable arrangements can be agreed and implemented.

A25.126 We also acknowledge that these differences would need to be reflected in the SLAs and SLGs for dark fibre fault repair. In particular, longer fault repair lead times would be required as BT would be responsible only for fibre faults which would generally take longer on average to repair than faults for active services, which are a mixture of fibre, active equipment and customer faults.

Service migration processes

A25.127 Several stakeholders emphasised the need for processes to facilitate migration of their current active circuits to a dark fibre product. In our current view, many end-users are likely to be deterred from migrating during the course of an existing service contract if doing so would involve risk of disruption to their services. We therefore consider that CPs are likely to focus initially on using regulated dark fibre to connect new services rather than to migrate existing ones. Minimising the risk of disruption to end-users' services is likely to be a key requirement in designing migration processes. We consider that requirements for migration processes are best agreed by negotiation between CPs and BT as part of the implementation process.

Infrastructure Discovery

A25.128 In their response to our April 2014 CFI, both Colt and UKCTA suggested the implementation of an online tool to enable CPs to view Openreach's infrastructure to inform their business plans and requests for passive access. We note that Openreach is currently assessing the feasibility of developing such a tool to allow CPs to view maps of its network at the pre-order enquiry stage of the Ethernet access process.[940]

A25.129 This will help CPs determine which parts of Openreach's infrastructure they could use for their requirements, as well as help CPs establish the costs of any digging which may be required to extend the available infrastructure to follow their desired route. We consider that, if this tool is implemented, it could be also easily used for dark fibre.

[940] Ibid.

Annex 26

Pricing approach for dark fibre

Introduction

A26.1 The relative pricing of active and passive remedies would be a key driver of how and where passive remedies are used, and of the ultimate impact on competition and consumers. For this reason, our assessment of whether to propose the imposition of passive remedies must take into account the potential approaches to the pricing of those remedies, and their likely impacts. In this section we set out our consideration of the pricing approach that could be adopted for our proposed passive (dark fibre) remedy and how these might be used to minimise the potential distributional impacts and arbitrage effects discussed in Annex 24 – Impacts and Risks of Passive Remedies. Our reasons for proposing a dark fibre remedy only, and not a duct access remedy (or both), are summarised in Section 7.

A26.2 This Annex is structured as follows:

- we first briefly recap the pricing options put forward in the November Consultation;
- we then summarise the views of the stakeholders provided to us in the initial CFI and subsequently in the November Consultation;
- we consider the merits of the alternative pricing approaches available and propose a single reference product active minus approach; and
- finally we consider in more detail the design of the active minus pricing approach.

Pricing options

A26.3 As outlined in our November Consultation, if passive access were introduced as a remedy, we consider that there are three main options for the regulation of pricing:

a) no specific pricing obligation;

b) fair, reasonable and non-discriminatory pricing obligations with guidance; or

c) charge control.

A26.4 In discussing these potential pricing options for passive access, we used the current active pricing structure as our starting point for considering the potential interactions between passive and active services. In the following section we briefly summarise the pricing proposals put forward in Section 7 of the November 2014 Consultation.

No specific pricing obligation

A26.5 Under this approach, BT would be required to provide access to passive infrastructure but there would be no *ex ante* obligation on BT in relation to the pricing of passive access.

A26.6 While such an approach could limit the arbitrage opportunities (and therefore reduce the scope for inefficient entry), BT is likely to have the incentive and ability to set its passive prices in a way which could deter take up. Allowing BT pricing flexibility may also create significant uncertainty over the pricing of passive access during the market review period for other CPs. As a result, this approach could potentially distort entry signals and reduce the scope for the use of passive access (even by efficient CPs).

Fair, reasonable and non-discriminatory pricing obligations

A26.7 Under this option, BT would be required to provide access to passive infrastructure and set prices for that access on fair, reasonable, and non-discriminatory ('FRND') terms. BT would still have significant pricing freedom, and could potentially set prices in a way which reduced the arbitrage opportunities discussed above. This approach could provide more efficient and sustainable entry signals which are not based on arbitrage opportunities, potentially limiting the extent of rebalancing of prices required.

A26.8 However, FRND pricing obligations could cause regulatory uncertainty which could in turn undermine incentives for other CPs to use passive access. To address this, we could provide guidance on how we would interpret the obligation in order to bound the flexibility enjoyed by BT before it sets its charges and to try to reduce this uncertainty for other CPs. This could, for example, relate to the absolute level of charges or to the margin to be maintained between active and passive services.

Charge control

A26.9 With this approach we would set an explicit regulatory control on the maximum charges for passive access. While this approach would tend to be more restrictive than a FRND-based approach, there is a range of ways a charge control can be set, with varying levels of flexibility afforded to BT. For example, we could set the specific price for passive access, or we could include it within a wider basket of services.

A26.10 Broadly speaking we consider that there are two main charge control approaches available for pricing dark fibre:

- A cost-based approach – this could be appropriate for both duct access and dark fibre, and would involve setting charges based on their respective underlying costs and could be implemented in relation to either duct access or dark fibre.

- A value-based ('active minus') approach – this would involve setting passive access charges equal to the price of an active service (or basket of services) minus the relevant incremental costs attributable to the active service. We consider that this approach is likely to be particularly difficult to implement for duct access (given the ability to provide multiple leased lines circuits through a single share of duct), and so consider that it is more likely to be an option in relation to dark fibre.

Cost-based approach

A26.11 We noted in the November Consultation that conceptually this form of pricing could be relatively simple, and would mean prices reflect the underlying costs of the passive infrastructure used. Although estimating the costs and translating these costs into prices would be a complex exercise (particularly in the presence of

common costs), the price would ultimately be based on either the total cost estimate for duct or dark fibre (including an appropriate contribution to common costs), divided by a measure of distance and then shared between passive access-using CPs.

A26.12 A cost-based approach is unlikely to result in passive pricing which reflects the current active pricing structure and current pattern of cost recovery by BT. We therefore noted that under a cost-based approach it was likely that a significant rebalancing of prices to maintain cost recovery would be required to reflect the likely effect of passive access on demand for, and pricing of, active products.

A26.13 We consider some of the more detailed implications of a cost based approach to passive pricing below.

Value-based ('active minus') approach

A26.14 In the November 2014 consultation we explained that the aim of this approach would be to reduce the regulatory arbitrage opportunities which could occur under the existing active pricing structure if cost-based passive access was introduced, and thereby also reduce the need to rebalance prices to maintain cost recovery.

A26.15 The relative prices of upstream (passive) and downstream (active) services will determine how and where investments are made by competing CPs, and in particular will be important in determining whether a CP uses passive access in preference to purchasing an active leased line service from BT. In principle, if the price difference equals BT's incremental cost of the active layer of the service, entry should occur if the CP either has a lower incremental cost to BT (in the active layer), or if the CP can exploit genuine innovation benefits from differentiating its services to end customers.

A26.16 To determine an appropriate passive access price, we would need to select an active wholesale product(s) to serve as a price benchmark, and deduct the incremental costs that the access provider would avoid by not providing the active components. Therefore, passive prices would still be based on a measure of cost, but would do so in a way which attempted to reflect the existing active market pricing structure and therefore pattern of common cost recovery.

A26.17 This approach could be implemented:

a) on each product individually, where the dark fibre price would depend on the downstream service being provided (meaning, for example, that the dark fibre price could be different depending on whether it will be used to provide 1Gbit/s services or 100Mbit/s services); or

b) on a basket of active products; or

c) using a single reference product (e.g. 1Gbit/s EAD), but where the dark fibre price would be the same irrespective of what service it is used to provide.

Each product individually

A26.18 Under this approach, the passive access price would depend on (and vary according to) the specific downstream service being provided by the access seeking CP. Once the equivalent active remedy product was identified, the dark fibre price would be set equal to the active price minus the active costs avoided.

A26.19 In principle, this approach would prevent value-based arbitrage as CPs could no longer target the highest value services simply to exploit the margin variation used to recover common costs. However, we noted that it would be necessary to monitor downstream sales by the access seeking CPs to ensure use was being accurately reported. Monitoring of this type may not be practical. This approach would also require CPs to provide products that could be readily identified as being similar to a BT active product.

Basket of active products

A26.20 An alternative approach is to price passive access based on a basket of BT's active products. The passive access price would then essentially be the weighted average price of existing BT active products, less the average avoided active costs. This approach would create a single access price, but an access price calculated as an average would result in a lower price than the single reference product discussed below (assuming the use of a higher price active product as the benchmark). As in the case of a cost-based approach, an average basket approach is unlikely to result in passive pricing which reflects the current active pricing structure and current pattern of cost recovery by BT.

Single reference product

A26.21 This option would involve using a single active product to set a wholesale passive access price which would apply irrespective of the downstream service it was used to provide. In order to minimise the arbitrage opportunities noted above with an averaged approach, it may be desirable to use a higher priced active product (i.e. an active product which makes a high margin/contribution to common costs), and deduct the incremental costs of that active service. In practical terms, this means using a 1Gbit/s or above benchmark product. The reasons for this are discussed in the final section of this Annex, which covers our choice of the benchmark product.

A26.22 In principle, using a reference product could reduce the arbitrage opportunities discussed above by maintaining some link between the passive access price and the contribution to fixed and common costs built into the active price structure. However, depending on the reference product used and the scope for circuit aggregation by CPs, it is unlikely to entirely address the opportunity for arbitrage. Nonetheless, while some rebalancing of prices may still be required to maintain BT's opportunity for cost recovery, this approach could reduce the extent to which it is necessary (relative to the pure cost-based approach) as it is likely to result in a higher passive price.

Stakeholder views

Responses to the CFI

A26.23 In the CFI we asked stakeholders the following question:

> *What are the strengths and weaknesses of different pricing structures that might be adopted for passive remedies, in particular:*
> *• uniform prices that do not vary either by geographic area or the use to which the passive remedy is put (e.g. residential NGA versus leased lines); and*
> *• prices that do vary according to geographic area or the use to which the passive remedy is put, and which reflect the value of the services provided or geographic differences in the intensity of passive infrastructure usage, more like the way BT's prices active products now?*

Interactions between active and passive remedies

A26.24 BT stated that we would need to consider the issue of pricing passive remedies "in the context of the impacts on different relevant markets through the lens of which of its statutory duties it considers most appropriate here", and so the next stage will need to go significantly beyond a simple weighing of strengths and weaknesses. However, it considered that a more detailed assessment is difficult at this stage before some of the prior questions around passive remedies (including specification and a detailed assessment of the impact of their introduction) are determined.[941]

A26.25 In relation to common cost recovery and the interactions between active and passive remedies, EE, Three and MBNL (in their combined response) recognised that passive remedies could potentially lead to BT reallocating its common costs between services. However, they noted that there are a range of approaches to common cost recovery and regulated prices.[942] They stated that there should be no presumption that BT's current pricing structure is efficient in principle, and would expect an explanation by Ofcom as to why it would be considered efficient or in the interests of consumers (and therefore should be protected).[943] In addition, they stated that Ofcom seems to rely on distributional factors in weighting impacts on consumers of low versus high bandwidth services, but in other contexts, Ofcom has specifically stated that dealing with equity concerns is not the role of the regulator, who should be more concerned with promoting competition and efficiency.[944] Whilst they noted that there may not necessarily be a direct read across between these regulatory decisions, they considered that there is a need for consistency in regulatory assessments.[945]

A26.26 Relatedly, UKCTA stated that it disagreed that passive remedies might force an inefficient pattern of cost recovery on active services and/or threaten BT's ability to recover its common costs based on the following:

a) forcing an inefficient structure of pricing would only be a concern if BT's pricing structure is already efficient (or at least, more efficient than it would be if passive remedies were to be applied), but there is no evidence that BT's pricing is efficient. Furthermore, there are no strong arguments (even in theory) why in the absence of passive remedies, it would be expected to be efficient;

b) there is no evidence or arguments that BT would be unable to recover its common costs in a world with passive remedies. The form of passive remedies

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[941] Paragraph 117, BT response to CFI.

[942] For example, they noted that Ofcom has used long run incremental costs, plus an equi-proportionate mark-up, for the recovery of common costs in several price controls; by contrast, BT currently recovers a greater proportion of its common costs from high bandwidth services compared to low bandwidth services; and finally, common costs have been excluded entirely in recent assessments of Mobile Termination Rates (MTR) in order to promote competition, particularly for smaller network operators.

[943] P10, Combined Response of EE, Three and MBNL to the CFI.

[944] Specifically, they stated that in the 2011 MTR review (and in the subsequent appeal processes) Ofcom argued that promoting equity should not be its primary concern when setting charge controls and that charge controls were "a highly inefficient tool" for pursuing "social" outcomes. Paragraphs A3.272-3 of Ofcom's "Wholesale mobile voice call termination" Statement, published 15 March 2011.

[945] P10, Combined Response of EE, Three and MBNL to the CFI.

that UKCTA proposes would include a fair contribution to common costs, as well as a fair return on capital deployed. [946]

A26.27 UKCTA also argued that the compatibility of passive remedies with price regulation of active remedies have evidently been solved in other markets, as their coexistence in Market 6 does not appear to have caused any fundamental problems with arbitrage or cost recovery in practice.[947]

A26.28 In relation to the arbitrage risks that could occur from passive remedies, Vodafone argued (supported by a detailed submission from Frontier Economics) that ultimately, a dark fibre access regime based on geographically averaged fibre costs should allow geographically averaged active prices to be maintained. It argued that the price of dark fibre access could be regulated using the existing costing framework underlying the price regulation of active services. It considered that this consistency between passive and active pricing would ensure that competition at the active level would be driven by efficiency rather than regulatory arbitrage. It also argued that there would be no fundamental change in the ability of BT or other providers of passive infrastructure to make a reasonable return on existing investments in duct and fibre. While it recognised that the introduction of effective passive access would limit BT's ability to price discriminate in downstream markets, it argued that any losses in allocative efficiency resulting from consequent rebalancing of tariffs would be offset by the dynamic efficiency gains from increased competition.[948]

A26.29 Colt also noted the existence of PIA as a remedy for the WLA market, and stated that while it is possible to distinguish the use of PIA for deploying NGA from deploying leased lines (and therefore devise a new, distinct remedy for the latter in the BCMR), there would be concerns in doing so where (for efficiency reasons) a passive offer involves both residential and business uses. As a result, Colt stated that a better solution would be to create a single PIA remedy at a single price that is invariant to the end use. Further, it argued that rather than jeopardise the efficacy of PIA use in residential markets, such an approach would promote it, by encouraging (for example) the deployment of backhaul "leased lines" in areas serving residential markets, thus promoting investment in local access.[949]

General comments on pricing

A26.30 BT stated that there is significant risk of regulatory failure with pricing passive remedies which would distort competition and investment incentives.[950]

[946] P2, UKCTA response to the CFI.

[947] P2, UKCTA response to the CFI.

[948] P22, Vodafone response to the CFI.

[949] P44-5, Colt response to the CFI.

[950] Paragraph 114, BT response to the CFI.

Relevant considerations for potential variations in prices by the use to which passive remedies are put and/or geographic usage

A26.31 UKCTA argued that it is not appropriate to link the charge for a "raw" wholesale input such as passive infrastructure, far upstream from its eventual end-use, to its intended use as this would potentially:

a) remove the benefit from the access seeker of any innovation developed and delivered on top of the wholesale input;

b) constrain the possible use or uses of the input;

c) constrain the deployment of downstream technology and potentially freeze in time any technology first used;

d) deny the access seeker the benefits of capturing the benefits of scope and scale;

e) frustrate competition in the downstream markets;

f) lead to inefficient use of the asset as the access seeker may be forced to purchase multiple inputs to meet various needs rather than re-use a single input for multiple uses; and

g) over compensate the access provider who, while not investing in the downstream innovation or risk, captures any upside benefits while being sheltered from any downside losses.[951]

A26.32 Relatedly, BT and Colt also raised concerns about the feasibility of varying passive prices according to the use, with BT noting that the very nature of passive products means that it is the purchasing CP which has the control over the use to which its own active electronics and lit fibre (within the purchased passive infrastructure) are put. As a result, BT stated that it is not clear how, or even if, it would be possible to set differentiated prices on a usage basis, and argued that even if there were a way for the initial use there would be considerable challenges in enforcing this over time.[952]

A26.33 Similarly, Colt argued that such a process would not be possible since identifying what type of service is delivered through passive remedies (particularly identifying interfaces and bandwidth) is not possible, and so attempting to do so would add complexity and give the incentive for CPs to wrongly advise BT on their deployments.[953] Colt also argued that attempting to price passive remedies in the same way as BT's current active prices, while not completely undermining the efficacy of passive remedies, would partially move passive remedies to becoming merely another agent in the "overlay to BT" competitive model that exists in the UK.[954]

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[951] P12, UKCTA response to the CFI. Note that Market 6 referenced in the submission is now Market 4 in the latest EC Recommendation.

[952] Paragraph 117, BT response to CFI.

[953] P45-6, Colt response to the CFI.

[954] P44, Colt response to the CFI.

A26.34 Instead, UKCTA argued that charges for passive infrastructure should be cost based, recognising its natural monopoly characteristics and the low probability for replicability. It also considered that a uniform charge would appear to be the most appropriate and pragmatic pricing structure to adopt. However, UKCTA did state that if there are objective, evidence based, geographic differences to the underlying incremental costs (that can be clearly and practically distinguished) and give rise to sufficiently material charges, then these might be considered to warrant varying the charge by region.[955]

A26.35 [✂

✂][956]

A26.36 BT also stated that geographically variable prices would be more practical, but considered that it would also raise significant implementation issues (e.g. boundary issues and how products which crossed pricing boundaries were treated). Further, it considered that the strengths and weaknesses of such approaches will depend on what criteria are applied in order to geographically differentiate prices. For example, BT said that it would not expect passive remedies to be mandated in areas where the relevant downstream markets had been found to be competitive or near competitive, but also considered that further geographic price differentiation beyond this may also be appropriate. It argued that this would be needed to minimise as far as possible the cherry picking which would (inter alia) undermine the efficiency of existing active pricing, as well as the other negative effect on competition and investment incentives of introducing passive remedies. However, it stated that this in turn could lead to a reduction in take up of passive remedies, making their introduction "worthless".[957]

A26.37 Notwithstanding its views above, Colt stated that it did not preclude the possibility of developing several offers for passive access with different pricing, where each variant is inherently more applicable to one type of use rather than another (i.e. so different forms of use self-select, rather than the product itself limiting the deployment to one usage model rather than another). It stated that there is some precedent for this in other EU countries[958], and while the different approaches

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[955] P1 and P12, UKCTA response to the CFI.

[956] [✂ ✂]

[957] Paragraph 118, BT response to CFI.

[958] For example, it referred to the case in France where a unique regulated offer gives access to ducts under the same principles, cost basis and geographical scope, but with three different subsets designed specifically to satisfy three different types of requirements (i.e. FTTx to enable residential operators, RCA for point-to-point fibre business connections, and REDR for mobile operators to connect their base stations). [✂

✂]

identified are of country specific, a similar logic could be found in order to price passive access differently in the UK.[959]

Responses to the November 2014 Consultation

A26.38 In the consultation, we asked the following questions in relation to the potential pricing approach for any proposed passive remedy:

Question 10: In light of the trade-offs identified, which broad options on pricing do you consider would be most appropriate for passive remedies and why? Please also provide details if there is another pricing approach you consider would be appropriate in light of the considerations identified in this section.
Question 11: If a value-based (active minus) approach to pricing dark fibre were adopted, what do you think would be an appropriate active wholesale product (or products) to reference?

A26.39 We now set out a summary of responses received from stakeholders on these questions, before setting out our provisional view in light of responses to both the April 2014 CFI and the November 2014 Consultation on this issue.

BT

A26.40 BT stated that none of the options that Ofcom has proposed would solve the multiple problems associated with pricing passive access. De-averaging of pricing would be essential for both passive services and Openreach would be forced to parallel these at the active layer in addition. BT argued that there would be very significant costs to industry, and ultimately to consumers, with no incentives to any material innovation in downstream markets.

A26.41 In BT's view a cost based duct access service would not look like the current PIA offer which is essentially for a single CP wishing to do a complete network build and where capacity problems will likely not arise. In the case of leased lines, BT argued the situation is quite different as it is likely that multiple CPs would be fighting for limited space in the same areas leading to disputes as to who should bear the cost of additional capacity in the duct network. BT noted that nobody has suggested that it is feasible to apply a 'retail minus' to duct access; and that this option was effectively rejected at the Colt Appeal and nothing new had come to light since then to make this workable.

A26.42 BT stated that a solution based on FRND would be nothing more than a precursor for disputes and appeals in which alternative methodologies and options would have to be considered.

A26.43 BT argued that Ofcom had failed to account either adequately or at all for a number of potential sources of arbitrage for dark fibre. These included circuit length, density and the existing active service base. BT argued that even if Openreach managed to re-balance its active portfolio for factors such as circuit bandwidth and length and the problems of stranded assets from circuit novation were solved, other sources of arbitrage would certainly remain.

[959] P45, Colt response to the CFI.

A26.44 BT argued that an 'average' bandwidth service or a typical or median service at 1Gb for example would inevitably invite arbitrage for higher bandwidth services necessitating Openreach to re-balance its prices. Furthermore, a basket of services would not solve the problem.

A26.45 BT stated that a 'retail minus' solution for dark fibre is not feasible given the rapid developments in service offerings and costs of equipment. In BT's view, it is far from clear how this model could be run in conjunction with a charge control framework given that volumes could be highly unstable if the benchmark active service declined in importance over time in favour of another active service even at the same bandwidth. BT argued that there would be a very serious risk that the 'fair bet' principle could not be adhered to and BT exposed to unreasonable risks on sunk assets. Further, setting the benchmark price at the highest possible level would be pointless and lead to disputes.

A26.46 BT noted that even if a 'retail minus' approach were adopted, and assuming that BT had SMP in the highest possible bandwidth service, it is not at all clear which active product should be selected. If Ofcom decided to select 10Gb as the reference product to set an active minus price, BT noted that currently Openreach have a number of 10Gb products (WES, BES, EBD, OSA and OSEA) with EAD 10Gb in development. BT stated that all of these products have different cost stacks which influence the pricing, regardless of the technology. BT also noted that whichever active service were adopted as the benchmark, Ofcom would be setting a benchmark against which Openreach itself would then have to set its commercial strategies, and this would be a highly unstable solution.

A26.47 BT stated that with respect to any of the pricing options which Ofcom has set out, it will not be possible for national averaging to be maintained for active services particularly if dark fibre is mandated. BT argued that de-averaging would have major repercussions for CPs and businesses throughout the UK with customers in the least developed or competitive areas subject to very large price increases.[960]

FCS

A26.48 The FCS stated that it would like to see FRND adopted, but noted that this could require considerable new guidance. The FCS also noted that CPs may be happier with a cost based charge control approach.[961]

Bit Commons

A26.49 Bit Commons considered that the cost plus approach for duct access should be considered given some level of re balancing is inevitable, but did not think the active minus option should be considered. It argued that we should run scenarios on future duct and fibre usage, as this may allay the arbitrage concerns.[962]

[960] BT non-confidential response to the November Consultation, paragraphs 10.37-10.48.

[961] FCS non-confidential response to the November Consultation, page 4.

[962] The Bit Commons Limited's non-confidential response to the November Consultation, page 5.

GTC

A26.50 GTC argued that pricing should take account of the specific purposes of these remedies, and in particular to facilitate backhaul to new housing developments (which it considered was not facilitated in the current pricing structure). In particular, it considered that it would be efficiency-enhancing to set a remedy which is specific to access backhaul connectivity, and value-based pricing according to the number of ultimate customers of the backhaul service would be efficient and practical.

A26.51 More specifically, GTC stated that from an allocative efficiency perspective, a theoretically optimal structure of prices where price discrimination is possible would result in prices reflecting incremental costs, plus a contribution to fixed and common costs which reflects willingness to pay of end users. However, for services provided to residential developments, the aggregate willingness to pay is a function of the number of homes served and as such an efficient cost recovery of the backhaul to a housing development is likely to reflect the number of customers served. Therefore, GTC argued it would be efficient to set a price which is partly based on the number of homes in the development (or some proxy). It stated that usage based pricing for connectivity to access infrastructure would be practical to implement, as this could be based simply on the number of homes built or connected, which can be easily measured and verified.[963] In particular, it proposed that price should be based on two components:

a) The incremental cost of fibre used for backhaul. It stated that BT should already be implicitly calculating a similar cost for its GEA-FTTC service. GTC noted that this should be substantially less than the fibre costs underlying BT's EAD services (which include a large implicit contribution to fixed and common costs). This could include separate one off connections charges, relating to the costs of provisioning the service and a rental charge to cover the long run incremental costs of operating and maintaining BT's fibre cables.

b) A per-home contribution to the fixed and common costs of the part of the BT network used by the backhaul service (i.e. excluding the costs of the distribution side network that GTC is providing). GTC notes that Vodafone currently uses a similar per-user pricing structure when supplying active core connectivity to GTC, and further that these forms of pricing structure are used by other regulated industries to provide analogous access connectivity.[964]

A26.52 GTC stated that it fully supports the objective that prices should be set such that BT is able to fully recover its common costs, and its pricing proposals should ensure that the impact of passive remedies is neutral for BT (i.e. whether BT services a new housing development or GTC serves the new development using passive access, the contribution to the fixed and common costs of BT's existing network should be broadly the same).[965]

A26.53 GTC provided further submissions on 20 March 2015 providing an updated and simplified proposed pricing approach. GTC proposed that the tariff structure for dark

[963] GTC's non-confidential response to the November Consultation, paragraph 6.7 – 6.11, page 19-20.

[964] GTC's non-confidential response to the November Consultation, paragraph 6.12, page 20.

[965] GTC's non-confidential response to the November Consultation, paragraph 6.41, page 26.

fibre connectivity to new home developments would be based on a Weighted Average Tariff per Home ("WATPH"), using EAD-type tariffs as a starting point. The level of the tariff would be set to allow BT to fully recoup its costs yet also avoid access-seekers being charged large fixed capacity style charges for passive access when very few homes have yet been built on the development. A per-home connected charge provides a mechanism to increase the payments for dark fibre access at each development site at the rate that individual plots are built and connected.[966]

WarwickNet

A26.54 WarwickNet stated that for duct access, current PIA pricing seemed to be appropriate. For dark fibre, EAD 1G is a logical benchmark from which an 'active minus' approach could work well.[967]

Confidential Respondent [✂ ✂]

A26.55 A Confidential Respondent noted that we identified that passive remedies may provide an opportunity for CPs to deliver some of the dynamic benefits with lower levels of infrastructure duplication, and that if the passive remedy price is 'too high' relative to the active price, this could disincentivise take-up of passive remedies (potentially forgoing dynamic benefits). It also argued that passive remedies should permit access to both duct infrastructure and existing dark fibre at a price set to motivate CPs within the market. In addition, it noted that one of the observations made which impacts the timely provision of telecommunications infrastructure to clients is the state of the Openreach duct infrastructure, and so a mechanism must be established that were a CP to attempt provision of their infrastructure within an existing Openreach duct, and that duct were found to be faulty, any remedy 'provided by the CP' must be recoverable from Openreach.[968]

A26.56 A Confidential Respondent also argued that pricing for dark fibre and duct access should be cost based rather than value based to ensure that the most efficient spend of capital for investment is made by all competing players (otherwise, for example, active minus could mean that dark fibre prices would artificially increased).[969]

Vodafone

A26.57 Vodafone stated that product prices should reflect costs, and that a cost orientated charge including a fair contribution to common costs of the passive inputs can be readily determined from the RFS. Vodafone argued that a passive access charge calculated this way would be compatible with full common cost recovery and the current active framework.

A26.58 Conversely, Vodafone stated that it opposed an active minus pricing regime on the grounds that it would lead to product use restrictions and ultimately limit the full potential of passive remedies. Vodafone argued that an active minus approach will

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[966] Further submission by GTC to Ofcom dated 20 March 2015.

[967] WarwickNet non-confidential response to the November Consultation.

[968] [✂ ✂]

[969] [✂ ✂]

require ongoing regulatory monitoring and intervention as BT develops new active services, resulting in a framework that will be contentious and subject to ongoing disputes over time.[970]

Level 3

A26.59 Level 3 considered that a fully allocated cost-based approach would be the most appropriate, reflecting the underlying costs of the passive infrastructure used. [✂

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A26.60 Level 3 did not think an active minus approach would be appropriate for a dark fibre remedy and made the following observations in support of this view:

- The active products are priced in relation to common costs which bear little direct relationship to infrastructure costs.
- There would be considerable risk that any cost over-recovery at the active level would result in inflated passive access prices.
- The market rental prices for duct and/or fibre infrastructure forms the basis for assessment by the VOA of business rates for CPs entire (self-provided plus leased) network. Level 3 argued that there is therefore a considerable risk that an unintended consequence of rental prices that are artificially higher than is already the case for leased dark fibre more generally in the UK would result in CPs facing much higher taxes than at present.[971]

Colt

A26.61 Colt stated that its general views on these questions were covered in the PAG submission, but noted two specific points related to arbitrage and cherry picking concerns.

A26.62 First, Colt noted that the extent to which Ofcom should be concerned about arbitrage is reduced in direct proportion to the degree of product differentiation on the part of the access seeker. Colt stated that its use of passive remedies is targeted at exploiting gaps in product and geographic markets that are unserved by BT. Colt noted that this should not raise an arbitrage concern, as this type of use of access would amount to a value adding, efficiency enhancing activity.

A26.63 Colt noted that Ofcom had acknowledged in the consultation (7.5) that concerns about cherry picking are effectively an issue with infrastructure competition in general, and not with passive remedies in particular. Colt stated that in line with this observation, passive access based competition is effectively nothing other than a form of infrastructure competition that makes efficient use of existing facilities.[972]

[970] Vodafone non-confidential response to the November Consultation, page 19-20.

[971] Level 3 non-confidential response to the November Consultation, page 8.

[972] Colt non-confidential response to the November Consultation , pages 7-8.

Passive Action Group (PAG)

A26.64 The PAG thought that a charge control would be the only pricing option that will address BT's SMP and provide the up-front regulatory certainty CPs require in order to make investment decisions.

A26.65 In relation to dark fibre, the PAG submitted that a 'cost plus' approach would be relatively straightforward and would provide a platform for innovation. In PAG's view an 'Active minus' pricing approach would be complex and consign dark fibre to being used as a substitute for existing services. It therefore submitted that 'active minus' was not likely to be the most appropriate pricing methodology for dark fibre.

A26.66 In relation to duct access, the PAG acknowledged that a 'cost plus' approach would involve price rebalancing by BT but argued that the impacts could be constrained given that decisions by CPs to invest in duct access are unlikely to be driven solely by cost considerations. The PAG felt that an 'active minus' approach would not be feasible for duct access and would entail significant regulatory complexity.[973]

A26.67 Frontier Economics provided a report in support of the PAG submissions.[974] Frontier do not offer an opinion on the answer to our questions i.e. which approach to pricing would be most appropriate and why and if active minus, what would be the best benchmark product. They do however offer views on the relationship between the RFS and approaches to passives pricing.

A26.68 Frontier considered a number of access types, the first of which is 'Simple fibre unbundling' (essentially 'EAD without the box'). Frontier argued that for both access and backhaul dark fibre costs can be derived from BT's regulatory costing system, and introducing dark fibre using these costs would allow BT to recover common cost on a 'proportionate basis'. However, the margin between the dark fibre price calculated on this basis and current active prices is not likely to reflect incremental costs and so BT would have an incentive to rebalance active prices.[975]

A26.69 Frontier also considered 'Dark fibre' – meaning segments of cable that may or may not terminate at a BT exchange or customer premises. Frontier argued that active Ethernet products have a cost per link for the fibre which is based on a cost per fibre (by fibre type) multiplied by average fibre length used. This could be used to create a per kilometre charge for dark fibre. Frontier note that a per kilometre charge of this type would be likely to produce margin differences – for example, it would suggest that dark fibre would have an advantage on links supplied with active products where the actual link length was less than the average. Frontier also note that BT's methodology allows for different fibre usage (e.g. SDH vs Ethernet vs GEA), and by location in network (access vs backhaul vs core). On this, Frontier state that on the basis of publicly available information it is unclear how unit cost per kilometre for fibre is affected by these factors. Overall, Frontier suggest that a more uniform dark fibre pricing structure '…could require some changes in the current recovery of common costs from existing services…'. Frontier also argue

[973] PAG non-confidential response to the November Consultation, page 14.

[974] Costing and pricing of passive access remedies, A report prepared for the Passive Action Group, Frontier Economics, January 2015.

[975] Costing and pricing of passive access remedies, A report prepared for the Passive Action Group, Frontier Economics, January 2015. Section 2.1.3.

'…there is no evidence that any such shifts would have an adverse effect on efficiency in the long run'.[976]

A26.70 Finally, Frontier considered 'Infrastructure access' (duct and pole access). Frontier argue that duct costs are recovered as a mark-up on cable costs, and hence 'duct' cost recovery actually reflects incremental cable costs rather than the costs of the duct that support the fibre. This implies that there is no direct connection between the cost and usage of infrastructure and the downstream services.

A26.71 Frontier conclude:

- The pooling of duct and cable costs is likely to have positive distributional and allocative efficiency effects via maximisation of demand and promotion of equality between different regions.

- Uniform access pricing could simplify regulation but would not be consistent with the current costing and pricing of active services. This could lead to further geographic de-averaging of prices.[977]

Six Degrees

A26.72 Six Degrees argued that a charge control would likely be the best way to encourage investment in new passive products, as it felt that "No specific pricing obligation" and "FRND" were not likely to create the appropriate level or stability of pricing needed to support investment by communication providers.

A26.73 Six Degrees thought that the cost based approach would be likely to lead to the lower onward pricing of the products which would in turn encourage the highest take-up of passive products. It also thought this would lead to higher levels of bandwidth availability to end-users, and noted that the cost differential of providing 1Gbps bearers in the last mile versus 100Mbps is negligible. Six Degrees thought that the differing impact of business rates when a provider other than BT lights the passive circuits needs to be taken into account.

A26.74 Six Degrees stated that if the value minus (or active minus) approach is used then the reference point will be crucial. Six Degrees thought that the per-product basis proposed in 7.25a is likely to be unworkable and would in any case inhibit some of the benefits. If a single reference product is to be used a 1Gbps EAD reference product would mean the product was not likely to be usable for 10Mbps or 100Mbps services, and hence argued that a value-minus set based on EAD100 (and EAD100-LA for exchange to end user variants) would open the advantages and benefits for the widest range of end-users. However Six Degrees acknowledged this would also have the largest impact on the existing active services, and therefore argued that it may be sensible to consider a weighted basket of active products if choosing EAD100 is unworkable.[978]

[976] Frontier report for PAG, January 2015, section 2.2.

[977] 'Further' refers to a greater degree of de-averaging than already seen between for example the WECLA and non-WECLA areas. Frontier for PAG, section 2.3.

[978] Six Degrees non-confidential response to the November Consultation, pages 6-7.

Sky

A26.75 Sky considered a cost based pricing approach for passive remedies to be preferable to an "active minus" approach. Sky argued that a cost based approach would allow CPs to use passive inputs to develop new services unrestricted by the specifications or price of the current suite of active products offered downstream by BT. Sky noted that where CPs aim to use passive inputs to provide new products or different product specifications, that are not offered by BT, an active minus approach would introduce significant complexity and uncertainty over the relevant downstream reference product and therefore the wholesale price. BT would have the incentive to refer to the most expensive active product, potentially limiting investment and innovation by other CPs.

A26.76 Sky stated that an active minus approach would afford BT significant influence over both the retail price and wholesale costs for business connectivity products, as its data would form the basis for Ofcom's estimates of the "active component" costs. This influence would undermine the opportunities for price innovation from other CPs that arise from cost based pricing, as BT would have significant control over pricing in the market as a whole.

A26.77 Sky noted that an active minus approach may allow BT to keep consistency in the tariff gradients between active and passive products, somewhat addressing Ofcom's concerns regarding arbitrage opportunities. However, Sky stated that this small benefit of an active minus approach would be outweighed by the detrimental impact of the removal of the opportunities and incentives to innovate under cost based pricing, and their long term benefits.[979]

TalkTalk

A26.78 TalkTalk stated that a cost based charge control would be the most effective and appropriate mechanism to ensure efficient dark fibre prices. TalkTalk argued that cost-based charge controls are Ofcom's default approach to setting charges and felt that there is nothing about dark fibre that would indicate the need to deviate from this approach.

A26.79 TalkTalk states that the economic benefits of a dark fibre product will be fully realised if its pricing is efficient and, in particular if:

- prices are not excessive; and,
- prices do not distort the efficient choice between using dark fibre and active Ethernet products. In particular, the difference in prices between dark fibre and active Ethernet products needs to reflect BT's costs of the active layer. If the difference is too large then it will allow arbitrage and encourage inefficient entry. If the difference is too small it will foreclose efficient entry.

A26.80 TalkTalk was of the view that a FRAND-type obligation would be exploited by BT to set excessive charges, whereas an active-minus approach would be complex and result in uncertainty that would chill innovation. TalkTalk argued that the claimed benefit of active-minus – that it can avoid BT rebalancing active prices – is a false benefit, since rebalancing will result in more (not less) efficient active prices.

[979] Sky non-confidential response to the November Consultation, page 8.

TalkTalk further argued that there is no risk of inconsistent dark fibre and active prices provided that they are both determined using the same cost model.[980]

Telefonica UK

A26.81 [✂ ✂] Telefonica stated that the value based charge control approach seemed pragmatic for dark fibre, and further that the use of a single reference product (to be determined) as the pricing benchmark would be more practical than using a basket of products or attempting to assess the downstream service being provided.

A26.82 With respect to which product should be used as a benchmark for pricing, Telefonica was of the view that this should be decided following wider discussion across the industry.[981]

Virgin Media

A26.83 Virgin Media stated that while it does not support the introduction of passive remedies but if Ofcom does pursue their introduction, value-based pricing would be preferable. This would test whether there are benefits from passive remedies beyond the private benefit to buyers from arbitraging current active prices. With value-based pricing only those who could supply the contestable parts of the service cheaper or 'better' than BT would be attracted to passive remedies. Virgin argued that under value-based pricing, the demand for the latter would be minimal. As a result, the consequential adverse distributional consequences from BT's need to recover more of its common costs from other products would be mitigated.[982]

CityFibre

A26.84 CityFibre provided us with submissions that covered a number of points including the potential approach to passive pricing, and potential associated impacts on CityFibre's business.[983]

A26.85 CityFibre argued that in order to support entry and the viability of operators like CityFibre BT's regulation should be changed to focus upon a reasonably efficient rather than equally efficient operator. This was both because entrant CPs could not realistically expect to replicated BT's scale, and because new high capacity all-fibre networks are designed differently to BT's legacy network, and hence the costs of constructing these networks will differ from BT's costs. A reasonably efficient operator standard would allow for adjustments to the cost base to be made for different network topologies and different scale effects, as well as any other relevant factors that may be identified through more detailed analysis. CityFibre also suggested that price floors should be implemented in order to counter BT's ability to target particular products in a way that stifles emerging competition.

[980] TalkTalk non-confidential response to the November Consultation, pages 21-26.

[981] Telefonica confidential response to the November Consultation, page 9.

[982] Virgin Media non-confidential response to the November Consultation, page 27-28.

[983] CityFibre letter of 17 March 2015.

A26.86 Much of CityFibre's argumentation relates to the general issue of the regulation of BT in leased line markets and the impact of that regulation on competitive infrastructure providers. Some submissions did however directly relate to the pricing of passive infrastructure. CityFibre currently uses a value-based approach to pricing its passive products, with prices set according to the use that will be made of the product by the wholesale customer. CityFibre argued that if BT is mandated to offer passive infrastructure products, then price controls should include floors as well as ceilings in order to encourage investment by other competitors.

Confidential Respondent [✂ ✂]

A26.87 A Confidential Respondent argued [✂

✂] [984]

A26.88 [✂

✂] [985][✂

✂] [986]

Our proposed pricing approach

A26.89 In deciding on our preferred pricing approach, we have considered the costs and benefits of the different options under the following headings:

- economic efficiency – including productive, allocative and dynamic efficiency;

[984] [✂ ✂]

[985] [✂

✂]

[986] [✂ ✂]

- compatibility with active remedies/risk of arbitrage;
- risk of gaming;
- ability to implement.

A26.90 In the following sections we consider each of these factors in the context of the general pricing options available. In summary we considered the following potential approaches:

- no pricing obligation;
- FRND pricing obligation with guidance;
- cost based charge control;
- 'Active minus' charge control pricing based on an:
    i) Individual product link;
    ii) Basket approach;
    iii) Single reference product.

A26.91 We explain below why we are not proposing to analyse in detail the relative merits of the no pricing obligation, FRND or 'individual product link' active minus approaches. We then provide our assessment of the relative merits of cost based versus the basket or single reference product active minus approaches.

No pricing obligation and FRND options

A26.92 Most of the respondents to our consultation have argued for a specific pricing obligation (either based on cost or active prices) rather than leaving pricing to BT. This was both because of concerns over BT's incentives, and the practical need for CPs to have a reasonable assurance as to the likely price level in order to assist planning and provide the certainty needed for investment.

A26.93 BT argued that in practice FRND would effectively lead to a charge control either through guidance or dispute resolution. Against this, BT argued that the option of no pricing obligation should be kept under review once further detail on the scope and coverage of the remedy was available.[987]

A26.94 We consider that for a passive remedy to be effective CPs will require some certainty as to the structure of prices and how those prices are likely to compare to active alternatives so they can make efficient investment decisions. Without this certainty it would be likely to lead to disputes that would require Ofcom to determine the appropriate pricing approach. As dispute resolution processes are not intended to provide a forum for major changes in Ofcom's approach to regulation, this suggests that we should specify our proposed pricing approach .

[987] BT non-confidential response to the November Consultation, paragraph 9.4.

‘Active minus’ pricing based on an individual product link

A26.95 This approach where the dark fibre price would depend on the downstream service being provided (meaning, for example, that the dark fibre price could be different depending on whether it will be used to provide 1Gbit/s services or 100Mbit/s services) would likely score highly against most of our assessment categories. This is because it would imply the least disruption to investor returns to infrastructure provision and to the current distribution of consumer prices which we consider is consistent with allocative efficiency and in particular to lower value consumers of leased line services.

A26.96 Nonetheless, we propose to reject this option on the grounds that it is not likely to be practical to implement. If for example the access seeker stated (for the purposes of access pricing) that the circuit would be used to sell a circuit in the downstream market that was equivalent to a BT 1Gbit/s service, BT would need to be able to ensure that the circuit was not used to supply a service with greater capacity than 1Gbit/s. However, it would be very difficult for BT to monitor the use of the circuit to verify this.

A26.97 We are also concerned that it would limit flexibility of application by downstream CPs and that it would involve an undesirable level of monitoring by BT of its downstream competitors. In coming to this view we note that no stakeholder suggested that this was a preferred option, while a number pointed out that it was unlikely to be practical or desirable from a competition perspective to implement this approach.

The practical implications of ‘cost based’ access prices compared with ‘active based’ access prices

A26.98 BT (and other competitive operators) take customer willingness to pay and preferences into account when setting the prices of active leased lines. The aim of an ‘active minus’ pricing approach would be to provide for passive access prices that are to some extent compatible with this structure. This is because most of the infrastructure cost is fixed and common across many customers, and it can be efficient in these circumstances to take demand into account when pricing the services that depend on the underlying infrastructure. This means for example that it may be efficient to have lower prices for low bandwidth, even if the productive costs are the same as for a higher bandwidth product.

A26.99 By ‘cost based’ access charges we mean charges that reflect the underlying cost (and cost structure) of the passive infrastructure. These charges would not in general be responsive to final consumer demand.[988] Downstream active pricing can differ from the price that would be derived from a cost based calculation in at least three key dimensions:

- A cost based price will not take into account consumer willingness to pay, and hence will not account for different consumption (bandwidth) except to the extent that it reflects incremental cost differences.

[988] So for example charges would not reflect bandwidth differences, except to the extent that there were differences in equipment costs.

- A cost based price will normally be priced on the basis of distance (e.g. metres) as distance is a key cost driver of the underlying passive infrastructure. This price might then be further broken down to reflect differences in underlying cost per meter in different geographic areas (e.g. rural areas versus central business district). Active prices may or may not have a distance based component to the charge, and similarly may or may not take geographic location information into account.

- Two-part tariffs. A cost based access price would set the split between upfront/connection charges and ongoing rental charges based on objective differences i.e. upfront connection charges would be set on the basis of the cost of connection related activities. Active pricing on the other hand may take account of consumer preferences when setting the balance between upfront and ongoing charges.

A26.100 The following sections therefore consider the relative merits of using cost or the different active price benchmarks as the basis for setting passive prices. In doing this, we have the potential for differences in pricing structures in the dimensions noted above in mind.

A26.101 As it is not possible to quantify the merits of the different options and there are many factors to take into account, the exercise is necessarily qualitative.

Economic efficiency

A26.102 In this section we consider the likely impacts on economic efficiency of the potential pricing approaches. For the purposes of our analysis, and in line with economic theory, our consideration of economic efficiency effects is broken down into three components:

- 'Allocative efficiency' is achieved when prices are close to cost.[989] This ensures that all consumers who value a product at more than its cost are able to purchase it;

- 'Productive efficiency' means that the costs of production are minimised;

- 'Dynamic efficiency' means that firms have the correct incentives to invest (e.g. in new infrastructure) and to innovate (e.g. to generate new products). Greater reliability and other quality improvements, and the creation of new products and services, are critically-linked to investment and innovation.

Allocative efficiency

A26.103 Our general views with regard to allocative efficiency and the impact of passive remedies are explained in detail in Annex 24 – Impacts and risks of passive remedies. Note that we assume that BT will (where necessary) rebalance its active prices in order to limit arbitrage opportunities. In terms of the allocative efficiency

[989] In the presence of fixed and common costs of production, firms can break even only by setting prices that are higher than marginal costs. Our views on the allocative efficiency issues raised by the need for mark-ups in the context of the leased line market, and the potential impacts of passive access on allocative efficiency are explained in detail in Annex 24 – Impacts and risks of passive remedies.

aspect of the pricing options available, many of the respondents to the November Consultation did not directly engage with this issue. A number of responses did however comment (either directly or indirectly) on the potential allocative efficiency implications of a change in the structure of prices due to passive access:

- DotEcon argued (for BT) that there were significant (allocative) efficiency advantages associated with the current structure of active prices. DotEcon argued there were also dynamic benefits as BT could respond to changing cost and demand conditions, and was also able to structure prices to encourage efficient migration between technologies.[990] BT argued that none of the passive pricing approaches proposed would preserve these benefits.[991]

- Colt noted that our 'cherry picking' concerns (including targeting high bandwidth circuits) were effectively a concern with infrastructure based competition in general.[992]

- GTC argued that pricing should take into account willingness to pay as prices should reflect incremental costs, plus a contribution to fixed and common costs which reflects willingness to pay of end users.[993]

- Frontier Economics (for the PAG) acknowledged that efficient cost allocations should take into account willingness to pay, and also that under certain specific conditions a regulated monopolist would have incentives to price discriminate in a way that maximised overall user demand. However, Frontier argued that price discrimination at the wholesale level would not be an efficient way to do this (due to the disconnect with downstream product usage). Further Frontier argued that BT's incentives would be distorted by substitute services outside the regulated basket (distorting demand elasticities), and by the potential for substitution from its regulated to unregulated services. Frontier suggested that in any case any adverse impact would be minimal as any increased cost recovery would be spread across a large number of lower bandwidth services, and by the general trend of falling prices as demand for Ethernet services rapidly grows.[994]

- Sky argued that any potential harm from higher prices for low bandwidth products would be small and would be outweighed by the benefits of increasingly important high bandwidth services being provided at prices which more closely resemble costs and by the dynamic efficiencies that would result from unconstrained passive access.[995]

- TalkTalk argued that whilst giving flexibility to BT could result in BT price discriminating in a welfare enhancing way, there was no positive evidence that the current pricing gradient is welfare enhancing. TalkTalk argued that BT's incentives were distorted for reasons similar to those put forward by Frontier for

[990] DotEcon (Report for BT), non-confidential response to the November Consultation, pages 13-14.

[991] BT, non-confidential response to the November Consultation, for example 10.45.

[992] Colt, non-confidential response to the November Consultation, page 7.

[993] GTC, non-confidential response to the November Consultation, paragraphs 6.10.

[994] Frontier Economics (Report for PAG), January 2015, page 21 and 25-27.

[995] Sky, non-confidential response to the November Consultation, 1.4 and 5.11.

the PAG. TalkTalk therefore argued that the introduction of dark fibre remedies will lead to an improvement in allocative efficiency.[996]

A26.104 We acknowledge the arguments put forward by Frontier Economics and TalkTalk that BT will have multiple incentives and that the bandwidth gradient might therefore be less optimal than would otherwise be the case. Nonetheless, as explained in paragraph A24.139 of Annex 24 (Impacts and risks of passive remedies), we remain of the view that in principle, BT has an incentive to maximise demand/output within the constraints of existing price controls, and that the existing structure may (broadly speaking) exhibit some of the characteristics/benefits that we would expect.

A26.105 In the following analysis we rank pricing approaches that take demand into account (and hence are likely to result in higher volumes consumed) as being preferred from an allocative efficiency perspective to those with little or no link to willingness to pay.

Table A26.1: Assessment of impact of potential passive pricing approaches on allocative efficiency

Approach	Allocative Efficiency[997]	Notes
Cost based	○	Likely to create relatively flat pricing structure, with little or no link between prices and demand.
Active basket	○	Similar to cost based approach with a single access price likely to create relatively flat pricing structure with little or no link between prices and demand.
Single active reference product	◑	Assuming a relatively highly valued benchmark product is selected, likely to reduce the bandwidth gradient for higher bandwidth products, but less impact on low bandwidth prices than an approach that would support a relatively flat pricing structure overall

A26.106 To the extent that the current pricing structure supports allocative efficiency, our assessment is that cost and an (averaged) active basket approach are likely to perform relatively poorly with regard to allocative efficiency. In both cases this is because these approaches are likely to drive the market towards a relatively flat pricing structure (based on a single passive access price), with little room to account for consumer demand in price setting.

[996] TalkTalk, non-confidential response to the November Consultation, section 3.2.

[997] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

A26.107 A single active reference product is ranked more favourably. This option offers the potential to preserve some element of demand based pricing for lower bandwidth circuits, but will overall still lead to a reduction in the level of demand based pricing and cost recovery. This could result in some loss of allocative efficiency as the need to recover common costs no longer recovered on circuits above the benchmark bandwidth can be expected to lead to somewhat higher prices for lower bandwidth products.

Productive Efficiency

A26.108 'Productive efficiency' refers to ensuring that the costs of production are minimised. Passive access may cause both benefits and costs in terms of productive efficiency.

A26.109 The major productive benefits identified are reduced interconnection costs (active equipment duplication), and reduced duplication of duct construction. There may also be some productive efficiency gains from allowing more of the value chain to be contested. In other words, competing CPs might be able to provide active services more cheaply than BT. The expected benefits of passives are discussed in detail in Annex 23 – Benefits of passive remedies.

A26.110 The major risks to productive efficiency appear to be ‘inefficient entry’, at least in a transition period until market prices adjust, and stranded assets. The major risks of introducing passives are discussed in detail in Annex 24 – Impacts and Risks of Passive Remedies.

A26.111 The analysis in the benefits and risks annexes show that a number of factors need to be considered when considering the potential effect of passive access on productive efficiency. The main benefits of passives are:

- reduced investment in costly duplicate trenching;
- reduced duplication of some active assets;
- increased productive efficiency associated with increased competition in the active layer.

A26.112 The main risks are:

- a potential loss of scale and scope benefits in BT’s active business;
- the potential for transient inefficient entry into the active layer;
- the potential for stranded investment in trenches, ducts and cables, particularly on the part of competitive CPs.

A26.113 In considering how to balance these factors we have also taken into account the following considerations:

- Transitory inefficiencies need to be taken into account, but in general are less of a concern than inefficiencies that are likely to be permanent.

- Our analysis has taken into account that active market prices are likely to need to rebalance in response to passive access. Price rebalancing will reduce arbitrage opportunities, suggesting that inefficient entry should be a limited concern.[998]

- We have not seen evidence that there would be a material loss of scale and scope for BT's business, particularly under a dark fibre remedy. Although there are economies of scale and scope in BT's business, these reside mainly in the passive components (e.g. duct, fibre and management overheads). We have not seen evidence of significant scale and scope economies in relation to active services, particularly as much of the equipment is customer-specific, or can be shared only between a limited number of customers.

- Stranded duct investment on the part of competitive CPs will be of particular concerns where the loss of return on historical investment that this implies impacts adversely on forward looking investment incentives. We take this factor into account when considering the impact of passives on dynamic efficiency.

A26.114 In light of these considerations, we summarise our assessment of the three pricing options, and how they would impact productive efficiency, in the table below.

[998] We note that this assumption is consistent with the approach to our analysis of the allocative efficiency impacts of passive access, which also assumes that prices will rebalance.

Table A26.2: Assessment of impact of potential passive pricing approaches on productive efficiency

Approach	Productive Efficiency[999]	Notes
Cost based		Scope for transient inefficient entry as cost-based access price is least compatible with current active market prices, but the level of inefficient entry should be limited by rebalancing of active prices. Good option for reducing inefficient ('parallel') duct duplication which accounts for bulk of passive infrastructure costs, and also for reducing active equipment duplication (as most circuits potentially passive). Possibility of improved costs of production in the active layer due to increase in competition.
Active basket		Scope for transient inefficient entry limited: BT has ability to keep some pricing dimensions consistent with current active market price structure. Level of inefficient entry overall limited by active price rebalancing. Good option for reducing inefficient ('parallel') duct duplication and also for reducing active equipment duplication (as most circuits potentially passive). Similar possibility of improved costs of production in the active layer due to increase in competition as in the cost based case.
Single active reference product		Potentially scope for limited and transient inefficient entry further reduced due to fewer circuits exposed to risk of arbitrage of bandwidth gradient. Reduction in inefficient ('parallel') duct duplication and active equipment duplication, but less than cost/active basket options as fewer circuits potentially converted to passive. Improved costs of production in the active layer due to increase in competition possible but potential benefit less than cost/active basket approaches as fewer circuits potentially converted to passive supply.

[999] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

A26.115 We have ranked cost and active basket based access pricing approaches as broadly similar in outcomes, particularly from a long run perspective once active prices have adjusted. This is because passive access has the potential to provide significant productive efficiency benefits both through reducing inefficient ('parallel') duct duplication which accounts for bulk of passive infrastructure costs, and also by reducing active equipment duplication. We also note the possibility of improved costs of production in the active layer due to increase in competition. In terms of translation to our preferred pricing approach, the cost and active basket approaches score well because using these approaches would allow most circuits to at least potentially be supplied using passive access.

A26.116 We accept that there is scope for transient inefficient entry with any of the approaches chosen, and that this could be worse for the cost and active basked based approaches given these approaches would support relatively widespread use of passive access. However, as noted above we consider that the level of inefficient entry should be limited by the expected rebalancing of active prices.

A26.117 Overall we have rated both cost and active basket based access pricing as performing well with respect to productive efficiency.

A26.118 We ranked the single active reference product less favourably for productive efficiency than either the cost or active basked based approach. This is because this approach limits the use of passives to some extent. While this is desirable from other perspectives, when considering productive efficiency alone it means the potential efficiency benefits of passive access will be reduced. We therefore rate it lower than the cost and active basket pricing options with regard to productive efficiency.

Dynamic Efficiency

A26.119 'Dynamic efficiency' means that firms have the correct incentives to invest (e.g. in new infrastructure) and to innovate (e.g. to generate new products). With respect to passive access pricing, the approach to pricing could impact the following factors that relate to dynamic efficiency:

- BT's incentive to invest in passive infrastructure;
- competitive CPs' incentive to invest in passive infrastructure;
- competitive CPs' incentives to invest in the provision of active services;
- as noted in Section 7, we take account of (amongst other things) incentives to invest in infrastructure, and the effect on competition in downstream markets. Our assessment of dynamic efficiency is relevant to both of these objectives.

A26.120 With these objectives in mind, we consider impacts on incentives in the active layer separately from possible impacts on the passive infrastructure layer, as it is possible to take actions that increase investment in one layer at the expense of the other.

Dynamic efficiency in the active layer

A26.121 In the active layer of leased lines markets passive access would allow competitive CPs to invest in their own active assets, with the potential for dynamic benefits as discussed in Annex 23 – Benefits of passive remedies. All three of our potential

pricing approaches offer these potential benefits, but the cost and active basket options offer the scope for wider usage of passives (potentially across circuits of all bandwidths) when compared with the single active reference product approach. This implies greater benefits from the cost and active basket options relative to a single reference product approach, based on the assumption that the availability of passive circuits then delivers increased investment in the active layer.

A26.122 Our rating of each of the pricing approaches with respect to dynamic efficiency benefits in the active layer is summarised in the table below.

Table A26.3: Assessment of impact of potential passive pricing approaches on dynamic efficiency – Active investment

Approach	Dynamic Efficiency Active Investment[1000]	Notes
Cost based		Likely to lead to relatively flat pricing structure meaning most circuits could potentially be provided by passives, allowing CPs to invest in their own active equipment and supply their services across the market. This benefit may be partially offset by lower volumes of low bandwidth circuits being purchased if prices rise.
Active basket		Like cost based access, likely to lead to relatively flat pricing structure meaning most circuits could potentially be provided by passives, allowing CPs to invest in their own active equipment and supply their services across the market. This benefit may be partially offset by lower volumes of low bandwidth circuits being purchased if prices rise.
Single active reference product		Allows CPs to invest in their own active equipment and supply their services across the higher bandwidth part of market. Benefit reduced relative to cost based and active basket options as fewer circuits potentially converted to passive.

[1000] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

Dynamic efficiency in the passive infrastructure layer

A26.123 When considering the impacts on incentives for investment in passive infrastructure we have separated consideration of BT and other competitive infrastructure providers. This is because BT as the SMP provider is in a different position to the other CPs. Given BT's market power in the relevant markets and the functioning of the active charge control, BT should be in a position to recover its efficiently incurred costs by rebalancing prices within the cap to the extent that this is needed to maintain overall returns. This is however not necessarily true in the case of competitive CPs. If prices and volumes rebalance following the introduction of passives, competitive infrastructure providers would not necessarily be able to recover losses in one part of the market (product or geographic) with gains in another part.

A26.124 When considering the impact on competitive infrastructure providers we have given separate consideration to the position and behaviour of Virgin Media.[1001] This is both because Virgin has accounted for most of the new duct construction on the market, and because Virgin's pattern of investment differs considerably from most other leased line competitors, largely as a result of its relatively widespread network footprint. We note that the majority of Virgin's network extensions in 2013/14 [✂ ✂].[1002]

A26.125 With regard to stranded assets, we note that the immediate risks to sunk investment in passive infrastructure by competitive providers would be lower prices and/or lower utilisation of their duct and fibre assets, either of which would lead to lower profits on existing infrastructure. It is reasonable to expect that this would then lead to lower expected returns on any new duct and fibre construction, lowering the incentive to invest in new infrastructure as a result. Where this is a likely outcome we consider this to be a potential loss of dynamic efficiency due to reduced investment incentives following the introduction of passive access.

[1001] We note that should CityFibre succeed in building wider area networks looking forward, that it would take on similar characteristics to Virgin with its current existing wide area coverage. Therefore, in the longer term, the comments specific to Virgin's current network could also apply to CityFibre.

[1002] For example, [✂ ✂] of on-net fibre-connected buildings (excluding residential buildings) connected by [✂ ✂] in 2013 involved circuits [✂ ✂], for which there are regulated wholesale access alternatives available from BT. Source: [✂ ✂].

Table A26.4: Assessment of impact of potential passive pricing approaches on dynamic efficiency – Passive infrastructure investment

Approach	Dynamic Efficiency Passive Infrastructure[1003]	Notes
Cost based		BT's incentives to invest maintained by maintaining opportunity to recover efficiently incurred costs and ability to charge ECCs for certain elements of a connection for a single end-user. Competitive CPs (except for Virgin Media) currently focus on higher value connections and high density areas. A reduction of the bandwidth gradient is likely to reduce incentives to invest in higher value connections, with some offsetting benefit from an increase in the value of lower bandwidth connections. Overall impact likely to be negative. Virgin has invested in significant network extension, [✂ ✂], so a reduction of bandwidth gradient should have limited impact on investment incentives. All competitive CPs that currently build own infrastructure likely to lose some market share (at passive infrastructure level) due to loss of ability to differentiate via active equipment and increase in competition based on BT passive infrastructure. Expect overall negative impact on investment in passive infrastructure build due to fall in expected returns.
Active basket		Analysis is similar to the cost based option, as we expect cost based and active basket to result in similar passive access prices over the long term.
Single active reference product		Relative to the cost and active basket approaches, the single reference product is expected to maintain a higher passive price which will reduce passive usage and mean less impact on competitive CPs.

[1003] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

A26.126 With respect to the potential impact on BT's incentives, we expect that BT's returns on investment should be preserved via maintenance of BT's opportunity to recover efficiently incurred costs, and hence we do not expect material negative effects on BT's incentives regardless of the passive pricing approach used. This is because we expect BT to be able to rebalance prices within its price cap in order to maintain its returns in the leased line market.

A26.127 As noted in Annex 24 at paragraph 24.93, in relation to the risk to other CPs' investment incentives, we consider that as well as the general design features, the extent to which the passive remedy fully replicates the benefits of self-build will affect the scale of risk. As such, while passive remedies may undermine some investment relative to an actives-only regime (particularly if it replicates the benefits of self-build), providing the passive remedy is designed appropriately (including in relation to form and price), it is not clear that this should have significant adverse effects for overall dynamic efficiency. With respect to our preferred pricing approach, we would expect the impact on other CPs to be larger for cost and active basket based access prices as these approaches would favour wider use of passives and a lower access price. A single reference product approach should limit the impact both by preserving more value in the high value part of the leased line market, and by limiting the extent to which passive access is an economic option.

Compatibility with active price structure/risk of arbitrage

A26.128 In this section we consider the extent to which the pricing approach would be able to maintain a good level of compatibility with the current structure of active prices.[1004] A low level of compatibility implies the likelihood of a significant change being needed in the structure of active prices and pattern of cost recovery whereas a high level of compatibility is likely to result in relatively minimal impacts on the active price structure currently in the UK leased line market.

A26.129 We have also considered the level of compatibility with our current approach to applying charge controls to BT's active leased line products and the extent to which the approach preserves the stability of the current regulatory regime. In particular we have a preference for an approach that is consistent with our general approach of applying price cap based regulation that allows a glidepath to cost to be employed during the charge control period, in order to encourage productive efficiency.

[1004] 'Compatibility' covers a number of pricing dimensions, particularly the approach to distance charging, the ability to maintain some form of demand based pricing, and the structure of charges such as connection and rental components to the charge.

Table A26.5: Assessment of impact of potential passive pricing approaches – Compatibility with active pricing structure

Approach	Compatibility with actives[1005]	Notes
Cost based		Cost based (flat) access price charged by distance accessed will lead to arbitrage of higher bandwidth products and geographic (distance) based arbitrage, requiring active price rebalancing.
Active basket		Similar to cost based a flat access price based on a basket will lead to arbitrage of higher bandwidth products and require price rebalancing, but with benefit of maintaining a glidepath to cost.
Single active reference product		Assuming a relatively highly valued benchmark product is selected, likely to flatten bandwidth gradient for higher bandwidth products, but less impact on low bandwidth product than an approach that would support a relatively flat pricing structure overall. Also maintains the benefit of the regulatory glidepath.

A26.130 A cost based approach to setting passive prices is likely to have a low or very low level of compatibility with the current pattern of active prices, depending upon how the price is calculated and implemented. If the charge is set at cost at the outset, it will be incompatible with our glidepath approach to setting charge controls, which brings prices into line with costs only by the end of the charge control period. Moreover, a cost based approach that leads to a flat access price but with little or no geographic de-averaging will lead to more arbitrage of higher bandwidth products and require a greater degree of price rebalancing than in the case of a single active reference product approach. A cost based approach based on distance accessed (as is common in other jurisdictions) will also lead to arbitrage based on the circuit length in cases where the price of an active product has limited or no distance component. A detailed bottom up cost based approach with costs of different geo-types modelled could lead to substantial arbitrage if it allowed low cost access to the highest value areas of the network (e.g. backhaul). There may however be some countervailing effects of modelling geo-types: for example high density and value areas (e.g. cities) are also likely to be relatively costly with regard to duct construction. It is not therefore *a priori* clear what the net effect of de-averaged modelling by geo-type might be. It is however clear that a cost based price charged by distance accessed would exhibit a low degree of compatibility with

[1005] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

the current active prices. We therefore rank this option as performing poorly in terms of compatibility with active price structures.

A26.131 Setting passive access prices based on an active basket would result in a flat (averaged) access price that would exhibit a low level of compatibility with the current active price structure. In the short term it would allow arbitrage of higher value active prices (i.e. those priced above average). In the long term this is likely to create pressure to flatten the overall active price structure in order to reduce the arbitrage opportunity offered by high value products while recouping some of the lost revenue by increasing the price of lower value products. We have rated this option as also performing poorly in terms of compatibility with active price structures, although we note that the active basked approach should give the regulated firm some opportunity to maintain a degree of compatibility between its active and passive prices. It will also preserve the glidepath approach to bringing prices down to cost over the period of the price control that is a key feature of the current approach to active leased line regulation.

A26.132 Finally a single active reference product would be likely to have less impact on the current pricing structure. A single reference product would be based on a relatively high value benchmark product. This would be likely to reduce the bandwidth gradient for products of higher bandwidth than the benchmark. There should however be less impact on lower bandwidth products, with the potential for some form of bandwidth gradient to remain in the market. This option is therefore ranked as better than either the cost or active basket approach, but nonetheless not exhibiting a high degree of compatibility with the current active price structure. Similarly to the active basket approach, this approach will also preserve the glidepath approach to bringing prices down to cost over the period of the price control.

Risk of gaming

A26.133 In this section we consider the risk of 'gaming' under each of the proposed pricing approaches. By this, we mean the risk that the remedy might be less effective than intended as a result of the regulated firm manipulating the chosen pricing methodology in ways that favour itself.

Table A26.6: Assessment of impact of potential passive pricing approaches – Risk of gaming

Approach	Gaming risk[1006]	Notes
Cost based	●	Cost based methods once in place likely to leave regulated firm with limited discretion.
Active basket	●	Once the basket is defined, limited discretion left to the regulated firm which should limit risk
Single active reference product	◐	Risk of pricing of reference product being set to disadvantage passive access seekers may require regulatory safeguards. May be scope for undermining the passive remedy by launching active products similar (but not identical) to benchmark product

[1006] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

A26.134 We assess cost based pricing methods as having a relatively low risk of significant regulatory gaming. This is because cost based methods – once in place – are likely to leave the regulated firm with limited discretion over pricing. As a result, there is also likely to be limited scope for significant gaming of the access price. Similarly an active basket approach is likely to exhibit a relatively low level of risk of gaming. Once the relevant active basket is defined as part of the BCMR, BT would have limited discretion in setting the access price, which should in turn limit the risk of substantial gaming. We have therefore ranked these options as equally preferred options that perform well with respect to the risk of gaming.

A26.135 We assess that there is a higher risk of gaming of a single active reference product. The first risk of setting the passive access price based on a single reference product is that BT will have an incentive to price that product in a way that discourages or disadvantages passive access seekers. Beyond this concern however there may be scope for undermining the passive remedy by launching active products similar (but not identical) to the benchmark product. As it is difficult to predict in advance (and take steps to prevent) all the ways in which this might be done, we consider that there would be some risk of gaming of this access pricing method, and have therefore rated it performed less well than the other options on this measure.[1007]

Ability to implement

A26.136 We acknowledge that any significant change in the approach to pricing of leased line products in the UK will involve material implementation effort on the part of BT, CPs and within Ofcom. However, some approaches will be significantly easier to implement than others. In this section we consider the relative ease of implementing the potential approaches under consideration.

Table A26.7: Assessment of impact of potential passive pricing approaches – Risk of gaming

Approach	Ease of implementation[1008]	Notes
Cost based		Difficult for 'bottom up' approach requiring detailed information on costs and density of duct by geo-type. Top down active minus approach equivalent to active basket approach.
Active basket		In principle a mechanical exercise once the products in the basket are specified.
Single active reference product		In principle a mechanical exercise once the benchmark product is specified.

[1007] We will consider as part of the June 2015 LLCC Consultation whether to impose a separate charge control on the reference product to limit this potential concern.

[1008] We use a qualitative ranking system where approaches that perform relatively poorly (compared to the other available options) are depicted by an empty ball, whereas approaches that perform relatively well are depicted with a fully shaded ball.

A26.137 'Cost based' pricing could in principle be established either using a bottom-up or top-down approach.

A26.138 A bottom-up approach would involve modelling the cost of the passive network infrastructure and then sharing that cost between CPs using the infrastructure. In principle this type of modelling could be done, but the modelling that would be needed is very different to the approach currently used which is built on BT's RFS and DAM that it is required to produce under its current regulatory obligations. To the extent that it was desirable to geographically de-average costs as part of the process, significant implementation issues would arise with regard to establishing the boundaries between geo-types. For the purposes or our analysis we consider this approach impractical for this price control review.

A26.139 A top down approach based on currently available information could be used. This would involve subtracting avoidable active costs from the total revenue allowed under the active price cap. This approach is however in principle equivalent to the active basket approach we consider further below.

A26.140 In principle using an active basket approach would be a relatively mechanical exercise once the products in the basket are specified. The main implementation challenge would be identification of the relevant avoidable active costs that need to be subtracted. Nonetheless, we assess this approach as relatively practical to implement compared to the other options, particularly in the near term.

A26.141 Finally, we think that using a single reference product would also be a relatively mechanical exercise once the benchmark product is identified. This method would have similar issues to the active basket approach with respect to the need to identify the relevant active costs to be subtracted when setting the passive access price. Beyond this however, given the dynamic nature of the market and growing demand for and falling cost of bandwidth, the benchmark product would need to be adjusted from time to time. This is however also an issue with the active basket approach, as the basket also needs adjustment over time. We therefore ranked this also as being relatively practical to implement compared to the other options.

Conclusion – preferred pricing approach

A26.142 The table below summarises the results of our qualitative analysis of the available pricing options.

Table A26.8: Assessment of alternative passive pricing approaches

Pricing Approach	Economic Efficiency				Active Compat.	Gaming risk	Ease of implem.
	Alloc.	Prod.	Dynamic Efficiency				
			Active	Infra.			
Cost based							
Active basket							
Single active reference product							

A26.143 As set out in Section 7, the regulatory framework requires us to take account of a range of considerations in assessing what remedies to impose, including the impact on efficiency (including allocative, productive and dynamic efficiency). Our analysis shows that the cost and active basket approach perform in a similar way, given that we expect them to have similar impacts on the market and current market pricing.[1009] Both of these approaches perform well on some metrics – such as productive efficiency and dynamic benefits in the active layer. However, they equally perform relatively poorly in certain areas, in particular the expected impact on competitive infrastructure investment, and on allocative efficiency.

A26.144 The single reference product approach on the other hand performs consistently with fewer benefits in terms of productive efficiency and investment in the active layer, but equally with reduced potential for negative impacts on competitive infrastructure providers and allocative efficiency (via potential increases in the prices of lower value active circuits).

A26.145 In reaching our view on the preferred pricing option, we have taken into account the trade-offs that exist between the factors included in our assessment framework (described in Section 7). A pricing approach which set the price of dark fibre at cost would maximise the productive efficiency benefits of reduced equipment costs and increased innovation in the active layer. However, this has to be balanced against reduced allocative efficiency from the reduction of the bandwidth gradient and reductions in dynamic efficiency due to some reduced investment by other infrastructure operators. A cost-based pricing approach would also raise issues of

[1009] In particular, both are expected to lead to a passive access price that will tend to drive the downstream active price structure towards a relatively flat pricing structure. This is explained in more detail in Annex 24 – Impacts and Risks of Passive Remedies. We also note that, at the end of the charge control period, both approaches should produce a similar passive access price level.

compatibility with our approach to regulating these markets, as it would be difficult to reconcile with Ofcom's long-standing approach to give BT flexibility in pricing and to reduce charges to cost through a glidepath.

A26.146 By contrast, the use of a single reference product, if the product chosen makes a higher than average contribution to common costs, has the potential to mitigate some of the allocative efficiency impacts as well as the impacts on other infrastructure providers. Using a reference product which makes an above average contribution to common cost recovery allows the potential for a bandwidth gradient still to exist (and so reducing impacts on low bandwidth users), as well as reducing the impact on other infrastructure providers as the relatively high common cost contribution of the dark fibre product will reduce the impact on the profitability of network expansion.

A26.147 We acknowledge that the choice of a single reference product with a relatively high common cost contribution may reduce some of the benefits, in terms of innovation and productive efficiency, relative to an approach which uses a lower passive price. The extent to which these benefits are reduced will depend on the extent to which take-up of passive solutions will be lower than under a cost-based/average active product approach.

A26.148 In light of the above analysis our view is that the single reference product approach provides the best balance of potential costs and benefits from the availability of a passive (dark fibre) remedy, and is therefore our proposed pricing approach.

Choice of the benchmark product

A26.149 The purpose of an 'active minus' approach to pricing dark fibre is to provide a link between a suitable downstream active product and the fibre access price that then maintains a similar level of contribution to common costs and allows some preservation of the bandwidth gradient.

A26.150 We consider that BT's EAD product is the logical benchmark Ethernet product, particularly on a forward looking basis. WES and BES are legacy products no longer available for new supply, and are not suitable as the benchmark should be based on current and future demand. Similarly products that aggregate and share bandwidth on a fibre (such as EBD) are less suitable than EAD as they are not pricing access to a dedicated fibre circuit.

A26.151 With regard to the question of which bandwidth(s) to include in the calculation, there are currently only two options - 100Mbit/s and 1Gbit/s. These services represent the vast majority of new connections of CISBO services.[1010] We would expect the average active minus approach to result in an access price that is between these two products (as it would be a weighted average of the two). Our assessment of the relative merits of the single reference product approach relative to the average active minus approach is predicated on the single reference product being a higher bandwidth than the average. Consequently, the suitable benchmark would be the 1Gbit/s service rather than the 100Mbit/s service. We also note that towards the end of the charge control period when BT's revenues should approximate its overall leased line costs, a 100Mbit benchmark could result in an access price below the (average) cost of the passive infrastructure. For these reasons, we propose to use

[1010] These two products accounted for [✂] of new BT connections in 2013/14.

the EAD 1Gbit/s product as the reference product for pricing passive access. As noted above, this decision also reflects a policy objective of preserving to some extent the bandwidth gradient, reducing the potential negative impacts on competing infrastructure providers and on the purchasers of low bandwidth leased lines.

A26.152 We are aware that BT is planning to launch a 10Gbit/s EAD product, and have considered whether this might be a suitable benchmark product (once available to the market). Our view is that this product will be attractive only to a small number of CPs – in particular those with demand for very high bandwidth connectivity. It is expected to account for a very small number of circuits during the next control period. We do not therefore view a 10Gbit/s product as a suitable benchmark, as it would not be likely to support a material level of use of a passive access product as a means of providing business leased line connectivity. This would mean there would be very little net benefit to be achieved from a dark fibre remedy benchmarked to a 10Gbit/s EAD product.

A26.153 The choice of a reference product also has implications for take-up, and indeed there may be little difference in take-up between dark fibre when prices on an average active minus basis and when priced at a 1 Gbit/s active minus basis. If the passive price were set on an average active minus basis, it is likely to involve a contribution to common costs which is greater than for the EAD 100Mbit/s product. This could mean that 100Mbit/s connections would not switch to dark fibre as it may not be cost effective, and so take-up may principally be among those who request 1 Gbit/s and above. However, this is the same group as would be viable with a 1 Gbit/s active minus pricing approach.

A26.154 BT's EAD products currently come in three main forms: EAD, EAD LA, and EAD ER ('extended reach').

A26.155 EAD LA is only available for circuits with one end terminating at ASN exchanges whereas EAD may be used to connect any two locations (including BT exchanges) subject to circuit distance limits. In terms of pricing structure, EAD LA is priced at a fixed price per circuit, regardless of length, whereas EAD and EAD ER both include a distance based main link component where the circuit crosses more than one exchange area. This main link element is a 'passive' charge as it included no active components. From 1 April 2015, the rental charge for a 1 Gbit/s EAD LA circuit was £3,000 per year, compared with £4,200 per year for an EAD 1 Gbit/s circuit (excluding any main link charges).[1011] These price differences in part reflect shorter average circuit lengths for EAD LA circuits. Issues related to the current structure, usage and pricing of BT's EAD and EAD LA products and our current proposal to set the price difference between EAD LA and EAD equal to LRIC are discussed in detail in Section 10 of this consultation.

A26.156 We propose that, as long as BT retains its current EAD structure, there should be separate passive access charges for dark fibre circuits that are equivalent (less the active equipment) to EAD LA and standard EAD circuits. In other words there should be 'Dark' and 'Dark LA' products.[1012] This is because dark fibre circuits

[1011] See 'Ethernet pricing differentials', Section 11 – Remedies – Specific CI Markets.

[1012] The ER variant differs in price due to different equipment being used to extend the reach of the circuit, but in the case of passive access this choice (and the relevant cost) will be under the control of the access seeking CP.

based on an EAD product price would not in general be economic for 'LA' applications, while an access price based on the LA variant would create an arbitrage opportunity if available to replace current EAD circuits. As noted the cost differences found in the ER variant reflect active component cost differences and hence this is no requirement for a 'Dark ER' product.[1013]

A26.157 Having decided that EAD forms the preferred benchmark product, and the variants that are likely to be necessary, we need to consider how the active increment should be calculated. This issue is considered in detail as part of the Leased Line Charge Control consultation.

A26.158 We expect that issues are likely to arise with regard to migration of the benchmark product over time (i.e whether the EAD 1Gbit/s product remains appropriate), and that this issue would need to be addressed in the next price control review period. We note that at that time it is possible that improved passive cost data might have become available, and that market pricing may have developed in ways that impact the analysis. We would therefore expect that the next price control review would need to reconsider whether to continue with an active minus reference price approach (and if so what that reference product and price should be), or whether to move to a more cost based approach.

Conclusion – preferred benchmark product

A26.159 For the reasons set out in this section we propose that:

- the EAD 1Gbit/s product is the appropriate benchmark; and
- both standard and 'LA' dark circuits are available to match the similar EAD product offering.[1014]

A26.160 This issue of how the increment should be calculated is considered in detail as part of the June 2015 LLCC Consultation.

[1013] As the main link charge for an EAD circuit relates only to passive components, the same main link charge would, in principle, be applicable to both active and passive circuits. Hence, for the avoidance of doubt, our intention is that BT would be under an obligation to provide a CP requiring what amounts to a 'dark ER' circuit at a price referenced to the EAD pricing structure

[1014] With the ability to create dark circuits equivalent to the current ER options, as noted in the previous footnote.

Annex 27

Innovation

Introduction

A27.1 CPs with their own infrastructure compete to introduce new technologies or adopt existing technologies quicker than their competitors. Where CPs do not have their own network infrastructure, they rely on regulated access to Openreach's active products. In addition to Openreach developing products based on its own plans, CPs can currently request changes to the existing active products through a formal process called the Statement of Requirements (SoR) process.

A27.2 Competition based on passive remedies would expose more parts of the value chain to CPs' control than active remedies. This could increase the scope and opportunity for innovation in networks and services, and allow CPs to differentiate the services offered to end users. We discuss in Annex 23 the potential benefits of passive remedies in terms of dynamic efficiencies and the greater scope for innovation and improvements in service quality.

A27.3 The purpose of this Annex is to explore the extent to which the existence of passive remedies could provide scope for innovation based on known developments in the market. In order to assess this we have conducted two pieces of analysis:

- **SoR analysis**: we have analysed requested changes to Openreach's active products to assess the extent to which they could be delivered with passive remedies; and

- **Innovation on other networks**: we have considered the evidence provided by CPs on the different applications (e.g. technologies, service features and network architectures) they use on their own networks and which they may provide using the Openreach network, if passive remedies were made available.

A27.4 This analysis provides an indication of the scope for innovation and differentiation that could be possible with passive remedies. If we observe that some CPs request developments that have not occurred in Openreach's active products, or are offering different services and technologies on their own networks than are available from Openreach, then this may be consistent with the existence of unmet demand for innovation under the current active remedies.

A27.5 We recognise the limitations of assessing known developments. In the future a wide range of as yet unknown innovations and product/service features may emerge and passive remedies may allow these to be developed faster.

A27.6 We analysed the SoRs for the business connectivity products from 2006 to November 2014.[1015] Overall, our analysis of the requested changes to Openreach's active products shows that:

27.6.1 There have been 188 requests under the SoR process;

[1015] Our analysis is based on the SoR dataset submitted by Openreach on 11/11/2014. Subsequent changes or updates to the SoR data are not reflected in our analysis.

27.6.2 Approximately one third of those have been delivered;

27.6.3 Of those SoRs that have been delivered, the average time from request to delivery was 17 months, although it ranges from 1 month to 5 years;

27.6.4 Of the 10 SoRs in development, eight have been in development for more than two years including five which have been in development for four to five years;

27.6.5 Of those SoRs which have been cancelled or rejected by Openreach, 27% could have been developed by CPs using passive infrastructure. All of the requests could be delivered by either dark fibre or duct access. Dark fibre would enable requests related to service features to be delivered more efficiently, while duct access may enable some additional innovations for the requests around network architectures/extending network connectivity.

A27.7 Our analysis of CPs' services on their own networks suggests that CPs take different approaches when providing services using their own networks, which they could potentially deploy more widely using passive remedies. Most of the examples provided by CPs relate to the active or electronics layer, which suggests that they could be delivered either with dark fibre or with duct access. Fewer examples relate to network architecture, where duct access may offer an additional benefit.

A27.8 Combined, these two analyses are consistent with passive remedies offering increased scope for innovation than active remedies. They suggest that there is demand for services that are different from those available under the prevailing suite of Openreach active products. Most of the services identified can be technically deployed as active products but they are not currently available from Openreach; under passive remedies CPs would have more flexibility to deploy their choice of technologies and network features.

A27.9 In what follows, we discuss our analysis and findings of the SoR requests and innovation on other networks in turn.

The Statement of Requirements (SoR) Analysis

A27.10 The Statement of Requirements (SoR) process is the process used for developing new products or changes for Openreach's regulated wholesale products. We give a brief description of the process, then we present our analysis and findings.

The Statement of Requirements (SoR) process

A27.11 In the BT Undertakings, BT committed that Openreach would process all requests for new product developments on an EOI basis.[1016] The purpose of these obligations is to ensure that BT does not discriminate in the provision of new wholesale leased line products. Under the SMP framework, Ofcom also specifies obligations concerning the manner in which requests should be handled. These obligations require BT to publish guidelines on how requests should be submitted

[1016] See, for example, Undertakings in lieu of a reference under the Enterprise Act 2002, 22 September 2005, see in particular paragraph 5.13.4, at http://stakeholders.ofcom.org.uk/binaries/consultations/752417/statement/statement.pdf.

and will be processed and also to specify timescales for handling of requests.[1017] This product development process for the wholesale leased lines services is known as the Statement of Requirements (SoR) process.[1018]

A27.12 Under the SoR process, new product developments for SMP products are determined by Openreach and provided to all CPs on equal terms. All requests for innovations to the SMP products (including requests by BT's downstream divisions) are submitted to Openreach to be assessed, after which Openreach will decide whether to deliver or reject a given request. Any technology development that Openreach agrees to deliver will be offered to all CPs at the same time, which means that the development is available on a non-discriminatory basis, but also that there is no 'first mover advantage'.

A27.13 SoR requests can be raised by CPs (including BT's downstream division), individually or collectively. In addition, Openreach uses the SoR process to raise and assess its own internal requests related to product development.[1019] Openreach explained that although they can develop new products or processes without using the SoR process, they prefer to run new ideas past the industry.[1020] However, we recognise that this is not always the case and not all Openreach developments are captured by the SoR process.

A27.14 For an SoR to be delivered, it follows several stages:[1021]

- a draft stage where industry support is sought and the content is discussed and agreed by industry;
- an assessment stage where the SoR is assessed by Openreach, including further discussion with industry, to establish the detail of the requirement and whether there is a sufficient business case to proceed. SoRs can be rejected by Openreach at this stage or cancelled by Openreach or industry;
- a development stage where Openreach has agreed to proceed and the new product or change are incorporated into its planned developments and delivery schedule; and
- a delivery stage where the new service or change to service is made available to industry for ordering, deployment and use.

A27.15 An SoR can either be cancelled or rejected at any point during the process. Cancellations are usually done by the CP submitting the SoR, in some cases because a request may be taken forward under a different route. Rejections – as

[1017] SMP Condition 1 – obligation to provide network access on reasonable request, SMP Condition 4 Equivalence of inputs basis and SMP Condition 10 – Requests for new forms of network access.

[1018] See Openreach presentation to Ofcom on 15 December 2014.

[1019] Openreach may raise SoRs to be made visible to CP's where it believes a change to a product is required. It may also use the SoR process to progress internal Openreach confidential requirements, which are not made visible to CPs. See Openreach document on "How to raise a Statement of Requirement for Openreach Products", page 3.

[1020] See notes of Leased Lines Charge Control meeting with BT on 15 December 2014.

[1021] See email dialogue between Derek Stagg (Ofcom) and Phil Locket (Openreach) from 29 October 2014 to 5 December 2014.

well as some cancellations- are made by Openreach, usually because it judges that the request is not economically viable. In this regard, it should be noted that even minor changes involve costs as any new functionality involves updating Openreach's systems. In a complex development, as much as 60-70 systems may be affected. [1022] Openreach has explained:

> "Where Openreach has not implemented certain services it has been because it was uneconomic to do so. While some solutions may have suited the particular requirements of an individual CP it is also important to take account of any significant costs which would stand to be recovered from the wider CP community."[1023]

SoR Analysis and Findings

A27.16 We analyse the SoR requests to provide an indication of the scope for passive remedies to deliver more innovations for wholesale leased lines services. Our analysis is based on the dataset provided by Openreach for the SoRs for BCMR services.[1024] The dataset includes a list of the requests submitted to Openreach between 2006 and November 2014.[1025] We note that subsequent changes or updates to the SoR data (e.g. SoRs which may have been delivered by Openreach in 2015) are not reflected in our analysis and findings.

A27.17 The range of requests is wide and includes requests for changed/new services as well as a wider set of requests related to ordering processes, fault reporting and support systems. For each request there is information such as the subject of the request, customer name, date of submission, the decision/outcome and the launch date for delivered SoRs.

A27.18 Our analysis covers the following:

- **Volume of requests:** the number of SoR requests broken down by year and by customer;
- **Record for delivery:** the success rate and timescales for meeting SoR requests; and
- **Potential impact of passive remedies:** the likely impact on delivering i) unmet requests (i.e. cancelled/rejected); and ii) requests in development.

A27.19 While our analysis of volumes and record for delivering SoRs include all requests for BCMR services, when considering the potential impact of passives we focus on the requests for new or changed BCMR services.

[1022] See Openreach presentation to Ofcom, "Openreach Development Process", Leased Lines Charge Control meeting, 15 December 2014.

[1023] See BT non-confidential response to the November Consultation, paragraph 12, page 90.

[1024] BT submission to Ofcom in response to 4th notice, s.135, Q.A8, on 11/11/2014. We have made minor changes to the dataset, which are i) updating the data for 5 missing entries for the year variable (i.e. the year in which the SoR was submitted), and ii) changing the classification of one SoR (8166) from cancelled to rejected as it was re-classified by Openreach after the data submission.

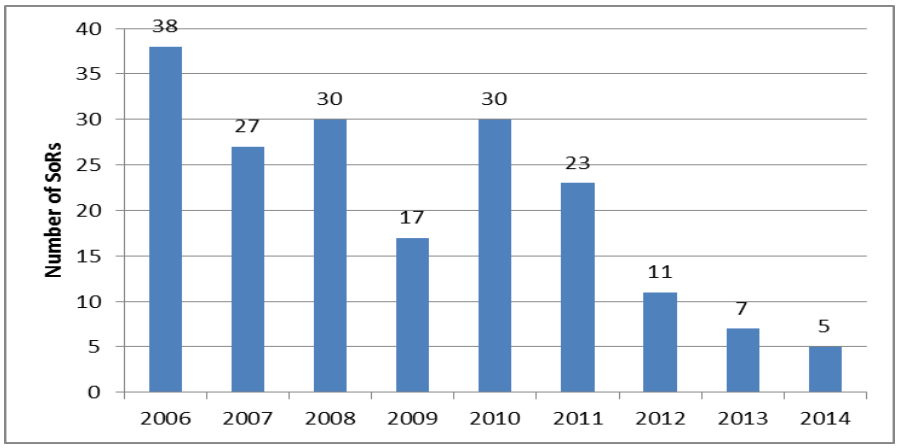
[1025] 2014 is a part year, which covers 1st of January- 11th of November (BT data submission date). Therefore, all the findings presented in this section for the SoR requests in 2014 are for part year.

Volume of requests

A27.20 In the period between 2006 and 2014 Openreach received a total of 188 SoRs.1026 We have analysed the number of SoR requests by year and by customer.

A27.21 First, we have considered the variations in the number of SoR requests over time. Figure A27.1 shows the number of SoRs submitted to Openreach each year from 2006 to 2014.

Figure A27.1: Number of SoR requests per year (2006-2014)



Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014.
Notes: 4 out of the 5 requests in 2014 are draft submissions

A27.22 The Figure illustrates a falling trend in the number of requests over time, with a sharp decline in more recent years. The highest number of requests was submitted in 2006 with a value of 38 SoRs, then dropped to 11 SoRs in 2012 and reached its lowest value in 2014 (5 requests, 4 of which are draft submissions).[1027]

A27.23 Second, we have compared the number of requests raised by different groups. These are BT Group companies (BTW, BTGS, BTR), other CPs,[1028] Openreach and OTA.[1029] We recognise that there is no clear dividing line between the requests raised by different parties. Requests are often raised by the nominating CP (including Openreach, BT Group companies as well as other CPs) on behalf of several CPs or even the whole industry. In addition, even though some SoRs can start from individual CPs in order to progress they need to have industry support, which means that they eventually become industry SoRs.

A27.24 Table A27.2 shows the number of SoR requests submitted by each customer group and its share out of the total SoR requests submitted to Openreach between 2006 and 2014.

[1026] We note that 4 out of the 188 requests are draft SoRs.

[1027] See paragraph A27.14 for the definition of draft submissions.

[1028] This includes UK Competitive Telecommunications Association (UKCTA)

[1029] We recognise that OTA submits SoRs on behalf of the industry.

Table A27.2: SoRs per customer Group (2006-2014)

	Number of SoRs	Share of Total SoRs
BT Group	107	57%
Other CPs	45	24%
Openreach	34	18%
OTA	2	1%
Total	188	100%

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8.

A27.25 Our analysis shows that 81% of the requests were submitted by CPs (including BT) compared to 18% by Openreach and only 1% by OTA. CP requests were predominantly made by BT Group. In particular, BT Group submitted 107 requests (57%) while other CPs, submitted 45 requests (24%), collectively.
[✂
✂]

Record for delivery

A27.26 We have looked at Openreach's record in delivering SoR requests in terms of the success rate and timescales for delivery. We present the results on average across all customers as well as the results for each customer group.

Success rate in delivering requests

A27.27 As explained in paragraph A27.14, an SoR request goes through various stages and can ultimately be delivered, cancelled or rejected. In our analysis, we have combined the early stages of the process where a decision has not been reached yet on whether to progress the SoR under a category named "under assessment".[1030] We present the results for the other stages and outcomes separately. In particular, these are whether an SoR is in development, delivered, cancelled, or rejected.

A27.28 Although we present the results for cancelled and rejected requests separately, we refer to them collectively as "unmet requests". As discussed earlier (see paragraph A27.15) some SoRs may have been cancelled by Openreach or the customer.[1031] This means that some of the unmet requests may have been no longer wanted (e.g. if they were cancelled because the proposing CP no longer wanted the change/or if a request was being processed by a different route).[1032] In other cases,

[1030] This includes SoRs categorized by Openreach as "DRAFT", "1st Response" and "Initial Offer (WD60)".

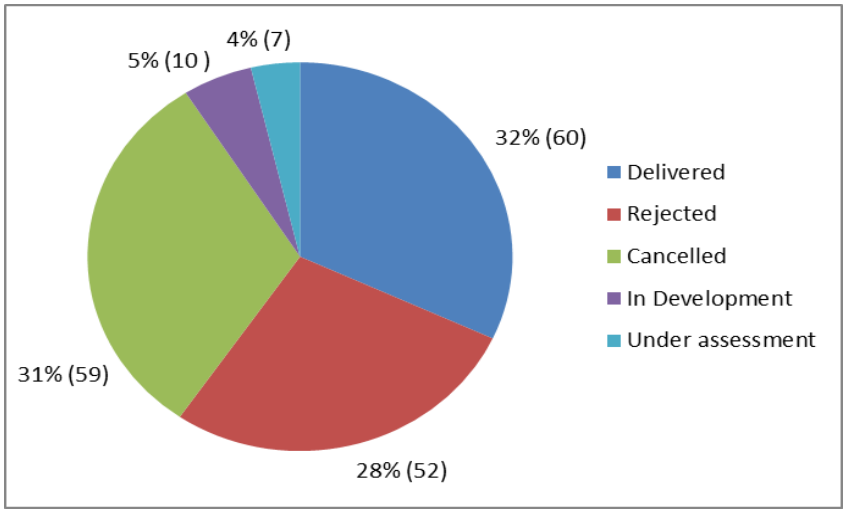
[1031] For example, as per the SoR dataset, some SoRs were cancelled by Openreach because they were not commercially viable. Other SoRs were cancelled because of "lack of clear commercial driver"

[1032] Part of the cancelled requests may not be considered as a failure by Openreach to meet customer requests. For example, as per the SoR dataset, some cancellations were due to the request being captured by another SoR or to be re-submitted after taking into consideration industry demands that were discussed at the Ethernet forum.

some requests may be cancelled when it is clear that there were insufficient volumes to cover the Openreach development costs. In such cases, it is less clear that the request was no longer wanted by the proposing CP.

A27.29 Figure A27.3 shows the number of SoR requests under each outcome and their share out of total SoR requests submitted between 2006 and 2014.

Figure A27.3: Number and share of SoR requests by outcome (2006-2014)



Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014.

A27.30 Our analysis shows that just below one third of the total SoR requests were delivered to the customers and around 5% of the requests are in development (60 SoRs and 10 SoRs, respectively). Around 60% of the requests were unmet either because they were rejected or cancelled. In particular, 28% of the requests were rejected and 31% were cancelled (52 SoRs and 59 SoRs, respectively). We note that 4% of the requests (7 SoRs) are still being assessed by Openreach and or the industry, where the outcome is still unknown.

A27.31 We have also looked at the outcomes across different customer groups. Results show that the success rate for Openreach is by far higher than average (65%). In addition, BT Group have a higher success rate compared to other CPs (27% and 18%, respectively). We note however that these results should be treated with caution. All SoRs are shared with all CPs via the agreed industry forum to enable collaborative work with all CPs interested in engagement on the requested changes. In some instances, e.g. with Synchronous Ethernet, the request may be proposed by BTW on behalf of a number of CPs, such that there may not be a clear dividing line between BT Group requests and those by other CPs. In addition, it may be the case that BT Group requests would be expected to have a higher success rate than those form other CPs. As mentioned earlier, Openreach usually rejects or cancels SoRs because they are not commercially viable (see paragraph A27.15). It is likely that BT Group, have greater demand volumes making the business case more likely to succeed during Openreach's assessment phase. CP requests, unless also wanted by BT Group, are inherently likely to have smaller demand, which will make the business case more difficult to justify.

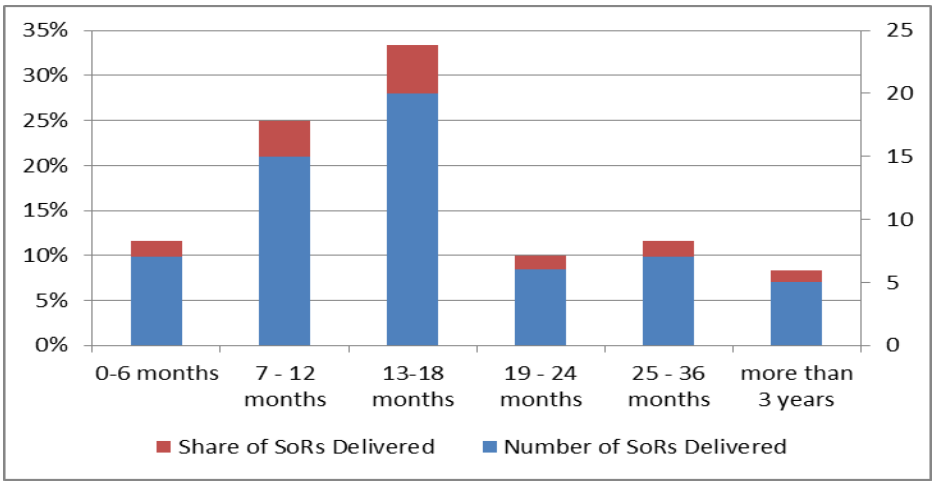
Timescale for delivery

A27.32 The speed of meeting a customer request is an important factor in shaping the scope for innovation under the SoR process. Therefore, we have looked at the time

taken by Openreach to deliver SoR requests. In addition, we have considered for how long some requests have been in development.

A27.33 For the 60 SoRs that were delivered between 2006-2014, we have calculated the time period between submitting a request and the launch date. This time includes Openreach collaboration with CPs via the agreed industry forum, and provision of further information by CPs to inform assessment of commercial benefits deriving from the required development. On average, it took Openreach around a year and half (17 months) from submission to delivery. However, there are significant variations across the various requests ranging from 1 month to 5 years. Figure A27.4 shows the number of requests delivered over different time intervals.

Figure A27.4: Time taken for SoRs to be delivered (2006-2014)



Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014.

A27.34 Results show that around 70% of the requests took up to 1.5 years to be delivered while 30% took a longer period. For the ones taking longer, 10% took up to 2 years, 12% took between 2-3 years and 8% took more than 3 years. Table A27.5 gives a list of the 10 fastest and 10 slowest requests that were delivered by Openreach.

Table A27.5: List of 10 fastest and slowest SoR requests (2006-2014)

	SOR	Year	SOR-Title	Customer	Time to Deliver (months)
10 Fastest SoR requests	[✂]	[✂]	Performance Report on Ethernet Early Life Failures (ELF) Specific to Virgin	[✂]	1
	[✂]	[✂]	EBD compliance to CESG IL2 security standards	[✂]	1
	[✂]	[✂]	Cable plug in for 10G circuits	[✂]	4
	[✂]	[✂]	Exchange connectivity	[✂]	4
	[✂]	[✂]	Monthly performance measures for WES/BES/WEES at CP level	[✂]	5
	[✂]	[✂]	EBD Vertical patch panel connectivity standards	[✂]	5
	[✂]	[✂]	eCo-Repair Site contact number Field Extension	[✂]	6
	[✂]	[✂]	Duct Connectivity to New Sites	[✂]	6
	[✂]	[✂]	Advanced Order Management Process - WES/WEES	[✂]	6
	[✂]	[✂]	Loopback on WES fulfilment	[✂]	7
10 Slowest SoR requests	[✂]	[✂]	Ciena 6500 OSEA Service	[✂]	30
	[✂]	[✂]	High Definition Video Interface 3G-SDI (1080P)	[✂]	31
	[✂]	[✂]	Broadcast Street Access Product	[✂]	32
	[✂]	[✂]	Exchange Closures and Openings: Impact on Current and Future Ethernet Products	[✂]	33
	[✂]	[✂]	Wavestream National OTU interface requirements for Optical Spectrum Services	[✂]	33
	[✂]	[✂]	Olympic Broadcast Services	[✂]	37
	[✂]	[✂]	Ethernet Dataset for Local Access Footprint	[✂]	42
	[✂]	[✂]	Optical Spectrum Access & Optical Spectrum Extended Access improved lead times	[✂]	42
	[✂]	[✂]	Optical Spectrum Services IBMC project	[✂]	43
	[✂]	[✂]	Externalising TILLBP	[✂]	65

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014.

A27.35 We have also considered whether timescales vary across different customer groups. Table A27.6 shows three statistics for the time duration taken to deliver SoR requests for each customer group. In particular, for each one it shows the average as well as the range for the time taken to deliver the customer's requests. Results do not seem to vary significantly across different customer groups and variations may possibly be explained by differences in the types and complexities of requests.

Table A27.6: Time taken for SoRs to be delivered by customer (2006-2014)

	Number of SoRs Delivered	Time to deliver (months)		
		Average	Min	Max
BT	29	14	4	37
Other CPs	8	15	1	29
Openreach	22	22	1	65
OTA	1	17	17	17
Total	60	17	1	65

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014

Timescales for requests in development

A27.36 For the 10 SoR requests in development, we have calculated the time period between submitting the SoR requests and the date of receiving the SoR dataset (11/11/2014). Table A27.7 gives a list of the current SoR requests in development and for how long they have been in development. Results show that 8 out of the 10 requests have been in development for over two years and the oldest one has been in development for 5 years. The other two requests have been in development for 9 months and just below two years.

Table A27.7: List of SoR requests in Development (2006-2014)

SoR	Year	SoR-Title	Customer	Time in development (months)
[✂]	[✂]	Five hour repair for Cablelink	[✂]	9
[✂]	[✂]	Customer Self Appointing	[✂]	22
[✂]	[✂]	ECC Dialogue Service	[✂]	30
[✂]	[✂]	Excess Construction Charges on the Equivalence Management Platform: band selection at KCI2	[✂]	34
[✂]	[✂]	OSA Enhancements	[✂]	37
[✂]	[✂]	Ethernet Strategic Transformation (EST) - Ethernet Access Direct Strategic Portal and B2B	[✂]	48
[✂]	[✂]	Synchronous Ethernet Capable EAD 100 & WES/EAD 10000	[✂]	48
[✂]	[✂]	Pro-actively Manage Order Issues to Prevent Delay	[✂]	48
[✂]	[✂]	Deemed Consent Reporting - Replacement for SOR6878	[✂]	56
[✂]	[✂]	Re-design EAD shelf management connectivity when located in BT exchanges.	[✂]	60

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014

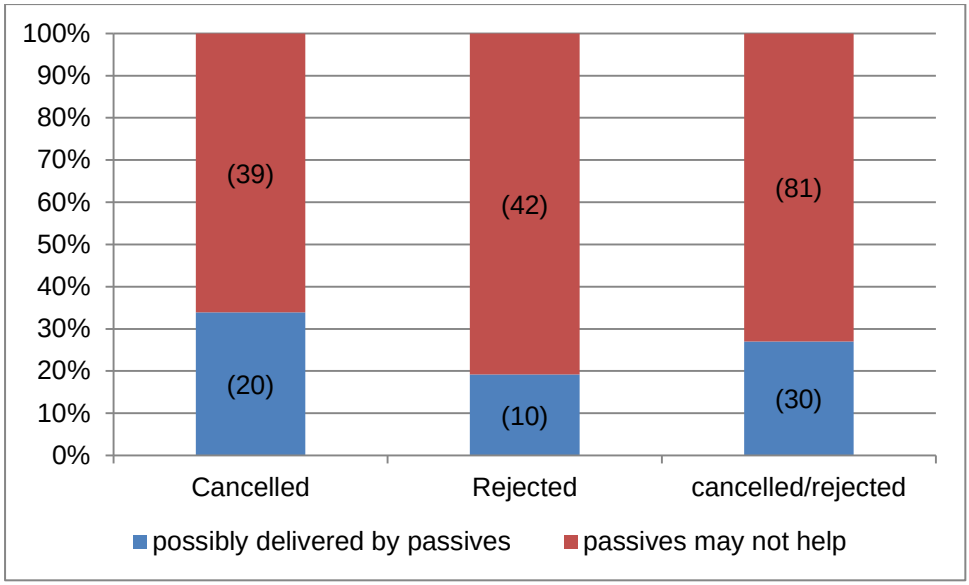
Potential Impact of passive remedies

A27.37 We have considered the potential impact of passive remedies on meeting customer requests. First, we have looked at unmet requests to consider whether some of them could have possibly been delivered by passive remedies. Second, we have looked at the SoRs in development to consider whether CPs may have been able to deliver these requests if they had access to passive remedies.

Potential for more innovation

A27.38 As shown by Figure A27.8, we consider that passive remedies could have possibly helped to deliver 27% of SoR requests that were unmet by Openreach between 2006 and 2014 (30 SoRs).[1033] In particular, passive remedies may help to deliver the changes requested in 20 cancelled SoRs and 10 rejected SoRs. These represent 34% of the cancelled requests and 19% of the rejected requests, respectively. In addition, our analysis shows that three additional unmet requests were effectively for a dark fibre product.[1034]

Figure A27.8: Numbers and shares of unmet SoRs possibly delivered by passives (2006-2014)



Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014

A27.39 Table A27.9 provides a list of the 30 SoR requests that we consider may have been delivered by passives. For each request, it shows the year it was submitted, whether it was cancelled or rejected, the customer name, and a description of the SoR.

[1033] These represent 16% of the total number of requests submitted to Openreach during the same period.

[1034] SoRs number [✂ ✂]

Table A27.9: Potential Impact of passive remedies on unmet SoR requests (2006-2014)

Year	State	Customer	SoR	Title
New service features or functions				
[✂]	Cancelled	[✂]	[✂]	Loop-back on WES circuit as part of co-op request on assurance
[✂]	Cancelled	[✂]	[✂]	Loop-back on downstream Ethernet product as part of co-op request on assurance
[✂]	Cancelled	[✂]	[✂]	BNS (BSC STM-4 site) resilience options
[✂]	Cancelled	[✂]	[✂]	Launch of 10G WES LA
[✂]	Cancelled	[✂]	[✂]	BNS enhanced resilience option - access links
[✂]	Rejected	[✂]	[✂]	Changes to the broadcast access product
[✂]	Cancelled	[✂]	[✂]	Synchronous WES/backhaul
[✂]	Cancelled	[✂]	[✂]	FSP3000 R7 NTE enhanced services
[✂]	Cancelled	[✂]	[✂]	Single channel digital CCTV transmission service
[✂]	Cancelled	[✂]	[✂]	Connectivity solution at BT nodes
[✂]	Cancelled	[✂]	[✂]	WES diagnostic request
[✂]	Cancelled	[✂]	[✂]	R02 product enhancement
[✂]	Cancelled	[✂]	[✂]	Ethernet OAM requirements
[✂]	Cancelled	[✂]	[✂]	Additional interfaces for the OSA Ciena product
[✂]	Cancelled	[✂]	[✂]	In-Band standards based Ethernet NID Access
[✂]	Cancelled	[✂]	[✂]	IEEE1588v2 on Adva NTEs
[✂]	Rejected	[✂]	[✂]	Facility looping capability
[✂]	Rejected	[✂]	[✂]	Sync timing source in colocate space
Product improvements reducing cost, space and power				
[✂]	Cancelled	[✂]	[✂]	Collection hub
[✂]	Cancelled	[✂]	[✂]	EAD multi-CP aggregation service
[✂]	Rejected	[✂]	[✂]	Upgrade Ethernet aggregation phase 1
[✂]	Rejected	[✂]	[✂]	Interim aggregated local handoff of EAD LA
[✂]	Rejected	[✂]	[✂]	Aggregation Phase 1 backhaul
[✂]	Rejected	[✂]	[✂]	High density handover for EAD + enhanced OAM features
Extending network connectivity				
[✂]	Cancelled	[✂]	[✂]	Fibre connectivity to/from BTW 21C fibre MSANs

[✂]	Rejected	[✂]	[✂]	Street Access
[✂]	Rejected	[✂]	[✂]	Street furniture to local exchange backhaul product
[✂]	Cancelled	[✂]	[✂]	Street furniture to local exchange backhaul product
[✂]	Rejected	[✂]	[✂]	Extension of Ethernet access products back to aggregation points or TAN
Service upgrade				
[✂]	Cancelled	[✂]	[✂]	PPC and RBS transfer to connectivity services Ethernet product

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q. A8 on 11/11/2014

A27.40 In each of the above cases we consider that a passive remedy would enable a CP to meet all or much of the need of the SoR with varying degrees of benefit. The majority of cases relate to requests that were raised by Openreach or BT group. Our analysis shows that passive remedies may have been able to deliver:

27.40.1 **18 requests[1035] for new service features or functions**: These active service enhancements support the interactions between the CP's connected equipment. They are related to (i) the operation of the CP's network (e.g. timing and synchronization); (ii) increasing capacity; or (iii) enhancing the ability of the CP to monitor the integrity and performance of their network. The CPs using passive remedies can introduce these changes themselves and would not have to wait for the enhancements to the Openreach's active equipment or adopt potentially cumbersome and costly alternative connectivity solutions.[1036]

27.40.2 **6 requests[1037] for product improvements yielding cost, space and power reduction**: These aggregation requests are aimed at reducing the number of interfaces between Openreach and CP equipment or reducing the amount of equipment involved in delivering a service thereby reducing cost, space occupied and power consumed. Passive remedies would allow CPs to achieve the aggregation objectives.

27.40.3 **5 requests[1038] for extending network connectivity to new types of location**: Passive remedies would only facilitate connections to new types of location as identified in these requests if the remedy can be accessed at these new location types. However, further service improvement would not need the cooperation of Openreach and its equipment suppliers.

[1035] [✂ ✂]

[1036] The natural transparency of passive remedies (i.e. no blockage in the dark fibre connecting CP equipment) inherently supports these interactions, whereas the active equipment providing the active service requires modification or replacement.

[1037] [✂ ✂]

[1038] [✂ ✂]

27.40.4 **One request[1039] for service upgrade**: The service upgrade SoR would not be helped by a passive remedy; however future upgrade requirements, where a passive remedy had been used, would not require Openreach to be involved.

A27.41 We consider that all of the requests could be met by a dark fibre or a duct access remedy. For new service features, a dark fibre remedy is sufficient as these relate mainly to the choice and configuration of the network equipment. Indeed, for such requests, a dark fibre remedy is likely to be more efficient than a duct remedy because only one or two fibres are required.[1040] The requests for new network connectivity might, in some cases, be better met by a duct/sub-duct passive remedy (See Annex 23 on benefits of passives, paragraph 104). However, technical solutions such as CWDM or GPON can enable a dark fibre remedy to provide similar benefits to a duct/sub-duct remedy.[1041]

SoRs in Development

A27.42 Regarding the SoRs in development, we consider that the introduction of passive remedies has a potential positive impact on 3 out of the 10 SoR requests in development.[1042] We present our detailed views in Table A27.10. For each SoR, the table shows the year, customer name, and the title of the SoR.

Table A27.10: Potential impact of passive remedies on SoR requests in development (2006-2014)

Year	Customer	SoR	Title
[✂]	[✂]	[✂]	Re-design EAD shelf management connectivity when located in BT exchanges.
[✂]	[✂]	[✂]	Synchronous Ethernet Capable EAD 100 & WES/EAD 10000
[✂]	[✂]	[✂]	OSA Enhancements

Source: Ofcom analysis based on Openreach data submitted in response to s.135, Q.A8 on 11/11/2014

A27.43 For the first request **[✂ ✂]** , if CPs get access to a passive remedy they would no longer require a re-design of the EAD shelf management, which has been in development for 5 years. When Openreach provides the active component of a service they need to manage it. **[✂ ✂]** has requested changes to

[1039] [✂]

[1040] In a duct remedy the CP leases a sub duct and installs its own cable. A sub duct can hold many optical fibres (tens to hundreds). If only a couple of optical fibres are required then a sub-duct remedy results in space being taken that could hold many more fibres making it an inefficient use of physical infrastructure.

[1041] A sub-duct allows the user to deploy many optical fibres and so serve multiple customers. One alternative is to use two fibres with multiple wavelengths to serve multiple customers (WDM) or use a much higher speed customer and share the bandwidth between multiple customers (GPON).

[1042] Passive remedies will have no impact on the other requests as 6 of them are related to order processing and one is a repair request.

the management of this connectivity. A passive remedy removes the active elements from Openreach's control and thus removes the need for them to manage it.

A27.44 The other two SoRs [✂ ✂] are for additional functionality on the equipment. CPs can use this to provide a more responsive service to their customers. Dark fibre and duct access would be equally able to deliver those requests.

Innovation on other networks

A27.45 In theory, the use of passive remedies would give CPs greater flexibility to replicate some of the applications currently provided through their own end-to-end infrastructure. Therefore, considering what CPs do on their own networks today provides one indication of the potential innovations we might see from passive remedies. In this section of the Annex we review examples provided by CPs of technologies, service features and network architectures that are used on their own networks (on-net) or could be used if passive remedies were made available.

A27.46 Table A27.11 below sets out some examples of applications currently provided by CPs with their own network infrastructure, which they would be able to deploy more widely using passive remedies. This list is not exhaustive, but instead seeks to combine those examples provided by respondents to the March 2014 CFI and the November 2014 preliminary consultation. For example, the list may not include all recent developments (e.g. Synchronous Ethernet deployed by Virgin) and we recognise that there may be other future developments that we may not be currently aware of.

Table A27.11: Examples of innovation/applications used by CPs on-net

Type	Operator	Description
Technology or service feature	[✂]	[✂ ✂][1043]

[1043] See [✂ ✂].

Network architecture	**[✂]**	[✂ CONFIDENTIAL CONFIDENT ✂][1044]
Technology or service feature	**Vodafone**	**Ethernet NID service monitoring and fault diagnosis functionality** Vodafone has suggested that it could more widely roll out improved service monitoring and fault diagnosis capabilities by using network terminating equipment that supports Ethernet NID global industry standards. Vodafone claims that this would have benefits for service monitoring and repair – allowing the interrogation of devices via the traffic stream to report on errors, command test capabilities such as loopbacks and test patterns.[1045]
Technology or service feature		**Proactive fault management** Vodafone noted that Openreach turned down its request for access to the service monitoring functionality of Openreach's Ethernet services. With a dark fibre remedy it would install its own equipment and would therefore have access to the service monitoring functionality, allowing it to carry out proactive fault management and repair.[1046]
Technology or service feature	**Warwick** **Net**	**Use of dark fibre** WarwickNet already consume dark fibre and argue it enables them to implement a number of features not possible with active remedies.[1047] These include scaling capacity, removing dependence on provider equipment and improved fault identification.
Network architecture	**[✂]**	[✂ CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL ✂][1048]

[1044] See [✂ ✂].

[1045] See Frontier non-confidential report for Vodafone in response to the CFI, page17.

[1046] See Vodafone, non-confidential response to the CFI, page 21.

[1047] See WarwickNet, non-confidential response to the November Consultation, page 2.

[1048] See [✂ ✂]

Network architecture	**GTC**	**FTTP-GPON technology** GTC would be able to accelerate the adoption of PON technologies. This offers cost advantages over point-to-point fibre networks by passively combining traffic from a number of subscribers onto a single fibre. A GPON head end collocated in a BT exchange can serve many new housing developments via a passive optical splitter in the footway box next to each development. GTC mainly serve new residential developments but also smaller businesses.[1049]
Network architecture	**[✂]**	[✂CONFIDENTIAL ✂] [1050]

Source: Ofcom analysis

Some respondents provided examples of innovation/applications they would use if they had access to passive remedies

A27.47 Respondents also highlighted features which they do not use currently on their own networks, but they would implement if they had the scope to install their own electronics and/or fibre using passive remedies. The examples listed in Table A27.12 below are mainly from respondents who do not have their own end-to-end infrastructure, but cited different approaches they would use with passives.

Table A27.12: Examples of innovation/applications CPs claim they would be able to deploy using passive remedies

Type	Operator	Description
Technology or service feature	**[✂]**	[✂CONFIDENTIAL CONFIDENTIAL

[1049] See GTC, non-confidential response to the November Consultation, pages 8, 19.

[1050] See [✂ ✂].

		CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL ✂][1051]
Technology or service feature	[✂]	[✂ CONFIDENTIAL ✂][1052]
Technology or service feature	**Six Degrees Group**	**Circuit upgrades** Six Degrees Group state that dark fibre would give CPs more flexibility over circuit bearer upgrades (i.e. to increase circuit bandwidth), rather than requiring co-ordination with Openreach. This would provide the potential for more flexible bandwidth products.[1053]
Technology or service feature	**Six Degrees Group**	**Handover** Six Degrees Group argues that currently multiple devices are often used at both ends of an active service, which could be replaced by a single device. This could save power and pace, lead to easier provisioning and monitoring and reduce points of failure in the network. [1054]
Technology or service feature	**Sky**	**Network termination equipment** Sky argues that as Openreach mandates its own network termination equipment (NTE) on its active products, CPs cannot access the full capacity of the underlying fibres. They would invest in their own NTEs to manage capacity optimally, lower costs and improve quality of service.[1055]

[1051] See [✂ ✂]

[1052] See [✂ ✂]

[1053] See Six Degrees Group, non-confidential response to the November Consultation, page 4.

[1054] See Six Degrees Group, non-confidential response to the November Consultation, page 4.

[1055] See Sky, non-confidential response to the November Consultation, page 2.

Technology or service feature	**[✂]**	[✂CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL CONFIDENTIAL ✂][1056]
Network architecture	**Sky**	**Optimised network architectures** Sky said that Openreach's active products have restrictions (such as arbitrary "hop count" and circuit distance rules). This means CPs are unable to implement network architectures optimised for resilience, cost and bandwidth efficiency and video content distribution.[1057]

Source: Ofcom analysis

Overall, there are a range of examples of different applications that are used on-net or would be used if passive remedies were made available

A27.48 It appears that currently there is not one major technology or application which is uniformly used by CPs across their networks, but not provided by BT. Instead we can see a range of different examples, reflecting the variation in approach to technology choices and deployment options taken by CPs. Although most of them can be technically deployed by active products, they are not currently provided by Openreach. In line with the results of the SoR analysis above, this suggests that under passive remedies CPs will have more flexibility to deploy their choice of technologies and network feature.

A27.49 In addition, where CPs do take a different approach when providing services over their own networks, most of the examples listed above relate to the active or electronics layer rather than the physical infrastructure itself. Overall this would suggest that significant opportunities for innovation are likely to reside in the electronic equipment associated with leased lines services and could be delivered by either dark fibre or duct access. We note that some additional benefits may be realised by duct access for the network architecture examples.[1058]

A27.50 This is consistent with the findings of our analysis of the unmet SoR requests which could have been delivered through passive remedies (see paragraphs A27.38 - A27.41). Here most of the requests could be met equally by a dark fibre or duct access remedy. For new service features, a dark fibre remedy was found to be sufficient as service features relate mainly to choice and configuration of the network equipment.

[1056] [✂ ✂]

[1057] See Sky, non-confidential response to the November Consultation, page 2.

[1058] Our view is presented in Annex 23 on the benefits of passive remedies.

A27.51 Taken together, the examples suggest two broad areas where innovation is occurring on-net and could occur using passive remedies:

- **Technologies and service features**: Dark fibre as well as duct access would provide CPs with greater flexibility to make technology choices independent of BT. CPs would select their own network equipment and would therefore have full control over the specification of the equipment and the services and (service) features offered to end customers. They would also have full control of the operations and maintenance capabilities that support network monitoring, service assurance, fault diagnosis and service configuration features of services.

- **Network architecture**: Duct access would allow CPs to develop alternative access network architectures that would for example: provide greater resilience at customer premises for example though the use of ring architectures or diversified routing; allow greater flexibility to adopt alternative network architectures such as Passive Optical Networks (PONs); and greater flexibility to deploy ultra-low latency connections that require optimisation of cable routing. Duct access would provide the greatest scope to realise the network architecture related benefits because CPs would deploy their own access networks in BT's ducts. A dark fibre remedy would provide less scope to realise these benefits as CPs would be constrained to some extent by the architecture of BT's fibre access network.

Annex 28

Glossary

21st Century Network (21CN)	BT's next generation network upgrade.
Accumulated (CCA) depreciation	Totality of deductions made to the original purchase price of a tangible fixed asset to reflect its cumulative consumption since acquisition.
Accumulated (HCA) depreciation	Totality of deductions made to the gross replacement cost of a tangible fixed asset to reflect its cumulative consumption since acquisition.
Alternative Interface (AI)	Leased line services typically using an Ethernet interface.
Alternative interface symmetric broadband origination (AISBO)	Leased line terminating segment typically using an Ethernet interface.
Anchor pricing	An approach that sets the upper bound for charges of existing services by reference to the cost of providing those services using existing technology. This ensures that the introduction of new technology which is intended to provide a greater range of services does not inappropriately lead to an increase in the cost of the existing services.
Asset Volume Elasticity (AVE)	The percentage increase in capital costs required for a 1% increase in volume.
Asymmetric Digital Subscriber Line (ADSL)	A variant of DSL that supports higher bandwidth on downlink transmissions, i.e. from the exchange to the end user than from the end user to the exchange.
Asynchronous Transfer Mode (ATM)	A network technology that uses asynchronous time division multiplexing techniques and which supports data transmissions at up to 622Mbit/s.

Backhaul	Connections between access nodes and core nodes.
Backhaul Ethernet Services (BES)	A BT wholesale Ethernet service providing high bandwidth inter-exchange connectivity.
Bandwidth	In digital telecommunications systems, the rate measured in bits per second (bit/s), at which information can be transferred.
Base-station Controller (BSC)	An element of a mobile telephone network that controls a number of Radio Base Stations.
Bearer	A transmission link that carries one or more multiplexed smaller-capacity connections.
Bulk Transport Link (BTL)	A BT wholesale Ethernet interconnection product providing high bandwidth, point-to-point connections between an Openreach Handover Point (OHP) to a Communications Provider's site.
Business Connectivity Market Review (BCMR)	This market review.
Call for Input (the CFI)	The document issued by Ofcom at the start of this review seeking initial stakeholder input.
Capital expenditure	Spending on assets that have physical substance and are held for use in the production or supply of goods or services, for rental to others, or for administrative purposes on a continuing basis in an entity's activities.
Central and East London Area (CELA)	The geographic market covering central and east London as defined by Ofcom in the 2007/8 Review.
Co-location	The provision of space and associated facilities at a BT exchange for CP equipment.
Communications Provider (CP)	An organisation that provides electronic communications services.
Compound Annual	The year-on-year smoothed annualised growth rate of an

Growth Rate (CAGR)	investment. It can be calculated as follows: CAGR = $(\frac{\text{Ending Value}}{\text{Beginning Value}})^{(\frac{1}{\text{number of years}})}$-1
Consumer price index (CPI)	The consumer price index (CPI) is a measure of inflation. It measures changes in the price level of consumer goods and services purchased by households. The most significant item excluded in the CPI, but included in the RPI, is mortgage interest rate payments.
Cost Volume Elasticity (CVE)	The percentage increase in operating costs for a 1% increase in volume.
Cost Volume Relationship (CVR)	The relationship of how cost and volumes move in relation to one another.
Current Cost Accounting (CCA)	An accounting convention, where assets are valued and depreciated according to their current replacement cost whilst maintaining the operating or financial capital of the business entity.
Customer Premises Equipment (CPE)	Sometimes referred to as customer apparatus or consumer equipment, being equipment on consumers' premises which is not part of the public telecommunications network and which is directly or indirectly attached to it.
Customer Sited Handover (CSH)	An interconnection between BT and another communications provider where the BT handover circuit terminates at the communications provider's premises.
Data Over Cable Service Interface Specification (DOCSIS)	A telecommunications standard that enables cable TV networks to support broadband internet access services.
Digital Private Circuit Network (DPCN)	A BT network that is used to provide very low bandwidth TI leased lines services (services at bandwidths below 2Mbit/s)
Digital Subscriber Line (DSL)	A family of technologies generically referred to as DSL or xDSL that enable the transmission of broadband signals over ordinary copper telephone lines. ADSL (Asymmetric Digital Subscriber Line), HDSL (High bit rate Digital Subscriber Line) and VDSL

	(Very high data rate Digital Subscriber Line) are all variants of xDSL.
Distributed long run incremental cost (DLRIC)	The LRIC of the individual service with a share of costs which are common to other services over BT‘s core network.
Distributed stand alone cost (DSAC)	An accounting approach estimated by adding to the DLRIC a proportionate share of the inter-increment common costs. Rather than all common costs shared by a service being allocated to the service under consideration, the common costs are instead allocated amongst all the services that share the network increment.
Equi-proportional Mark-Up (EPMU)	The application of the same percentage mark-up to the incremental costs of two or more services.
Equivalence of Input (EOI)	A remedy designed to prevent a vertically-integrated company from discriminating between its competitors and its own business in providing upstream inputs. This requires BT to provide the same wholesale products to all CPs including BT’s own downstream division on the same timescales, terms and conditions (including price and service levels) by means of the same systems and processes, and includes the provision to all CPs (including BT) of the same commercial information about such products, services, systems and processes.
Ethernet	A packet-based technology originally developed for and still widely used in Local Area Networks. Ethernet networking protocols are defined in IEEE 802.3 and published by the Institute of Electrical and Electronic Engineers. Developments of this technology known as Metro Ethernet or Carrier Ethernet are now being used in communications providers’ networks to provide leased line and backhaul services.
Ethernet Access Direct (EAD)	A BT wholesale Ethernet product offered by Openreach providing high bandwidth, point-to-point connections.
Ethernet Backhaul Direct (EBD)	A BT wholesale Ethernet backhaul product providing high bandwidth, inter-exchange connectivity between designated BT exchanges.

Ethernet in the First Mile (EFM)	A network technology for the delivery of Ethernet services over access networks. Although the technology also encompasses fibre access networks, in common usage, EFM refers to the provision of Ethernet services over copper access networks.
Excess Construction Charges (ECC)	A charge levied by BT where additional construction of duct and fibre or copper is required to provide service to a customer premise.
Fibre Channel	Standardised storage area network protocol operating at bandwidths between 1Gbit/s and 16Gbit/s
Fibre-to–the-Cabinet (FTTC)	An access network structure in which the optical fibre extends from the exchange to the street cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.
Fibre-to-the-Premises (FTTP)	An access network structure in which the optical fibre network runs from the local exchange to the end user's house or business premise. The optical fibre may be point-to-point – there is one dedicated fibre connection for each home – or may use a shared infrastructure such as a GPON. Sometimes also referred to as Fibre To The Home (FTTH).
FICON	IBM specific SAN protocol based on Fibre Channel operating at bandwidths of 1, 2, 4 or 8Gbit/s
Financial capability maintenance (FCM)	The maintenance of an entity's financial capability (i.e. the amount of the shareholders' equity interest) when determining the profitability of an entity.
Frame Relay	A packet-based network technology, typically used to interconnect Local Area Networks.
Fully allocated cost (FAC)	An accounting approach under which all the costs of the company are distributed between its various products and services. The fully allocated cost of a product or service may therefore include some common costs that are not directly attributable to the service.

Gbit/s	Gigabits per second (1 Gigabit = 1,000,000,000 bits) A measure of bandwidth in a digital system.
General Building Cost Index (GBCI)	A national index that measures the costs of construction work including materials and labour.
Gigabit Passive Optical Network (GPON)	A shared fibre network architecture that can be used for NGA.
Gross Replacement Cost (GRC)	The cost of replacing an existing tangible fixed asset with an identical or substantially similar new asset having a similar production or service capacity.
HCA (historical cost accounting) depreciation	The measure of the cost in terms of its original purchase price of the economic benefits of tangible fixed assets that have been consumed during a period. Consumption includes the wearing out, using up or other reduction in the useful economic life of a tangible fixed asset whether arising from use, effluxion of time or obsolescence through either changes in technology or demand for the goods and services produced by the asset.
Hull Area	The area defined as the 'Licensed Area' in the licence granted on 30 November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and Kingston Communications (Hull) plc.
In Building Handover (IBH)	An interconnection between BT and another communications providers' network where the handover takes place at collocation space rented by a CP in a BT local exchange.
In Span Handover (ISH)	An interconnection between BT and another communications provider where the BT handover circuit terminates at a point between BT's premises and the communications provider's premises.
Internet Protocol (IP)	A network technology used in packet-switched networks to route packets across network nodes.
Internet Service Provider (ISP)	An organisation that provides internet access services

ISDN	A digital telephone service that supports telephone and switched data services.
ISDN30	A digital multiline telephone service conforming to the ISDN Primary Rate Access standard as defined by the ITU.
Jitter	A measure of the variation of delay in transmission over a transmission path.
June 2015 LLCC Consultation	The forthcoming consultation on charge controls for leased lines services.
kbit/s	Kilobits per second (1 kilobit = 1,000 bits) A measure of bandwidth in a digital system.
Latency	A measure of delay in transmission over a transmission path.
Leased line	A permanently connected communications link between two premises dedicated to the customers' exclusive use.
LLCC 2009	The statement published in 2009 implementing charge controls in wholesale leased lines markets. See Annex 16 for links to this document.
Local Area Network (LAN)	A network typically linking a number of computers together within a business premise, enabling intercommunication between users and access to email, internet and intranet applications.
Local loop	The access network connection between the customer's premises and the local serving exchange, usually comprised of two copper wires twisted together.
Local Loop Unbundling (LLU)	A process by which a dominant provider's local loops are physically disconnected from its network and connected to competing provider's networks. This enables operators other than the incumbent to use the local loop to provide services directly to customers.
Local Loop Unbundling	A circuit provided by BT that enables the connection of a

(LLU) backhaul circuit	communications provider's DSLAM to a communications provider's point of connection with BT's SDH network.
Local Serving Exchange (LSE)	A building at which local loops are terminated and which also houses telecommunications network and switching equipment.
Long Run Incremental Cost (LRIC)	The cost caused by the provision of a defined increment of output given that costs can, if necessary, be varied and that some level of output is already produced.
Main Distribution Frame (MDF)	A wiring flexibility frame where copper local loops are terminated.
Mbit/s	Megabits per second (1 Megabit = 1 million bits). A measure of bandwidth in a digital system.
MDF Site	A BT operational building containing an MDF. Also referred to as a Local Serving Exchange
Mean capital employed (MCE)	The mean value of the assets that contribute to a company's ability to generate revenues.
Mobile switching Centre (MSC)	A component of a mobile telephone network that switches voice calls between mobile users
Modern equivalent asset (MEA)	The approach to set charges by basing costs and asset values on what is believed to be the most efficient available technology that performs the same function as the current technology.
Multi Protocol Label Switching (MPLS)	A packet-based network technology that uses label switching techniques in order to prioritise the routing of packets between network nodes. MPLS is commonly deployed in VPN and NGN core applications.
Multi Service Access Node (MSAN)	A network access device associated with an IP-based networks that provides network interfaces for telephony, broadband and other services. MSANs are typically installed in a telephone exchange or a roadside cabinet.
Multiple Interface (MI)	Leased line services with bandwidths greater than 1Gbits/s and

leased lines	leased lines services of any bandwidth delivered using WDM equipment at the customer's premises.
Multiple Interface Symmetric Broadband Origination (MISBO)	Leased line terminating segments supporting high bandwidth services –either an Ethernet interface with bandwidths greater than 1Gbit/s or services of any bandwidth/interface delivered using WDM equipment at the customer's premises.
Net current assets (NCA)	Total current assets less current liabilities.
Net replacement cost (NRC)	Gross replacement cost less accumulated depreciation based on gross replacement cost. An alternative is Depreciated replacement cost (of tangible fixed assets other than property:- The cost of replacing an existing tangible fixed asset with an identical or substantially similar new asset having a similar production or service capacity, from which appropriate deductions are made to reflect the value attributable to the remaining portion of the total useful economic life of the asset and the residual value at the end of the asset's useful economic life.
Next generation access (NGA)	A new or upgraded access network capable of supporting much high capacity broadband services than traditional copper access networks. Generally an access network that employs optical fibre cable in whole or in part.
Next Generation Network (NGN)	An IP based multi-service network capable of providing voice telephony, broadband and other services.
Openreach Network Backhaul Services (ONBS)	A BT wholesale Ethernet backhaul service providing high bandwidth inter-exchange connectivity.
Operating capability maintenance (OCM depreciation)	The maintenance of an entity's operational capability (i.e. the capacity to produce goods and services) when determining the profitability of an entity. OCM depreciation is calculated as the sum of CCA depreciation and HCA depreciation.
Operating expenditure	Costs reflected in the profit and loss account excluding

	depreciation financing costs such as interest charges.
Optical Spectrum Access (OSA)	A BT wholesale WDM service.
Optical Spectrum Extended Access (OSEA)	A BT wholesale WDM services supporting longer circuits than OSA.
Other Communications Providers (OCPs)	A communications provider other than BT.
Partial Private Circuit (PPC)	A generic term used to describe a category of private circuits that terminate at a Point of Connection between two communications providers' networks. It is therefore the provision of transparent transmission capacity between a customer's premises and a point of connection between the two communications providers' networks.
Passive Infrastructure Access (PIA)	A remedy requiring BT to provide CPs with access to its passive access network infrastructure (i.e. ducts and poles).
Passive Optical Network (PON)	A point to multipoint fibre-optic network architecture that uses passive optical splitters
Plesiochronous Digital Hierarchy (PDH)	An older digital transmission technology that uses Time Division Multiplexing. Although PDH systems are is still in widespread use, they are being replaced by SDH and increasingly Ethernet services.
Point of Handover (POH)	A point where one communications provider interconnects with another communications provider for the purposes of connecting their networks to 3rd party customers in order to provide services to those end customers.
Point of Presence (POP)	A node in a CPs network (such as an exchange or other operational building), generally one used to serve customers in a particular locality.
Points of Connection	A point where one communications provider interconnects with

(POC)	another communications provider for the purposes of connecting their networks to 3rd party customers in order to provide services to those end customers.
Public Switched Telephone Network (PSTN)	A telecommunications network that uses circuit switched technology to provide voice telephony services.
Radio Base Station (RBS) backhaul circuit	A circuit provided by BT that connects a mobile communications provider's base-station to a mobile communications provider's mobile switching centre.
RAV model	This model calculates the forecast asset values, depreciation and holding gains for Access Copper and Duct. The model also applies a regulatory adjustment (RAV adjustment) previously applied by Ofcom.
Regulatory asset value (RAV)	The value ascribed by Ofcom to an asset or capital employed in the relevant licensed business.
Regulatory financial statements (RFS)	The financial statements that BT is required by Ofcom to prepare, have audited and publish
Retail price index (RPI)	A measure of inflation published monthly by the Office for National Statistics. It measures the change in the cost of a basket of retail goods and services.
Return on capital employed (ROCE)	The ratio of accounting profit to capital employed. The measure of capital employed can be either Historic Cost Accounting (HCA) or Current Cost Accounting (CCA).
Service Level Agreement (SLA)	A contract between a network service provider and a customer that specifies, usually in measurable terms, what services the network service provider will furnish.
Service Level Guarantee (SLG)	A contractual agreement specifying the compensation payable if the service provider fails to deliver the agreed service performance.
SSNIP	Small but Significant Non-transitory Increase in Price, usually considered to be 5 to 10 per cent, which is part of the

	hypothetical monopolist test used in market definition analysis.
Stand Alone Cost (SAC)	An accounting approach under which the total cost incurred in providing a product is allocated to that product.
Storage Area Network (SAN)	A network dedicated to data storage. SAN protocols include additional checking of transmitted data integrity and can be distance limited.
Supplementary depreciation	The additional depreciation charge to convert an HCA depreciation charge into a CCA depreciation charge.
Symmetric broadband origination (SBO)	A symmetric broadband origination service provides symmetric capacity from a customer's premises to an appropriate point of aggregation, generally referred to as a node, in the network hierarchy. In this context, a "customer" refers to any public electronic communications network provider or end-user.
Symmetric Digital Subscriber Line (SDSL)	A DSL variant that allows broadband signals to be transmitted at the same rate from end user to exchange as from exchange to end user.
Synchronous Digital Hierarchy (SDH)	A digital transmission standard that is widely used in communications networks and for leased lines.
The 2007/8 Review	Ofcom's review of retail and wholesale leased lines markets, concluded in 2008
The Act	The Communications Act 2003.
The LLCC Consultation	The forthcoming consultation on charge controls for leased lines services, forming part of this market review.
The November 2014 BCMR Passives Consultation	The November 2014 consultation forming part of this market review.
Tier 1	A tier in BT's SDH network that denotes a network of nodes covering areas of high population. These nodes are connected by very high capacity line systems and denote the BT trunk

	network.
Time Division Multiplexing (TDM)	A method of combining multiple data streams for transmission over a shared channel by means of time-sharing. The multiplexor shares the channel by repeatedly allowing each data stream in turn to transmit data for a short period. PDH and SDH are examples of systems that employ TDM.
Traditional Interface (TI) Leased Lines	Leased lines services with an ITU G.703 Interface.
Traditional interface symmetric broadband origination (TISBO)	Leased line terminating segment with an ITU G.703 interface.
Virtual Private Network (VPN)	A technology allowing users to make inter-site connections over a public telecommunications network that is software partitioned to emulate the service offered by a physically distinct private network.
Voice over IP (VoIP)	A generic term used to describe telephony services provided over IP networks.
Wavelength Division Multiplex (WDM)	An optical frequency division multiplexing transmission technology that enables multiple high capacity circuits, to share an optical fibre pair by modulating each on a different optical wavelength.
Weighted average cost of capital (WACC)	The rate that a company is expected to pay on average to all its security holders to finance its assets.
Western, Eastern, Central and East London Area (WECLA)	The geographic market defined by Ofcom in the BCMR 2013.
Wholesale Broadband Access (WBA) Market	The wholesale market for fixed broadband services.
Wholesale end-to-end	A BT wholesale Ethernet product that can be used to provide a point-to-point connection between two customer's sites.

service (WEES)	
Wholesale Extension Service (WES)	A BT wholesale Ethernet product that can be used to link a customer premise to a node in a communications network.
Wholesale Line Rental (WLR)	A remedy that requires BT to rent telephone lines to CPs on a wholesale basis.
Wholesale Local Access (WLA) Market	The wholesale market for fixed telecommunications infrastructure, specifically the physical connection between end users' premises and a local exchange.
Wide Area Network (WAN)	A geographically dispersed telecommunications network, typically a corporate network linking multiple sites at different locations.

Annex 29

Equality Impact Analysis

Introduction

A29.1 Ofcom is required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality. Equality impact assessments (EIAs) also assist us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers regardless of their background or identity.

A29.2 Unless we otherwise state in this document, it is not apparent to us that the outcome of our review is likely to have any particular impact on race, disability and gender equality. Specifically, we do not envisage the impact of any outcome to be to the detriment of any group of society.

A29.3 Nor are we envisaging any need to carry out separate EIAs in relation to race or gender equality or equality schemes under the Northern Ireland and Disability Equality Schemes. This is because we anticipate that our regulatory intervention will affect all industry stakeholders equally and will not have a differential impact in relation to people of different gender or ethnicity, on consumers in Northern Ireland or on disabled consumers compared to consumers in general. Similarly, we are not envisaging making a distinction between consumers in different parts of the UK or between consumers with different levels of income. Again, we believe that our intervention will not have a particular effect on one group of consumers over another.

Equality impact assessment

A29.4 We have considered whether the remedies that we have proposed for the business connectivity markets would have an adverse impact on promoting equality. In particular we have considered whether the remedies would have a different or adverse effect on UK consumers and citizens with respect to: age, disability, gender reassignment, pregnancy and maternity, race, religion, sex and sexual orientation, and, in Northern Ireland, religious belief and dependants.

A29.5 The intention behind our approach to regulating the business connectivity markets is to impose a set of regulatory obligations on CPs with SMP that will promote competition by requiring them to provide other CPs with access to their networks on regulated terms, and to protect consumers by preventing abusive conduct such as over-charging.

A29.6 We do not have detailed sectoral information on the businesses that purchase wholesale business connectivity services or whether there is a correlation between the customers of their products or services and the defined equality groups. We also do not have information on any correlation between retail business connectivity services and the defined equality groups.

A29.7 However, we do not have any reason to suspect that there would be a correlation between the affected consumers and businesses and any of the above defined equality groups. We also do not find any reason to suspect that our proposals have the potential for negative impacts on members of the defined equality groups. On that basis we believed that it would be disproportionate to commission relevant research and have not done so.