



Mobile call termination:
Consultation on proposed
guidance on dispute resolution

Consultation

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Section 1

Executive summary

- 1.1 This consultation follows our Wholesale Mobile Voice Call Termination Market Review consultation published on 1 April 2010 (the 'April 2010 consultation').¹ The April 2010 consultation was part of our review of the markets in which mobile call termination on individual mobile networks is supplied in the UK.²
- 1.2 In the April 2010 consultation we proposed to impose a SMP condition setting a charge control on Everything Everywhere, Vodafone, O2 and H3G. We did not propose to impose a charge control on other mobile communications providers (MCPs) who do not operate national radio access networks, such as smaller providers and those offering mobile VoIP³ services using mobile numbers.⁴ For these providers, we proposed that the SMP condition, which requires network access and interconnection to be provided on fair and reasonable terms and conditions (including charges), would apply⁵.
- 1.3 We recognise that negotiations relating to mobile termination rates which are not subject to a charge control may give rise to potential disputes as to what constitutes a fair and reasonable rate in individual circumstances.
- 1.4 Ofcom has certain dispute resolution powers pursuant to sections 185-191 of the Communications Act 2003 (the 2003 Act). Where a dispute which is submitted to Ofcom meets the requirements of section 185, and Ofcom does not consider that there are appropriate alternative means for resolving the dispute, Ofcom is required to handle and resolve the dispute within four months except in exceptional circumstances.
- 1.5 We recognise that given the short timescale for the resolution of disputes, the process can be a demanding one for stakeholders in terms of both time and resources, especially for smaller stakeholders whose resources are limited.
- 1.6 In this consultation we set out for comment draft guidance on how Ofcom would be likely to assess what is a fair and reasonable mobile termination rate if called to do so in a dispute. We believe that this will be useful for stakeholders, both in terms of their negotiations with respect to mobile termination rates and preparation for any dispute resolution should those negotiations ultimately fail.
- 1.7 We recognise that any dispute would have to be considered on its specific facts. This guidance is therefore intended to provide a framework for assessment, and an indication of the factors Ofcom would be likely to take into account. It does not purport to provide a definitive answer to any individual set of circumstances.

¹ <http://stakeholders.ofcom.org.uk/consultations/wmctr/>

² When fixed and mobile operators offer their customers the ability to call UK mobile numbers, they pay mobile communications providers a wholesale charge to complete those calls. The rates that operators pay are called 'mobile call termination' (MCT) charges or more commonly 'mobile termination rates' (MTRs).

³ Voice over Internet Protocol

⁴ Some of these providers offer national *services* (by purchasing wholesale access – that is, national roaming from a national mobile communications provider).

⁵ Included as Condition M1 in annex 7 of our April 2010 consultation, which applies to all companies addressed by the notice.

- 1.8 Section 2 of this document sets out our proposed guidance on how we would assess what constitutes fair and reasonable mobile termination rates, should we be asked to do so in the context of a dispute submitted in accordance with section 185 of the 2003 Act.
- 1.9 Annex 4 sets out information on technologies and business models that are currently used to provide mobile voice services. This provides relevant background to our proposed guidance in Section 2.
- 1.10 We seek responses to this consultation by **18 February 2011**.

Section 2

Proposed Guidance

Introduction

April 2010 consultation

- 2.1 In the April 2010 consultation we proposed to identify 50 different markets for call termination, with each of these individual markets relating to a mobile communications provider and comprising:

“termination services that are provided by [named mobile communications provider] (MCP) to another communications provider, for the termination of voice calls to UK mobile numbers⁶ that MCP has been allocated by Ofcom⁷ in the area served by MCP and for which MCP is able to set the termination rate”⁸.

- 2.2 We proposed to define markets for mobile voice call termination (MCT) on individual mobile networks, recognising that the elements that comprise those networks include, amongst other things, the number ranges hosted by the individual mobile network.⁹ By definition, in this market review, these are numbers in the 07X range. These number ranges are used by:

- 2.2.1 National mobile communication providers;
- 2.2.2 Sub-national mobile networks, some of whom purchase national roaming to supplement their services and some of whom do not;
- 2.2.3 Over-the-top MCPs who offer services accessed over an internet connection which may be provided by the MCP in question or by another provider; and
- 2.2.4 Communications providers using the numbers for one-way access services (for example, international call-forwarding operators or SMS push operators).

- 2.3 We further proposed that, across all of the mobile number ranges where the MCP in question offers MCT:

- 2.3.1 these call termination services were sufficiently similar in the essential characteristic that the number range holder was *not constrained by* competition (and hence, all the range-holders should be designated as having SMP).

⁶ ‘Mobile numbers’ refers to numbers of the form 07XX XXX XXX in the range 071 to 075 and 077 to 079, inclusive.

⁷ Applicable to those mobile number designations and allocations that are made by Ofcom in accordance with the UK’s National Telephone Numbering Plan. Further details of our telephone number allocation procedures can be found at:

http://www.ofcom.org.uk/telecoms/ioi/numbers/applying_num/.

⁸ April 2010 consultation, pages 17 to 18.

⁹ See Section ‘Market Definition’ on pages 17 to 39 of the April 2010 consultation.

- 2.3.2 a single (symmetric) rate would be set for the four national MCPs, (benchmark MTR) calculated based on an estimate of the costs of a hypothetical efficient national mobile operator (using 2G and 3G/HSPA¹⁰); and
- 2.3.3 an obligation to supply mobile call termination on fair and reasonable terms be imposed on the other range holders.¹¹
- 2.4 We also proposed in the April 2010 consultation that we would expect to find that symmetrical rates among all MCPs at the level of the cost-based benchmark MTR estimated for the national MCPs to be fair and reasonable.¹² This is also an aspiration of the European Commission's Recommendation in 2009 on the regulatory treatment of mobile termination rates.¹³

Submissions received to the April 2010 consultation

- 2.5 While not all respondents commented on our market definition and SMP findings, of those that did, the majority agreed with our proposals.¹⁴
- 2.6 Regarding our proposed guidance that symmetric rates would be fair and reasonable for smaller MCPs, responses were mixed. Some respondents agreed with our assessment. Vodafone, BT, Talk Talk, and Gamma generally agreed that this approach would provide more clarity, while Cable & Wireless (C&W) suggested that the guidance could go further in addressing the conditions of symmetry.¹⁵ Submissions associated with the 'Terminate the Rate' campaign, including that of the Communications Management Association, generally agreed with the proposal of symmetry for smaller MCPs.¹⁶
- 2.7 O2 and Everything Everywhere (EE) disagreed with our approach. O2 submitted that smaller MCPs should also be subject to cost-based charge controls, rather than guidance under a 'fair and reasonable' rule, claiming that symmetric rates would distort competition between sub-national MCPs and national MCPs. EE considered that "a price control in respect of the MTRs of new entrants is necessary in order to ensure that these do not set MTRs at excessive levels".¹⁷ They also accepted that the benchmark MTR is likely to be appropriate for MCPs with MVNO or roaming contacts, who would have similar costs to the national MCPs.

¹⁰ In making that proposal, we considered the least-cost proven efficient technology (and, therefore, the appropriate benchmark to consider the cost of mobile call termination) during the period of this market review was a network using 2G and 3G/HSPA. We found that cost benchmarks based on new technologies, such as LTE, were too uncertain and that other next-generation technologies were not commercially proven.

¹¹ For these providers, we proposed that the SMP condition, which requires network access and interconnection to be provided on fair and reasonable terms and conditions (including charges), would apply. This was contained in our proposed condition M1 in annex 7 of our April 2010 consultation, which applies to all companies addressed by the notice.

¹² Paragraph 7.76 of the April 2010 Consultation.

¹³ Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU (2209/396/EC), paragraph 11.

¹⁴ 15 MCPs provided comment on the proposed market definition, of which 14 agreed with our analysis. Regarding SMP, only three respondents disagreed with the finding of SMP in the markets for MCT.

¹⁵ Particularly in relation to flip-flopping.

¹⁶ <http://stakeholders.ofcom.org.uk/binaries/consultations/wmctr/responses/CMA.pdf>; www.terminatetherate.org/

¹⁷ Everything Everywhere response to Ofcom wholesale mobile voice call termination, p 44; http://stakeholders.ofcom.org.uk/binaries/consultations/wmctr/responses/Everything_Everywhere.pdf

- 2.8 However, where the costs to terminate a call are significantly different, EE argued that a different MTR should apply. EE cited the use of different technologies, different coverage or vertically disintegrated business models as relevant differences, arguing that “operators providing national coverage cannot in fact compete on the same basis as new entrants that cherry pick rollout or rely on a radio access layer provided and paid for separately.”¹⁸
- 2.9 EE submitted that, because the national benchmark rate is calculated using cost-orientation, the most appropriate rate for other MCPs should also be calculated and applied in a way that reflected the different costs to supply MCT.

This consultation does not change the proposal to set a ‘fair and reasonable’ condition on smaller providers

- 2.10 As we proposed in our April 2010 consultation, smaller MCPs have SMP in relation to the termination of calls to mobile numbers they have been allocated. This is because only the MCP allocated a given number can connect calls to the customer to whom that number has been issued. Absent regulation, smaller MCPs would be able to profitably raise the price of MCT to these numbers.

Our view on what is likely to constitute a fair and reasonable termination rate in light of responses to the April 2010 consultation

- 2.11 We consider that companies in similar positions should have a similar opportunity under the regulatory regime. We therefore remain of the view that in most cases the same benchmark rate is likely to be appropriate. However, in light of the submissions received in response to our April 2010 consultation we now consider that the benchmark MTR may not be appropriate for some MCPs. We recognise that not all MCPs are in the same position; in particular that in some cases there are significant differences between the costs of providing mobile call termination services and differences in which party actually bears those costs. This is particularly true because of recent technological developments in the industry.
- 2.12 In cases where there are significant differences in the underlying cost base and/or the party who actually bears the cost, it may not be fair and reasonable for the price of MCT to be regulated by reference to a single cost-oriented benchmark (that is, the benchmark MTR). We have therefore set out below for comment draft guidance on how we intend to interpret an obligation to provide network access (which includes connection) on fair and reasonable terms and conditions (including charges). We have identified three broad scenarios which we consider should capture the majority of likely current (and future) providers.
- 2.13 The purpose of our guidance is twofold:
- 2.13.1 First, it is intended to provide stakeholders with sufficient information to be able to negotiate constructively with a view to agreeing termination rates which comply with the fair and reasonable requirement in the SMP Condition we intend to set;¹⁹ and
- 2.13.2 Second, where agreement on termination rates is nonetheless not reached and a dispute is submitted to Ofcom for resolution pursuant to section 185-

¹⁸ Everything Everywhere consultation response (as above) page 42.

¹⁹ See Annex 7 of the April 2010 consultation for our proposed condition.

191 of the 2003 Act, the guidance gives an indication of our likely approach to resolving such a dispute, in light of our statutory duties.

Proposed guidance on calculating a fair and reasonable MCT rate

- 2.14 Where stakeholders are unable to agree a MCT rate following commercial negotiations, we anticipate that they may seek to submit a dispute to Ofcom for resolution in accordance with sections 185-191 of the 2003 Act. We have therefore set out below our views on how we would be likely to go about determining what is a fair and reasonable rate in an individual case, in light of our statutory dispute resolution powers and duties.

Dispute resolution

- 2.15 Ofcom has published in 2004 guidelines for stakeholders in relation to its dispute resolution functions.²⁰ On 17 December 2010, we published for consultation revised dispute resolution guidelines.²¹ These set out in detail how Ofcom's dispute resolution process works.
- 2.16 For the purposes of this guidance, we note that Ofcom resolves disputes as the regulator, not as a commercial arbitrator. As dispute resolution is therefore a regulatory function, we are required to resolve disputes in light of our statutory duties and objectives, including those duties set out in Article 8 of the Framework Directive. The most relevant of those duties relating to dispute resolution is our duty to promote competition in the provision of electronic communications networks and services and associated facilities.
- 2.17 Pursuant to section 188(5) of the 2003 Act, we are required to resolve disputes within four months except in exceptional circumstances. This is a short timeframe, and has an impact on the level of analysis that it is feasible for Ofcom to undertake in resolving disputes. We are not, for example, able to carry out the same detailed level of analysis of costs as we would in a market review.
- 2.18 Our powers to resolve disputes are set out in section 190 of the 2003 Act. They include the power to give a direction fixing the terms or conditions of transactions between the parties to a dispute, and/or to give a direction imposing an obligation on the parties to a dispute to enter into a transaction on the terms and conditions fixed by Ofcom.

Proposed methodology for determining a fair and reasonable MCT rate

- 2.19 In the April 2010 consultation we identified 50 markets that correspond to smaller MCPs, all of whom would be subject to an SMP condition requiring them to supply MCT on fair and reasonable terms. For the purpose of this guidance, it is useful to identify two groups of smaller MCPs.
- 2.19.1 the first group includes all MCPs who either operate their own radio access network (RAN) - or otherwise incur RAN costs (e.g. via roaming) – for all of the calls that terminate on the number ranges that they host. This group includes sub-national MCPs and MVNOs;

²⁰ <http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/other/guidelines.pdf>

²¹ <http://stakeholders.ofcom.org.uk/consultations/dispute-resolution-guidelines/>

- 2.19.2 the second group of MCPs provide MCT without operating a RAN – or otherwise incurring RAN related costs *at least some of the time*. We refer to these as ‘OTT MCPs’. The technical facts relating to the provision of OTT services are described in further detail in Annex 4.
- 2.20 Where a dispute is brought to us in relation to the termination rate being proposed by a smaller MCP, we propose to assess what is a fair and reasonable MCT rate in accordance with the following general principles.
- 2.21 In the MCT market review we estimate the unit costs of terminating calls to mobiles for an efficient national operator, where efficient costs are projected based on a model which is itself calibrated on the costs of the 2G/3G operators.. This determines the benchmark MTR for the charge control for the four national operators.
- 2.22 As set out in Annex 4, the mobile world has changed since the conclusions of the previous market review in 2007. During the period covered by the current market review (i.e. from 1 April 2011 to 31 March 2015), we expect different MCPs with different business models from the traditional national MCPs to develop.
- 2.23 We could (as we originally proposed in the April 2010 consultation) take the view that all MCPs should set their termination rates in line with the benchmark MTR that determines the charge control for the four national MCPs. In that case, we would simply resolve any dispute brought to us by requiring MCPs to charge the benchmark rate.
- 2.24 However, as we noted above, in some cases a given MCP’s costs for providing MCT will be substantially and structurally different from the costs of the national MCPs. If we simply applied the benchmark MTR to that MCP regardless of this difference in underlying costs, a MCP with a low cost of termination would make an “extra” margin if it received the benchmark MTR, and may be able to use this higher margin on MCT to fund aggressive retail packages. The more it grew, the more traffic it would receive, and the more it could fund its own expansion using its extra margin in MCT as an advantage.
- 2.25 Ofcom has a duty to promote competition and our concern is that in this case allowing such providers to charge the benchmark MTR (and thereby enjoy a material “extra” margin on their costs of providing MCT) would distort the competitive process (and therefore over time reduce competition in the retail mobile market).
- 2.26 It is not feasible to set out guidance which covers every possible individual case. We have therefore identified three broad categories of smaller MCPs, and assessed the likely characteristics of their position vis-à-vis the national operators, in order to give guidance of what might be a fair and reasonable charge that these MCPs might make for each given category.
- 2.27 In each case, what follows below should be seen as our starting point, to be considered against the individual facts of a specific case. In many cases, it is likely that no further adjustment would be necessary; however, we would always retain the ability in a dispute to consider specific submissions as to why a particular case should be treated differently.

Category 1

- 2.28 Category 1 comprises smaller MCPs with national roaming arrangements offering national services.

- 2.29 We consider that the costs incurred by these operators would be very similar to the costs incurred by the national MCPs. For example, the domestic roaming charges they pay would be based on the termination costs of the national MCPs so this business model incurs very similar termination costs to the national MCPs. If this is the case, then applying the benchmark MTR appears likely to be appropriate to this category, given the similarity in the underlying costs.
- 2.30 We have already resolved a dispute involving a MCP operating a network supplemented by a roaming agreement with a national MCP. In resolving that dispute we applied the benchmark MTR and it seems to us likely that this approach will still be appropriate in the event that we receive a similar dispute in future.²²

Category 2

- 2.31 Category 2 comprises smaller MCPs without domestic roaming arrangements.
- 2.32 These MCPs operate a network serving only a small area and thus offer MCT in only a small area. However, because such MCPs offer a mobile retail service that can only be used in a small area they are only likely to be attractive to a smaller number of users.
- 2.33 In the particular area they serve, their efficient unit costs of termination are unlikely to be lower than the efficient unit costs of the national MCPs. Equally, even if in a specific case they did have lower unit costs of termination, their higher margin on MCT than the national MCPs would not be likely to have a material impact on competition in the retail mobile market, given their comparatively limited offering and correspondingly limited role in the market.
- 2.34 As a result, we consider it likely to be consistent with our statutory duties to adopt an approach which applies the benchmark MTR for these operators as well. This is consistent with the approach we took in a dispute brought to us by M-Com.²³

Category 3

- 2.35 Category 3 comprises OTT smaller MCPs, which includes both pure over-the-top (OTT) and hybrid OTT providers. These are MCPs who are likely to have substantially lower costs than the national MCPs because of the technology and business model they use (see Annex 4 for further details). As a result, if we were to apply the benchmark MTR to them, there would be a risk that they would gain an “extra” margin on MCT which they could use to fund aggressive retail offers.
- 2.36 If in the future this business model became successful and the national retail services marketed by these players became significant in terms of competition in the UK retail mobile market, this might give rise to concerns. Such concern would arise because the market would have evolved, not through efficient competition and market entry, but (at least partially) due to an advantage for this category of MCPs created by regulation.²⁴ It is possible that we would be acting inconsistently with our statutory

²² Dispute between T-Mobile and Cable & Wireless
(http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01004/)

²³ See http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01000/

²⁴ In considering whether in a specific case charging the benchmark MTR for OTT services will lead to a competitive distortion, a number of additional factors need to be taken in to account. These include a consideration of (i) the closeness of substitution between the services at the retail level, and (ii) the

duties, including our duty to promote competition where appropriate, if we enable this situation to be realised.

- 2.37 Therefore, adopting the benchmark MTR for this category of smaller MCP, may not be fair and reasonable. We consider that an approach which more closely reflects the actual costs of this category of smaller MCPs is more likely to provide a fair and reasonable MTR.
- 2.38 Given the inherent limitations of the dispute resolution process in light of the four month deadline for resolving disputes, we propose the use of proxies for this category of smaller MCPs' actual costs as a pragmatic way of setting fair and reasonable MTRs. This would avoid the need for a very burdensome (and naturally imprecise) case-by-case assessment of their costs.²⁵
- 2.39 The costs incurred in terminating a call using pure OTT (i.e. when radio access network infrastructure costs are not incurred by the terminating MCP) may be similar to the cost of switching a fixed call. As a result, we propose using the benchmark fixed termination rate (FTR) as a benchmark when a MCP is a pure OTT provider – i.e. when it does not incur any radio access network costs to provide MCT. Where a significant amount of MCT is also provided by OTT MCPs using their own radio access infrastructure (or paying for wholesale national roaming on another mobile network), we consider that a higher termination rate than the FTR is likely to be appropriate.²⁶ A graduated scale of termination rates would therefore result.
- 2.40 At this stage, we would propose the following thresholds:
- 2.40.1 we would use the FTR for an OTT operator that terminates less than 25% of calls using a radio-access network for which it incurs the costs;
 - 2.40.2 we would use the benchmark MTR for an OTT operator that terminates at least 75% of calls using a radio access network for which it incurs the costs; and
 - 2.40.3 we would use an average of the benchmark MTR and the benchmark FTR for hybrid operators that terminate between 25% and 75% of calls using a radio access network for which they incur the costs.

available margin between the MTR and the actual cost of termination for the OTT operators. These two factors (among others) will determine the number of subscribers to OTT services and more generally the “materiality” of the potential competitive distortion.

²⁵ In principle, and as an alternative, it might be possible to adapt the cost model we use to set the charge control for the national MCPs – or extract certain model outputs – to create further cost-based benchmarks as suggested by stakeholders during certain disputes. However, given the large number of smaller MCPs and the nascence of some business models and networks that we discuss in Annex 4, such an exercise risks being arbitrary and thus defeating its purpose, and/or unwieldy (i.e. creating too many rates). The result of this exercise could therefore increase the costs of regulation to industry, increase uncertainty, and produce inaccurate outcomes as the entrants' businesses and technology choices change.

²⁶ See

http://stakeholders.ofcom.org.uk/binaries/consultations/wnmr_statement_consultation/summary/main.pdf

Proportion of traffic that terminates using OTT services	Termination rate charged for all calls by the MCP
Less than 25 per cent	Benchmark MTR (currently 4.4ppm ²⁷)
Between 25 per cent and 75 per cent	Average of the benchmark MTR and the benchmark FTR (around 2.3ppm ²⁸)
More than 75 per cent	Benchmark FTR (currently around 0.2ppm ²⁹)

- 2.41 We consider that this is a reasonable approach to take, because as the proportion of calls terminated using a radio access network increases, so do the MCP's underlying costs, and these become more closely aligned with the benchmark MTR such that the differential between the two reduces, and with it the concern of an unfair competitive and regulatory advantage also reduces.
- 2.42 As indicated in our April 2010 consultation, the benchmark MTR is proposed to decrease substantially over the next few years. As a result, the difference between the benchmark MTR and the benchmark FTR will also reduce substantially, such that any disparity will have an increasingly limited effect on competition in the relevant market. As such, we consider that adopting the approach described above (of a graduated scale of termination rates) is likely to remain consistent with our statutory duties.
- 2.43 The precise thresholds set out above could be varied without affecting the fundamental approach and we will consider carefully any comments made to us by stakeholders on these thresholds, before deciding exactly where they should lie.

Application of guidance to alternative enforcement action

- 2.44 Finally, we note that whilst dispute resolution is likely to be the most common regulatory means of considering whether a smaller MCP's termination rate is fair and reasonable, it is not the only regulatory instrument available.
- 2.45 It remains open to Ofcom to investigate whether or not MCPs are complying with a SMP condition by commencing enforcement proceedings under sections 94-103 of the 2003 Act, whether or not a dispute has been submitted.
- 2.46 Our current position is that we would propose to take this guidance into account in any such enforcement proceedings.

Question 1 : Ofcom considers that the publication of guidance as to how we would approach an assessment of what are fair and reasonable mobile termination rates in dispute resolution

²⁷ This is the maximum charge permitted for the 2G/3G MCPs for the charge control year 1 April 2010 to 31 March 2011 (in nominal terms, rounded to the nearest 1/10th of a penny).

²⁸ Based on a simple average of the benchmark MTR and FTR values shown of 4.4ppm and 0.2ppm, respectively.

²⁹ Rounded to the nearest 1/10th of a penny and taken from BT's Regulatory Financial Statements (year ending 31 March 2010) for the local exchange fixed call termination rate (time of day weighted average) plus the PPP charge (essentially the non-network costs associated with providing wholesale interconnection services).

would be useful for undertaking; particularly when negotiating termination rates. Do you agree?

Question 2: Do you consider that this proposed guidance is appropriate? In particular, do you have any comments on:

- symmetry of termination rates for Category 1 and Category 2 MCPs with the benchmark MTR
- a graduated scale of termination rates for Category 3 MCPs; or
- the particular thresholds proposed for the graduated scale applied to Category 3 MCPs?

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 18 February 2011**.
- A1.2 Ofcom strongly prefers to receive responses using the online web form at <http://stakeholders.ofcom.org.uk/consultations/mct-fair-reasonable/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 Paul.Jacobus@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 7783 3574
- 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. 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 statement in Spring 2011.
- 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 Vicki Nash, Director Scotland, who is Ofcom's consultation champion:

Vicki Nash
Ofcom
Sutherland House
149 St. Vincent Street
Glasgow G2 5NW

Tel: 0141 229 7401
Fax: 0141 229 7433

Email vicki.nash@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

Name/contact details/job title

Whole response

Organisation

Part of the response

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.

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Name

Signed (if hard copy)

Annex 4

Technologies and business models

Introduction

- A4.1 In developing our proposals for guidance, we have taken into account the changes in technologies and business models in this market and the implications for the cost of mobile termination services. This annex discusses these changes.
- A4.2 This annex in particular considers:
- 4.2.1 the different technologies that are available today to terminate a call to a number in the 07X range.³⁰
 - 4.2.2 the different business models and charging methods employed by MCPs offering mobile call termination (MCT).
- A4.3 The delivery of services is inevitably more complex than the simplified discussion in this annex. In many cases, UK MCPs use networks designed using a number of different approaches at the same time, and may also combine several business models to provide the same service.

Various technologies can be used to offer mobile call termination

- A4.4 In our consultation *Mostly Mobile*,³¹ we identified growing prospects for fixed-mobile convergence and highlighted that the increasing adoption by operators of new technology (in particular IP-based transmission combining many services or applications into a single network design) is a factor contributing to a more diverse market environment. As a consequence of this, new application providers are entering the provision of mobile services, at different parts of the supply chain. An example is the emergence of mobile-focused VoIP³² providers.
- A4.5 In general, conventional voice networks (including fixed, mobile 2G and mobile 3G) use circuit-switched technology - as opposed to newer technologies which employ packet-switched designs.³³
- A4.6 IP-based networks - both those operating today and those that are likely to be deployed in the future (for example using the LTE standard) - allow many different

³⁰ By technologies, we intend both the different standards to provide mobile access, e.g. 2G, 3G, Wi-Fi, LTE etc. and the different network deployments that combine existing standards in an alternative fashion, e.g. the use of femtocells, picocells, etc.

³¹ See, for example, section 3 of our second consultation on the mobile sector assessment, published in July 2009, *Mostly Mobile*

(<http://stakeholders.ofcom.org.uk/binaries/consultations/msa/summary/msa.pdf>).

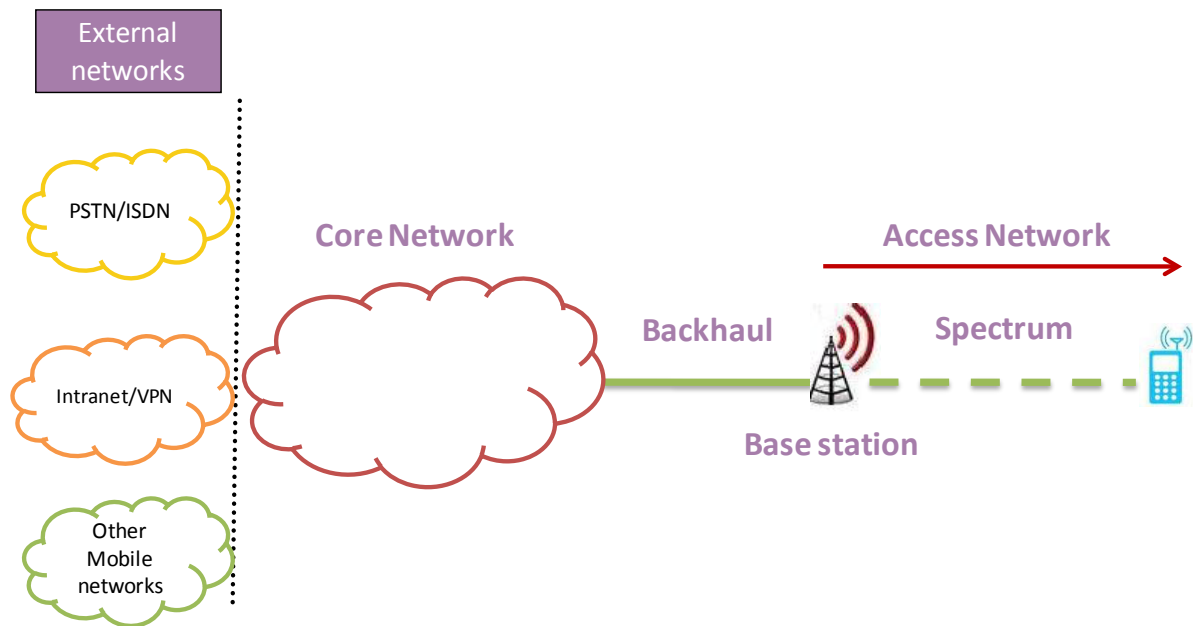
³² Voice over Internet Protocol

³³ Circuit switching is based on a static resource allocation, e.g. when user A calls user B a circuit is established between A and B for the whole call duration. The network resource, e.g. the radio access channel allocated, is not shared and it is not released until the conversation is hung up. In packet-switched networks such as the Internet and generally IP based networks, the conversation is digitized, the resulting stream of bits is chopped into packets and packets can flow independently across the network. As long as they flow fast enough, i.e. as long as the IP network has sufficient capacity and the voice handsets at both ends are quick enough, the quality of the voice conversation is typically equivalent to a circuit switched call.

applications to be provided using a single data connection. Changes in the equipment and software markets mean that there are a growing number of applications available to users, of which the ability to make voice calls is one.

- A4.7 As a consequence, the ability to develop several applications on top of a common mobile network platform has allowed for new business models. A communication provider willing to offer mobile calls, for example, is not necessarily required to deploy its own access and transport networks. It can develop its own voice application, be assigned mobile numbers and offer voice calls “over the top” (OTT) of one or more third party networks.
- A4.8 Offering an OTT service may be done as a stand-alone activity, or in conjunction with an access network. In some cases, new access networks may only extend to a specific area, and may use wireless access technology relying on licensed (exclusive) access to spectrum, or may use licence exempt spectrum (such as Wi-Fi).
- A4.9 At the same time, services to devices capable of being used in motion can be delivered using:
- 4.9.1 several standard technologies; and
 - 4.9.2 different network designs.
- A4.10 The standards include 2G (i.e. GSM), 3G (i.e. UMTS), LTE, Wi-Fi, WiMAX and DECT. Alternative network designs sometimes combine these standards to offer alternative network architectures and mobile connectivity. Examples include the use of femtocells, picocells, unlicensed mobile access (UMA) and so on.
- A4.11 In general, in competitive markets, providers seek to use new technology to offer new services or to reduce costs. Regulation, when it seeks to mimic outcomes observed in competitive markets, can be designed to include incentives to adopt new technology so as to deliver services more efficiently.
- A4.12 In the mobile sector, the adoption of new technology has two main consequences. First, the variety of solutions allows fragmentation of the supply chain. Second, applying the same regulatory approach to alternative network designs with different underlying infrastructure costs may cause a competitive distortion (see discussion in Section 2). For example, in some of the adopted business models, the receiving party is already paying for part or all of the cost to physically terminate the call, while the receiving MCP performs only some of the voice termination functions
- A4.13 Figure 1 below presents a simplified diagram of the main network elements necessary to provide MCT. When the number issued to the user is dialled by a user of another network, e.g. a mobile or fixed network, that originating network initiates a connection to the core network of the receiving party.

Figure 1 General model for mobile termination



A4.14 Through a backhaul connection, the call is then routed to the base station of a radio access network and terminated by establishing a connection to the receiving party's mobile device by allocating a channel over the radio spectrum (right side of the diagram). These network elements can vary depending on the technology used. For example, in the case of a circuit-switched call, the traffic is carried across a core network composed of mobile circuit switches and location registers, whereas a mobile VoIP call is carried across a core network of IP routers.

A4.15 A MCP can combine technical standards and alternative network designs to initiate and terminate mobile calls. We have identified the following alternatives, based on how a mobile call can be routed.

- Circuit-switched mobile voice:
 - 2G
 - 3G
 - Femtocells
 - Picocells
- Packet-switched voice or “over the top” services (OTT):
 - VoIP over 3G/HSPA
 - VoIP over LTE
 - VoIP over Wi-Fi

A4.16 Before describing these technologies in more detail, we discuss three specific properties of mobile voice networks that are relevant to this discussion: coverage, mobility and call quality. These factors shape the consumer's experience of voice

calls terminated using that network, with potential implications for the regulation of the underlying service of call termination to that number.

Coverage

- A4.17 Radio coverage is usually obtained dividing a large region in smaller areas. Each area is then covered by a serving antenna (e.g. the cells of a cellular network).
- A4.18 Different standard technologies can provide very different types of coverage. Cellular networks typically have a national coverage. GSM and UMTS standards are designed to provide coverage on a wide scale, e.g. substantially covering an entire country. By contrast, Wi-Fi technology³⁴ is more suitable for local indoor coverage. Wi-Fi works using spectrum that is licence exempt under certain conditions, for example, when transmission power does not exceed certain thresholds.³⁵ This essentially means that the use of the spectrum is open to all, although in areas with more than one user, this spectrum may be subject to interference. In addition, a typical Wi-Fi antenna broadcasts its signal over a range of about 60 to 100 metres compared to the 1 to 15 km range of a typical cellular network.³⁶
- A4.19 The extent of radio coverage, however, often depends on the specific business model chosen by the MCP rather than on the specific technology employed. Sometimes, these choices are constrained by regulation (for example, 3G licensed operators have previously met – and then chosen to exceed - a national coverage obligation).³⁷ Others, however, can decide to cover a sub-national area and choose to offer mobile coverage only within their targeted area or rely on national roaming when users roam outside the served area.

Mobility

- A4.20 The National Telephone Numbering Plan³⁸ defines a 'Mobile Service' as "[...] a service consisting in the conveyance of Signals, by means of an Electronic Communications Network, where every Signal that is conveyed thereby has been, or is to be, conveyed through the agency of Wireless Telegraphy to or from Apparatus designed or adapted to be capable of being used while in motion".
- A4.21 Generally speaking, use in motion or mobility over radio networks is difficult to achieve and requires complex engineering. Similarly to coverage, different wireless technologies offer different degrees of mobility. For example, when a mobile user is engaged in a phone conversation and moves across different areas (i.e. cells), the network uses control systems to hand over the call seamlessly to the receiving antenna of the new cell. This mechanism is called "call handover".

³⁴ Based solely on the IEEE 802.11 standard.

³⁵ The licensed exempt band is also known as the Industrial, Scientific and Medical (ISM) radio band. Specifically Wi-Fi works at 2450 MHz and 5800 MHz bands.

³⁶ Note that cellular coverage can vary substantially according to the specific frequency range used, the type of service (voice vs. data), the indoor vs. outdoor extent and the technology standard. The range in the text refers to a typical outdoor GSM 800MHz service. GSM 1800MHz and UMTS 2100MHz may reduce the range to 1-5 km.

³⁷ The 3G coverage obligations are described in our consultation

http://stakeholders.ofcom.org.uk/binaries/consultations/3g_rollout/summary/3g_consultation.pdf.

Latest coverage maps can be seen at <http://www.ofcom.org.uk/static/cmr-10/UKCM-1.68.html>

³⁸ <http://stakeholders.ofcom.org.uk/binaries/telecoms/numbering/numplan080410.pdf>

A4.22 Call handover may be an intrinsic feature of a given standard (as it is in 2G and 3G voice services) or it may be achieved using additional capability for services that might not otherwise include it (for example, VoIP services over Wi-Fi may or may not offer call handover). The trend is towards increasing opportunities to blend different forms of network access, sometimes within the same service – for example, newer technologies such as UMA allow call handover between 2G and Wi-Fi networks in a seamless fashion.

Call quality

A4.23 Call quality measurements have traditionally been subjective. Being based on human perception, there is not an objective way to score call quality. The leading subjective measurement of voice quality is the MOS (mean opinion score) which averages people's perceived quality over a scale from zero (worst call quality) to five (best call quality).³⁹

A4.24 A communication network carrying voice calls must be designed to have very low latency and jitter.⁴⁰ For this reason, voice calls have generally been carried over circuit-switched networks, where the end-to-end communication takes place over a dedicated physical circuit (or a dedicated radio channel) and voice is conveyed through un-contended bandwidth.

A4.25 Today, however, voice compression technology (also known as voice codecs)⁴¹ that enable human speech to be encoded in digital signals has improved dramatically and voice can be sent over packet-switched networks (e.g. the Internet) with very similar quality to traditional telephony services. The recent design of voice codecs has aimed to preserve voice quality against the contended nature of the Internet Protocol.⁴²

A4.26 Of the three characteristics of mobile networks discussed here, call quality is the least significant, in terms of regulatory distinctions between different forms of call termination. As most consumers are only too aware, call quality varies within a given mobile network, in different places and at different times, as a result of a wide variety of factors within, and outside, the control of the network provider or the user.⁴³ This makes it difficult to generalise about the relative call quality of different technologies or standards. In this consultation we generally assume (unless the text indicates differently) that all the technologies discussed in this consultation document can be used to provide the same level of call quality. This simplification may not be appropriate in all cases.

³⁹ MOS is described in the ITU (International Telecommunications Union) recommendation p.800.

⁴⁰ Latency is the delay that occurs when a packet crosses a network connection, from sender to receiver. Jitter is the variation of latency, i.e. the irregularity with which voice packets reach the destination. For voice, latency of 150ms is barely noticeable so is acceptable. When it gets higher than 250 ms, it becomes unacceptable. Jitter can be addressed by buffering voice packets before delivering them to the destination.

⁴¹ A codec is a device or computer program capable of encoding and/or decoding a digital data stream or signal.

⁴² For example, in order to reduce the latency and jitter typical of IP networks, codecs may use transmission redundancy, i.e. the information is sent across multiple times.

⁴³ These issues are also discussed in our 'not spot' research (<http://www.ofcom.org.uk/static/cmr-10/WAL-1.29b.html>) and Section 8 on coverage in our *Mostly Mobile* document (<http://stakeholders.ofcom.org.uk/binaries/consultations/msa/summary/msa.pdf>).

Circuit-switched mobile calls

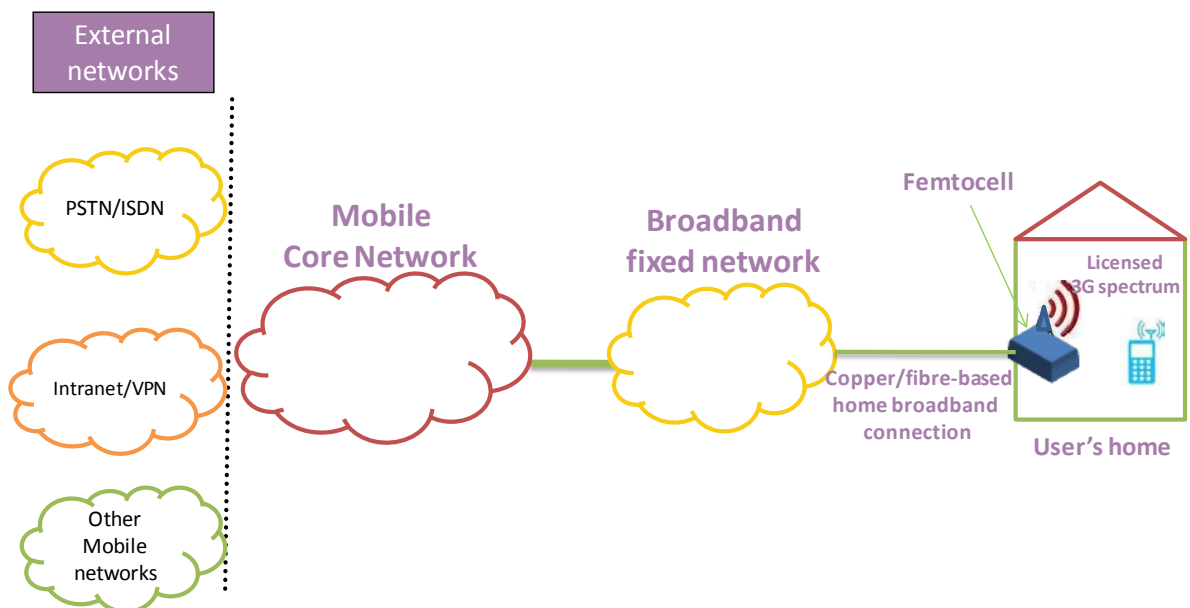
A4.27 2G and 3G technologies were extensively discussed in the April 2010 consultation. Voice calls over traditional 2G/3G networks are terminated using network elements provided or paid for by the terminating operator, i.e.:

- the circuit-switched core, composed of mobile switching centres and location registers;
- the backhaul network to reach out to the 2G/3G radio base stations. Backhaul is either purchased from third party fixed operators⁴⁴ or self-provided.
- radio base station systems based on GSM and UMTS technology. These are normally antennas installed over masts or buildings connected to base station controllers.
- licensed spectrum at 900MHz, 1800MHz, 1900MHz, 2100MHz.

Femtocells

A4.28 A femtocell is a low power base station intended to improve 2G or 3G indoor coverage. When the user is at home, all calls are routed via the user's home broadband connection to the core network of the operator supplying services (see Figure 2 below). When the user is away from home, calls are routed through the macro network. The user's mobile network retains control of the call or data

Figure 2 Call termination on femtocells



A4.29 With reference to the network diagram of Figure 2, calls over femtocells are provided by using:

- The circuit-switched core network as in 2G/3G networks above;

⁴⁴ These are normally based on TDM leased lines or radio links, connecting radio base stations to base station controllers and mobile call switches.

- The backhaul link of the broadband fixed network to which the femtocells interconnect.
- Femtocell radio base stations, i.e. radio stations installed at the user's premises and connected to the home broadband fixed network.
- Licensed spectrum at 900MHz, 1800MHz, 1900MHz, 2100 MHz.

A4.30 Femtocells use a network design which is very similar to Wi-Fi, as they link a radio access network to a core network using backhaul over the broadband network of a fixed operator. Backhaul using leased lines is a significant recurring cost for the national MCPs. This cost can be reduced if a significant proportion of users' traffic is routed via user supplied broadband connections.

Picocells

A4.31 Similarly to femtocells, picocells are small mobile radio stations used to increase coverage to indoor areas where outdoor signals do not reach well, or to add network capacity in areas with very dense mobile usage, such as train stations, airports, street corners, etc.

A4.32 Calls terminated over picocells still rely on a circuit-switched 2G/3G core network. Similarly to 2G/3G calls, the backhaul network can be self-provided or based on third party's leased lines, or similarly to femtocells, backhaul can be based on a third party fixed broadband provider. These miniature base stations are normally provided by the MCP and can be located in users' premises, either indoors or outdoors. Picocells use licensed spectrum. This can be 2G and 3G spectrum or DECT guard band spectrum.⁴⁵

Packet-switched mobile calls

A4.33 There are a number of different ways to access VoIP services on a mobile handset, that can vary depending on the:

4.33.1 Different applications that can be used to access the service, including:

- a web browser interface, for example Internet Explorer Mobile, Opera Mobile or Safari; or
- a custom voice application, for example , Google Voice or Truphone.

4.33.2 The nature of the access connection. The VoIP call can be routed through a Wi-Fi connection or through the 3G cellular network. There can be cases such as the UMA technology, where the same voice call is initiated over Wi-Fi and handed over seamlessly to the GSM network or vice versa.

A4.34 In what follows, we describe mobile VoIP calls over Wi-Fi, over 2G/3G and the prospects of voice over LTE. Differently from all the aforementioned technologies, this type of mobile voice service runs 'over the top', i.e. over an existing broadband connection. In other words, the OTT service providers are not required to open a

⁴⁵ Frequency bands 1781.7-1785 MHz paired with 1876.7-1880 MHz (concurrent spectrum access licences). These spectrum bands, called 'DECT guard bands', were originally set up to protect cordless phones (Digital Enhanced Cordless Telecommunications) from interference by mobile telecommunication transmission.

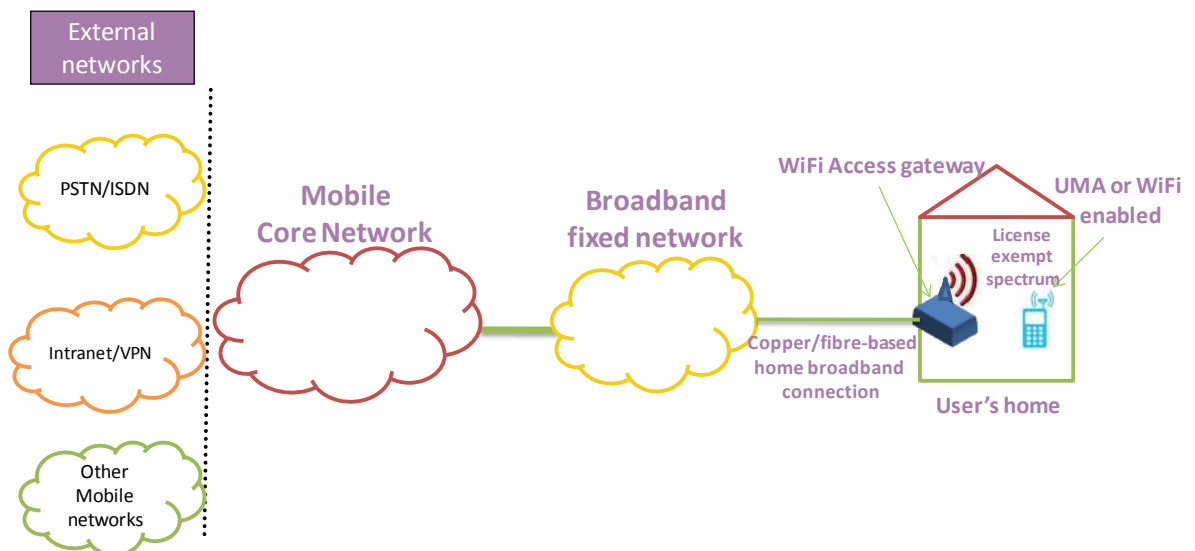
dedicated circuit to carry a call, they only need to interconnect their VoIP gateways to existing fixed cores and mobile access networks.⁴⁶

- A4.35 In other words, a typical UMA call terminated over Wi-Fi still uses the 2G core network, but it is routed through an ISP broadband fixed network. SIP based VOIP running over Wi-Fi follows similar principles, with the exception that VoIP gateways are separated from other network elements, for example 2G/3G networks.

VOIP over Wi-Fi

- A4.36 Wi-Fi today is commonly used to offer data connections to computers and mobile phones in houses, airports, restaurants and cafes. Increasingly, smartphones are available that can use both conventional and Wi-Fi connections, opening the door to a variety of voice services that bypass the integrated services of conventional operators.⁴⁷ For example, a VoIP application on a consumer's handset can utilise a domestic Wi-Fi connection to allow the making and receiving of calls, which from an end-users perspective appears identical to the more common 2G/3G standards (see Figure 3 below). There are several providers using Wi-Fi technology to originate and terminate mobile calls. Similarly to femtocells, this type of call termination can offload the voice traffic to fixed networks (recall that the voice call is routed through a broadband connection of a fixed network provider and finally through a Wi-Fi access gateway). For example, Orange now enables the UMA capability of some of its handsets. Once set up these provide near-invisible routing of mobile calls over Wi-Fi connections.⁴⁸ These UMA calls are routed using a Wi-Fi connection and eventually connect to the core network of the MCP.

Figure 3 Example of Call termination using VoIP over Wi-Fi



⁴⁶ Mobile VoIP providers normally run core networks with VoIP gateways (generally based on SIP signalling) and PSTN termination services. Alternatively they can use an unlicensed mobile access (UMA) based approach which provides external IP access into the mobile network core.

⁴⁷ Mobile handsets with Wi-Fi transmitters coupled with either 2G or 3G.

⁴⁸ BT Fusion and Orange Unique (<http://www.orange.co.uk/unique/>) are examples of UMA services launched in the UK. BT Fusion is no longer available to new customers.

VoIP over 3G/HSPA

- A4.37 “VoIP over 3G” means running a VoIP application over a 3G data connection. Mobile VoIP providers normally run core networks with VoIP gateways (generally based on SIP signalling) and PSTN termination services. According to some MCPs,⁴⁹ VoIP services that use 3G are not succeeding. Where 3G coverage is patchy and upload speeds are poor, VoIP remains lower quality than circuit switched voice calls. However, we would expect network quality issues to be resolved as HSPA handsets become more common and operators continue upgrading their networks.
- A4.38 In addition, some current mobile VoIP applications are not easy to install and use on a mobile handset. As they are not supported by operators, they are usually not integrated with handset and network functionality. Finally, some MCPs preclude the use of VoIP services in their terms and conditions.

VoIP over LTE

- A4.39 Unlike GSM and UMTS, Long Term Evolution (LTE) is completely based on IP from access to core. However, while LTE modems delivering mobile broadband services are already available, mass availability of LTE phones are still some way off. The reason is that manufacturers and operators have yet to reach a final agreement on how calls will be placed and voice traffic carried over LTE all-IP networks. However, in February 2010, some mobile network operators in partnership with 3GPP created the task force VoLTE (voice over LTE) to work on a common voice over LTE standard.⁵⁰
- A4.40 When LTE mobile phones are standardised and adopted by users, the underlying structure to terminate a voice call will be substantively different, as LTE will employ a packet-switched network based on IP rather than a circuit-switched network. This will mean that LTE voice will be closer in operation to VoIP than today’s circuit switched networks.

MCPs can adopt various business models and charging methods

- A4.41 As well as choices about which technology to use, MCPs also have adopted a variety of different business models, affecting the way in which consumers can and do use those services, for example:
- 4.41.1 the degree of mobility e.g. Wi-Fi, femtocells, or UMA for indoor connections and 2G/3G networks for outdoor;
 - 4.41.2 the coverage offered, e.g. national or sub-national with/without national roaming;
 - 4.41.3 the combination of services, e.g. data and/or voice.
- A4.42 The following paragraphs discuss these different business models. It is clear that while the cost associated with these business models differ, the attractiveness of the retail packages offered by the MCPs is closely correlated with the characteristics of the mobile services they are able to offer.

⁴⁹ <http://www.3g.co.uk/PR/Oct2009/3G-Mobile-VoIP-in-Slow-Lane-3G.html>

⁵⁰ http://www.gsmworld.com/our-work/mobile_broadband/VoLTE.htm

'Classic' national mobile business model

- A4.43 A national 2G or 3G access network, linking to a national core network, enables mobile voice calls, text messages and data access to be provided, as individual services or in bundles, to a national retail mass market. This business model currently accounts for the vast majority of mobile calls made and received.
- A4.44 In order to estimate the efficient unit costs of MCT in our April 2010 consultation, having considered different network technology scenarios, we based our cost model on a network deploying 2G and 3G/HSPA. This reflects the existing network deployments of the national MCPs and is expected to be the prevailing technology mix used for the period of the market review.
- A4.45 This business model relies on the provision of all elements of the mobile network, from the core elements and connectivity to the radio access base stations and licensed spectrum.

Sub-national models

- A4.46 It is useful to identify two types of sub-national business models:
- A stand-alone small network
 - A small network with national roaming.
- A4.47 MCPs like C&W or Mundio Mobile⁵¹ provide examples of the above types. Both Mundio Mobile (formerly MCom) and C&W were awarded DECT (Digital Enhanced Cordless Telecommunications) guard band spectrum alongside 10 others, following Ofcom's auction in May 2006⁵² and offered mobile services by rolling out picocells. Mundio Mobile deployed a stand-alone small network, whereas C&W signed a national roaming agreement with a national mobile operator to complement its coverage outside the footprint of its own picocells.
- A4.48 In particular, under its DECT guard band licence, Mundio Mobile built concentrated areas of coverage, based on the location of its target market. Due to the limited power the DECT guard band licences permit, and to maximise in-building coverage, Mundio Mobile built a network of GSM base transceiver stations (BTSs) using picocell BTSs 400m or so apart sited on rooftops of residential homes, public telephone boxes (operated by Spectrum Telecoms), poles or advertising hoardings.
- A4.49 The fixed and mobile convergence (FMC) service provided by C&W, instead, delivered telephony services using 2G technology over picocells indoors and through national roaming outdoors.

Alternative business models

- A4.50 As described above, 2G/3G services rely on vertically integrated supply of radio access and mobile call provision. Mobile VoIP calls, on the other hand, allow the separation of mobile call provision from the underlying network infrastructure,

⁵¹ Formally known as Mapesbury Communications Ltd (MCom)

⁵²

see

http://www.ofcom.org.uk/radiocomms/spectrumawards/completedawards/award_1781/documents/

allowing new business models where the receiving party contributes significantly to the cost of the access network.

- A4.51 This cost contribution can range from some part of the access network cost, through to 100% of the cost of the whole network. The Truphone business model, for instance, consists of three separate sub-models according to the specific network architectures used to terminate the call, i.e. Wi-Fi, 3G VoIP or national roaming. When using Wi-Fi and VoIP over 3G, Truphone is only incurring the costs of switching and encoding the call, i.e. the core network element. The rest of the costs are incurred by the receiving network which in turn recovers those costs by charging the subscriber for retail access.
- A4.52 Figure 4 below compares different business models against the main cost components of mobile voice termination, i.e. core, backhaul and radio access networks (the latter is split by base stations and spectrum). Ticks indicate that the cost of that network element is met by the MCP; crosses instead that the network element cost is incurred by another entity and typically recovered from the receiving party. As set out in the first three rows, Mundio Mobile and C&W bear the costs of all of their network elements, similarly to 2G/3G voice provision where all the costs of the network components are met by the MCP. We also recognise that, although there are some providers whose business model is 100% OTT with 100% receiving party payment for the terminating connectivity (see VoIP over 3G row in Figure 4), there are also mixed business models where MCPs use this technology only some of the time. This figure illustrates the fact that the structure of the costs incurred by MCPs can vary – both between different services and between MCPs.

Figure 4 Examples of different costs of termination⁵³

	Total cost of termination →			
	Core network	Backhaul	Cost of Radio Access →	
Legend			Base stations	Spectrum
✓ Cost met by the MCP				
✗ Cost NOT met by MCP				
Classic 2G/3G business mode	✓	✓	✓	✓
Mundio Mobile picocells	✓	✓	✓	✓
C&W FMC picocells	✓	✓	✓	✓
Stourmarine ⁵⁴ WiFi	✓	✓	✓	✗
Trufone via National roaming	✓	✓	✓	✓
Trufone via WiFi	✓	✗	✗	✗
Trufone with 3G VoIP	✓	✗	✗	✗
VoIP over 3G	✓	✗	✗	✗
Vodafone femtocells	✓	✗	✓	✓
Orange UMA	✓	✗	✗	✗

⁵³ Stour Marine is a UK based operating in the unlicensed band, WiFi & WiMAX. See the Stour Marine website at <http://www.stourmarine.com/> see for further information regarding Stour Marine.