Narrowband Market Review

Consultation on possible approaches to cost modelling for the Network Charge Control for the period 2013-2016

Consultation

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Section 1

Executive Summary

Purpose of this document

1.1 This document invites you to comment on the general approach we intend to take if it is necessary to set a new network charge control (NCC) when the current network charge control expires on 30 September 2013.

1.2 Fixed (wireline) voice telephone services are provided in the UK by a variety of different companies (retail communications providers) who either use their own network, or pay another provider (a wholesale communications provider) to supply end customers. As the UK's communications regulator, Ofcom's primary duty is to further the interests of consumers. One way that we fulfil this duty is to review certain retail and wholesale markets for voice telephony (as required under the EU regulatory framework for electronic communications) and, in that review, to set rules that may be necessary if the markets are not effectively competitive.

1.3 We began our review of fixed narrowband markets[1] by publishing a call for inputs (CFI) in May 2012.[2] The deadline for responses was 28 June 2012. In that document we indicated that, whilst in previous fixed narrowband market reviews we have considered the markets for telephone lines (access) and telephone calls (conveyance) together, in this review we intend to only consider the markets for calls.[3] The wholesale markets regulated in this area comprise:

- Wholesale fixed call origination;
- Wholesale fixed geographic call termination;
- Single transit; and
- Interconnect circuits and the administrative costs of managing interconnection (i.e. BT's "Product Management, Policy and Planning" (PPP) charges).

1.4 In each of these markets, our previous market review concluded that the market was not effectively competitive, and that BT had significant market power (SMP) in those markets. As a result, BT is required to offer a number of services:

1.4.1 Wholesale call origination, this is a service provided by one communications provider (the wholesaler) to another, to enable the latter to offer telephone calls to a customer connected on the wholesalers' network (e.g. to use BT's network in the UK excluding Hull);

[1] Narrowband services provide connectivity at up to 64kb/s (or 128kb/s for services via ISDN2 where two 64kb/s channels are used together). This means narrowband services can be used for basic telephony services (including facsimile) and dial-up internet access.
[2] *Fixed Narrowband Market Review and Network Charge Control – Call for Inputs*, 17 May 2012, Ofcom. http:// stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/summary/condoc.pdf
[3] The market for access will be analysed in a future market review.

1.4.2 Wholesale fixed call termination, which is the service provided by one CP (the terminating CP) to connect a call made by a customer of another CP (the originating CP);

1.4.3 Single transit which allows originating and terminating CPs which are not directly interconnected to each other to switch calls through BT's network (in the UK excluding Hull);[4] and

1.4.4 Interconnect circuits which allow the physical interconnection of other networks to BT's.[5]

1.5 Since 1997, we have regulated BT's charges for these services through the NCC. The current NCC was set by Ofcom in September 2009[6] and, as noted above, expires on 30 September 2013.

1.6 This consultation deals with some questions relating to the nature and design of a possible future NCC. It does not set out any proposed regulatory rules. We are continuing to analyse the relevant markets and we expect to publish our proposals in January 2013 which may include the imposition of charge controls as a means of addressing competitive concerns where we have identified that a provider holds SMP in any relevant market.

Proposals in this document

1.7 If an NCC is considered appropriate for the period from 1 October 2013 to 30 September 2016, we anticipate using a cost model as the basis for such controls. For the reasons set out in this document, we are proposing to adopt a different approach to cost modelling to that undertaken in previous market reviews.

1.8 We are now consulting on our proposed approach to the cost modelling exercise. Specifically:

a) We intend to model the costs of a next generation network (NGN) rather than a network that uses time division multiplexing (TDM) technology;

b) We set out the proposed design of the model NGN; and

c) We set out our proposals regarding the design of the cost model and how to implement a LRIC calculation for call termination.

1.9 We are also publishing a spreadsheet model, reflecting the proposals above. We are making the model available now in order to give stakeholders a chance to comment on our approach and make any specific points about the model before we publish any specific charge control proposals. This model is able to generate unit costs for network services. We have provided this capability at this time so that interested stakeholders are able to see the impact of changing model assumptions. However, the outputs from this current model do not form the basis of any charge control proposals.

[4] Single transit relate specifically to calls routed via BT's network that traverse only one tandem exchange. Transit calls that route via multiple tandem exchanges are classified as inter-tandem transit calls.
[5] In the Hull area, KCom is subject to regulation in relation to call origination and fixed call termination but is not subject to charge control requirements. There is no single transit market defined in Hull and single transit is not subject to a charge control on the BT network.
[6] A charge control was not imposed on Single Transit in 2009.

Next steps

1.10 The closing date for responses to this consultation is 9 November 2012.

1.11 We anticipate publishing a consultation setting out our full proposals in relation to the Narrowband Market Review in January 2013. The January 2013 consultation document will set out proposed relevant markets, our proposed determinations as to SMP and, if relevant, any proposed remedies.

1.12 If we propose a charge control in January 2013, we will publish a further version of the NCC cost model at that time.

Section 2

Introduction

2.1 In this section we set out the history of NCCs and how the issues covered in this document fit within our wider review of narrowband wholesale markets.

Regulatory framework

2.2 The regulatory framework has its basis in five EU Communications Directives, each of which have been implemented into national legislation.[7] It imposes a number of obligations on relevant national regulatory authorities (NRAs). One of these obligations is to carry out periodic reviews in certain markets.

2.3 The review is carried out in three stages:

i) we identify and define the relevant markets;

ii) we assess whether any of the markets are effectively competitive, which involves assessing whether any operator has significant market power (SMP) in any of the relevant markets; and

iii) we assess the appropriate remedies which should be imposed, where there has been a finding of SMP, based on the nature of the competition problem identified in the relevant markets.

2.4 In carrying out the review, we are obliged to define relevant markets "appropriate to national circumstances". [8] In so doing, we are also obliged to take "utmost account"[9] of the European Commission's Recommendation[10] and SMP Guidelines.[11]

2.5 Where we have identified that one or more providers holds SMP in a relevant market, we may impose remedies to address competitive concerns within that market which result from the SMP identified. These include, among others, access remedies, non-discrimination and price remedies such as a charge control.

Role and history of NCCs

2.6 NCCs are designed to prevent BT from using its position of SMP to charge excessive prices for the supply of wholesale call conveyance and interconnection services which are necessary inputs for its competitors in downstream (e.g. retail) markets. Previous NCCs have operated alongside other remedies which are designed to

[7] Recent amendments to the five EU Communications Directives were transposed into national legislation and came into effect from 26 May 2011.
[8] See Article 15(3) of the Framework Directive (Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services, as amended).
[9] Ibid.
[10] Commission Recommendation on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services (Second Edition) (C(2007)5406 rev1).
[11] Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services (2002/C 165/03).

protect competitors and consumers from the harm which could result if SMP was left unchecked.

2.7 Previous NCCs have set charges over a number of years applying an 'RPI + / - X' formula. This approach provides incentives for greater efficiency by BT while at the same time allowing charges to converge to (forecast) efficient costs over the period of the control.

2.8 Under the existing NCC, which expires in September 2013, Ofcom imposed an RPI +/- X control on BT in relation to four distinct control baskets.[12] These were:

- Call termination: RPI+3.75%
- Call origination: RPI+2.75%
- Interconnection circuits: RPI+3.75%
- PPP: RPI+1.50%

2.9 The existing NCC was set:

- for 4 years;
- using a cost model based on a hypothetical ongoing TDM network (in which costs were forecast based on asset values consistent with an ongoing network);
- using a current cost accounting (CCA) and a fully allocated cost (FAC) approach to cost recovery; and
- using a glide path from the charges at the end of the previous charge control to align with charges equal to forecast (efficient) FAC in the final year of the control.

EC Recommendation on call termination

2.10 In May 2009, the European Commission issued its *'Recommendation on the regulatory treatment of fixed and mobile termination rates in the EU'* (2009 EC Recommendation).[13]

2.11 The 2009 EC Recommendation seeks to create a standardised approach to the regulation of voice call termination rates across the EU. In particular it recommends that the costs of call termination services should be calculated on the basis of forward-looking long-run incremental costs (LRIC) and, more specifically, an approach whereby the relevant increment is the wholesale call termination service which will capture only the (long-run) avoidable costs associated with termination. For this reason the approach is often referred to as "pure LRIC".[14]

[12] "The 2009 Wholesale Review", *Review of the Fixed Narrowband Services Wholesale Markets-statement on the markets, market power determinations and remedies including further consultation*,15 September 2009.
http://stakeholders.ofcom.org.uk/consultations/wnmr_statement_consultation/summary
[13] http://ec.europa.eu/governance/impact/ia_carried_out/docs/ia_2009/c_2009_3359_en.pdf
[14] The term "pure LRIC" is used in the Recitals to the 2009 EC Recommendation and was the terminology we used when setting MTRs in the 2011 MCT market review statement. Pure LRIC is a measure of incremental costs different from the calculation of "long-run average incremental costs"

2.12 In addition, the EC recommends that the cost model to calculate call termination rates should be based on the efficient technological choices available in the timeframe considered by the model. Therefore the core network "could in principle be Next-Generation-Network ('NGN')-based".[15]

Structure of this document

2.13 This consultation is structured as follows:

2.13.1 First, we discuss our proposed technology choice for NCC cost modelling. This includes the background to the choice of technology used in the previous (i.e. 2009) NCC cost model and the framework that we have used in proposing the technology for the period covered by this review (i.e. 2013-2016).

2.13.2 Second, we discuss our approach to cost modelling including reference to relevant developments since the 2009 NCC.

2.13.3 Third, we describe the structure of the cost model (which is published alongside this consultation) and discuss the key assumptions made.

(LRAIC) or "distributed LRIC" (DLRIC). LRAIC or DLRIC both capture a measure of incremental cost taking a broader increment approach – e.g. all traffic services – rather than just the traffic subset of externally provided voice call termination.

[15] Paragraph (4) of the 2009 EC Recommendation.

Section 3

What sort of network technology should we reflect in our model?

Introduction

3.1 Today, UK consumers make voice calls over networks using two different technologies: time division multiplexing (TDM), which is used, for example, in BT's network, and next-generation networks (NGN), which use Internet Protocol (IP) based technology (used by some of BT's competitors). Any new NCC cost model will need to reflect either the costs of a TDM network, or an NGN. This section explains the framework we propose to use to assess which approach to adopt if we need to set a new NCC.

3.2 We propose that any NCC model should be based on an NGN. To ensure that this allows for recovery of efficiently incurred costs we propose to use TDM costs as a cross-check, based on rolling-forward from prevailing TDM costs and using the model used in setting the 2009 to 2013 NCC. We also propose that any NGN model should not result in a path of costs higher than a hypothetical ongoing TDM network (i.e. a TDM network in which assets are not largely, or almost entirely, depreciated).

3.3 We also discuss how we assess the number of locations at which the modelled network is assumed to receive calls from, and hand them over to, other networks – each a 'point of interconnection' or (PoIs). We propose to model an NGN with 20 PoIs.

Technology choice in the 2009 NCC

3.4 In the 2009 NCC review, we considered whether it was appropriate to move towards an NGN cost model. We also noted that there was the potential for BT to migrate customers from its TDM network to an NGN in the period covered by that review – i.e. by 2013. BT had previously published plans to do that, these plans being commonly referred to as its 21st Century Network (21CN).[16]

3.5 In 2009, we saw two obstacles to modelling efficient voice network costs where NGNs and TDM networks are running in parallel:

- Uncertainty over NGN costs, replacement services and migration patterns; and
- The distortion of incentives with regard to the efficient migration of traffic and services from one network to the other.

3.6 In relation to cost modelling, we recognised that BT's 21CN was not yet operational and that the characteristics of new and replacement services were not then known.

3.7 Therefore, we set the 2009 NCC by modelling a hypothetical ongoing network based on TDM components. The cost model was designed assuming established TDM

[16] BT deferred its plans to migrate voice traffic from its TDM network to its 21CN during the period 2009-2013. However, BT has continued 21CN investments for other services.

technology was used to deliver the relevant wholesale narrowband voice services (like BT's network). However, the cost model assumed:

- All traffic would be carried on the TDM network throughout the control period (ignoring the impact of traffic being carried on BT's 21CN, if any); and

- Capital costs (i.e. depreciation and cost of capital employed) and operating costs of the network were set at the efficient levels that would be expected if the network was an ongoing TDM network. That is, we adjusted certain equipment net asset values to reflect an ongoing TDM network, i.e. not heavily depreciated TDM assets as was (and is) actually the case. We also removed from the cost base any 21CN-specific investments.

2009 EC Recommendation

Summary of the EC's position on technology choice

3.8 The 2009 EC Recommendation states that: *"The cost model should be based on efficient technologies available in the timeframe considered by the model. Therefore the core part of both fixed and mobile networks could in principle be Next-Generation-Network (NGN)-based."*[17]

3.9 The associated Explanatory Note to the 2009 EC Recommendation provides further detail on technology choice as follows:

> *From a forward-looking perspective, a new operator would choose a packet-switched network with all services delivered over an IP core network. Given that regulating termination rates at the level of efficient costs aims at reflecting a situation which would prevail under competitive circumstances, this implies the selection of the most efficient technologies subject to the availability of such technologies in the timeframe considered by the model. In a competitive market, a new entrant would opt for the most efficient available technology, i.e. one based on NGN, for the purposes of building a core network. Hence, a BU model built today could assume that the core network is NGN-based, to the extent that the costs of such a network can be reliably identified.*[18]

3.10 While the 2009 EC Recommendation relates only to call termination markets, we consider that the technology choice for the NCC needs to be consistent across the services within scope of the review, particularly where those services share common infrastructure, as is the case with call origination and termination.

[17] 2009 EC Recommendation, paragraph 4.
[18] Section 5.1.1 of the Explanatory Note.
http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/termination_rates/explanatory.pdf

Approach taken by other NRAs

3.11 Alongside our CFI we published a report by Analysys Mason that set out the approaches taken by other NRAs in relation to the choice of cost model.[19]

3.12 The report by Analysys Mason indicates that, since the publication of the 2009 EC Recommendation, in relation to setting fixed termination rates (FTRs) at least eight NRAs have built NGN models.[20] This is in spite of the fact that, as far as we are aware, none of the incumbent operators have moved their voice services wholly onto an NGN, even though some have made NGN investments.[21]

CFI responses

3.13 In the CFI we asked for stakeholders' views on whether, based on the 2009 EC Recommendation that the core network cost model *"could in principle be Next Generation Network (NGN)-based"*, we should model an NGN.

3.14 A number of respondents supported building an NGN cost model:

- TalkTalk argued that: *"[f]or a long time, it has been beyond dispute that NGNs are based on proven technology that is much more efficient than TDM*".[22]
- [✂] argued that in principle it was *"...difficult to bring any form of cogent argument against the full adoption of the EC Recommendation."*[23]
- ITSPA explained that *"All ITSPA members operate an NGN core network of some description and find themselves continually frustrated by a regulatory regime that promotes the deferral of investment in new core network technologies by incumbent and large TDM operators..."*[24] ITSPA went on to argue that this review was *"...the only opportunity this side of 2016 for Ofcom to lay out a specific roadmap for the expedient migration from legacy, decades-old technology, to new, more efficient and ultimately beneficial technologies."*

3.15 Other respondents were undecided:

- H3G noted that although voice calls have traditionally been delivered using circuit switched technology, it considered IP-based NGNs to be *"...significantly less costly to build and operate than circuit-switched networks..."*[25] However, it went

[19] Report for Ofcom, Study of approaches to fixed call origination and termination charge controls, 15 May 2012. http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/annexes/analysys_mason.pdf
[20] See the summary table at Figure 65 of the 15 May 2012 Analysys Mason report. Even though some NRAs were setting cost-based FTRs using a blend of TDM and NGN cost models, all had implemented, or were proposing to integrate, NGN model results in their charge controls.
[21] For example, France Telecom operates both a TDM network and an NGN, although some alternative operators in France have rolled out NGNs. ARCEP, the French NRA, considered that TDM was sub-optimal and so regulated on the basis of NGN model outputs only. In Austria, Telekom Austria is in the process of rolling out its NGN, however, RTR, the NRA, regulates on the basis of an NGN model. This was also the situation in Belgium. For the other countries surveyed, it was not clear whether the incumbent was in the process of migrating to NGN. Nevertheless, the NRAs still chose to regulate on the basis of an NGN or an NGN-TDM blended model.
[22] TalkTalk response to CFI, p.11
[23] [✂] response to CFI, Question 26
[24] ITSPA response to CFI, p.1
[25] H3G response to CFI, p.5, Question 25

on to note that *"...Three understands that the majority of calls to fixed geographic numbers terminate on TDM networks. Ofcom has traditionally excluded technologies at low levels of deployment for cost modeling purposes when regulating call termination in both fixed and mobile networks."*

- A similar point was raised by EE, which also argued that while it did not have a specific view on the appropriateness of using an NGN model for some or all of the NCC, the use or otherwise of such an approach should ensure a competitively neutral outcome.[26]

- C&WW considered that an NGN-core network would be an appropriate approach, but was uncertain as to whether it would be the most appropriate approach. Therefore, it considered that we should model both TDM and NGN (with the latter including interworking costs[27]) and use whichever gave the lowest costs.

- On the question of model calibration, C&WW was sympathetic to the difficulty of the task, given that BT does not yet operate a national NGN, however, it argued that this was not a reason not to adopt an NGN-based model. As C&WW explained *"...otherwise ultimately NGN-based costs will never be used until such a time that BT chooses to deploy a national NGN."*[28] Indeed [✂] went further and argued that the absence of a national NGN operated by BT meant that the model could be specified without interference from the commercial and strategic choices made by BT.[29]

- KCom accepted that it was valid for Ofcom to consider NGNs in the context of cost modelling for regulated services, but argued that the physical way in which CPs interconnected was a distinct policy issue meriting separate consideration.[30]

- Virgin Media neither came out in favour of or against NGNs for cost modelling, but instead noted the practical difficulties of the task, in particular the lack of a national NGN on which to base the model. Virgin Media went on to argue that we should not simply model NGN on the basis of the 2009 EC Recommendation.[31]

3.16 BT did not object to an NGN based model, but identified a number of considerations that needed to be addressed:

- *"The apportionment of costs where assets are shared between services – PSTN is the primary voice service and has strict quality of service requirements which have to be met. Some 150kb is required to emulate PSTN over IP as opposed to 64kb in legacy networks. Peak usage has to be accommodated to the same high standard and resilience is a prerequisite, all of which requires dedicated resources.*

- *The transition from legacy to NGN networks requires a lengthy period of parallel running and this needs to be taken account of in the modelling. Also, migration costs are potentially a major barrier to change and any charge control needs to take them into account.*

[26] EE response to CFI, p.5
[27] We take "interworking costs" to mean the costs of converting TDM traffic to IP and vice versa.
[28] C&WW response to CFI, p.22, Question 26
[29] [✂] response to CFI, Question 26
[30] KCom response to CFI, p.3
[31] Virgin Media response to CFI, Question 26

- *A critical issue to be debated is where hypothetical NGN based termination rates would apply from.*

- *The assumptions made about the number of players in the hypothetical market will need to be decided. We assume it will be 4 players with equal shares as in the MTR model.*

- *Assumptions will need to be made about the network topology and how a hypothetical model is related to the existing node structure."*[32]

3.17 The issues raised by Verizon on the issue of technology change were primarily geared towards the consequences for remedies such as Carrier Pre-Selection (CPS) and Indirect Access (IA) rather than about the appropriate technology choice for cost modelling.[33]

Choice of network technology for the cost model

3.18 Before outlining our proposals for NCC cost modelling in the 2013-2016 period, it is useful to outline our framework for technology choice.

The Modern Equivalent Asset Approach

3.19 Ofcom's most recent consultation to consider the issue of technological change and the basis of charge control cost modelling is the *Leased Lines Charge Control Consultation: Proposals for a new charge control framework for certain leased lines services* (2012 LLCC Consultation).[34] In that document we explained that in setting charges, we prefer to base costs and asset values on the most efficient available technology that performs the same function as the current technology. This is sometimes described as the modern equivalent asset ('MEA') approach to pricing.

3.20 Setting prices on the basis of MEA costs is consistent with asset valuation under the CCA framework where assets are valued at their current replacement cost. This is then reflected in changes in the underlying asset prices, which results in either holding losses (associated with reductions in the asset prices) or holding gains (increases in asset prices). In some circumstances the replacement asset might not be identical to the asset in use – it may work better and/or support new services. In such cases, the CCA value of the existing asset should be reduced to reflect the cost of a functionally identical modern asset. Where an additional adjustment to the asset value is required, we have previously referred to this as "abatement".[35] [36]

[32] BT response to CFI, p.14, Question 25
http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/responses/BT.pdf
[33] Verizon response to CFI, p.1
[34] http://stakeholders.ofcom.org.uk/binaries/consultations/llcc-2012/summary/LLCC_2012.pdf, para 4.54 et seq.
[35] Charge control review for LLU and WLR services, paragraph 7.95, 7 March 2012, Ofcom, http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/statement/statementMarch12.pdf
[36] Ofcom takes the standard approach to MEA valuations to be that set out in the "Byatt report" ("Accounting for economic costs and changing prices, a report to HM Treasury by an advisory group", HMSO 1986). We consider this the most authoritative source on the relevant principles.

The use of 'anchor pricing' during technological change

3.21 Although gradual technological change can be incorporated by the MEA approach, more radical technological changes may pose significant challenges. When technology is changing rapidly, we also consider (and in some cases, prefer) the adoption of an approach which we refer to as 'anchor pricing'.

3.22 We first consulted on the anchor pricing approach in the September 2007 next generation access (NGA) consultation.[37] [38] A similar approach referred to as "technology neutrality" was used for the NCC in the 2005 NCC consultation.[39] Under the technology neutral approach, the cost modelling and thus regulated charges were *anchored* to a hypothetical efficient TDM network.[40]

3.23 The principle behind anchor pricing is that following technological change, prices should not be higher than they would be if the existing technology were still used. This ensures that new technology which is intended to provide a greater range of services does not inappropriately increase the prices for the same services provided using the existing technology. Anchor pricing can be implemented in a number of ways, for example by using the current price as a starting point or by modelling based on the cost of existing technology, allowing for business-as-usual efficiency gains, rather than that of any new technology which might be adopted during the control period.

3.24 The anchor pricing approach means that charges do not immediately reflect the costs of a new technology but, for a time, may be based on the costs of an existing, proven technology. This approach is intended to give the regulated firm incentives to invest in new technology only when providing services over the new technology would lower its overall costs and/or would enable it to provide higher quality services for which consumers are willing to pay a premium. At the same time, consumers of existing services are not made worse off by the adoption of new technology. The price (and quality) of existing services are anchored by the legacy technology, even if the services are actually provided over new technology.

Criteria for assessing the most appropriate approach

3.25 In our view, the questions relevant to the choice of modelled technology are as follows:[41]

i) Can we identify the relevant MEA for delivering the service in question?

ii) Can we calculate robust cost estimates for the services based on the MEA?

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[37] *Future broadband – policy approach to next generation access*, September 2007, http://stakeholders.ofcom.org.uk/binaries/consultations/nga/summary/future_broadband_nga.pdf See, in particular, Annex 7.

[38] Next Generation Access (NGA) refers to an upgrade of the access network (the connection that links end customers into the operator's backbone or core network) which allows broadband services with speeds of over 24Mb/s to be provided. These upgrades rely on the deployment of fibre to replace some or all of the existing copper connection between the customer and the rest of the network.

[39] *Review of BT's network charge controls - Explanatory statement and Notification of proposals on BT's SMP status and charge controls in narrowband wholesale market*, March 2005, http://stakeholders.ofcom.org.uk/binaries/consultations/charge/summary/ncc.pdf

[40] Ibid, paragraph 1.9, paragraph 4.19 et seq.

[41] These questions are consistent with the approach taken in the 2012 Leased Lines Charge Control Consultation http://stakeholders.ofcom.org.uk/binaries/consultations/llcc-2012/summary/LLCC_2012.pdf

iii) Would the use of the MEA approach allow an efficient operator to recover its costs?

iv) Does the MEA approach give appropriate migration signals to consumers?

Can we identify the relevant MEA for delivering the service in question?

3.26 For several years, all major new networks deployed in the UK have used NGN technology. Several of the largest NGNs in the UK have been deployed by CPs providing retail broadband and narrowband services based on purchasing BT's local loop unbundling (LLU) services, for example:

3.26.1 TalkTalk began deploying its NGN to support voice and broadband services provided over LLU in 2005-6.[42]

3.26.2 Sky initially deployed a broadband-only service but from around 2009 onwards commenced deployment of a voice-capable NGN and migration of its customer base.[43]

3.27 Other CPs (that do not provide services via LLU) have also deployed NGNs. These networks may connect to business customers directly (via the CP's own direct access network or via a leased line) in addition to connecting via wholesale voice call origination and termination services purchased from BT (which they would do where it is not economic to deploy their own access network). Deployment of these NGNs commenced around 2000, albeit on a relatively small scale initially.

3.28 Equipment suppliers continue to maintain *existing* TDM equipment, but, as far as we are aware, they are not providing TDM equipment for new network build. Therefore, any new network deployments would need to be NGN-based.

3.29 Whilst the geographic coverage and the scope of services provided by NGNs currently deployed in the UK may not be as comprehensive as that provided by BT, these networks connect to substantial numbers of consumers across a significant proportion of the UK.[44]

3.30 For these reasons, we consider that NGNs are a proven technology for the provision of voice services in the UK. But even if NGNs are proven technology, we also need to consider whether they can provide voice services more cheaply than TDM networks. One approach to answering this question would involve obtaining cost estimates directly from network operators. This is considered under the next sub-heading below. Before doing so, we first make some observations based on the network deployments recently made by competing operators. Given the competitive and commercial pressures facing such operators we might expect their behaviour to provide some insights on what efficient technology choices are for the provision of the services of interest.

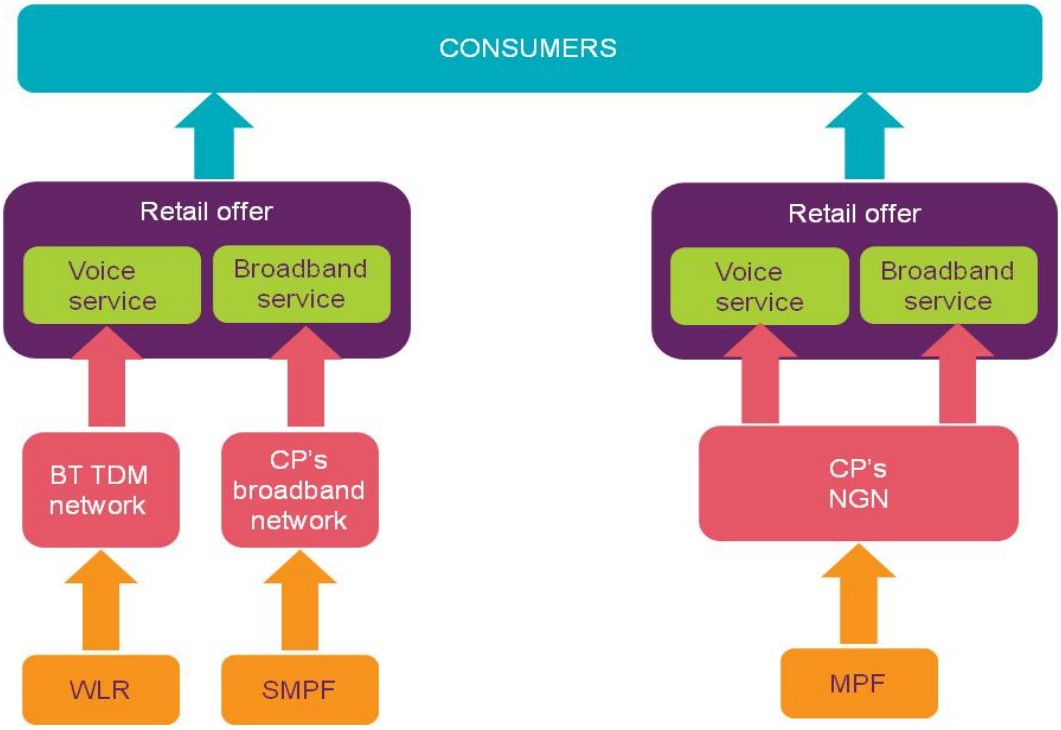
[42] TalkTalk reported on progress of rollout of its NGN in its November 2006 interim results presentation:
http://www.talktalkgroup.com/~/media/Files/T/TalkTalk/pdfs/presentations/2007/interim06.pdf

[43] Sky reported on progress of its deployment of full unbundling (based on rollout of its NGN) in its July 2009 results presentation:
http://corporate.sky.com/file.axd?pointerid=6c49f7d77d904eecb1d330bd1029549d

[44] For example, as of July 2012, TalkTalk's network footprint covers 93% of the UK providing voice and broadband services.
http://www.talktalkgroup.com/~/media/Files/T/TalkTalk/pdfs/presentations/2012/strategy-update-pres.pdf%20title=

3.31 Several of the largest NGNs in the UK have been deployed by CPs providing both retail broadband and voice services. CPs using LLU to supply their broadband have a choice: they can deploy a broadband-only network (based on buying the Shared Metallic Path Facility (SMPF) from BT[45]), or they can deploy a network capable of supporting both voice and broadband (i.e. by purchasing Metallic Path Facility (MPF) from BT – also known as 'full' unbundling). This is shown below in Figure 1 below.[46]

Figure 1: Provision of voice and broadband services by LLU operators



3.32 In the initial stages of LLU deployment, the broadband-only approach (i.e. SMPF) was predominant, but now the majority of LLU-based services are provided over MPF with both voice and broadband provided over the CP's network. At the time we set the last NCC in 2009, 70% of LLU lines were provided via SMPF and only 30% via MPF, whereas now around 30% are provided via SMPF with the majority – around 70% - via MPF. In deciding on the best approach to providing their own voice service (i.e. whether to invest in LLU for broadband only or for both voice and broadband) CPs take into account a number of factors, including whether voice services provided over an NGN are able to compete with those provided over a TDM network.

3.33 Basic telephony services are mature and consumers know what to expect from their provider; there is therefore limited scope for differentiation in service based on providing different functionality as a means of gaining a competitive advantage.

[45] SMPF allows the CP to connect its own broadband equipment in the BT local exchange to the customer's line so that the CP can provide broadband services over its own network, whilst the narrowband portion of the line remains connected to BT's narrowband network for the provision of voice services.

[46] Where a CP deploys a broadband-only LLU network, it may choose to offer voice services using BT's wholesale services as shown in Figure 1, or be a broadband only provider, in which case the consumer will be provided with voice services by another provider.

Therefore, CPs that deploy NGNs to provide voice services are competing with the services provided on TDM networks primarily through the prices offered.

3.34 There may be more scope for product differentiation between voice services supplied to businesses. However, businesses are sensitive to the prices for basic call conveyance and so are unlikely to switch to NGNs if call prices are higher than offered by TDM network operators, irrespective of the additional features that may be available.

3.35 Since several of the largest NGNs in the UK have been deployed by CPs providing retail broadband and narrowband services across most of the UK, and because such CPs will have made those investments in order to maximise profits (implying cost-minimisation), we consider that this provides evidence that those providers believed that NGN technology was an efficient way to offer voice services.

Can we calculate robust cost estimates for the services based on the MEA?

3.36 Notwithstanding the inferences which can be drawn from commercial operator behaviour, strictly the choice of MEA for voice services depends on identifying the least cost proven technology for the provision of these services alone. However, the recent operator investments noted above have been made in the context of providing both voice and broadband, not voice services on a stand-alone basis.

3.37 In its response to the CFI, C&WW suggested that a cost comparison between NGN and TDM technologies be performed to determine which technology yields the lowest cost.

3.38 Comparing the costs to deliver voice services on TDM networks and NGNs raises conceptual and practical difficulties. For example, if the current technology can deliver just one service (say, voice calls) and a new technology can deliver two or more services (e.g. voice calls and broadband), then the new technology is the MEA in two scenarios:

- First, if the multi-service new technology costs less in total than the single service technology it replaces; or
- Second, if the efficient allocation of costs to the service of interest (e.g. voice) results in a lower level of costs for the single service than the current technology asset it replaces.

3.39 In the first case, the new multi-service technology is unambiguously the MEA. In the second scenario, the answer depends on the level of costs allocated to the single service (e.g. voice). In other words, the multi-service asset needs to be abated for the additional functionality it offers (e.g. the value attributable to the provision of broadband). The MEA analysis would then involve comparing the cost of the suitably abated multi-service asset with the cost of the single-service asset it would replace.

3.40 Economic theory suggests that the efficient allocation of costs to the service of interest (i.e. voice) would be the cost of the multi-service asset minus the economic value attaching to the other service (e.g. broadband). In principle, this economic value could be derived from the net revenue (i.e. revenue minus service incremental costs) under competitive conditions from the supply of the other service (e.g. broadband).

3.41 However, this implicit value approach is likely to be difficult to implement, not least when the other service is often sold in bundles and/or is sold both at a wholesale and a retail level (which is the case for broadband).

3.42 In the present case, both NGN and TDM networks support multiple services, which compounds the problem of comparing the costs of the alternative technologies for a single service (i.e. voice). For example, duct, cable and accommodation are likely to be shared by many services (including voice, broadband and leased lines) and transmission assets will also be shared.[47]

3.43 In implementing cost analysis for setting regulated prices, whether based on NGN or TDM, it is important, in principle, that the costs identified are consistent with stable ongoing networks. However, any analysis which relies on the observed costs of such networks today will need to be mindful of the fact that:

- NGNs are still relatively new; and
- TDM networks are now relatively old.

3.44 Recognising the first point above, in both 2005 and 2009, Ofcom adopted a hypothetical ongoing network cost model (referred to as a "technology neutral model" in 2005) in large part because of concerns over whether NGNs were sufficiently mature.[48] [49]

3.45 While the choice of MEA should not be determined by actual operator behaviour – since otherwise there are incentives on the regulated firm to delay investment in new technology, even if it is otherwise efficient – we clearly wish our regulatory judgments to be grounded in commercial reality. As was the case in 2005 and 2009, today there is no NGN deployed with the geographic scope and product set capable of providing service to all UK customers – BT, the only CP with fully national coverage, has continued to operate its TDM network for voice services by extending the useful lives of these assets. However, BT's NGN migration for other services, including broadband, is well underway.[50]

3.46 More importantly, competing CPs have built NGNs since Ofcom first addressed the question of technology choice for voice services (i.e. in the March 2005 NCC Consultation[51]). LLU investment has resulted in around 93% of UK premises now being served by unbundled exchanges. At the time of the previous NCC consultation, 84% of UK premises were covered by unbundled exchanges.[52] As noted above (paragraph 3.32), there has also been a significant shift since the last NCC from SMPF (where the voice service continues to be provided via BT's TDM network – at least for the call origination leg) to MPF, where the voice service is provided via the CP's NGN.

[47] For example, traditional interface leased lines, TDM voice networks and legacy broadband services are likely to share SDH transmission assets, whilst alternative interface leased lines, newer broadband services and IP-based voice networks will share Ethernet transmission assets.
[48] 2009 NCC Statement, paragraph 4.7
[49] 2005 NCC Statement, paragraph 1.12-1.13
[50] https://www.btwholesale.com/pages/static/Library/Network_Information/21CN_Broadband_Availibility/index.htm
[51] http://stakeholders.ofcom.org.uk/binaries/consultations/charge/summary/ncc.pdf
[52] Source: Ofcom/operator data.

3.47 Therefore, we consider that NGN technology is sufficiently mature that it is reasonable to assess the costs of NGNs directly from CPs investing in and operating such networks.

3.48 Establishing the efficient costs of TDM networks is difficult because equipment manufacturers are no longer supplying such equipment. Migration to a fully digital TDM network was completed by BT in the mid-1990s[53] and BT has continued to deliver voice services using this infrastructure (with appropriate software and equipment upgrades and network equipment maintenance).

3.49 BT's accounting data shows that as at March 2011[54], the Net Book Value (NBV) of critical TDM-specific assets (i.e. Total Local Exchanges and Transmission Equipment excluding Duct) was 5.5% of the Gross Book Value (GBV). Since BT recovers most of its capital costs via depreciation charges, this suggests that BT has had the opportunity to recover these costs.[55] Around 80% of these TDM assets were fully depreciated and by 2013 the remaining assets will also be further depreciated.

3.50 Based on this evidence, we consider that the NGN cost data that can be gathered from CPs in 2012 is likely to provide at least as robust an estimate of the ongoing costs of a fixed voice network as the best available TDM cost data.

Would the use of the MEA approach allow an efficient operator to recover its costs?

3.51 As noted in the 2012 LLCC Consultation, if BT has not had a fair opportunity to recover its investment in technology, then an approach that prevents BT from recovering sunk costs could deter future investment. But, as also noted in the 2012 LLCC Consultation, this does not mean that the MEA approach should prevent losses that are caused by an operator's inefficiency. Nor should it lead to higher prices than would be charged under an anchor pricing approach.[56]

3.52 In addition to the question of the recovery of technology specific fixed and sunk costs, there is a separate question as to how quickly the hypothetical efficient network is assumed to move to the new technology (i.e. the MEA). The costs of moving from TDM to NGN may include:

3.52.1 **Interworking costs:** sometimes referred to as "conversion costs" or "inter-operability costs" these costs arise from the need to convert voice traffic from TDM to IP and vice versa during the period of parallel running; and

3.52.2 **Migration costs:** an operator that migrates from a TDM network to the NGN will face operational costs to disconnect the customer line from the TDM network and re-connect to the NGN. We have not included these costs in our modelling to date but plan to consider the extent to which (and if so, how) these might be included in any cost modelling in our January 2013 consultation.

3.53 Our aim is to capture only efficiently incurred costs in setting charge controls. For example, we wish to avoid inefficiently long periods of parallel running. We also consider that there may be other off-setting factors such as:

[53] Source: BT Annual Report and Accounts 1996.
[54] Source: BT response to s135 under Communications Act, June 2012.
[55] The rest of these costs are recovered via return on capital employed which will diminish as the net asset value reduces through depreciation.
[56] See paragraph 4.70, Leased Lines Charge Control consultation, 2012. http://stakeholders.ofcom.org.uk/binaries/consultations/llcc-2012/summary/LLCC_2012.pdf

3.53.1 **Costs common to NGN and TDM networks:**[57] The more assets are used to support a TDM network which can also support an NGN, the lower the costs of parallel running (provided there is spare capacity in these assets) and the easier NGN deployment will be (for example, new duct and trench does not need to be dug and installed, existing space in buildings can be used, all of which will speed up NGN deployment).

3.53.2 **Installed customer base:** An incumbent operator such as BT will have an installed customer base. Therefore, potential unit cost inefficiencies from lower than optimal TDM and NGN utilisation during migration are offset because BT can achieve adequate NGN utilisation by migrating existing customers and not by having to win market share (as is the case for an entrant NGN).

3.54 If we model an NGN, and not a TDM network, we think that it is important to verify the model outputs in the following way:

- NGN unit costs are no higher over the 2013-2016 period, than if based on a hypothetical ongoing TDM network (i.e. based on the modelling approach of the 2009 NCC);
- The path of unit costs from the NGN does not depend on an assumption that it was possible to charge more in historic periods than envisaged under previous cost models used by the regulator; and
- The unit costs from the NGN model over the 2013-16 period would not deny BT the opportunity to recover its efficiently incurred costs (in particular those of TDM specific assets).

3.55 We describe how we propose to meet these objectives in the cost verification sub-section of Section 4 below.

Does the MEA approach give appropriate migration signals to consumers?

3.56 If the choice of technology ultimately rests with consumers, it is important that consumers face prices that give efficient migration signals. In contrast, if the behaviour of operators drives technology choices, then clearly their investment incentives will be more important in determining the efficient outcome.

3.57 In the present case, where we are considering whether the MEA for the provision of a narrowband voice service is an NGN or a TDM network, the technological choice used to provide voice services (and broadband) is typically determined by network operators rather than consumers.

3.58 Therefore, in the present case, we place more weight on ensuring efficient investment and migration decisions by CPs, rather than by consumers.

Conclusion on the proposed technology choice

3.59 We think that the time has come when NGNs can be reasonably considered as the MEA for voice services. In particular, new entrants have deployed NGNs, suggesting that it is a proven technology. Equipment manufacturers no longer supply TDM

[57] We estimate that these common costs account for approximately 35% of the current cost of NCC services.

equipment for new network deployments. Nevertheless, we recognise that there are practical concerns in implementing an NGN model which we will explore further through this consultation and the January 2013 consultation.

3.60 We are also mindful of our duty to take utmost account of the 2009 EC Recommendation which identified that the model (for the regulation of termination at least) should *"...be based on efficient technologies available in the timeframe considered by the model"* and that the core part of the network *"...could in principle be Next-Generation-Network (NGN)-based".*[58]

3.61 We consider that the approach described above (and in Section 4 below) is consistent with the 2009 EC Recommendation and also with the approach taken by other NRAs in Europe.59

Question 1: Do you agree with our proposal that NGNs can be considered the MEA for the purposes of modelling call origination and call termination services? If not, please explain why.

NGNs and impact on points of interconnection (PoI)

3.62 In BT's current network, each switch (Digital Local Exchange (DLE) or tandem exchange) acts as a PoI. In order to access call origination and call termination services provided on BT's TDM network, CPs must interconnect with BT's DLEs – of which BT currently has over 650.[60] Previous NCCs for call origination and call termination have been based on the cost of conveying calls between the customer's point of connection to the network where traffic aggregation occurs (the Remote Concentrator Unit (RCU) in the BT TDM network) and the DLE.

3.63 In an NGN there is no direct equivalent of the DLE. In considering what costs should be included in charge controls for call origination and call termination services we therefore need to consider how interconnection would be achieved by an efficient NGN.

3.64 In an NGN, the number and location of PoIs involves a trade-off. Fewer PoIs may lead to lower equipment costs but conveyance distances will be greater between each PoI and the customer's point of connection to the network where traffic aggregation occurs (typically a Multi Service Access Node (MSAN) in an NGN). That is, more transmission will be included in providing the call origination and call termination services. NGNs offer economies of scope in conveyance due to the ability to support multiple services on a single infrastructure, and these economies may reduce the impact on cost of these greater conveyance distances.

3.65 Increased conveyance distances may also increase end-to-end transmission delay (which would reduce quality of service) although in the UK this may not be a

[58] 2009 EC Recommendation, paragraph (4).
[59] As evidenced, for example, by the 8 NRAs described in the May 2012 Analysys Mason report (which have implemented, or are transitioning to, NGNs for the regulation of wholesale call conveyance services). See the 15 May 2012 Analysys Mason report at http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/annexes/analysys_mason.pdf
[60] Alternatively, if a CP does not connect to all DLEs it is able to purchase call origination and call termination in combination with local-tandem conveyance (LTC) and inter-tandem conveyance (ITC) from BT. However, LTC and ITC are de-regulated services, provided on a commercial basis.

significant factor due to the relatively short transmission distances involved. Alternatively, more PoIs will reduce the conveyance distance (and so may reduce conveyance costs and/or improve quality) but may result in higher equipment costs.

3.66 A further consideration is the extent to which equipment can be shared by services other than interconnection of voice services, for example broadband interconnection, so that consideration of how interconnection is provided for other services could be a factor in assessing the number of PoIs to assume for voice interconnection.

3.67 In the absence of a national NGN for voice services, an important reference point is the industry-wide consideration of a national NGN that occurred during BT's 21CN development process. In this context, the number of PoIs that should be provided by BT was debated at length by NGNuk.[61] Several options were discussed including interconnection at the metro nodes (of which there are 106) and 27+2 POIs, where full national coverage could be provided via 27 PoIs, but two further points were provided for resilience purposes.

3.68 In addition, as a further source of evidence, we note that the NGN models developed by NRAs in other European countries typically support a relatively small number of PoIs. For example, in France, ARCEP required IP interconnection to be made available at fewer than 24 POIs, compared to around 400 TDM interconnection points.[62]

3.69 A number of respondents to the CFI expressed views on how many PoIs would be reasonable to assume for an NGN:

3.69.1 BT argued that the optimal number of PoIs was open to conjecture as data volumes were still developing. It pointed to the fact that the relevant number could be up to a thousand as this is the number of points where Ethernet service handover is available.[63]

3.69.2 C&WW made a number of points about the change in architecture that arises in an NGN which allows, for example, for call control and media to connect via different PoIs. However, C&WW also said that it believed that the conditions that led industry to conclude on 20-30 PoIs still existed and so this should form the start point for our assessment.[64]

3.69.3 [✂] identified similar architectural points to C&WW and said that the starting point for a CP was the number of PoIs needed to satisfy the requirements arising from the General Conditions (specifically GC2 and GC4) but that in BT's case the regulated rates should apply from the previously agreed 27+2 PoIs in the first instance. These could be reviewed as experience developed.[65]

[61] NGNuk was the body set up by Ofcom to facilitate industry negotiations on the migration of the UK voice network to NGNs.
[62] See the 15 May 2012 Analysys Mason report at http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/annexes/analysys_mason.pdf
[63] BT response to CFI, p.9, Question 13
[64] C&WW response to CFI, p.13, Question 13
[65] [✂] response to CFI, Question 13

3.69.4 H3G highlighted that an NGN would typically have fewer PoIs than a TDM network.[66]

3.69.5 ITSPA noted that discussions have ranged between 106 and 27+2, which it said were "fairly arbitrary" but did not express a view on the approach we should take to identify the number of PoIs in the model.[67]

3.69.6 TalkTalk argued that BT (and other operators) should be required to provide IP interconnection at [✂] PoIs, though it did not explain the basis for this number of PoIs.[68]

3.70 In response to BT's argument regarding the location of Ethernet PoIs, we would expect that the locations of the voice PoIs would be a subset of the Ethernet handover points, rather than being distinct physical locations. As such, infrastructure could be shared between these services at these points. To support interconnection at 1,000 points would require equipment to be deployed to support voice services at each of these locations, which could result in reduced economies of scale.

3.71 Based on the views expressed by other respondents to the CFI, the previous discussions relating to BT's 21CN deployment and the approach taken in modelling NGNs in other countries, we consider it unlikely that an NGN with 1,000 PoIs would be the most efficient network design. Our initial view is that a smaller number is likely to be the optimum approach based on the discussions held by industry in relation to 21CN, given that these discussions would have taken account of these trade-offs.

3.72 We have proposed a hierarchical network within our NGN cost model. This hierarchy has around 1,000 "Super Access" nodes, 100 "Aggregation" nodes and around 20 "Core" nodes. 20 PoIs (i.e. interconnection at the core nodes), or something close to 20, would be consistent with a number of responses to the CFI, the models developed by other NRAs and previous discussions in the context of BT's 21CN deployment. Further, whilst BT did not deploy the voice capability of 21CN, it has rolled out the broadband service that uses the 21CN – Wholesale Broadband Connect (WBC) – and interconnection to WBC is offered at 20 PoIs.

3.73 We propose to model 20 PoIs, so that PoIs are co-located with the core nodes in our model.

Application of the charge controlled rates

3.74 We propose that the charge controlled rates set by the NCC should apply for traffic handed over at 20 PoIs (for the reasons explained in paragraphs 3.62 to 3.73). We recognise that in reality, there is a mix of NGNs and TDM networks in the UK, and interconnection is realised by TDM technology, requiring NGNs to convert traffic from TDM to IP. Therefore consideration is needed on how the rates we have modelled should apply to existing networks.

3.75 Where an NGN provides the charge controlled call origination or call termination service and provides IP interconnection (that is, an IP-based interconnection product for voice services), we propose that the charge set by our NGN model would apply. For a nation-wide network, i.e. BT, we propose that the charge controlled rates would

[66] H3G response to CFI, Question 13
[67] ITSPA response to CFI, p.2
[68] TalkTalk response to CFI, Question 13

be applicable at 20 – 30 PoIs[69] for traffic handed over via an IP interconnect. For existing NGN operators, which are sub-national, we propose that the regulated termination rate would be applicable from the existing number of NGN nodes on their network.[70]

3.76 If a CP that operates a TDM network continues to provide TDM interconnection, we propose that the charge controlled rates would apply for traffic handed over at the PoI nearest to the called customer. In BT's current network, the relevant PoI would be at the DLE. Therefore, when a call is handed over at the DLE, the charge derived from our NGN model would apply.

Question 2: Do you agree with our proposal that our NGN model should include PoIs based on IP interconnection? If not, please explain why.

Question 3: Do you agree with our proposal on 20 PoIs for our NGN model? If not, please explain why.

Conversion between TDM and IP traffic

3.77 Currently, the operator of an NGN bears the costs for conversion of traffic between TDM and IP, as explained in our statement: *Fair and reasonable charges for fixed geographic call termination, Statement and final guidance* ("The 2011 FTR Guidance").[71]

3.78 At the time of publishing the 2011 FTR Guidance we explained that (paragraph 4.84):

"At least while TDM technology is the basis of the Benchmark FTR, IP operators should ordinarily bear the costs of conversion, except where they are able to make reasonable requests for IP termination. This balances, on the one hand, the provision of efficient investment signals, and, on the other, ensuring that competition is not distorted and that consumers do not pay more for existing services as a result of the introduction of new technology."

3.79 If, from 2013 onwards, we identify NGN is the MEA for voice services, we need to review how to treat the costs for conversion of calls between TDM and IP. We recognise that, today, networks deployed by BT and some other CPs are still based on TDM technology and interconnection is realised using TDM interconnection. It has also been argued that standards for IP interconnection are still evolving so that TDM interconnection is still required.[72]

3.80 However, for the reasons set out above, we consider that there are good reasons to identify NGNs as the MEA for setting cost based regulation of wholesale call

[69] We have modelled 20 PoIs within our model. However, we recognise that industry agreed 27+2 PoIs in previous discussions and do not discount that, for operational reasons (such as location of existing network deployment), industry may consider that up to 30 PoI is a reasonable number on which to base regulated network access.
[70] For CPs other than BT, and subject to our forthcoming narrowband market review consultation, the relevant regulated service would be geographic call termination.
[71] See paragraphs 4.70 – 4.85, *Fair and reasonable charges for fixed geographic call termination, Statement and final guidance*, 27 April 2011. http://stakeholders.ofcom.org.uk/binaries/consultations/778516/statement/fair-reasonable-statement.pdf
[72] C&WW response to CFI, Question 22

termination and call origination, which implies that efficient interconnection would, in principle, be between NGNs.

3.81 This regulatory approach would imply that TDM operators should bear their own costs of conversion (and those costs should not be included in the charge controlled rates). In particular:

3.81.1 Given our proposal that NGNs are the MEA, then two efficient CPs would each have deployed NGNs and would seek to interconnect using IP interconnect. In these circumstances there would be no equipment costs for conversion of traffic between TDM and IP for the two efficient CPs.[73]

3.81.2 By definition, the cost of conversion between TDM and IP traffic would only arise if one CP is using TDM technology and the other NGN. In this scenario, our view is that the CP that has deployed the MEA, which in our view is NGN, should not face higher charges (or incur costs) greater than those for interconnection with a CP also using the MEA.

3.81.3 In principle, the provision of TDM-IP conversion may be contestable, although in practice it may be that NGNs are likely to have lower costs in providing conversion than TDM networks.

3.82 Notwithstanding the above, we have estimated the costs of conversion in our modelling to allow us to assess the likely efficient level of such costs. We will consider further the exact nature of any obligations in relation to TDM-IP conversion in our January consultation.

Question 4: Do you consider that if the MEA is NGN, the costs of conversion from TDM to IP should be excluded from cost-based call origination and call termination rates? If not, please explain why.

[73] We note that as there are several IP interconnection standards currently available, there may be software costs related to supporting multiple standards.

Section 4

What approach should we take to building our model?

Introduction

4.1 This section sets out some proposed features of a cost model to forecast efficient costs of narrowband conveyance during the period from 1 October 2013 to 30 September 2016.

Developments since the 2009 NCC statement

4.2 Since the previous NCC was set in 2009, UK and European regulators have been changing their approach to regulation, specifically:

4.2.1 a shift towards using bottom-up LRIC models to set termination rates; and

4.2.2 the appropriate technology on which to base the network cost model (see Section 3).

4.3 Both of the above are central aspects of the 2009 EC Recommendation.[74]

4.4 We have applied a bottom-up approach to LRIC modelling to set pure LRIC MTRs (and that approach has been upheld by the CAT).[75] Other European NRAs have implemented LRIC for both MTRs and FTRs – and a summary of implementing the 2009 EC Recommendation in respect of FTRs accompanied our May 2012 CFI.[76]

4.5 The 2009 NCC used a top-down accounting cost model using an FAC cost standard (equivalent to LRIC plus a contribution to common costs such that, overall, common costs are fully recovered). Therefore, adopting a bottom-up pure LRIC model, requires us to change our modelling approach.

Bottom-up and top-down modelling

4.6 A top-down model uses total network cost data and allocates these costs to services based on service usage factors. Typically, this top-down cost data is adjusted to make it suitable for regulatory price-setting (e.g. to take account of efficiency and changes in the volume of network traffic), but this type of model will not rely on detailed assumptions about how the network is constructed. Instead, the modelled costs are calculated using cost-volume elasticities which reflect assumptions about the way the cost of high-level network components change as traffic rises or falls.

4.7 A bottom-up model estimates how much network equipment is needed for the forecast level of traffic (based on network build parameters). The total cost of this network equipment is then calculated (using evidence of the unit cost of each piece of equipment). The use of bottom-up models to set cost-based charge controls has a

[74] 2009 EC Recommendation recital 2 (bottom-up modelling) and recital 4 (choice of technology).
[75] Competition Appeals Tribunal, BT et al v Ofcom, Judgement, 3 May 2012.
[76] See the 15 May 2012 Analysys Mason report at http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/annexes/analysys_mason.pdf

long-standing tradition in the regulation of MTRs, where we have used bottom-up models (typically verified against top-down cost data) since 2001.[77]

4.8 In the 2009 NCC, we used top-down modelling because (1) BT's accounting data was available and (2) this approach was consistent with the use of top-down modelling in NCCs since 1997.[78] Using top-down modelling in the NCC was also consistent with the approaches taken to modelling in other fixed network charge controls.

4.9 Even though it is sometimes more complex, bottom-up modelling has a number of advantages over top-down modelling:

4.9.1 By using network build parameters, bottom-up modelling allows us to more accurately model underlying cost/volume relationships.

4.9.2 It is also more transparent; the model can be published without redacting confidential information and it is usually clearer to all concerned why and how network components drive service costs.

4.9.3 Building a bottom-up model allows us to create an efficient forward looking network which in this case we consider to be a national NGN.

4.10 Building a bottom-up model is also consistent with the 2009 EC Recommendation, which recommends that: *"...the evaluation of efficient costs is based on current cost[s] and the use of a bottom-up modelling approach..."*[79]

4.11 Consequently, we are building, and propose to use, a bottom-up model to calculate the unit costs of fixed call termination and call origination. The different sections of this bottom-up model are discussed in more detail below.

Question 5: Should we use a bottom-up modelling approach for calculating the efficient costs of call termination and call origination? If not, please explain why.

Calculating pure LRIC

4.12 We are building a cost model that will enable us to estimate the unit costs of fixed call termination on a pure LRIC and a LRIC+ basis. When recommending the use of pure LRIC, the 2009 EC Recommendation uses the following definitions:[80]

i) "incremental costs" are the costs that can be avoided when a specific traffic increment is no-longer provided; and

ii) "traffic-related costs" are those fixed and variable costs that vary with the level of traffic.[81]

[77] See Oftel 2001 Review of the charge control on calls to mobiles, http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm0901.htm#sum
[78] We note that in 1997 there was also some use of bottom-up modelling.
[79] 2009 EC Recommendation Recital (2).
[80] See 2009 EC Recommendation Recital 5.
[81] In this context the EC Recommendation refers to "fixed" costs in the sense of service-specific (i.e. traffic-related) costs. Fixed common costs would, by definition, be excluded from the incremental costs of the traffic increment.

4.13 Pure LRIC is a particular form of LRIC modelling that estimates the unit cost based on the avoidable costs of carrying a given quantity of traffic (termed the 'increment'). When calculating pure LRIC, the traffic increment should be treated as the final increment (i.e. the network equipment for carrying all other network traffic is present before the increment is added). Therefore, costs that are shared between fixed call termination and other services (common costs) are excluded from the pure LRIC of termination.[82]

Calculating pure LRIC

4.14 In calculating pure LRIC for FTRs, we propose a decremental approach similar to that applied in our 2011 MCT model and supported by the Competition Commission (CC) in the 2012 CC determination[83] and upheld by the Competition Appeal Tribunal (CAT).[84]

4.15 This decremental approach involves four stages:

a) Run the bottom-up model with all traffic services included and calculate the total amount of network equipment required and the costs (both capex and opex) of that equipment;

b) Run the bottom-up model with all traffic services excluding incoming calls and calculate the total amount of network equipment required and the costs (both capex and opex) of that equipment;

c) Calculate the difference in network costs between the two runs of the model; and

d) Run these costs through the economic depreciation algorithm in order to recover them over time.

4.16 The decremental approach to calculating pure LRIC is appropriate if the modelled relationship between traffic and costs is correct for the final traffic increment. When the call termination traffic increment is removed, the total network cost will be reduced by the avoidable costs of that increment.

Question 6: Do you agree that we should use a decremental approach when calculating the pure LRIC of call termination? If not, please explain why.

Verification of cost model outputs and cost recovery

4.17 As explained in Section 3, we want to ensure that, in modelling the costs of an NGN, the following three conditions are met:

- **No increase in costs compared to an anchor pricing approach based on a hypothetical ongoing TDM network:** Specifically, the NGN unit costs are no higher over the 2013-2016 period, than if based on a hypothetical ongoing TDM network (i.e. based on the modelling approach of the 2009 NCC);

[82] See 2009 EC Recommendation Recital 6.
[83] Competition Commission 2012 MCT Determination. Para 3.68.
http://www.catribunal.org.uk/239-7143/1180-3-3-11-British-Telecommunications-PLC.html
[84] Competition Appeal Tribunal 2012 MCT Judgment.
http://www.catribunal.org.uk/239-7143/1180-3-3-11-British-Telecommunications-PLC.html

- **No retrospection:** The path of unit costs from the NGN does not depend on an assumption that it was possible to charge more in historic periods than envisaged under previous cost models used by the regulator; and

- **Fair opportunity for cost recovery:** The unit costs from the NGN model over the 2013-16 period would not deny BT the opportunity to recover its efficiently incurred costs (in particular those of TDM assets).

4.18 On the cost recovery point, this might involve comparing the NGN unit costs against the forecast of unit costs assuming that BT continues to run a TDM network for all (or nearly all) voice traffic, but reflect accounting costs based on BT's heavily depreciated TDM network. (In other words, we would not increase net asset values to generate a hypothetical ongoing network asset base). This analysis would also consider such costs as might efficiently arise in migrating traffic to the NGN.

4.19 In relation to each point, we propose to assess compliance against the unit costs of origination and termination expressed in LRIC+ (or CCA FAC) terms. This is because we want, as far as possible, a like-for-like comparison between the cost models. Previous NCC cost models and BT's regulatory accounting systems do not generate pure LRIC outputs (whether for termination or any other service).

4.20 This approach to comparing the results of bottom-up modelling with the outputs of top-down models is also supported by the EC in its Recommendation which states that:

"*NRAs may compare the results of the bottom-up modelling approach with those of a top-down model which uses audited data with a view to verifying and improving the robustness of the results and may make adjustments accordingly.*"[85]

4.21 When building other bottom-up models, we have calibrated the model outputs against real-world data wherever possible. In the 2011 MCT modelling[86], we compared model outputs with mobile CP data to check that the model was producing realistic outputs. We compared the amount of network equipment and the total cost of that equipment (GBV, NBV and opex) against the average, maximum and minimum for these values from the CP data. By comparing these values over time, we can be more confident in the robustness of the cost-volume relationships in the model.

4.22 We cannot take the same approach in this case. For the NCC, we are modelling a national NGN for the UK; no such network exists for us to check our model outputs against. That said, we still believe that there is value in comparing the outputs of our NGN model with relevant real world data where we can. For example, we might cross-check our model outputs in the following way:

4.22.1 **Against existing sub-national NGNs**: Although there are no national NGN operators, there are sub-national NGN operators (such as Sky and TalkTalk). By using a comparable subset of outputs from our model we can check that the network costs and equipment volumes change in line with those of sub-national operators.

4.22.2 **Against other NRA NGN models**: Ofcom is not the only NRA modelling an NGN for the purpose of regulating fixed call termination and origination

[85] 2009 EC Recommendation Recital (3).
[86] We also used this approach in earlier versions of the MCT model.

charges. We could, for example, check our model outputs against the LRIC+ and pure LRIC outputs of other NRA models, or, where the modelling approach was sufficiently similar, we could look at other metrics such as total network costs and the quantity of network equipment.

4.23 Both these approaches were raised by respondents to the CFI:

4.23.1 C&WW suggested that Ofcom use whatever empirical evidence is available, including both information from other regulators and data from "national scale CPs" that are using NGNs.[87]

4.23.2 H3G agreed that Ofcom should calibrate the model against real world data and suggested doing this using data from those operators that had deployed NGNs or by benchmarking against NRA data included in the Analysys Mason report produced for Ofcom.[88]

4.23.3 TalkTalk did not consider the calibration of an NGN model to present a particular challenge and believed that Ofcom should look at models produced by other EU NRAs. TalkTalk also suggested that Ofcom compare the outputs of its NGN model with TalkTalk's NGN model.[89]

4.23.4 [✂] suggested that modelling the costs of an NGN presented an opportunity to calibrate a model without the influence of BT's commercial strategy. [✂] suggested that the best way to do this was through engaging with NGN operators about the cost of their networks.[90]

4.24 We believe that calibrating the NGN cost model against sub-national NGNs and against the results produced by other NRAs is likely to represent the best means by which to calibrate our model with real-world networks.

Question 7: Do you agree with our approach to network cost verification? If not, please explain why.

[87] C&WW response to 2012 CFI Question 26
[88] H3G response to 2012 CFI Question 26
[89] TalkTalk response to 2012 CFI Question 26
[90] [✂] response to 2012 CFI Question 26

Section 5

How should we implement our proposed cost model design?

5.1 In previous sections, we set out our proposal to model the costs faced by a hypothetical efficient NGN (the 2012 NCC model). This section describes some specific characteristics of that model:

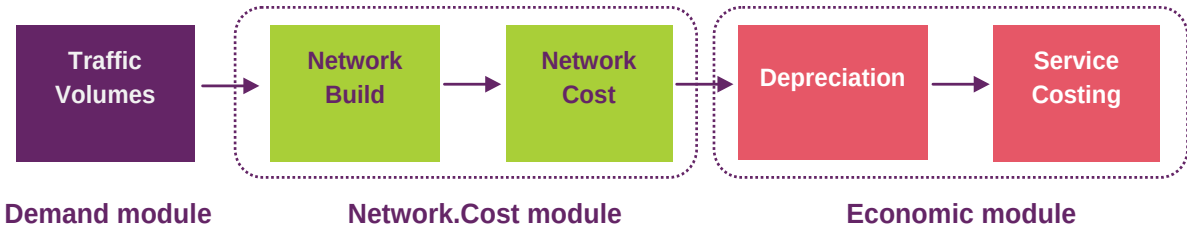
5.1.1 The model builds a hypothetical efficient NGN that can meet all the traffic volumes that are forecast to pass over it.

5.1.2 The model then calculates the costs (capital and operating) of this network and how these costs should be recovered over time using an economic depreciation algorithm.

5.1.3 The final stage in the modelling is to allocate the yearly costs across traffic services based on how much each service uses the network.

5.2 Figure 2 below shows the high level structure of the model.

Figure 2: NCC model structure



5.3 The remainder of this section describes each section of the 2012 NCC model in turn.

Traffic volume forecasts

5.4 Telecommunications networks are characterised by economies of scale: more traffic, caused by market growth or increased market share, leads to a smaller proportionate increase in total cost than in total volume. Similarly, telecommunications networks can benefit from economies of scope: i.e. common costs can be recovered from a range of services which results in lower unit costs compared to a stand-alone provider of one of those services.

5.5 In a TDM network, voice calls use dedicated circuits within the network between the calling and called parties for the duration of the call. Therefore, voice traffic volumes will tend to drive switching-related costs – that is, the cost of establishing the connections at voice exchanges (switches) to create these circuits (although other assets will be shared between voice, broadband and leased lines – e.g. duct, fibre property and some transmission equipment[91]).

5.6 However, in an NGN, because voice calls are one service amongst a number that are all provided using a common transport medium (packets routed using the IP), the

[91] For example, Synchronous Digital Hierarchy (SDH) systems could be shared by multiple services.

equipment routing calls will, to a greater extent, be shared between voice and data services. The common transport protocol creates greater scope for sharing equipment. Given the considerable growth in packet data traffic (and expected future growth), we expect that data service volumes will be a significant cost-driver in an NGN.

5.7 It is therefore necessary not only to produce forecasts for voice services but also for data services.

Industry traffic volumes

5.8 We consider a range of services that pass over the hypothetical efficient NGN in order to produce traffic forecasts. We first forecast the traffic carried by all fixed networks and then assign a proportion of this traffic to our modelled network (reflecting our market share assumption). The model uses these traffic forecasts to calculate how much network infrastructure will be required.

5.9 We have created a range of forecasts for the following services:

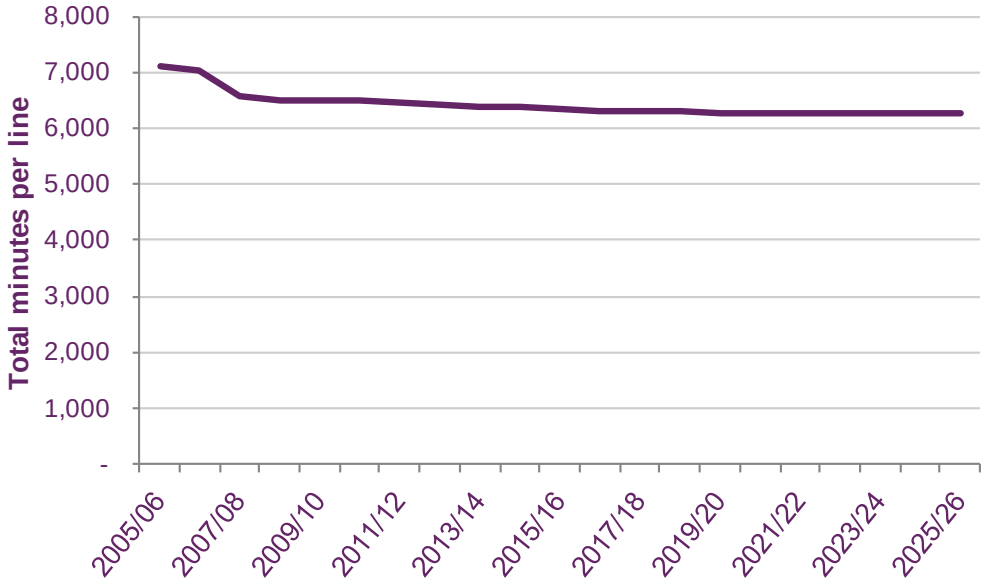
- Incoming voice calls from off-net;
- Outgoing off-net voice calls;
- On-net voice calls;
- Transit; and
- Packet data.

5.10 These forecasts extrapolate trends in the number of active phone/broadband lines and the usage per line of different traffic types.[92] The amount of traffic that passes over the network will be determined by the average use per line.[93] Figure 3 below shows our forecasts for the average annual voice usage per line. We have forecast a very gradual decline in voice usage until 2025/26 at which point we hold the forecast volume constant.

[92] We have also cross-checked our forecasts against other sources such as: Analysys Mason: Telecoms Market Trends and Forecasts 2011-2016 http://www.analysysmason.com/Research/Content/Forecasts/RDDF0_Western_Europe_forecast_2011-2016_Jul2011/ and Enders Analysis: UK fixed line market analysis http://www.endersanalysis.com/content/publication/uk-broadband-and-telephony-trends-june-2010

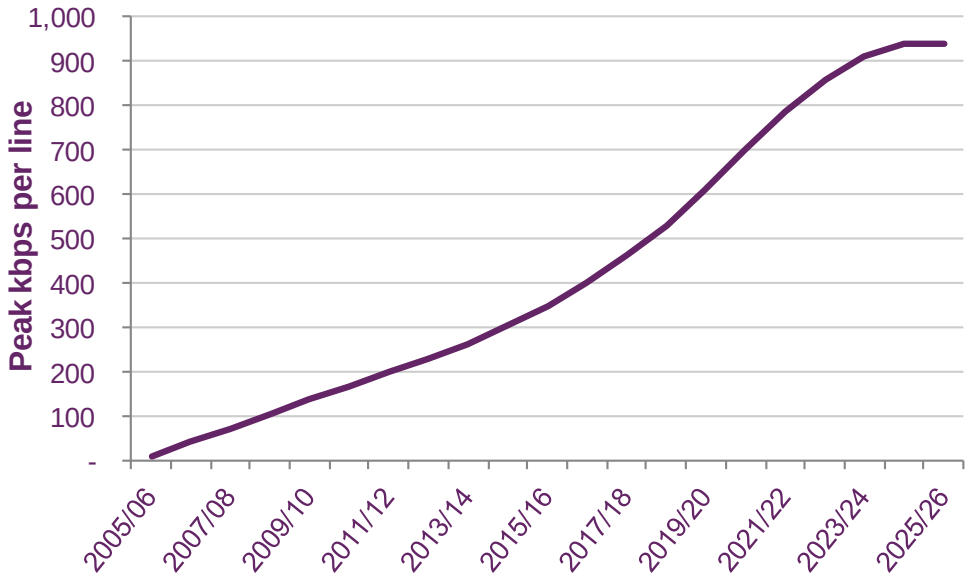
[93] The network will also calculate transit traffic, which is calculated based on an estimate of the ratio of the transit traffic to non-transit traffic that a hypothetical network would carry.

Figure 3: Forecast for annual average voice usage per line (residential)[94]



5.11 Figure 4 below shows our forecast of peak kbps per broadband line. We expect to see a steep increase in the peak broadband usage. As with voice, we assume that that the growth in peak broadband usage levels off and is flat by 2025/26.

Figure 4: Forecast for peak kbps per line[95]



Market share and NGN deployment assumptions

5.12 We propose to begin with an industry-wide projection of traffic volumes. The quantity of traffic that is carried by the modelled network is determined by the market share of voice and broadband lines for the hypothetical CP over time.

[94] Ofcom forecasts based on data collected from fixed operators.
[95] Ofcom forecasts based on data collected from fixed operators.

5.13 The cost model that we propose is based on a competitively neutral market share for a national NGN operator. While we accept that today only BT has truly national coverage, other major fixed CPs have close to full national coverage.

5.14 The 2009 EC Recommendation is not specific in the approach to apply to determining the market share for FTR cost modelling – as compared with MTR cost modelling. In respect of fixed networks, the Annex to the 2009 EC Recommendation states:

"To determine the efficient scale of an operator for the purposes of the cost model, NRAs should take into account that in fixed networks operators have the opportunity to build their networks in particular geographic areas and to focus on high-density routes and/or to rent relevant network inputs from the incumbents. When defining the single efficient scale for the modelled operator, NRAs should therefore take into account the need to promote efficient entry while also recognising that under certain conditions smaller operators can produce at low unit costs in smaller geographic areas. Furthermore, smaller operators that cannot match the largest operators' scale advantages over broader geographic areas can be assumed to purchase wholesale inputs rather than self-provide termination services."[96]

5.15 We envisage three scenarios for market shares including:

5.15.1 A market share of 50% of wholesale fixed lines nationwide for all years in the model.

5.15.2 A market share based on BT's historic market share and then a projected market share of access lines from BT's current level.

5.15.3 A market share based on an even split of the market between the largest direct access operators in recent years. To date, BT, Virgin Media, Sky, and TalkTalk have accounted for the vast majority of directly connected residential customers across the country.[97] An even split between these operators would suggest a 25% market share for the modelled operator.

5.16 The advantage of the first scenario is that it seems to us to most closely follow the spirit of the 2009 EC Recommendation by noting that in setting cost-based symmetric FTRs we should reflect the need to promote efficient entry, but also recognise that entrants can purchase wholesale inputs (from the incumbent) rather than self-provide. A scenario in which the modelled network has 50% of fixed lines is likely to be consistent with a situation in which there is ongoing *ex-ante* regulation of wholesale exchange lines. While market shares do not determine market power, the 2002 EC SMP Guidelines[98] note that a sustained market share at 50% or more of the market is a likely indicator of SMP.[99] However, we recognise that a model of

[96] A similar wording is set out in the Explanatory Note to the 2009 EC Recommendation, see section 5.1.3 of http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/termination_rates/explanatory.pdf

[97] Over [✂%] of directly connected customers are accounted for by these operators.

[98] *Guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services*, OJ [2002] C 165/6. eur-lex.europa.eu/LexUriServ/LexUriServ.do%3furi=OJ%3aC%3a2002%3a165%3a0006%3a0031%3aEN%3aPDF

[99] As the EC's 2002 SMP Guidelines note (paragraph 75), *"[...] According to established*

competition based on duopoly may not be an appropriate competitive counterfactual scenario. For example, models of duopoly which result in competitive market outcomes have quite restrictive assumptions which are unlikely to hold in fixed telephony markets.[100]

5.17 The second scenario involves a market share which moves from monopoly (or near-monopoly) to BT's market share today in wholesale exchange lines. In so far as the model has a number of periods with monopoly or near monopoly provision, it is difficult to envisage this being a reasonable competitive market counterfactual – since our cost modelling should be seeking to mimic the path of prices in a competitive market.[101] However, it would be more consistent with the approach we have taken to top-down modelling in past NCCs.

5.18 Adopting the third scenario (market share of 25%) would attach more weight to the desire to mimic a competitive market outcome. It is a model of competition in which there is competing direct access (e.g. cable and/or LLU) across UK fixed lines. In practice, given the way we anticipate the model deploying NGN capable exchanges, the overall market share of 25% will only be reached once all exchanges are migrated to NGN. That is, the modelled operator is assumed to capture 25% of lines at each NGN capable exchange. In its response to the CFI, BT also favoured a 25% market share assumption, on the grounds that this was more consistent with the 2011 MCT cost modelling.[102]

5.19 For the first and the third scenario, we assume that the modelled operator has the same market share for all network services. For the second scenario, we would seek to match BT's market share for different network services.

5.20 From the survey we commissioned of other NRAs' approaches to modelling NGNs and implementing the 2009 EC Recommendation,[103] we found that different methods had been used:

5.20.1 OPTA used a 1/n approach, where (n) is the number of fixed operators. OPTA set n=2.

5.20.2 BIPT set the market share of the model equal to the market share of the incumbent network (Belgacom).[104]

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case-law, very large market shares — in excess of 50% — are in themselves, save in exceptional circumstances, evidence of the existence of a dominant position. An undertaking with a large market share may be presumed to have SMP, that is, to be in a dominant position, if its market share has remained stable over time."

[100] For example, the Bertrand model of duopoly predicts that any price above marginal cost will be undercut, so that the equilibrium price is one of marginal cost pricing. However, this model assumes no fixed costs (whereas telecoms networks typically have high fixed costs), no product differentiation (even though product differentiation is commonly observed in telecoms markets) and no capacity constraints (in practice, very few, if any, pieces of fixed network equipment are likely to have sufficient capacity to handle a market share of 50%).

[101] Only in a perfectly contestable market is a monopolist likely to be subject to competitive pressure. The key assumptions of contestable market theory (i.e. no barriers to entry, exit or expansion) are clearly violated in the case of fixed telecoms: at least in a scenario in which there is no ex-ante regulation of the markets in question.

[102] BT response to the 2012 CFI question 25 http://stakeholders.ofcom.org.uk/consultations/narrowband-market-review-call/?showResponses=true

[103] http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/annexes/analysys_mason.pdf

5.21 Given our relevant statutory duties, we think that seeking to mimic the path of prices in a competitive market is one of our most important objectives in adopting a cost model for this NCC. Therefore, our preliminary view is that the third scenario (i.e. based on a 25% market share) is likely to be the most satisfactory and most consistent with the 2009 EC Recommendation. However, we plan to examine the impact of different market shares on the model outputs.

5.22 The market share assumption is only one element that determines the amount of traffic that passes over the network. Deployment of an NGN should not be assumed to be immediate; evidence from real-world network deployments suggests that an assumption that it will occur over a number of years is more reasonable. Our base case assumption is that the NGN starts being deployed in 2005/06 and is complete by 2014/15. Given that we are modelling the costs of an NGN, we will only wish to include the traffic carried by that NGN. The 3 market share scenarios described above only apply to the lines that are on an NGN exchange (i.e. if 50% of lines are on local exchanges that are NGN enabled and the modelled operator has a market share of 25%, the modelled operator has a share of total lines equal to 50% * 25% = 12.5%).

5.23 A description of how traffic volumes are used to dimension our modelled network can be found in Section 4 of Annex 7.

Question 8: Do you agree with our proposed approach to traffic forecasting and the modelled market share? If not, please explain.

Network costs

Scorched node assumptions

5.24 Our bottom-up network model is based on a 'scorched node' approach. A scorched node approach takes account of a network's existing topology. Although we are building a hypothetical NGN, we have used the location and serving area of BT's existing exchanges.

5.25 The alternative would be to use a 'scorched earth' modelling approach. A scorched earth approach would involve us locating the model's exchanges in the most efficient (lowest cost) formation. Although the scorched earth approach would allow us to model the most efficient network possible, it would add considerable complexity to the modelling process, would introduce a potential further source of migration costs and would not be a more realistic model of likely competitive outcomes. We believe that BT's existing local exchange topology provides an acceptable proxy for an efficient network and our cost model is predicated on competitive entry using LLU and NGN deployment at BT's local exchanges.

Network design choices

5.26 As noted above, the hypothetical modelled NGN structure is described in detail in Annex 7. The modelled NGN consists of a number of interconnected nodes. Each node includes a number of different pieces of network equipment and performs a specific function:

[104] The precise market share of Belgacom is not reported by BIPT.

- Basic access node (BA): The BA node is the node closest to the end-user at which the copper access lines terminate.

- Remote access node (RA): The RA is a specific kind of BA, serving remote and/or hard-to reach locations. For these nodes it may prove difficult or cost prohibitive to connect via the resilient backhaul rings we have modelled for BA nodes in general. For the RA nodes we have assumed resilient point to point connections instead. In addition, for the most remote nodes additional functionality has been included to maintain local service in the event that network connection is lost.

- Super Access (SA) Node: SA nodes are co-located with BA nodes and aggregate traffic from BA nodes before passing it on to the aggregation node.

- Aggregation node: The aggregation node aggregates traffic from the SA nodes and passes it on to the core node or to other CP networks via the interconnect nodes. Voice and broadband traffic are separated at the aggregation node by an Ethernet switching layer.

- Interconnect node: The interconnect node supports voice interconnection between the modelled NGN and other CP networks on both a TDM and an IP basis. As discussed in Section 3, we propose to model a network with 20 PoIs. These 20 PoIs will be co-located with the core nodes described below.

- Core node: The core node transports traffic between aggregation nodes. There are approximately 20 core nodes.

- Service node: The service nodes house the servers providing the service functionality, such as call servers, directory servers, etc.

Treatment of “passive” network elements

5.27 Using the network model described above, our main focus is to model the ‘new’ elements of a hypothetical NGN. In addition to NGN specific assets, there will be assets that could be shared between a TDM network and an NGN. Rather than model these costs in a bottom-up way, we propose to use the cost of these assets that are currently allocated to NCC services. We add a mark-up to voice services based on the proportional contribution that these assets make to the unit cost of NCC services on a TDM network. The cost categories of interest here are:

5.27.1 Duct: The pipes, tubes and conduits through which underground cables are passed.

5.27.2 Land and Buildings: Including both corporate offices and network buildings that are owned or leased by BT.

5.27.3 Transmission: The core transmission used to link exchanges.

5.28 We are exploring whether any of these asset costs vary if termination traffic is removed. If the cost or quantity of these assets does not change when the fixed call termination increment is removed, we would not include any costs from these assets in the pure LRIC of fixed call termination. However, even if we do not allocate any of these costs to the pure LRIC of fixed call termination, we still need to be able to calculate the cost of these assets in order to calculate the LRIC+ of call termination and call origination.

Non-network costs

5.29 In addition to network costs, other non-network costs are included (as 'administration costs'). In previous NCCs, administration costs have been captured as a separate service, i.e. PPP. However, we now propose to model administration costs as a cost item within the cost stack for the modelled conveyance services, rather than as a separate charge controlled service as previously done in NCC cost models. This is because, to the extent that there are any administration costs are incremental to the provision of the fixed call termination service, we should include them in the pure LRIC model. Those costs that are not incremental should be excluded from the costs of fixed call termination and recovered on other services.

5.30 Therefore, administration costs in each year will now be allocated across all network activities in proportion to those activities' share of total network costs. These costs are included in the cost model and are used to calculate the LRIC+ for the call conveyance services modelled (i.e. call origination and call termination).

5.31 At this stage, we do not propose to include administration costs within the pure LRIC call termination cost stack. During the past 7 years BT has experienced a steady decline in the volume of PPP services. During this period, the unit cost of PPP and the total cost of PPP services have, in different years, increased and decreased. This would suggest no clear link between traffic volumes and the cost of administration services.

5.32 Similarly, we found no clear relationship between administration costs and traffic volumes in our 2011 MCT Statement.[105] We considered that if there were traffic sensitive administration costs – when call termination was modelled as the final increment – these were likely to be immaterial. The Competition Commission supported Ofcom's approach to administration costs in its 2012 MCT Determination noting that:

"*there is considerable complexity involved in assessing the true relationship between voice termination as the final increment and administration costs*"[106]; and

"…Ofcom's judgement that it was not proportionate to calculate the incremental administration costs has not shown to be an error."[107]

5.33 We are continuing to investigate whether there is evidence that some administration costs are incremental to incoming termination and will seek to gather further data from stakeholders.

Question 9: Do you agree with our approach to non-network costs and passive network elements? If not, please explain.

Cost of capital

5.34 Our approach to estimating the weighted average cost of capital (WACC) was developed in a statement in August 2005 covering a number of issues relating to risk

[105] See 2011 MCT Statement, Section A9.93.
[106] Competition Commission 2012 MCT determination, Para 3.612
[107] Competition Commission 2012 MCT determination, Para 3.613
http://www.catribunal.org.uk/239-7143/1180-3-3-11-British-Telecommunications-PLC.html

and return.[108] In that statement, we set out our approach to estimating disaggregated WACCs for different parts of BT to reflect variations in systematic risk between different activities. We concluded that it was appropriate to estimate a disaggregated WACC for BT's copper access business and to have another rate for 'the rest of BT'.

5.35 This disaggregated approach has since been used in a number of charge controls, including the 2005 and 2009 NCCs. In the 2005 NCC we concluded that it was appropriate to use a rate for 'services on BT's core network', which is analogous to the 'rest of BT' rate. We calculated this value as 11.4% pre-tax nominal. [109] We also used the 'rest of BT' rate in the 2009 NCC, which we calculated as 11% pre-tax nominal.[110] We continue to believe that this 'rest of BT' rate is appropriate when looking at the BT services considered in this market review.

5.36 We estimated the WACC for Openreach, BT Group and the 'rest of BT' in detail in the WBA Charge Control Statement in July 2011 ("the 2011 WBA Charge Control Statement"). In that statement, the rate determined for the 'rest of BT' was 9.7% pre-tax nominal, consistent with a pre-tax real rate of 6.5%.[111]

5.37 In the 2011 WBA Charge Control Statement, we explained that we intended to use the WACC figures estimated therein for future relevant charge controls, provided that the estimates remained relevant. We noted that consistency is important, but that this needs to be balanced against the possible need for updating those WACC estimates. The WACC estimated in the 2011 WBA Charge Control Statement was appealed by BT. This appeal has now concluded and the CAT upheld Ofcom's estimate for the purposes of that charge control.[112]

5.38 We considered whether our estimate of BT's WACC calculated for the purposes of the 2011 WBA Charge Control Statement remained appropriate in the subsequent WLR and LLU Charge Control statement (published in March 2012).[113] In the 2012 WLR and LLU Charge Control Statement, we reviewed the most recent evidence on the individual parameters to ensure that the estimates remained relevant, and we concluded that they were.

5.39 Our preliminary view is that the WACC (for the 'rest of BT') estimated in the 2011 WBA Charge Control Statement remains appropriate for the cost model on which we are consulting for the NCC, without the need to update the estimates. This is because our updated analysis was performed relatively recently (in the 2012 WLR and LLU Charge Control Statement) and we therefore do not consider it necessary to undertake additional analysis for the purposes of this consultation – which is primarily concerned with the design of the cost model itself, rather than the specific charges implied by the model. In reaching this view, we have also taken account of the CC's

[108] http://stakeholders.ofcom.org.uk/binaries/consultations/cost_capital2/statement/final.pdf
[109] Para 6.72 of http://stakeholders.ofcom.org.uk/binaries/consultations/charge/statement/statement_ncc.pdf
[110] Para A2.67 of http://stakeholders.ofcom.org.uk/binaries/consultations/review_bt_ncc/statement/nccstatement.pdf
[111] 2011 WBA Charge Control Statement, paragraphs 1.18 and 1.19 http://stakeholders.ofcom.org.uk/binaries/consultations/823069/statement/statement.pdf
[112] See http://www.catribunal.org.uk/237-7278/1187-3-3-11-British-Telecommunications-plc-Wholesale-Broadband-Access-Charge-Control.html
[113] See paragraph A8.15 to A8.47 of the WLR LLU CC Statement.

recent Determination in respect of BT's appeal against our decisions in the 2011 WBA Charge Control Statement concerning the WACC.

5.40 We are therefore using a pre-tax real WACC for the 'rest of BT' of 6.5% within the NCC cost model on which we are now consulting.[114] In order to ensure that the value of the WACC in our model remains appropriate, we intend to consider any movements in the WACC parameters prior to consulting on proposals for regulated charges in January. If the relevant parameters have changed materially, we will consider whether a change to our WACC estimates would be appropriate.

Figure 5: Real pre-tax WACC series[115]

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
Real WACC	8.7%	8.7%	8.7%	8.7%	8.3%	8.3%	6.5%	6.5%

Cost recovery

Cost recovery over time

5.41 Once the total costs of the hypothetical NGN have been calculated, we must determine how these costs are recovered over time. In the new NCC model, we are proposing to adopt economic depreciation, rather than accounting depreciation. Economic depreciation better reflects the forward looking economic value of an asset than accounting approaches to depreciation and so better mimics the outcome of a competitive market. Economic depreciation considers costs over the whole economic life of the network and in particular avoids the inverse relationship between in-year utilisation and unit costs prevalent under accounting approaches to depreciation.[116]

5.42 Using economic depreciation in bottom-up cost modelling is consistent with the 2009 EC Recommendation, which states that:

"*The recommended approach for asset depreciation is economic depreciation wherever feasible.*"[117]

5.43 Economic depreciation has been used in MCT cost models since 2001. In the 2011 MCT Cost Model,[118] we used a form of economic depreciation known as Original ED.[119] This method matches the cost of equipment to its actual and forecast usage over the long term. Consequently, there is relatively little depreciation in years when utilisation is low and relatively high depreciation in years of full, or almost full, equipment utilisation.

[114] When the WACC is calculated for the WBA charge control and inflation rate of 3% was used. The NCC model uses a 2.5% forecast inflation assumption, however we will be using the real pre-tax WACC rather than the nominal.
[115] From 2011/12, the WACC is held constant at 6.5% in perpetuity.
116 An accounting approach to depreciation would usually involve taking the price that would be paid for equipment (or was paid under historic cost accounting) and dividing this value by the expected equipment life to reach a depreciation charge for that year. As a result, in periods of low utilisation unit costs are relatively high and in periods of high utilisation unit costs are low.
[117] 2009 EC Recommendation, Recital (7).
[118] We also used this form of economic depreciation in the 2005 MCT Cost Model and the 2007 MCT Cost Model.
[119] Original ED was developed as a depreciation approach by Oftel see http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/depr0901.htm

5.44 An alternative way to characterise economic depreciation is as a cash flow analysis to answer the question: what time series of prices, consistent with trends in the underlying costs of production and given forecast traffic, yield an expected present value equal to the capital and operating cash flows arising from building and running the network. In order to answer this question, the Original ED calculation is performed in three stages:

- **Stage 1**: A constant unit cost is calculated as if the final year utilisation and input costs applied over the entire lifetime of the network.
- **Stage 2**: A second component is added to recover the additional costs caused by earlier under-utilisation of the network compared to the final year level.[120] This step is also applied as a constant unit price for all years.
- **Stage 3**: A third component is added to recover the remaining un-recovered (or-over-recovered) costs due to input costs, including the WACC, being above (or below) the final year level. The shape of this component is determined by the arithmetic difference between in-year and final-year input costs,[121] and is therefore zero in the final year (or any year that shares the same level of input costs and WACC as the final year). More costs are recovered in years when asset prices and the WACC are higher than the final year.

5.45 When traffic levels are not relatively stable, we believe that Original ED is likely to produce a more satisfactory path of unit costs than accounting forms of depreciation. This is because it smoothes the path of unit costs and is not subject to large variation due to short-term asset under-utilisation. We also consider Original ED to be a better depreciation approach to other similar forms of economic depreciation because we think it better mimics a competitive market. For example, other forms of economic depreciation, such as "Simplified ED",[122] do not calculate the terminal price based on mimicking a hypothetical competitive market; rather, the terminal price is a by-product of scaling the shape of the cost recovery profile to achieve full cost recovery.

5.46 As noted above, this approach to economic depreciation has been widely applied by Ofcom in previous bottom-up MCT cost models[123] and has been supported by the Competition Commission each time it has been appealed; most recently in the 2012 CC determination.[124]

[120] If under-utilisation is increasing then this could be a negative value.
[121] The "input costs" for a particular year are the asset price (or operating cost) for that year and the WACC. The arithmetic difference between in-year and final year inputs cost can be written as = (Asset price$_t$ x WACC$_t$) – (Asset price$_n$ x WACC$_n$). Where (t) is the current year and (n) is the final year.
[122] We have included Simplified ED in the model to enable us to perform a cross check against the Original ED algorithm.
[123] See http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/depr0901.htm for an explanation.
[124] Reference under section 193 of the Communications Act 2003, British Telecommunications plc v Office of Communications, Everything Everywhere Ltd v Office of Communications, Hutchinson 3G UK Ltd v Office of Communications; Vodafone Ltd v Office of Communications, and Telefonica UK Ltd, Determination, Competition Commission, 9 February 2012, http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/telecommunications-price-control-appeals/final_determination.pdf

Cost recovery between assets

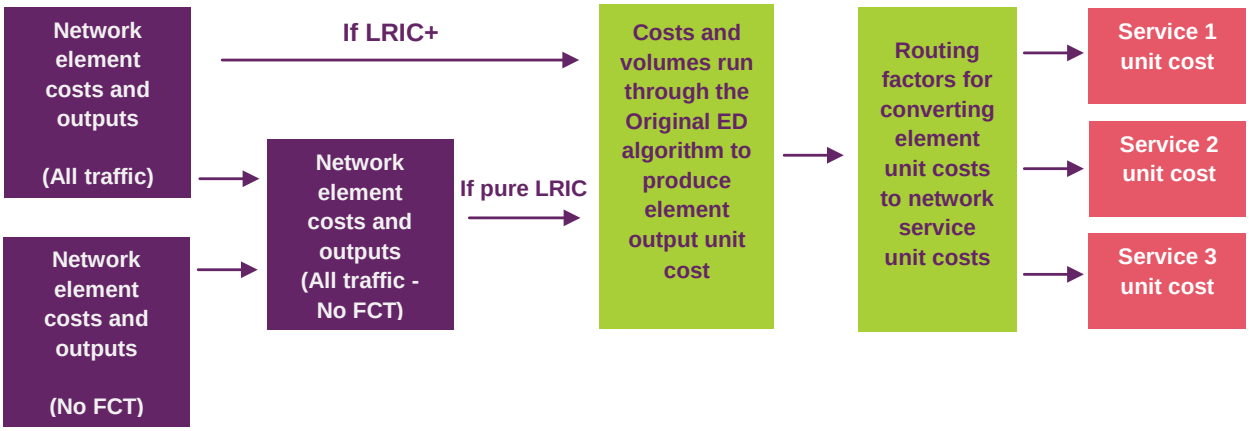
5.47 Once we have determined how the costs of a particular network element should be recovered over time, we need to calculate how they will be recovered from different network services. The costs recovered by a particular service are linked to the costs that are driven by that network service. Each network service will have a routing factor relating to each piece of network equipment, which will drive the amount of network equipment needed to carry a unit of the service.

5.48 These routing factors are also adjusted so they reflect different proportions of traffic in the busy hour (i.e. if data traffic has a greater proportion of total traffic in the busy hour than voice traffic, data services should recover more of the costs). These adjusted routing factors will be used to determine the network element output from which costs are recovered and allocate costs to network services.

5.49 The economic depreciation algorithm allows us to calculate the yearly unit element output cost for each network element. The unit element output cost is then multiplied by the adjusted routing factor to give the service unit cost. The outputs of this algorithm allow full cost recovery and thereby it follows that the service unit costs represent the LRIC+ for each service (in each year modelled).

5.50 When we calculate pure LRIC, the model uses the same approach. The difference occurs in the inputs to the economic depreciation algorithm. The network costs and network element outputs are calculated as the difference between a network with and without the fixed call termination increment. Figure 6 below shows the flow of calculations when costs are being allocated across time and between services.

Figure 6: Cost recovery over time and across services[125] [126]



Question 10: Do you agree with our proposed approach to cost recovery? If not, please explain why.

[125] For illustration only, the figure shows a 3 service model.
[126] Fixed Call Termination (FCT).

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 9 November 2012**.

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

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

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

Paul Jacobus
4th Floor
Competition Group
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 020 7981 3333

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

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Paul Jacobus on 020 7981 3574.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all

responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

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

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

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a further consultation on the Narrowband Market Review in January 2013. The January 2013 consultation document will include our proposals relating to market definition, findings of SMP and proposed remedies – should remedies be necessary.

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

Ofcom's consultation processes

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

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

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

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

Tel: 020 7981 3601

Email Graham.Howell@ofcom.org.uk

Annex 2

Ofcom's consultation principles

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

Before the consultation

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

During the consultation

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

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

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

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

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

After the consultation

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

Annex 3

Consultation response cover sheet

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

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

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

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

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

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

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

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

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

DECLARATION

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

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

Name

Signed (if hard copy)

Annex 4

Consultation questions

A4.1 In this consultation, we have identified the following questions that we would like stakeholders to consider. These are:

Question 1: Do you agree with our proposal that NGNs can be considered the MEA for the purposes of modelling call origination and call termination services? If not, please explain why.

Question 2: Do you agree with our proposal that our NGN model should include PoIs based on IP interconnection? If not, please explain why.

Question 3: Do you agree with our proposal on 20 PoIs for our NGN model? If not, please explain why.

Question 4: Do you consider that if the MEA is NGN, the costs of conversion from TDM to IP should be excluded from cost-based call origination and call termination rates? If not, please explain why.

Question 5: Should we use a bottom-up modelling approach for calculating the efficient costs of call termination and call origination? If not, please explain why.

Question 6: Do you agree that we should use a decremental approach when calculating the pure LRIC of call termination? If not, please explain why.

Question 7: Do you agree with our approach to network cost verification? If not, please explain why.

Question 8: Do you agree with our proposed approach to traffic forecasting and the modelled market share? If not, please explain.

Question 9: Do you agree with our approach to non-network costs and passive network elements? If not, please explain.

Question 10: Do you agree with our proposed approach to cost recovery? If not, please explain why.

Annex 5

Links to relevant documents

Ofcom Documents

- "The 2009 Retail Review", *Fixed Narrowband Retail Services Markets - Identification of markets and determination of market power*, 15 September 2009, http://stakeholders.ofcom.org.uk/consultations/retail_markets/statement/

- "The 2009 Wholesale Review", *Review of the Fixed Narrowband Services Wholesale Markets- statement on the markets, market power determinations and remedies including further consultation*,15 September 2009, http://stakeholders.ofcom.org.uk/consultations/wnmr_statement_consultation/summary

- *Review of the Retail and Wholesale ISDN30 Markets* 20 August 2010, http://stakeholders.ofcom.org.uk/consultations/isdn30/?a=0

- *Review of the Fixed Narrowband Services Wholesale Markets-further statement on the wholesale transit markets and remedies in the wholesale call termination market*, 5th February 2010, http://stakeholders.ofcom.org.uk/binaries/consultations/wnmr_statement_consultation/statement/statement.pdf

- *Review of the Wholesale Local Access Market-statement on market definition, market power determinations and remedies*, 7 October 2010, http://stakeholders.ofcom.org.uk/binaries/consultations/wla/statement/WLA_statement.pdf

- *Review of the Wholesale Fixed Analogue Exchange Lines Markets- statement on market definition, market power determinations and remedies*, 20 December 2010, http://stakeholders.ofcom.org.uk/consultations/review-wholesale-fixed-exchange/statement

- "The 2009 NCC Statement", *Review Of BT's Network Charge Controls-statement*,15 September 2009, http://stakeholders.ofcom.org.uk/binaries/consultations/review_bt_ncc/statement/nccstatement.pdf

- "The 2011 MCT statement", *Wholesale mobile voice call termination- statement* 15 March 2011, http://stakeholders.ofcom.org.uk/consultations/mtr/statement

- "The 2011 FTR Guidance", *Fair and reasonable charges for fixed geographic call termination,* 27 April 2011, http://stakeholders.ofcom.org.uk/binaries/consultations/778516/statement/fair-reasonable-statement.pdf

- "The 2010 NGN Statement", *Next Generation Networks,* 28 January 2010, http://stakeholders.ofcom.org.uk/binaries/consultations/ngndevelopments/statement/ngn_statement.pdf

- "The 2012 simplifying non-geographic numbers consultation", *Simplifying non-geographic numbers,* 4 April 2012, http://stakeholders.ofcom.org.uk/consultations/simplifying-non-geographic-no/?utm_source=Media-updates&utm_medium=Media-email&utm_campaign=non-geo-no-mediaNR

- The 2012 dispute relating to BT's Standard Interconnect Agreement, 14 February 2012, http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/open-cases/all-open-cases/cw_01083/

- "Call for Inputs", *Fixed Narrowband Market Review and Network Charge Control, Call for Inputs*, 17 May 2012, http://stakeholders.ofcom.org.uk/binaries/consultations/narrowband-market-review-call/summary/condoc.pdf

- *Leased Lines Charge Control, Proposals for a new charge control framework for certain leased line services*, 5 July 2012, http://stakeholders.ofcom.org.uk/binaries/consultations/llcc-2012/summary/LLCC_2012.pdf

- *Fair and reasonable charges for fixed geographic call termination, Statement and final guidance*, 27 April 2011. http://stakeholders.ofcom.org.uk/binaries/consultations/778516/statement/fair-reasonable-statement.pdf

Other Documents

- EC, Revised European Framework for Electronic Communications, 18 December 2009, http://ec.europa.eu/information_society/policy/ecomm/index_en.htm

- Directive 2002/22/EC of the European Parliament and of the Council, 7 March 2002, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0051:0051:EN:PDF

- *Directive 2002/22/EC of the European Parliament and of the Council (as amended by Directive 2009/136/EC),* 7 March 2002, http://ec.europa.eu/information_society/policy/ecomm/doc/136univserv.pdf

- *Directive 2002/19/EC of the European Parliament and of the Council (as amended by Directive 2009/136/EC),* 7 March 2002, http://ec.europa.eu/information_society/policy/ecomm/doc/140access.pdf

- *EC Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU*, 20 May 2009, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:EN:PDF

- Competition Commission, *BT et al, v Office of Communications, Determination, 9 February 2012,* http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/telecommunications-price-control-appeals/final_determination.pdf

- *Competition Commission Determination, 2002,* http://www.competition-commission.org.uk/rep_pub/reports/2003/475mobilephones.htm

- *Competition Commission Determination 2009,* http://www.competition-commission.org.uk/appeals/communications_act/mobile_phones_determination.pdf

- *Competition Commission Determination 2012,* http://www.catribunal.org.uk/files/1.1180-83_MCT_Determination_Excised_090212.pdf

Annex 6

Glossary

21CN: BT's planned, but not implemented, next generation network upgrade.

BT: British Telecommunications plc

CAT: Competition Appeal Tribunal

CC: Competition Commission

CFI: 'Call for Inputs'

Charge control: A control which sets the maximum price that a communication provider can charge for a particular product or service. Most charge controls are imposed for a defined period.

Common costs: Costs which are shared by all the services supplied by a firm.

Communications Act or "the Act": Communications Act 2003

CP: Communications Provider

Carrier Pre-Selection (CPS): is the facility offered to customers which allows them to opt for certain defined classes of call to be carried by an operator selected in advance without having to dial a routing prefix or follow any other different procedure to invoke such routing.

CS: Carrier Selection (see IA)

Current cost accounting (CCA): An accounting convention, where assets are valued and depreciated according to their current replacement cost whilst maintaining the operating or financial capital of the business entity.

Digital Local Exchange (DLE): The telephone exchange to which customers are connected, usually via a concentrator.

EC: European Commission

ED: Economic Depreciation

End-user: The final consumer of a product or service

Fully Allocated Cost (FAC): An accounting approach under which all the costs of the company are distributed between its various products and services. The fully allocated cost of a product or service may therefore include some common costs that are not directly attributable to the service.

FCP: Fixed Communications Provider

Fixed Termination Rate (FTR): The wholesale charge levied by FCPs for Fixed Call Termination.

Indirect Access (IA): is a facility which allows a customer to opt for calls to be carried by an operator which is different to the operator that provides the network to which the customer is connected, on a call by call basis, by dialling a routing prefix to invoke such routing.

Internet Protocol (IP): A telecommunications protocol that allows data packets to be routed across a network or series of interconnected networks. It is the protocol that underpins data transmission in the Internet.

ISDN2: A digital telephone line service that supports telephony and switched data services. ISDN2 provides the calling or data capacity equivalent to two analogue telephone lines

ISDN30: A digital telephone service that provides up to the equivalent of 30 analogue lines over a common digital bearer circuit. These lines provide digital voice telephony, data services and a wide range of ancillary services

ISP: Internet Service Provider

ITC/ITT: Inter-tandem conveyance and transit

KCOM: KCOM Group PLC, formally Kingston Communications

Local Loop: The access network connection between the customer‘s premises and the local serving exchange, usually comprised of two copper wires twisted together.

Local loop unbundling (LLU): A process by which a dominant provider‘s local loops are physically disconnected, or partially disconnected, from its network and connected to competing provider‘s networks. This enables operators other than the incumbent to use the local loop to provide services directly to customers.

Long Run Incremental Costs (LRIC) or pure LRIC: LRIC is defined as the long run avoidable cost of an operator carrying a particular increment of traffic. The increment in question is treated as the final traffic increment on the network,

Long Run Incremental Costs Plus (LRIC+): The long run (average) incremental costs plus an equi-proportionate mark-up for the recovery of shared and common costs. LRIC+ should be taken to mean the same as LRAIC+ (a term used by some other NRAs).

LTC/LTT: Local-tandem conveyance and transit

MCP: Mobile Communications Provider

Mobile Call Termination (MCT): The service provided by a MCP to allow an OCP to connect a caller with the intended mobile call recipient on that MCP’s network.

Modern Equivalent Asset (MEA): An approach to setting charges that bases costs on what is believed to be the most efficient available technology that performs the same function as the old technology.

Multiple Service Access Node (MSAN): A device typically installed in a telephone exchange (although sometimes in a roadside cabinet), which connects customers telephone lines to the core network, to provide telephony, ISDN, and broadband all from a single platform.

Mobile Termination Rate (MTR): The wholesale charge levied by MCPs for MCT.

NCC: Network Charge Control (see charge control)

Next generation network (NGN): A network that uses IP technology in the core and backhaul to provide multiple services over a single platform.

National Regulatory Authority (NRA): The relevant communications regulatory body for each country in the EU. Ofcom is the NRA for the UK.

NTS: Number Translation Services

Originating CP (OCP): The CP of the end-user making a call, i.e. the CP from which the call originates.

Ofcom: The Office of Communications.

Product Management, Policy and Planning (PPP): Overheads associated with marketing activities, customer service management, billing and finance activities directly related to the regulated service.

Public Switched Telephony Network (PSTN): The telephony network used to provide telephone calls using (or emulating) circuit-switching and using telephone numbers to identify subscribers or called locations, allowing all customers connected to the network to call all other customers.

Pure LRIC: Pure Long Run Incremental Costs

Regulatory Financial Statements (RFS): The financial statements that BT is required by Ofcom to prepare, have audited and publish.

SMP: Significant Market Power

SSNIP: Small but Significant Non-transitory Increase in Price

Terminating CP (TCP): The CP of the end-user receiving a call, i.e. the CP from which the call terminates.

Time Division Multiplex (TDM): A method of putting multiple data streams in a single signal by separating the signal into many segments, each having a very short duration. Each individual data stream is reassembled at the receiving end based on the timing.

Voice over Internet Protocol (VoIP): The traffic method of carrying voice calls on fixed and mobile networks by packetizing speech and carrying it using IP.

WFAEL: Wholesale fixed analogue exchanges lines

WLA: Wholesale Local Access

Wholesale Line Rental (WLR): The service offered by BT to other UK communications providers to enable them to offer retail line rental services in competition with BT's own retail services. Line rental is offered along with calls (and other service elements, such as broadband) to retail customers.