BT's response to Ofcom's consultation document

"Business Connectivity Market Review Consultation on Data Analysis"

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Contents

1. Executive Summary

Business connectivity markets are diverse and complex, and this is reflected in the magnitude of the data collection task that Ofcom has undertaken in the Business Connectivity Market Review (BCMR). The consultation document shows the great efforts that Ofcom has taken to seek information from Communications Providers (CPs), to identify omissions in the information received and to devise methodologies for filling in these gaps through the use of uplifts and assumptions.

We appreciate these efforts, but at the same time we consider that the data produced by these methodologies is still characterised by omissions, errors and high levels of uncertainty. This really matters, as this data will form the basis for the next step in the BCMR, which will set the regulatory framework for business connectivity that will be in place until 2019. An incomplete or flawed dataset could lead to Ofcom drawing the wrong conclusions about market power and remedies.

The impact of these deficiencies will be especially pronounced in markets with low volumes where Ofcom's decisions will be affected by small differences in the data, for example markets for high bandwidth Ethernet and Optical services, which we believe are increasingly competitive.

This response sets out our detailed comments on Ofcom's data collection and analysis methodologies and our suggestions for improving the quality and integrity of the data used in the BCMR. The most significant points in the response may be summarised as follows:

- The definition of leased lines in the formal information requests issued to CPs does not capture all business connectivity services, so CPs may not report all the circuits that form part of the market. We suggest a 'topology-neutral' definition that should be used to collect data for the BCMR.

- The limitation of information requests to a number of large CPs will not give a true picture of competition for high bandwidth services, where small niche operators may be prominent players. Our response gives examples of such operators from which Ofcom should consider collecting data.

- Of the almost one million circuit records that Ofcom has collected, between 25% and 55% are missing key information such as postcode and bandwidth. Some of the assumptions and uplifts that Ofcom applies are simplistic, minimise the true level of uncertainty in the data and introduce a systematic bias against CPs that have provided complete information. The cumulative effect of these will have a material impact on Ofcom's analysis, especially in low volume markets.

- We suggest ways that Ofcom should improve its methodologies. For example, Ofcom should obtain further data on a targeted basis on markets where market power assessments are likely to be finely balanced, such as those for high bandwidth services across the UK and Ethernet in London. Where a CP's data displays a particular pattern of missing data, uplifts and assumptions should be informed by knowledge of the CP's commercial model.

Despite these deficiencies, Ofcom's data outputs paint a picture of strong competition in many areas consistent with BT's market experience, showing a material increase in high network reach areas (with almost 30% of businesses outside London located in such areas) and an estimated BT share in high bandwidth services outside London below the level associated with market power. This lends strong support to a continued regulatory approach based on active products and scope for lighter regulation.

We note that the outputs may change following Ofcom's planned reconsideration of a number of issues not addressed in this consultation, for example 'dig distance', the use of postcodes in geographic analysis and the treatment of data centres.

We commented on these fundamental aspects of Ofcom's analysis in the last BCMR, and we are pleased that it intends to review them now. A sound conclusion to the BCMR depends on Ofcom taking the right decisions on these matters as well as resolving the data issues set out in this response.

2. Overview

Introduction

1. Business connectivity markets are highly complex, characterised by diverse technologies, customers and providers and, in many parts of the country, multiple competing networks. This makes data collection, verification and analysis very challenging for Ofcom.

2. Our major concern is that in a market that is highly dynamic and increasingly competitive in some sectors, Ofcom could draw incorrect conclusions about market power if the underlying dataset that it uses is incomplete or flawed.

3. In view of this, we support Ofcom's decision to conduct a separate consultation on data analysis in advance of the main (BCMR) consultation planned for Spring 2015. This should help to avoid issues that arose in the last BCMR, where there was insufficient clarity on the information that Ofcom collected and the methodologies used to analyse it.

4. The result was that stakeholders found it difficult to understand how Ofcom had derived its final market shares and the scenarios that were set out in the final Statement. We believe that the market share base cases in the Statement showed a systematic bias against BT and that Ofcom's scenarios did not recognise the uncertainties and errors in the data collected.

5. In our view, Ofcom's methodologies in the last review overstated BT's position in business connectivity markets and underestimated the strength of other CPs. It is essential that Ofcom's approach to data collection and analysis in this review results in an accurate assessment of competition and assessments of market power.

6. Given the large dataset, we appreciate it is inevitable there will be missing data, and an important consideration for Ofcom is to ensure that the service share ranges presented are a true reflection of the state of the business connectivity markets consistent with CP's commercial experience.

7. Whilst Ofcom's market analysis must be based on comprehensive and accurate data on business connectivity markets as they are now, it must also be forward-looking: the information obtained by Ofcom relates to markets as they were at March 2014, but the regulation introduced by this BCMR needs to remain fit for purpose until March 2019, five years later.

8. The remainder of this overview sets out our key points on i) scope and coverage of the data collected by Ofcom, ii) data processing and iii) data outputs. Our answers to Ofcom's questions are given in Sections 3, 4 and 5 of this response. We also provide supporting annexes looking at i) the impact of the definition of leased lines used in the BCMR Section 135 Notice on the data collected and Ofcom's analysis and ii) examples of CPs whose activities in the high bandwidth markets could have a significant impact on Ofcom's assessment of those markets and therefore need to be taken into account in the BCMR.

Scope and coverage of the data collected by Ofcom

9. The scope of the data collected rests on the definition of leased lines implicit in the Section 135 Notice issued to fixed network operators. The definition does not capture all the services used to provide business connectivity, with a resulting impact on Ofcom's data capture and market analysis. Annex 1 explains this issue and how we believe Ofcom should resolve it by adopting a 'topology-neutral' definition of leased lines.

10. There are other gaps in the information Ofcom has collected. The most significant are outlined below, and others are flagged in our answers to Ofcom's questions later in this response. These need to be investigated and resolved before Ofcom undertakes its market definition and SMP analysis.

11. Ofcom has collected information from the seventeen fixed network operators it considers large enough to have a material impact on its network reach and service share analyses. This may be appropriate in lower bandwidth, high volume markets. However, we do not believe it will give a true picture of competition for high bandwidth Optical and Ethernet services, where smaller niche

operators may have strong positions. Ofcom should identify and gather information from such operators. We have suggested who some of the relevant operators could be in Annex 2.

12. MLL is one of the four large CPs that Ofcom believed did not own or lease any access infrastructure and which provided responses to information requests confirming that this was the case. However, MLL's website indicates that it does own such infrastructure in the form of microwave radio links: Ofcom therefore needs to revisit the information provided by MLL.

13. It appears Ofcom has only collected information on backhaul circuits that are supplied by BT and those purchased by the MNOs and the biggest LLU operators. This means Ofcom is missing data on self-supplied backhaul circuits used by the MNOs, the LLU operators and Virgin Media.

14. We also note that Ofcom has not yet made decisions on key aspects of its data collection and analysis methodology which, taken together, could have a material impact on its market assessment, particularly in high value, low volume product and geographic markets, for example:
    – whether radio/microwave links fall within the scope of the review (these can substitute for fixed leased lines in a number of market segments);
    – whether total business size is the most appropriate criteria for selecting the businesses to be included in the analysis (many businesses employing large numbers of people have limited telecoms demands whilst many major users of connectivity have few employees, for example data centres);
    – how Ofcom will use the data collected on fibre-connected building and what length of 'dig distance' will be assumed (we believe providers will dig out further for high value optical contracts than for low bandwidth services); and
    – whether postcode sector should still be used as the building block for geographic markets (this approach is likely to miss competitive 'hotspots' such as data centres outside city centres, where postcode sectors are geographically larger).

Data processing

15. Of the almost one million circuit records in Ofcom's current dataset, between 25% and 55% – up to around half a million – are missing one or more key data attributes. The consultation sets out in some detail how Ofcom attempts to correct for the missing information by making assumptions and applying uplifts. It also outlines proposals for how Ofcom will resolve the outstanding issues in the Spring 2015 consultation. We have a number of observations on Ofcom's proposals.

Circuit end classification

16. Ofcom's intention is to exclude circuit ends terminating at network rather than customer sites. However, as the document explains, there are many joint customer-network sites, for example large data centres. For the purposes of this consultation, Ofcom has calculated service share estimates on two bases, i) treating all joint sites as network sites and ii) treating all joint sites as customer sites. There are two significant problems with this approach:
    – network sites are identified with reference to postcodes, and 25% of circuits – around 230,000 – have missing postcode data: this means the level of certainty over circuit end type classification is far lower than the 96% claimed by Ofcom;
    – the difference between service shares calculated on the two bases is substantial in some markets: the prime example is BT's share of AI circuits in the 'WECLA' London geographic market, which is 38% on one basis and 50% on the other.

17. There are a number of ways to address this issue. For example, Ofcom should identify the largest joint sites and seek more information to enable it to estimate the overall percentages of circuit ends at each that are customer and network ends respectively.

Missing postcodes

18. Postcode information is at the heart of Ofcom's network reach and service share analysis, but 25% of the circuit records in the dataset are missing postcode information. We suggest Ofcom should publish breakdowns as to how these circuits are distributed across market segments: if

significant numbers are in the low volume, high value markets, this will compromise the robustness of Ofcom's service share estimates.

19. Ofcom states that half of the records with missing postcodes relate to circuit ends reported by two CPs, who say they are "largely" at network sites: as such, they are removed from the analysis and there should be little impact on service share estimates. We disagree: in fact some of this large volume of circuits will be at customer sites, so the shares of the two CPs involved will be under-estimated. This can have a big impact in markets where there is a big difference between service shares calculated under the two bases referred to in paragraph 14 above: some of the circuits with missing postcodes will be at joint customer-network sites but will not be counted under the basis that treats all circuits ends at joint sites as customer ends.

20. In addition, Ofcom's uplift methodology only allocates circuits with missing postcodes to postcode sectors on records that do have postcode information. This does not take account of the fact that the circuits with missing information may be in other areas not covered by the 'known' postcodes.

Missing on-net and off-net information

21. We agree that only including 'on-net' circuits in the analysis is a better way of deriving wholesale service shares than the 'sales less purchases' approach used in previous reviews. However it is a major concern that the on-net/off-net status of 11% of circuits in the dataset – around 100,000 circuits – is unknown. Ofcom plans to allocate 'missing circuits' in proportion to 'known circuits' once its service share model has been finalised. We believe Ofcom's allocation should also be informed by market intelligence on CPs' business models: otherwise significant numbers of circuits could be left out of the analysis simply as a result of random errors in the data supplied.

Missing bandwidth information

22. Another issue is missing interface markers, i.e. markers to indicate whether a circuit is AI, TI or MI. Ofcom applies sensible assumptions to reduce the number of circuits with no identified interface from 7% to 1% of the dataset. It is not clear how these circuits have been treated in the service share analysis in the document (they may simply have been omitted), but Ofcom states it will seek to obtain the missing information "during the consultation". It is important that Ofcom is successful in this. The 1% of circuits with no identified interface marker equate to around 9,000 circuits and therefore 18,000 circuit ends: this could be significant for Ofcom's market analysis given that the total MI market only has between around 9,000 and 14,000 circuit ends, of which around 2,000 to 6,000 are in WECLA.

Overall impact of Ofcom's assumptions

23. It is important to recognise that the sequential treatment of missing data results in multiple layering of assumptions. It would be useful if Ofcom set out the impact of the sequential treatment of data missing from the initial dataset, such as i) the proportion of circuits that have missing data for each of the data attributes and ii) the proportion of circuits with at least one piece of information missing. This methodical approach would provide insight into the impact of each of the assumptions on the final estimates: this has not been provided in the consultation.

24. The output of these many assumptions and uplifts is a summary of total circuit numbers for each CP split by bandwidth and postcode sector. These are then used to calculate service shares. Missing and incorrect data for each data attribute must have a cumulative effect on the possible range of service shares calculated. Sensitivity tests based on changing one assumption at a time would be interesting, but what would be more relevant would be the combination of the assumptions. Ofcom needs to set these out clearly so that stakeholders can make comparisons between the different scenarios.

25. Finally, 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 the CP's commercial strategy.

Network reach analysis

26. Network flexibility points play a key role in Ofcom's network reach analysis. We agree with Ofcom's proposal in Annex 7 (para A7.7) that 'all flexibility points should be treated as being equally available". However, the maps in Figures 4 and 7 in the consultation show that some areas around London that were found to have 'high network reach' in 2011 no longer do so. This can only be explained by the 'disappearance' of flexibility points. This is highly unlikely, and Ofcom should review the flexibility point data provided by CPs in light of this.

Data outputs

27. Ofcom states that the purpose of setting out the network reach and service share outputs in this section of the consultation is to

    "allow CPs and other stakeholders to see some aggregate outputs of the data and identify any issues relevant to the data cleaning and processing exercise, for example by reference to whether they appear consistent with their recent commercial experience".

28. Both the network reach and service share outputs support both BT's experience of an increasingly competitive market:

    Network reach
    – Figure 5 indicates a material increase in the number and coverage of high network reach areas across the UK;
    – Figure 7 highlights significant newly identified blocks of high network reach around London, including the Stratford and Croydon areas which we flagged as competitive in our response to the last review;
    – Table 6 shows that the proportion of postcode sectors outside WECLA with high network reach has doubled from 4% to 8%, and that the number of business outside WECLA in high network reach areas has increased from 20% to 29%.

    Service shares
    – BT's estimated shares in the MI market outside WECLA are below the level normally associated with a finding of SMP;
    – BT's share in the AI market in the UK outside WECLA appears to have fallen significantly from 74% to around 55%-57% when calculated on the 'on-net' basis.

29. Our response to Question 10 sets out our comments on Ofcom's methodologies for processing data on flexibility points. We would like to stress that Ofcom should take a different approach for the low volume, high bandwidth MI market, where customers are typically clustered geographically rather than being spread across the UK and often have few employees.

30. To allow stakeholders to make further comparisons between Ofcom's service share outputs and their own experience of the market, it would be useful if Ofcom published more granular information on shares, in particular for AI services at 1Gbit/s, where our experience is that competition is significantly more intense than at lower bandwidths, especially in London.

31. Finally, we welcome Ofcom's intention to consider separately how competition in the provision of services terminating at data centres should be assessed and how such sites should be treated in the BCMR[1]. Given that data centres are large consumers of connectivity, this clearly has the potential to affect Ofcom's data analysis and processing methodologies and the market assessments it carries out in the BCMR.

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[1] Paragraphs 3.23 and A7.40

3. Scope and Coverage of the Data

> **Question 1:** *Are you aware of any fixed network operators that have access infrastructure that Ofcom has not requested data from that are likely to have a material impact on our network reach or service share analysis?*

32. There are a number of actual and possible omissions in the data that Ofcom has collected which could have a material impact on its network reach and service share analysis. These relate to omissions from the information provided by CPs from which Ofcom requested information as well as the omission of CPs from Ofcom's data collection exercise.

Omissions and information inconsistencies resulting from the definition of leased lines

33. In the BCMR Section 135 Notice that Ofcom issued to the seventeen fixed network operators listed in Annex 5 of the document, Ofcom states "In the [last] BCMR, we described a leased line as a symmetric service of dedicated (i.e. uncontended) capacity between two fixed locations". Ofcom also set out diagrams illustrating two examples of leased lines services, one based on direct connections between a company's branch offices and its head office, the other based on connections between branch offices and a head office using a VPN.

34. There are a number of ways in which this definition may have led fixed operators to omit information from their responses to Ofcom or to mischaracterise circuits that they did report. For example:

    – Where a CP provides connectivity to more than one end customer at a site, the access link is likely to be shared between end users and therefore be contended. CPs could have considered such services to be outside the scope of the information request and therefore not reported them;

    – CPs may use 'daisy chain' topology between end customer sites. The links between sites will not be uncontended, and the topology is different to that in both of Ofcom's example. Again, this may have led CPs not to report the circuits used;

    – The services provided to end customers in Ofcom's two examples are the same, but because the network configurations are different, the numbers of circuits and bandwidth provided will be measured differently by Ofcom.

35. These issues and BT's proposed approach are considered in Annex 1 to this response.

Missing information on point-to point microwave radio links from MLL

36. Although Ofcom excluded microwave radio links from the product markets defined in the last BCMR, this may not be the case in the current review, and Ofcom's Section 135 Notice clearly includes point-to-point microwave links in the definition of "physical links" that can be used to provide leased lines. MLL is one of the four large CPs that Ofcom understood "not to own or lease any access infrastructure" that were issued with s135 notices and which confirmed that they did not own or lease access infrastructure. However, MLL's website (www.mlltelecom.com) indicates that it does own such infrastructure, stating that:

    "The MLL Telecom Point to Point microwave radio service provides connectivity wherever there is line-of-sight between two end points.

    "Our carrier class service can be used to supply you individual links or can be combined to create a wireless based network solution. It is available as a build only or fully managed service and can deliver from nx2Mb/s to multiple 1Gbit/s throughputs and above.

    "MLL Telecom is a fully licensed operator with code system powers. This grants us the planning permissions we need to enable rapid wireless circuit deployments. We own wireless spectrum

across the UK at 32GHz and 42GHz, which offers you interference-free Point-to-Point microwave radio services."

37. In view of this, Ofcom should seek the relevant information from MLL and include it in its data analysis and processing in the BCMR.

Missing information from high bandwidth operators not covered by Ofcom information request

38. In our view, accurate and comprehensive information from the fixed network operators listed in Annex 5 of the consultation document should be sufficient for Ofcom to carry out its network reach and service share analyses for high volume mass market business connectivity services.

39. However, the competitive environment for high bandwidth Optical and Ethernet services is different. Smaller niche operators may have strong positions in these markets, often with a focus on specific areas such as city centre business districts and data centres. Information on these operators' activities needs to be taken into account for Ofcom to accurately assess competition in high bandwidth services.

40. Examples of such operators from whom Ofcom has not collected information are set out in Annex 2 to this response. Ofcom should investigate whether data needs to be collected from these and similar operators to ensure it has the information necessary to carry out a sound assessment of high bandwidth markets.

Missing information on backhaul circuits

41. It appears that Ofcom has only collected information on backhaul circuits that are supplied by BT and those that are purchased by the MNOs and the biggest LLU operators. This means that Ofcom is missing data on self-supplied backhaul circuits used by the MNOs, the LLU operators and Virgin Media. Ofcom should obtain the missing information before assessing market power and considering remedies.

Missing information on dark fibre

42. The Section 135 Notice issued to fixed network operators listed in Annex 6 shows that Ofcom has asked for information on dark fibre that these CPs lease from other companies. We believe that where CPs state that they lease dark fibre, Ofcom should identify the companies from whom the dark fibre is leased and seek information from these companies on their customers for dark fibre. This will help to identify any missing gaps in Ofcom's information on competing networks that are used for business connectivity.

Missing information on points of interconnection

43. In paragraph 2.21, Ofcom states that it has asked CPs to provide information on their points of interconnection with BT. To establish a correct view of CPs' network presence, Ofcom also needs to obtain information on CPs' points of interconnection with non-BT CPs.

4. Data Processing

Question 2: *Are there any missing circuits in the leased line data you provided to Ofcom? If so, please provide your best estimate (together with, if possible, a lower and an upper-bound estimate) of the number (or percentage) of circuits that are potentially missing and indicate whether they are likely to be accounted for primarily by a particular set of interfaces or bandwidths.*

44. We are not aware of any omissions in the leased lines data that BT has provided to Ofcom.

45. Taking a wider view, we would urge Ofcom to critically assess and 'sense check' the data that CPs have provided to identify any potential gaps in the data provided or any potential misunderstanding by CPs of Ofcom's data requirements. For example, if there is a geographic area where all CPs including BT classified their circuits as 'off-net', information must be missing any CPs who own the leased lines infrastructure in that area. It would be useful if Ofcom published any such checks that it carries out on the data it has received to give CPs confidence that any potential anomalies in the data have been identified and resolved.

Question 3: *Are there other factors relevant to how your leased line sales and purchases are recorded that have implications for Ofcom's service share analysis?*

46. We do not believe there are any such factors, however there may still be broader issues over comparability of data supplied by different CPs.

Question 4: *Do you agree with our approach to classifying circuits that are delivered using WDM technology? Have we correctly classified circuits as WDM in the data you have provided, based on our current definition?*

47. We agree with Ofcom's approach. However, we would ask Ofcom to 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 own downstream retail operations.

Question 5: *Do you agree that 'Ethernet over SDH' circuits should be classified as Ethernet circuits? If not, please explain why.*

48. We agree that 'Ethernet over SDH' circuits should be classified as Ethernet circuits.

Question 6: *Do you agree that presenting a service shares range is the most appropriate way of quantifying the uncertainties involved in identifying network sites for the purposes of this review? Are there alternative methodologies for dealing with this issue?*

49. In order to ensure that circuit ends are counted consistently across different CPs, and their different network architectures, Ofcom is attempting to only include leased lines that terminate at a customer site[2]. The methodology that Ofcom has used identifies network sites with reference to postcodes submitted by CPs, and then uses this to match to the circuit end postcodes. CPs have also submitted data indicating which of their network sites are coincident with a customer site. Ofcom has used this data and presented a range of service shares.

50. We note that since Ofcom's methodology of identifying whether an end is a network or customer end is based on the postcode information of the circuits, 25% of the ends would initially be unidentified. Ofcom then assumes that 21% of these are either outside the UK or network ends, and the remaining 4% are customer ends. From these Ofcom then compares the postcodes to identify the joint customer-network sites.

51. We support Ofcom's desire to calculate the potential ranges in service shares in general. We also note that there are other uncertainties that Ofcom has to deal with, in addition to that of

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[2] See Paragraph 3.18 of the consultation.

identifying network sites, and we hope that Ofcom will attempt to calculate the ranges resulting in combining these uncertainties. It is possible that for some markets these ranges will be large, and in cases where it could make a difference in the SMP assessment, Ofcom should examine the assumptions in greater depth. This would help to indicate the point in the range that is best likely to reflect the underlying state of the market, since the mid-point of a range may not be the most likely outcome. We would like to help establish how this could be done in the context of circuit count methodologies during the course of the BCMR.

Illustrated example of the derivation of Ofcom's service share range

52. With this in mind, and as requested in Paragraph 3.23, we attempt to use the numbers presented for "AI in WECLA" in Table 8 to illustrate our points[3]. Ofcom's preferred method of service share calculation is that based on the "on-net only" rather than "sales less purchases" approach. We have therefore used this in our example.

53. For this market, Ofcom presents a range of 38% to 50% for BT's service share. This range is derived from the following two scenarios:

- All ends which for which the recorded postcode does not match the postcode of a CP network site, plus the 4% of circuits which do not have a recorded postcode, and have not been allocated as a network site. We refer to this as the "Joint customer-network ends excluded" scenario, which results in a 50% share for BT.

- All ends identified above, plus all ends with a recorded postcode that matches a postcode of a CP network site where a CP has stated it is coincident with a customer site. We refer to this as the "Joint customer-network ends included" scenario, resulting in a 38% share for BT.

54. Using data published in this consultation, BT's circuit inventory and data published in the 2013 BCMR Statement, it is possible to estimate how the AI circuit ends in WECLA are distributed across known and unknown postcodes and the three end types. These are presented in the table below.

Table 1 BT's estimated volumes for AI WECLA circuit ends (total market)

	"Customer"	"Joint"	"Network"
Ends with known postcode	~40k	37k	~30k
Ends without postcodes	~2.5k	0	~13k
Total	42.5k	37k	~43k
BT share	50%	25%	-

55. As Ofcom has only published top-level volumes of the percentage of circuits without postcodes, we have assumed that 25% of these circuits have a single end missing, and 16% of these have been allocated to customer, and the remaining 84% as network sites.

'Joint customer-network ends excluded' scenario

56. As Ofcom's methodology is based on postcode matching, there is a difficulty in separating customer ends located at postcodes where there are both customers and network operators. The more significant issue concerning this scenario is that it is biased against CPs who do not generally co-locate network equipment at customer sites, because the circuit volumes for those who do are excluded from the calculations. We do not think this can be viewed as a realistic approach to calculating BT's service share.

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[3] We appreciate that Ofcom's inclusion of Table 8 is without prejudice to the markets to be defined in this review.

57. Although Ofcom has attempted to remove all ends at network sites, BT believes that there are still a significant number of network locations missing from Ofcom's list. In the last review, BT data showed that there was evidence of network sites at almost 11,000 postcodes. This was based on details of BT exchanges and network to network products such as BES and PPC handover. At the time Ofcom audited this and found the list to be "appropriate". The list used in this consultation only includes 8,544 postcodes. Ofcom has therefore included many true network ends. One contributing factor is the postcode matching method Ofcom have adopted, rather than a geographic matching method based on location. We believe Ofcom has allocated each BT exchange a single postcode. In reality multiple postcodes are used. For example, BT's circuit inventory has ends at Bolton telephone exchange recorded as both BL1 2AA (~20% of ends) and BL1 2AB (~80% of ends), but Ofcom has only flagged the former postcode and therefore has only excluded a fraction of the relevant circuits. A similar situation applies to West Kensington Exchange which has the two postcodes SW6 1TJ and SW6 1TH: here Ofcom's choice only accounts for about 60% of circuit ends.

'Joint customer-network ends included' scenario

58. Including all joint customer-network circuit ends provides an upper limit for the number of ends, but this does not provide a true limit to BT's service share. In the case of AI in WECLA, BT believes that the data used by Ofcom shows that BT's share of ends at these "joint" sites is about 25%. This result is not surprising as, in WECLA, many CPs have installed networks that daisy-chain between customer sites, leading to a high volume of circuit ends which are co-located with network equipment.

59. In reality, we believe that this "joint" site category represents a wide range of sites. Many "daisy-chain" sites will have many customer ends, some circuits may even be only within the building between the customer office and the CP switch, after which the service is aggregated and carried over the CP's cloud network. In many instances, a CP may not have even reported the self-supply underlying network transmission, and so there may be no "network" end in the inventory supplied to Ofcom. At the other end of the spectrum are BT's exchange sites which are predominately network nodes, but may have been identified as "joint" sites due to the presence of a customer at the same postcode. One extreme example of this is Faraday Exchange which has been classed as a "joint" site and so ALL circuit ends at this extremely busy exchange have been counted. This site alone accounts for so many of the "joint" ends in WECLA that removing this one site would reduce BT's service share from 38% to below 37%. We believe that Ofcom should investigate the high-volume "joint" sites to determine if it is appropriate to include them in the service share calculation.

Treatment of circuit ends with missing postcodes

60. A second source of error is Ofcom's treatment of the circuit ends without recorded postcodes. This is discussed elsewhere, but is relevant here, as Ofcom has allocated a large portion of these ends as network sites. From the table above, it can be seen that 40% to 50% of the network sites are included as joint sites for the scenario where joint customer-network ends are included in the calculation of service shares. This contrasts to the sites where a CP has failed to provide location data, where none of these network sites are included in the scenario. This therefore introduces a systematic bias against the CPs that have provided more complete data.

61. To correct for this bias, Ofcom could re-categorise a proportion of the assumed "network" ends as "joint" ends, and so they are counted in one of the scenarios. Using the above estimated volume of ends without postcodes results in a reduction of BT's estimated service share from 38% to almost 35%. Alternatively Ofcom could treat the "single-ended" circuits with complete data in the same way as circuits where incomplete data has been provided, thus removing the network end of EFM and EAD-LA from all service share calculations. A similar approach could be adopted for both ends of fixed network backhaul circuits such as BES and EBD.

Presentation of scenarios

62. In the 2013 BCMR Ofcom emphasised that its primary concern was that the methodologies deployed should not lead to the likelihood of systematic bias. Whilst this is important, it is also important to be able to derive reasonable error bounds on the estimates and taking into account the different sources of uncertainty. This is key where market share is the pivotal consideration in an SMP assessment. Ofcom's presentation of the base case and the different scenarios in the 2013 BCMR did not adequately address the uncertainties and errors in the circuit data provided by CPs.

63. We think it is very important for stakeholders that ranges and scenarios can be presented in a coherent and comprehensible way. We have emphasised that all sources of uncertainty need to be separately accounted for and shown as independent or correlated to produce a more informative view of the total level of uncertainty. As we have indicated above, we do not consider that Ofcom's two proposed approaches to dealing with mixed customer and network points are adequate. All PPC, EAD-LA and EFM circuits must have a network end, and both ends cannot be customer ends.

Question 7: *Do you agree with our preferred approach of estimating the supply of wholesale leased lines by counting 'on-net' circuits only? Do you have any concerns with this approach?*

64. We agree that the approach of deriving estimates of wholesale leased line volumes based on counting 'on-net' circuits has the advantages set out in the consultation document. However, we have the following specific concerns:

   – CPs could have erroneously classified EFM circuits as off-net on the grounds that they use copper lines leased from Openreach. In fact, for the purposes of the analysis in the BCMR, EFM is on-net for the EFM provider;

   – We also note that according to the figures in Table 8, CPs' estimated service shares are almost always higher under the 'on-net only' calculation than under the 'sales less purchases' approach. We believe Ofcom should investigate and explain why this is the case.

Question 8: *With respect to missing information, do you agree with our proposed approach of using uplifts for three variables and presenting ranges for two variables? Should we consider alternative methodologies for dealing with missing information?*

65. We welcome Ofcom's initiative in setting out its approach to data analysis ahead of the BCMR 2016 consultation next year. Given the large dataset, we appreciate it is inevitable there will be missing data. It is crucial that Ofcom ensures the service share ranges presented reflect the state of the business connectivity market and resonates with CPs' experience.

The range proposed will not capture the true level of uncertainty in the data

66. We summarise our response to Ofcom's proposed methodology for dealing with missing data in the table below.

Table 2. BT's response to Ofcom's treatment of missing data

Circuit attribute	Circuits with missing data	Proposed approach for Spring 2015	BT comments
Interface type	64,000 circuits (7% of total)	Ofcom has inferred the type from bandwidth information for 6% of the circuits. For the remainder Ofcom will try to identify the missing data. Where this is not possible, Ofcom will present a range or sensitivity analysis.	We would like to understand the kind of assumptions Ofcom intends to adopt and what combinations of assumptions will be used to develop the scenarios for the sensitivity analysis.
Bandwidth	129,000 circuits (14% of total)	Pro-rata uplift by postcode sector for each CP	This assumes that there is no systematic distribution to the missing data.
Postcode sector	230,000 circuits (25% of total)	Pro-rata uplift by bandwidth for each CP	We think Ofcom should check whether there is correlation between the distributions of circuits across postcodes, bandwidths, whether it is a network or a customer end, and whether it is on- or off-net.
End type	37,000 circuits (4% of total)	The missing ends are assumed to be customer ends (this is similar to the approach taken in BCMR 2013). Ofcom proposes to present a range or sensitivity analysis.	The actual level of unknown end types should be presented as 25% to reflect those circuits without postcodes. Of these 21% have been assumed to be out of scope or network ends. For the remaining 4% we do not agree that an "all-in-or-all-out" approach to classifying end types is appropriate.
On-net / off-net	101,000 circuits (11% of total)	Ofcom assumes a simple uplift for the purposes of this Consultation, but will develop an uplift methodology for Spring 2015.	We would like to understand Ofcom's proposed uplift approach, e.g. with reference to each postcode or bandwidth.
Total	**230,000 to 459,000 circuits (25% to 55% of total)**		**Ofcom should present the impact of the sequential treatment of the missing data from the initial dataset.**

67. Ofcom's proposed approach is to treat three of the five characteristics (i.e. bandwidth, postcode sector, and on-/off-net) with missing data as deterministic, and then make assumptions about the other two (i.e. interface and end type) to arrive at sensitivity ranges. We appreciate that whilst the proportions of missing data for each circuit attribute is small, together they add up to a large share of total circuits that have at least one piece of missing information. We strongly support Ofcom's efforts to work with CPs to reduce this.

68. Ofcom's approach takes the two characteristics with the smallest proportions of missing data (i.e. 1% for interface type and 4% for end type), and makes some assumptions about them as part of a sensitivity analysis to arrive at a range of potential service shares. Given the proportions involved, the "all-in-or-all-out" approach is likely to end up with a small range which does not paint a true picture of the underlying level of uncertainty.

69. In our view, the true level of uncertainty should also include the other three features of the circuit: bandwidth, postcode sector and whether the circuit is provided on- or off-net. Ofcom is treating these via uplifts and assuming them to be fixed, and as such they do not affect the sensitivity range. We believe further investigation is required to see, for example, whether a CP's circuits are indeed distributed randomly across postcode sectors, to ensure that this approach does not create a bias in the service share estimates, particularly for the low volume markets.

Sequential treatment of data is required to understand the multiple layering of assumptions

70. After Ofcom has carried out its initial data cleaning process, the extent of the missing leased lines data range from 25% (assuming that circuits have the postcode data missing along with at least one other piece of circuit information), to 55% (if circuits only have one attribute missing). This is a significant amount of data, even if not all circuits are relevant for the calculation of market shares (for example because they include ADSL/NGA circuits). We think it is important to present the scale as well as the magnitude of the unknowns alongside the sensitivity analysis and the likely range of service share estimates. It would be useful for Ofcom to set out the impact of the sequential treatment of missing data from the initial dataset, such as the proportion of circuits that have missing data for each of the characteristics at this stage, as well as the proportion of circuits that have at least one piece of information missing. This methodical approach can provide insight into the layering of assumptions required to arrive at the final estimates, which has not been set out clearly in this Consultation.

71. For example, to get an indication of the number of circuits that are relevant for the purposes of measuring market shares, a first step to reducing the initial dataset might be to identify the interface type and exclude those that are outside the scope of this market. Table A7.3 shows the assumption made to reduce the amount of missing data on interface type from 7% down to 1%. For the remainder of the circuits with unknown interfaces, there could be at least, say four different sensitivities that we expect Ofcom to consider in the Spring 2015 Consultation, i.e. all SDH/PDH, all Ethernet, all WDM, or all ADSL. Depending on the assumption made, the proportion of missing data that is relevant for the market share analysis will change.

72. The next step might be to identify the postcodes for each of the ends of the circuits. Of the 25% of circuits that have one or both postcodes missing, Ofcom states that by excluding all network ends, the proportion of circuits that have missing postcode data reduces from 25% to 12.5%. However, the identification of network ends is itself based on the assumption that the full postcode is used, and that the reduction of 25% unknowns down to 4% itself is based on a number of assumptions. These may also be relevant in the testing of the estimates, and not just the 4%.

Uplifts are also assumptions and should feature in the sensitivity analysis

73. The uplifts that Ofcom describes in this consultation are based on the premise that circuits with missing data are distributed evenly for each CP. This may not be the case, and can have a significant impact on the market share estimates, which use the narrowed down dataset which has been split by geography, by bandwidth and by CP.

74. Three sets of assumptions on missing data are required before Ofcom's proposed uplifts on postcodes, bandwidth and whether a circuit end in on- or off-net can be applied:
   – interface type (say three types, for SDH, Ethernet and WDM);
   – whether it is a network end or a customer end; and
   – the treatment of joint customer-network sites (e.g. all-in, all-out or somewhere in between).

75. If these are discrete options (e.g. all of one type) there would already be 12 different scenarios. We appreciate introducing a mix of different interface types or treatment of joint customer-network sites would result in countless scenarios for each CP, so we believe it is important to sense check the data and assumptions, e.g. by checking them against the distribution of circuits against other attributes, as well as involving CPs to resolve missing data issues.

76. Given that there is a binary choice for whether a circuit is on-net or off-net, this might be selected as the next attribute to deal with. Of the total number of circuits 11% have this information missing, although this may well be different after excluding circuits that are not in the business connectivity market. Ofcom has proposed that it would allocate the missing circuits in proportion to each CP's share of on-/off-net circuit ends. So, if 20% of a CPs' circuits are off-net, then the remaining missing data would be split 80% on-net and 20% off-net. However, this is not a sufficient criteria in itself, and presumably this uplift would have to be done on a postcode basis.

77. For example, there may be other aspects of a CP's circuits that might be taken into account. It is plausible that most of a CP's on-net circuits could be higher bandwidth, or NGA circuits. Since Ofcom is proposing to use on-net circuit ends to determine market shares, the choice of how to uplift the missing data could have a significant impact on the final results.

78. As an illustration, consider the following CP. Of the circuits it reported to Ofcom, 10% do not have on-net/off-net information. Ofcom's proposed methodology does not consider the additional information available on the circuits, and assumes that 8% of the 10% circuits would be on-net and therefore included in the service share calculations. An equally reasonable approach would be to analyse the CP's data in detail, and the uplifts differ according to postcode and bandwidth.

Table 3. Illustrated example of a distribution of circuits for a hypothetical CP

Postcode	On-net	Off-net	Bandwidth <= 1Gbit/s		Bandwidth > 1Gbit/s	
			On-net	Off-net	On-net	Off-net
A	50%	50%	30%	70%	70%	30%
B	60%	40%	50%	50%	40%	60%
C	100%	0%	20%	80%	20%	80%
Total	80%	20%	60%	40%	100%	0%

79. One can see that with seventeen CPs and different choices for the uplifts, this immediately creates a large number of possible scenarios. Nonetheless, summary statistics such as the above would confirm or otherwise the appropriateness of Ofcom's uplift approach. In essence, this tries to take into account that the missing data may not be randomly distributed. A similar treatment can be adopted for uplifting bandwidths and postcodes.

80. We note that Ofcom has not proposed to include the uplifts in the ranges and sensitivity analysis. We think it is necessary to consider them. For example, the missing data may not be distributed in the same way, and could all be associated with, say high bandwidth, low volume circuits. In cases where service volumes this will have a significant impact on the estimated shares.

Impact on service share estimates

81. The outcome of these assumptions and uplifts is that there is a summary table of total circuit numbers for each CP split by bandwidth and postcode sector. These are then used to calculate service shares. As we have illustrated, the building up of this dataset requires Ofcom to make a number of assumptions. Missing and incorrect data for each characteristic must have a cumulative effect on the possible range of service shares calculated. The results of sensitivity tests based on changing one assumption at a time would be interesting, but what would be more

relevant would be the combination of the assumptions. We recognise that this can give rise to an untenable number of permutations so Ofcom could potentially present a selected number of scenarios based on likely options for each of the five circuit attributes as set out in Table 2. We note that any scenario that excludes other CPs' circuits can only increase BT's service shares, and should not be considered as a reasonable upper bound of a sensitivity range. We would welcome the opportunity to discuss our data with Ofcom to reduce the number of scenarios to a more manageable set.

82. Service shares are a key input in the SMP assessment, so when presenting the results we think it would be useful to present the base case alongside a confidence interval, and recognise whether the base case is indeed a central estimate, and perhaps see how service shares have changed over time, particularly as this market review is expected to cover the five year period up to March 2019.

> **Question 9:** *Do you have any views on other aspects of our data processing and cleaning, as set out in Annex 7?*

Physical network flexibility point data

83. To perform network reach analysis, Ofcom clearly needs details on both a CP's physical network and an understanding on how it is used to serve businesses. We expressed concerns in the last market review that by applying a "200m network build distance" from flexibility points, Ofcom would understate the coverage of operators who have chosen to deploy a network with limited numbers of flexibility points but extensive duct network beyond those points. Economic build to new sites would therefore be limited by the distance from existing duct network and not the location of the flexibility point.

84. Some CPs have stated that they would extend from any point in their duct network, and Ofcom has used the duct location as their flexibility points. We still believe that where a CP has supplied few flexibility point locations, Ofcom should also gather data on how the CP serves its customers. The new build data collected that Ofcom collected via Question C2 in the information request will help. A further sense check could be made by comparing the reported flex point data to the on-net customers served.

85. We are also concerned about the apparent reduction in flexibility points in some areas between 2011 and 2014. Ofcom sets out maps showing high network reach areas around London using i) flexibility points reported in 2011 and 2014 business location data (Figure 4) and ii) 2014 network reach analysis using the same business location data but updated flexibility points (Figure 7). A comparison of these maps shows that some areas, particularly near Slough, are no longer identified as high network reach areas. We believe this could only arise if flexibility points in an area were physically removed. Given that this is highly unlikely, we believe Ofcom should revisit the data on flexibility points provided by CPs and investigate any which were reported in 2011 but not in 2014. Even if a flexibility point has been 'mothballed' for some reason, it should still be included in Ofcom's analysis if it could be brought back into use reasonably quickly. In our opinion, this is the case if a flexibility point still exists physically and is connected to the CP's network.

86. In the last BCMR there was a specific issue of incomplete network data for Virgin Media, who had been unable to provide locations of their fibre joints, in effect their flexibility points. Ofcom attempted to address this by carrying out a sensitivity test which included the locations of all Virgin Media cabinets, including non-fibred CATV distribution cabinets. This added 48 sectors to WECLA, mainly in residential areas, containing 1% of total UK AISBO circuit ends (WECLA accounted for 18% of AISBO volumes, so this would be a 5% increase in the WECLA). Ofcom concluded that because this overstatement of the Virgin Media footprint had little effect, it was not appropriate to use the larger list of cabinets.

87. We do not agree with this conclusion. Although the addition of many residential CATV cabinets and drawing 200m circles around each will result in a larger coverage area than using only the fibre-enabled cabinets, it does not correct for the missing network data in business areas. If the cabinets are spaced at 1km in a business area, a 200m distance will leave large areas classed as "unserved" when in reality these would be served from the intermediate fibre joints. If Virgin Media is still unable to provide locations of their fibre joints, a more realistic solution would be to use all duct locations in the vicinity of the fibre nodes, rather than the inclusion of copper-fed CATV distribution cabinets.

88. Ofcom does not state i) how this issue has been addressed, ii) specifically what data Virgin Media has now been able to provide or iii) any assumptions Ofcom has made. We believe Ofcom should publish this information as soon as practical, perhaps in a follow-up to this interim consultation. This is particularly relevant given the high level of Virgin Media's activity in business connectivity services indicated in Ofcom's preliminary estimates of service volumes and shares.

89. We also note that although Ofcom includes radio, copper and coaxial cable as examples of a physical network connection (A7.2) the analysis focuses on fibre and duct infrastructure. The coverage of the other infrastructure also needs to be taken into account. As EFM represents 10% of the AI volume (footnote to table 8), CPs' EFM footprints should be considered.

90. Similarly, although currently outside the market definition, microwave represents a significant percentage of the MNO base station backhaul circuits. In addition to MNO self-supply, MLL telecom is active in the use of supplying point to point links that deliver between nx2Mbit/s to multiple 1Gbit/s using its own spectrum. MLL are clearly positioning themselves as an alternative to fixed network providers, and as such their infrastructure (both microwave and EFM) should be included in Ofcom's network reach analysis.

Leased lines data

91. On the whole, we believe that Ofcom's approach of cleaning the original raw data received from CPs is appropriate. We have a number of comments on the treatment of each of the circuit attributes.

92. We note that most of the missing interface type data can be created with reference to data on bandwidth, as set out in Table A7.3. Presumably the 1% of circuits that still have missing interface type data after this process will also have missing bandwidth information. As such, we are not certain what kind of sensitivities Ofcom proposes to consider, because any that is used will end up being superseded by the bandwidth uplift. Furthermore, there is an endless number of possible combinations for the proportion of SDH/PDH, Ethernet and WDM circuits to be allocated, so a more systematic treatment would be required in order to make sense of the sensitivity analysis and service share range.

93. We agree with Ofcom's processing of the bandwidth data carried out prior to the uplift for the 14% of circuits with missing information.

94. We believe that the volume of circuit data without postcodes for both ends will introduce large error margins in the results, irrespective of the methodology for dealing with these omissions are treated. Ofcom has gathered data on 918,000 circuits, but postcode information is missing from 230,000 (25%) of these.

95. In order for parties to understand the true implications of these omissions, Ofcom should publish detailed break-downs as to how these circuits are distributed between supply and purchase and across the proposed markets. For example if they are skewed toward the purchase of ADSL tails, this may have less of an impact on the market power assessments, but if there are significant numbers within the low-volume, high value, markets it will create a large distortion.

96. Ofcom states[4] that half of the omissions (115,000 circuits) "are relevant to the B-ends provided by two CPs ….. the CPs have clarified that the B-ends are largely network sites…. the fact that the B-ends are missing should not represent a material issue for our service share analysis". We disagree with this statement as this omission does have an effect on the service shares of CPs who have provided location data for both ends of their circuit inventory. The CPs themselves accept that these omissions will **largely** be network ends so Ofcom's omission of **all** of these ends will overstate the shares of the other CPs. Additionally, and more significantly, the high-volume scenario we set out in our response to Question 6 counts many network ends that fall at "mixed" sites. In the case of the results presented in Table 8, BT estimates that for its AI circuit ends in WECLA, the high volume case counts for 40% of the network ends as customer ends. For these two CPs, **none** of these 115,000 assumed network ends are counted in the 'joint customer-network ends included' scenario, thus inflating BT's service share for these cases.

97. Annex 7[5] provides further details of how the ends without a recorded postcode are treated. In addition to the two CPs discussed above, non-UK locations are removed, and then unknown ends of "single ended" services are deemed to be network sites if the known end is a customer site. These three assumptions reduce the percentage of unknown circuits from the 25% stated above, to 4%. Ofcom does not provide data on the volume of non-UK locations, but if this is relatively low, then up to 21% of circuits (193,000) have an assumed network end which is never included in the calculation, further inflating BT's service share in the 'joint customer-network ends included' scenario.

98. Following these allocations, Ofcom states in paragraph A7.38 that as the percentage of remaining "unknown" end types is only 4% it will not have a material effect. As discussed above, the end-type assumption actually affects 25% of circuits, and there will certainly be a number of circuits that are incorrectly allocated as "network site". Whilst there may be no bias against the treatment of data across all CPs, there will undoubtedly be a bias in the service share estimates. We think it would be beneficial for Ofcom to provide a break-down of how both these sets, the 25% (230,000 circuits) and the 4% (37,000 circuits), are distributed by market to better understand the impact of the error margins on the lower volume markets.

99. Although Ofcom has collected data on leased line sales between fixed operators, Ofcom notes that its service share analysis excludes such circuits if they are between two network sites (ref A7.41). From reading the data requests, it is apparent that all self-supply leased lines are not only excluded from the service share analysis, but have not been collected. This will include self supply LLU backhaul and all self-supply backhaul from the MNOs.

100. Ofcom does not describe its approach to processing the data on on-/off-net. We presume that no processing is required to arrive at the 89% of circuits with this information.

Network site data

101. We have commented on the use of network site data and its use in the calculation of service share ranges as part of our answer to Question 6. Specifically on data processing, we believe that Ofcom has omitted many network sites, and the reliance on postcode matching is likely to introduce additional errors. Providing the clean circuit data to CPs will hopefully allow the identification of many of these omissions as it is apparent how the network site list has been used. BT welcomes the chance to input into this process.

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[4] See paragraph A7.32 of the Consultation.
[5] See paragraph A7.37 of the Consultation.

5. Data Outputs

Question 10: Do you have any comments on our methodology for processing data on flexibility points and business locations in light of our network reach outputs? Would you suggest alternative methods or assumptions?

102. We would like to make the observations set out below on Ofcom's network reach methodology.

103. In the last BCMR Ofcom revisited the build distance assumption and quoted the distribution of build distances reported by other CPs[6]. BT questioned the use of this data to justify a build distance from the flex points as in practice the actual new build would be from existing duct which could be considerably closer to the customer than the reported flex point.

104. To address this concern, Ofcom requested data on newly connected buildings in Section C2 of the BCMR Section 135 Notice. This involved collection of data on the actual distance dug, and the distance to the nearest flexibility point. This will allow Ofcom to assess whether 200m from a current flexibility point is an appropriate distance to use. However, given the different architectures and data provided to Ofcom, care needs to be taken when interpreting the data. For example a CP that states their entire duct network is essentially a continuous flexibility point will report a shorter "distance to flex point" than another CP that only has flexibility points at 500m spacings along its duct network.

105. We also believe that it would be more appropriate to use a significantly longer dig distance for higher value services, and we are pleased that Ofcom is planning to reconsider the issue of dig distances.

106. As noted in our answer to Question 9, it appears that some flexibility points reported in 2011 have been omitted from the latest data request. Detailed analysis of any such omissions should be part of the data cleansing process.

107. The consultation states that Ofcom has not reached a view on which businesses to use in the network reach analysis, but it does not put forward any views on how it would reach its decision on this matter. The selection of sites to represent the geographic distribution is a fundamental input to Ofcom's network reach methodology, as is demonstrated by the different results obtained from data sets from two suppliers by comparing figures 4 and 7 as discussed above.

108. As stated previously, BT does not believe that selecting all the sites of each company that employs more than 250 people across the whole of the UK will give a truly representative view of demand for leased lines. We believe that a more sophisticated way of selecting the representative sites from within the overall Market Locations site is feasible. This could be based on the number of employees at a site and the industry sector of the business. This would then differentiate between:

   − a company's headquarters site and their branch offices;
   − a retail outlet and an IT services company, both of which may employ 10 people but have different telecoms needs.

109. We also believe Ofcom should attempt to define a demand distribution appropriate for the product market, rather than using a single demand distribution which will be dominated by the high volume, lower value, services. As was demonstrated in the 2013 BCMR Statement, MI services have a much more clustered demand profile, and a demand based on 150,000-200,000 sites is not appropriate in defining areas of uniform competitive conditions

110. Despite our misgivings over the choice of inputs (business sites, dig distance and postcode sectors) we strongly support the current analysis which shows significantly more areas of high

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[6] Table 24, BCMR consultation 18th June 2012

network reach (HNR) than in the last review, as shown by a comparison of Figures 4 and 5 in the document. We believe this confirms our view that the last BCMR materially underestimated the degree of competition, especially as there has not been significant network build in the last three years. This is further reinforced by the figures in Table 6 which show that 32% of the UK business sites chosen have been calculated as having a choice of two or more other CPs (excluding BT), up from 24% in the last review. We believe that for sites that require higher value services, this figure will be significantly higher still.

111. Table 6 also provides evidence to support a move away from Postcode Sectors, especially in the less metropolitan areas where CPs have tended to build in a very focused manner to areas of high demand and thus the competitive conditions are not uniform across these larger geographic postal sectors. When the network reach value is averaged over a Postcode Sector, the number of business included in HNR areas outside WECLA drops from 29% to 16%. Contiguity requirements then reduce this even further, and could be close to the 5% of sites in WECLA.

112. BT notes that Ofcom has chosen to change its supplier of the source data used to represent the geographic distribution of leased line demand. Ofcom has re-run the network reach analysis using the new data, and concludes that "the areas covered are substantially the same". However, Figure 4 shows that the choice of the data supplier does change HNR areas. For example more areas around Stratford and south of Croydon would have been included in the WECLA definition in the 2013 BCMR as these areas are contiguous to the existing definition. Since this dataset is one of the key elements used to define the geographic boundary it shows that Ofcom's geographic analysis can be sensitive to the underlying assumptions used. We therefore think it is important for Ofcom to examine the results in detail to ensure that there is no undue switching in the regulatory status of postcodes purely as a result of different data inputs.

> ***Question 11:*** *Do you have any comments on our methodology for processing circuit data in light of our service share outputs? Would you suggest alternative methods or assumptions?*

113. Ofcom states that the purpose of setting out the network reach and service share outputs in this section of the consultation is to

> *"allow CPs and other stakeholders to see some aggregate outputs of the data and identify any issues relevant to the data cleaning and processing exercise, for example by reference to whether they appear consistent with their recent commercial experience".*

114. Both the network reach and service share outputs support both BT's experience of an increasingly competitive market and many of the arguments we made in the last BCMR. In particular:

Network reach

− Figure 5 indicates a material increase in the number and coverage of high network reach areas across the UK;

− Figure 7 highlights significant newly identified blocks of high network reach at all points of the compass around London, including the Stratford and Croydon areas which we flagged a competitive in our response to the last review;

− Table 6 shows that the proportion of postcode sectors outside WECLA that are high network reach has doubled from 4% to 8%, and that the number of business outside WECLA in high network reach areas has increased from 20% to 29%.

Service shares

− BT's estimated shares in the MI market outside WECLA are below the level normally associated with a finding of SMP;

− BT's share in the AI market in the UK outside WECLA appears to have fallen significantly from 74% to around 55%-57% when calculated on the 'on-net' basis.

115. The changes in market volumes also accord with our experience, for example they confirm that:
 – The AI and MI markets have grown strongly;
 – Lower bandwidth TI services are in decline;
 – Volumes in medium and high bandwidth TI services have dwindled to the extent that there must be a question mark over the proportionality of continued Ofcom scrutiny of these market segments.

116. To allow stakeholders to make further comparisons between Ofcom's estimated service shares and their own experience of the market, it would be useful if Ofcom published more granular information on shares. This is particularly relevant in the case of AI services at 1Gbit/s, where our experience is that competition is significantly more intense than at lower bandwidths, especially in London. It would also be useful if Ofcom published separate volume information on 1Gbit/s services since this would give stakeholders an insight into the strength of migration from services at lower bandwidths.

117. Finally, we welcome Ofcom's intention to consider separately how competition in the provision of services terminating at data centres should be assessed and how such sites should be treated in the BCMR[7]. Given that data centres are large consumers of connectivity, this clearly has the potential to affect Ofcom's data analysis and processing methodologies and the market assessments it carries out in the BCMR.

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[7] Paragraphs 3.23 and A7.40

Network topologies and the definition of leased lines in the BCMR Section 135 information request

Summary

The purpose of this Annex is to draw out some potentially unforeseen consequences of the scoping definition of Ofcom's S135 Information Request as set out in Annex 6 of the Data Analysis Consultation. Our observations are given in the specific context of how Ofcom has chosen both to define and then subsequently represent the provision of leased lines by specific network design features. This Annex does not make any comments on how information is processed, which are given in the main section to our response.

Ofcom has defined leased lines as "*symmetric service of dedicated (i.e. uncontended) capacity between two locations*"[8]. We think that the current development of the market means that "dedicated" and "contended" are not interchangeable characteristics of a data connection between two points. This definition is too narrow and may inadvertently exclude some circuits that would otherwise appear the same as a standard leased line circuit from the perspective of the customer. As a result, this exclusion would result in an incorrect assessment of CPs active in the market and the circuit counts that are relevant for the market share analysis.

Furthermore, Ofcom's examples of leased lines and distinctions between access ends and bearers also create ambiguities around the reporting of circuit bandwidths depending on the providing CP's network and how the service is delivered. Given that service shares are calculated by CP by postcode and by bandwidth, this can have consequences in the SMP assessment stage of Ofcom's market review.

We believe that the definitions should be revisited, and potentially additional circuit data collected from CPs. We provide an alternative definition that encapsulates different network topologies that exist in the market today.

Introduction

The key issue addressed in this Annex can be summarised as follows. The analysis of the data is essentially a 'single-ended' analysis of services to sites. However, the information request is couched in a framework of **two-ended uncontended** services between separate locations (emphasis added)[9]. We believe that this creates an underlying mismatch which will likely have important consequences for how some CPs in particular will choose to report their circuit information. This creates two issues. First, different network implementations create ambiguous and inconsistent views on what is the relevant two-ended uncontended service. Second, there are important cases of network implementations where no such upstream service exists, self-supply or otherwise.

A full discussion of market boundaries is outside the scope of this Annex and we will provide additional observations to Ofcom in due course[10]. In passing we wish to emphasise that in our view, Ofcom's scoping definition is not a requirement of Commission Guidelines[11]:

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[8] See Annex 6 of the Data Analysis Consultation.

[9] This is in the framework of the retail and wholesale product market boundaries which Ofcom has used and which BT disputed in the last BCMR.

[10] As mentioned in our working paper of 15th October 2014 - 'The Calibration of Service Shares and Scenarios', we do provide a limited response to some of Ofcom's arguments in the BCMR Statement Annex 5 where the parallel issue of network topologies is discussed.

- There is nothing in the Commission which leads to a conclusion that 'dedicated' capacity means 'uncontended' and such an interpretation goes well beyond both the letter and the intent of the Guidelines.
- Ofcom's scoping definition is not technology neutral which is an overriding consideration in the Commission Guidelines.
- Even if the Commission Guidelines were to support such a scoping definition of leased lines themselves, all price constraining products in the SMP assessment need to be taken into account and this should be reflected in the information request on the lines we explain below.

In our view, Ofcom should have based this information request on a single-ended service scoping definition which would have avoided these potential problems[12]. This need not result in major changes as information currently supplied automatically meets this scoping definition by separating the two ends as the current processing methodology does at the first stage.

With regard to the current information request, we believe Ofcom should re-request CPs for additional information which they may have deemed to be out of scope based on the issues identified in this Annex. For the future, we believe the scoping definition needs to be either dropped or changed.

Scope of the S135 Information Request and the relevant downstream market

We understand that the aim of the information request is to assemble sufficient market information to form an important input into the subsequent assessments of market power in relevant downstream markets. It is therefore important that the information collected includes all products from all network operators which have a plausible price constraining influence on any product or set of products which might be associated with an operator regarded as having SMP.

In this regard, we note that the S135 request opens which with the explanation that the context and scope of the information request is 'leased lines' and that:

> "In the BCMR, we describe a leased line as a symmetric service of dedicated (ie uncontended) capacity between two locations."

The opening section gives the clear message that the scope of the S135 is restricted to the networks and products which conform to this definition. However, we believe that a plausible interpretation of this scope will often have ambiguity as to the relevant bandwidth to be reported to Ofcom, and even more significantly, will likely exclude important price constraining products altogether as being outside the scope of the BCMR and S135 information request.

As a background comment, we note that Ofcom has included a reference to uncontended as its understanding of dedicated in the definition of leased lines (for example paragraph 3.8 of the June 2012 Consultation). While this may have been true, de facto, when TDM was the predominant technology, this linkage of 'dedicated' to 'uncontended' is now out of date with the widespread use of packet technologies for all traffic types.

Indeed, we are of the view that contention was never the principal feature of 'dedicated capacity' or 'dedicated connectivity'. The principal characteristic of 'dedicated' is the **isolation** of the traffic within the service. With a dedicated service, (be it point to point, hub and spoke, or VPN) internal traffic cannot egress from the service and neither can external traffic enter the service. This is the critical

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[11] Commission Recommendation C(2007) 5406 rev 1 and Commission Staff Working Document SEC(2007) 1483 final.

[12] Every two ended circuit is also two single ends; however, not every single end is the end of a two ended circuit.

feature which allows users of such services to build their own networks where their traffic is fully isolated from other traffic outside their network. This was always the most important feature. Contention was always a secondary feature affecting the ability the builder of a network to be able to predict the overall end to end contention within their network of which any contention with the leased service is only one part. Moreover, as we have stated above, we do not believe that the Commission Guidelines require any such narrow definition of 'dedicated' as 'uncontended'.

We also note that in responding to some of BT's comments made in response to the June 2012 consultation, Ofcom used this definition of 'dedicated' as 'uncontended' in seeking to clarify ambiguity between different network scenarios highlighted by BT. While this may have been intended to give clarification and remove ambiguity between apparently upstream and downstream services, we do not believe that this is the case.

There are still many realistic scenarios where the positioning of technical functionality can vary greatly in the production chain, including the position of contention. In other words, 'uncontended' is not a defining characteristics of an 'upstream' service nor is contended a defining characteristic of a supposedly 'downstream' service. In fact, we believe that a likely consequence of this strict adherence to 'dedicated' as 'uncontended' is to give an erroneous justification for the exclusion of some CP product volumes as being out of scope of the information request itself.

Specifically we highlight the following two issues:

– The distinction between the two examples illustrated in Figure 1 and Figures 2 of the S135 request (reproduced as Annex 6 of the Data Analysis Consultation) leads to an arbitrary and ambiguous distinction between 'end to end', 'access end', and 'access bearer', and hence the relevant bandwidth for the S135 request is also arbitrary and ambiguous.
– There are important services which are essentially identical from the point of view of the end user (and therefore must be part of the same economic market) that under some detailed network implementations conform to the scoping definition, but other important network implementations do *not* conform to the scoping definition and may be legitimately interpreted as outside the scope of the BCMR and S135 information request.
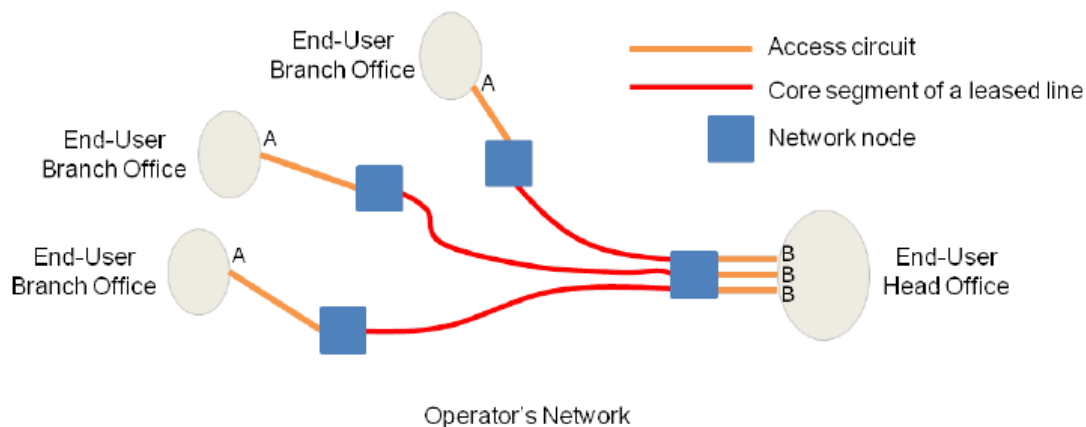
We examine each of these issues in turn below.
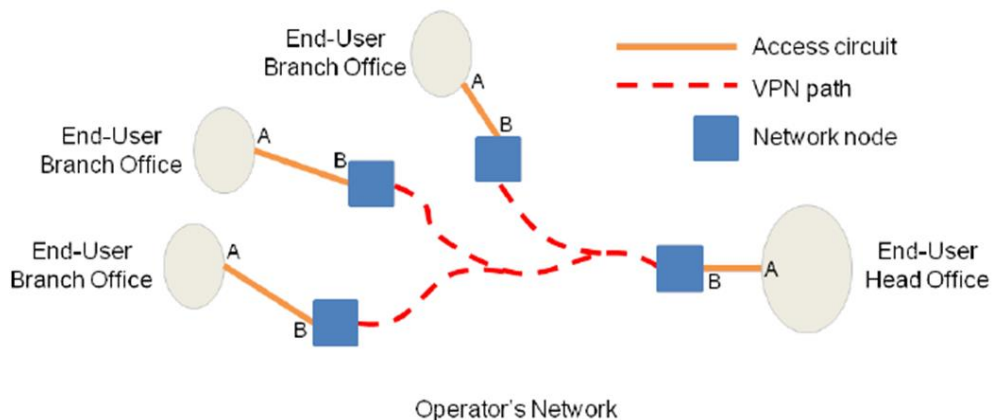
Ambiguity in Relevant Bandwidth

The scenario given in the S135 request and illustrated in Figure 1 and Figure 2 consists of an organisation with a number of branch offices and a head office as shown below.

Figure 1. *Example given in the S135 request (this is a reproduction of Figures 1 and 2 of Annex 6 of the Consultation)*
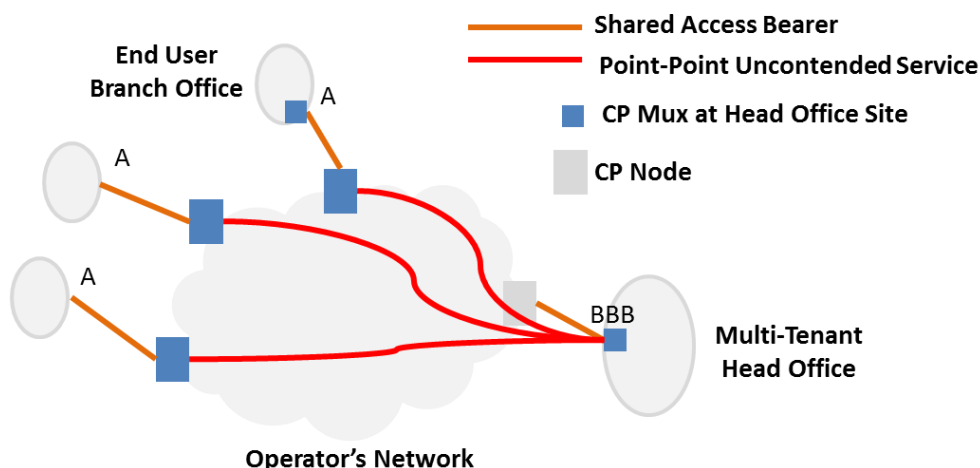

The service and network alternatives that are differentiated by Ofcom are 'direct connections' (Figure 1) and 'VPNs' (Figure 2). Importantly, in the case of the 'direct connections', Ofcom indicates that the relevant two-ended service is the end to end connection between the branch office and the head office. However, in the case of VPNs, they indicate that the relevant two-end service is the aggregate access link between the head office (or branch office) and the CP serving network node.

If we were to consider the situation where there is only one branch office and one head office, then the current counting methodology will give the same answer whether considered as 'direct connections' or a 'VPN'. In the 'direct connections' case, the counting methodology will yield a circuit end at the branch office site and the head office site respectively. In the 'VPN' case, the counting methodology will yield the circuit ends at the branch office and the head office plus two CP node ends. However, these two CP node end are removed according to their designation as a CP network nodes and the two scenarios become identical.

26

The bandwidth and circuit count ambiguity is apparent at the head office end. In this 'direct connections' case, there are three connections terminating at the head office with each of the bandwidths connecting to their respective branches. In the 'VPN' case, the head office has a single connection of a bearer bandwidth which must be greater than the aggregation of each individual branch traffic, taking account of any contention in the multiplexing. This is illustrated in Figure 2 below. In this case, the diagram shows the access to the head office as one shared access bearer and not as three access circuits.

Figure 2. *Example of a common access bearer at the head office site (BT diagram)*

Common Access Bearer at Head Office

The 2013 BCMR Statement, in paragraph A5.141 bullet 3, acknowledges the existence of this issue but only in terms of the issue of relating upstream to downstream services. However, this is not adequate as the issue is more far reaching as it affects the basic measurements that are subsequently used in the SMP assessment. Asking for information according to the 'direction connection' scenario is automatically pre-supposing a market boundary that this Consultation itself acknowledges has not as yet been defined[13]. We consider that it also contradicts the Statement at paragraph 2.4.

In this regard, we disagree with the assertion in Annex 5 of the 2013 Statement that the differences "between the scenarios[14] reflect service differentiation which should be taken into account in the measurement of supply volume" (paragraph A5.135). The differences arise from two factors, neither of which are a matter of service differentiation:

–   First, there is a general and universally acknowledged one way substitution from TDM technology to packet technology. The predominant volumes under 'direction connections' are TDM while those of 'VPNs' are packet technology. There is no meaningful evidence of any new supply of TDM services as a matter of service differentiation as would be necessary for the statement of A5.135 to be true and relevant.
–   Second, any boundary between a packet switching protocol layer and the physical medium protocol on which the packet are carried (e.g. Ethernet PHY layer, WDM, OTN, or even SDH) is a matter of a CP's network implementation and topology choice and has no direct bearing on the service and makes no meaningful contribution to service differentiation. Moreover, to

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[13] Implicitly Ofcom is taking what it decided in the 2013 Statement.

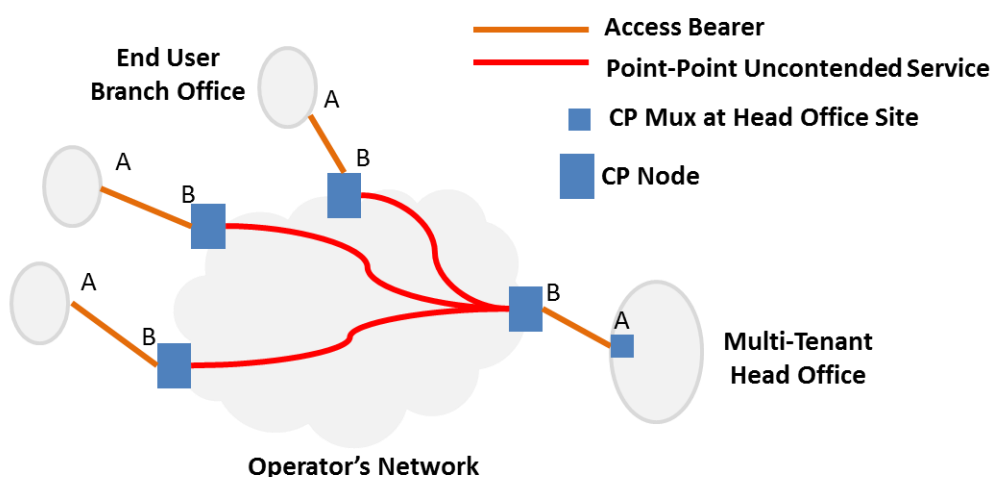[14] Scenarios A to E from BT's response to the June 2012 consultation.

make a distinction based on the details of the physical medium protocol and its topology would be incompatible with the principle of technology neutrality.

More generally, in regard to the issues raised by BT in its response to the June 2012 consultation in relation to the linkage between definitions, services, different network implementation choices, and circuit counting, we do not find that the responses in the Final Statement adequately address the basic issues raised[15].

In our view, this issue of consistency between the 'direct connection' and 'VPN' examples can be resolved by requesting the details of the access bearer in all cases and the details of the access bearer are the primary characteristics used in all the data analyses. We therefore suggest that all future information from CPs should be requested according to the 'VPN' model (notwithstanding that further clarification is needed to this 'VPN' model). In this case, in any scenario that looks like the example of 'direction connections', the branch sites may well report the same information as at present. However, the head office end would report the single aggregate bearer carrying all three of the end-end connections. Even greater consistency can be achieved if the access bearer is reported directly as illustrated in Figure 3 below.[16] Such a model, (with suitable clarification to deal with the second issue below) directly addresses most of the issues raised by BT in its response to the June 2012 consultation.

Figure 3. *A consistent model for the reporting of 'direction connections' (BT diagram).*

Consistent Model for 'Direct Connections'

Different Access Topologies in the 'VPN' Scenario
A general implication of the 'VPN' scenario is that the exact volume of traffic between pairs of end-user sites is not of primary significance and is often - indeed, normally - not recorded as part of the service[17][18]. The focus of the service specification is largely on the service interface at each site and the aggregate bandwidth flowing through this interface.

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[15] Notably A5.91-A5.102, A5.122-A5.145, and A5.164-A5.174 of the 2013 BCMR Statement.

[16] While outside the scope of this response, we note that this framework also resolves issues of the definition of 'trunk' or 'core' already raised by BT.

[17] This does not preclude the existence of SLA and SLG for throughput on a pairwise end-user site basis.

[18] There are examples of services where pairwise bandwidth characteristics are part of the service specification, mainly confined to specific service topologies, notably hub and spoke.

However, the scoping definition of the S135 request requires that somewhere there be "dedicated (i.e. uncontended) capacity between two locations". In at least two importance network implementation scenarios such connectivity does not exist, even though they are technically equivalent to scenarios where such connectivity does exist. Despite one set of scenarios being defined as out of scope and some in scope, there is no meaningful service differentiation between the two.
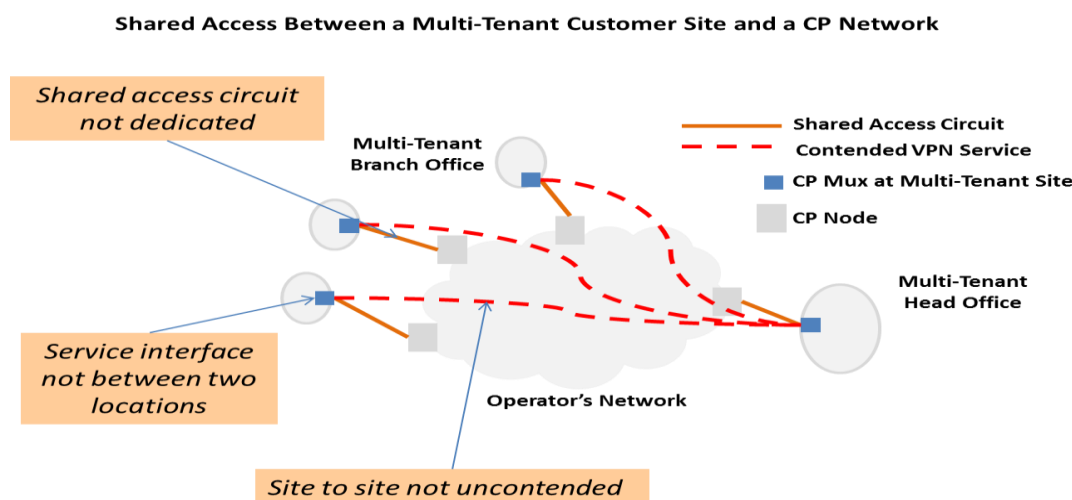
The first scenario concerns multi-tenanted end-user sites which can include many office blocks as well as specific nodes such as multi-tenanted data centres.

In this scenario, the CP places a packet multiplexer in the end-user site and multiplexes service to the different customers present at the site together using this multiplexer. Under most normal circumstances, today the multiplexer will include the use of the packet multiplexing technology, and this multiplexing would be, critically, contended[19].

As is illustrated in Figure 4 below, there is no part of this scenario which can be described as "dedicated (i.e. uncontended) capacity between two locations":

- The access link is not dedicated as it is shared between end users using a contended multiplex.
- The connectivity between any pairwise end-user sites is not uncontended.
- The service interface, which will be both dedicated to one end-user and be uncontended, does not extend between two locations.

Figure 4. *'VPN' scenario with multi-tenant end-user sites and shared access links (BT diagram)*
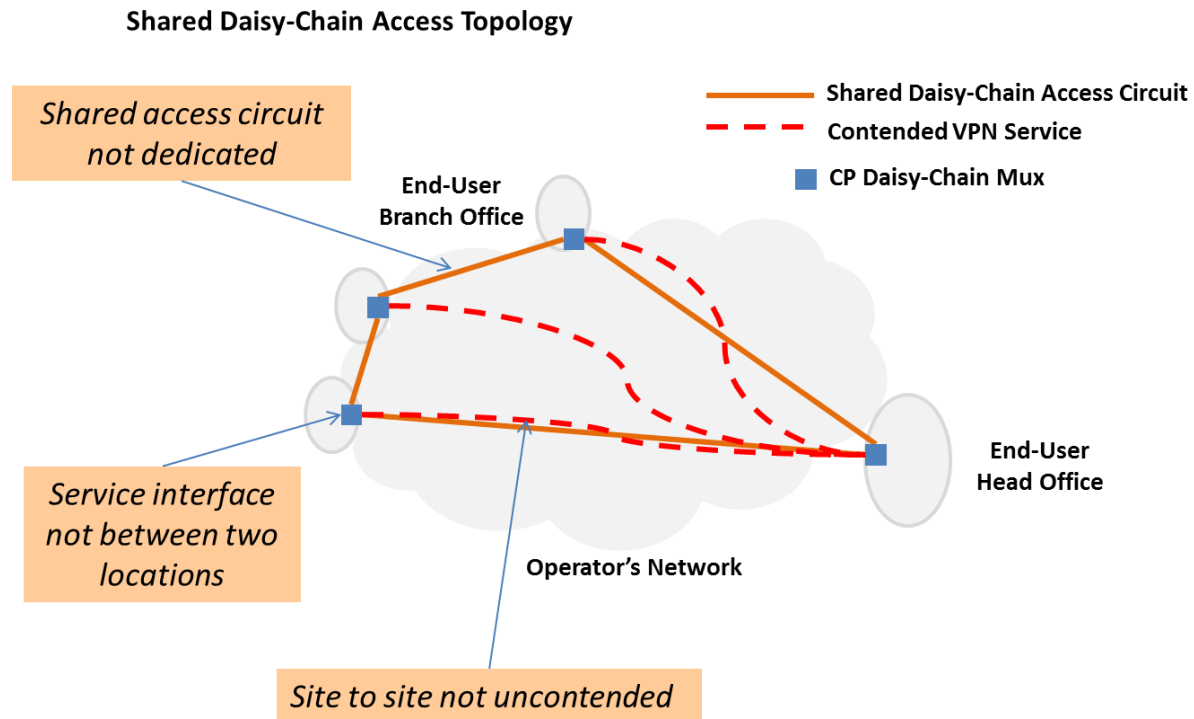

A second scenario where the same issue arises is when a CP uses a 'daisy-chain' topology between end user sites, even if in this case, each individual site has a single tenant. This is illustrated in Figure 5 below. Once again, there is no part of this scenario which can be described as "dedicated (ie uncontended) capacity between two locations":

- The access link is not dedicated as it is shared between end users using a contended multiplex.

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[19] While it is clear with TDM, WDM, and any similar technology, that the multiplexing is uncontended, with packet technology, it is not technically obvious what the precise definition of 'uncontended' should be. There are many plausible definitions. This includes a plausible definition that packet multiplexing is always and inherently contended.

- The connectivity between any pairwise end-user sites is not uncontended.
- The service interface, which will be both dedicated to one end-user and be uncontended, does not extend between two locations.

Figure 5. *'VPN' scenario with a 'daisy-chain' topology between end-user sites (BT diagram)*

Shared Daisy-Chain Access Topology

In at least these two scenarios, any CP responding to the S135 information request is fully entitled to believe that such services are outside the scope of the information request and not include them in their response.

This situation arises directly from the scoping definition. Again, we suggest that the information request must be clear that such scenarios are within the scope of the request.

We believe that this is a substantive issue which is easily resolved and therefore disagree with both elements of Ofcom's view that - "this is a difficult issue. However, even if some ambiguity in the measurement of supply volumes is unavoidable, we do not consider that it is likely to lead to material bias in the service share estimates"[20].
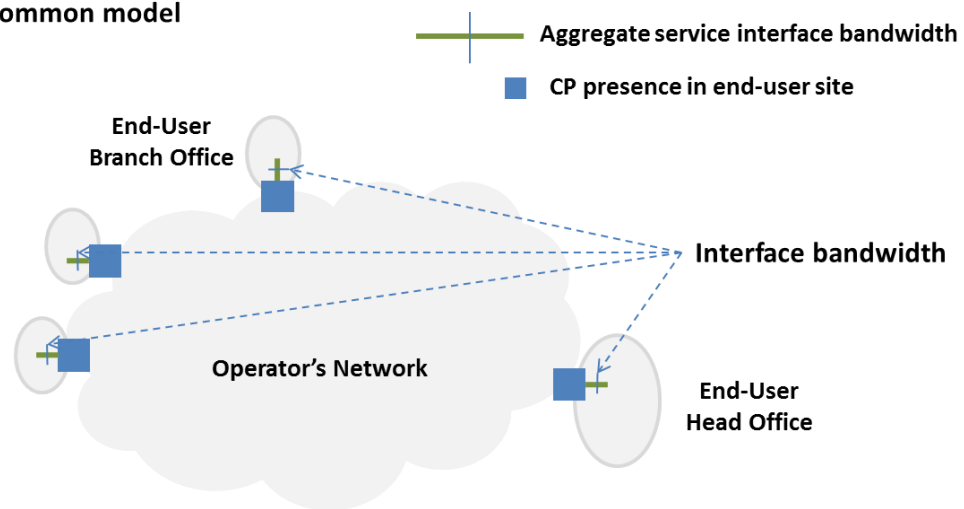
Indeed, the network and service scenario of daisy chains offering packet VPN services highlighted by this second issue is consistent with much current technology and the approach of many newer entrants.

In addition, addressing this issue is directly compatible with addressing the first issue raised in this Annex. The information request should be based on a VPN model which does not require that there is 'dedicated (i.e. uncontended) capacity between two locations'. The information request should be based on the total aggregate capacity handed over at a site as illustrated in Figure 6 below.

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[20] Paragraph A5.168, 2013 BCMR Statement.

Figure 6. *Consistent common model (BT diagram)*

We therefore invite Ofcom to follow up with CPs the issues we have raised above to ensure that we have a consistent set of data allowing a fair calibration of relevant service shares.

Annex 2

Examples of operators whose data could potentially be significant for Ofcom's analysis of high bandwidth markets

The table below lists a number of CPs which i) publicly available information suggests are likely to own and operate their own networks, ii) are not among the operators from whom Ofcom has requested circuit and network information in the BCMR and iii) whose data taken together could potentially be significant in an assessment of high bandwidth markets. We have i) shown whether each of these CPs has Code Powers, ii) indicated any geographic focus of the CPs' activities and iii) provided links to the CPs' own websites or relevant press articles.

CP and basis for potential inclusion in Ofcom's data collection	Code Powers?	Geographic focus?	Links
Daisy. Five UK data centres. Not clear whether fibre is owned or leased	N	London, Southampton and Manchester	Daisy
euNetworks. Fibre-based metro network	Y	West London and Slough	euNetworks
Gyron (NTT). Three UK data centres. Not clear whether fibre is owned or leased	N	Hemel Hempstead	Gyron
GVA Connect. Data Centre. Not clear whether Fibre is owned or leased	N	M25	GVA Connect
Geo. Metro fibre optic network offering dark fibre-based hosting solutions. Acquired by Zayo in May 2014. Ofcom should check that all full Geo network assets have been captured in data provided by Zayo	Y	South Croydon, West London	GEO
Hyperoptic. 'Gigabit footprint' enabling 1Gbit/s connections to residential premises	Y	London, Cardiff, Bristol, Glasgow	Hyperoptic
Interoute. MetroWANs and "largest EU Cloud Services Platform in Europe". Acquired by Vtesse in October 2014	Y	National: 48 major towns in England, Scotland and Wales	Interoute
The Loop. Fibre ring network. Owned by Gamma. Ofcom shoud ensure Gamma has reported all network assets it its Section 135 response	Y (as Gamma)	50 Mile Fibre ring around Manchester	The Loop
SSE. 13,700km private telecoms network and 15 data centres. SSE owns Neos, which did receive an information request: Ofcom needs to ensure that the Neos response covered all SSE's network assets	Y	National	SSE 1 ssetelecoms.com

CP and basis for potential inclusion in Ofcom's data collection	Code Powers?	Geographic focus?	Links
UKFast. Data hosting and cloud specialist. Not clear whether fibre is owned or leased.	N	4 Data Centres in Manchester	UK Fast
Cogent Telecommunications. National Tier 1 Optical IT network	Y	London, Manchester, Slough Southport, Cambridge, Edinburgh, Glasgow	Cogent
Concept Solutions. Aspires to become the leading provider of dark fibre infrastructure	Y	London, Birmingham. Liverpool, Maidstone	Concept
Fibrespeed. High performance fibre network	Y	North Wales	Fibrespeed
Fibrewave. Dark fibre WAN provision and bespoke network solutions for business	Y	Various UK locations	Fibrewave
Newnet/Timico. Core IP network, Tier 3 data centre and carrier-grade VoIP switch	Y (via Newnet)	London, Newark, Milton Keynes, Fareham and Manchester	timico Manchester
Redcentric Communications. 10Gbit/s UK MPLS ne`twork	Y	Seven principal locations in UK	redcentric