Routing calls to ported telephone numbers

Consultation on proposals

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Consultation

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Contents

Section 1

Executive summary

1.1 This document sets out Ofcom's consultation on proposals that could amend the regulation of the way in which calls from mobile telephones to ported mobile numbers are routed.[1]

Background

1.2 Number portability is the facility that allows subscribers to keep the same telephone number when they change provider.

1.3 Currently, a call to a ported number is routed to the communications provider who was first allocated the called number.[2] This provider (who no longer serves the customer using the number) recognises that the dialled number has been ported to another provider and *forwards* the call to the network on which the ported number now resides. When the call reaches this provider, the call is passed through to the called subscriber. This same routing principle applies to all calls to ported telephone numbers irrespective of whether the call is made from or to a fixed line or mobile subscriber. This process is referred to as 'onward routing'.

1.4 All other things being equal, onward routing is efficient when the volume of calls to ported numbers is low. But, as more subscribers port their numbers and the volume of calls to ported numbers increases, a point is reached where it becomes more efficient for the calling subscriber's provider to change its systems so that it can first identify whether, and to whom, a number has been ported and then route the call *directly* to the called subscriber's current provider. This alternative approach to routing calls to ported numbers is referred to as 'direct routing'.

1.5 For calls to ported mobile numbers which are onward routed, the mobile provider serving the subscriber receives the termination rate of the onward routing operator and not its own termination rate.[3] Currently, this rate may be more, the same or less than its own termination rate, because of the differences in the mobile termination rates of some mobile providers.

1.6 Also, the mobile provider serving the subscriber makes a payment to the onward routing operator to contribute to the costs of onward routing the call (the "conveyance costs"). The remainder of this porting conveyance cost is borne by the onward routing operator itself. The operator originating a call and who is making the decision about how to route a call does not bear any of the costs of onward conveyance.

[1] Our proposals concern mobile voice calls only. We are not making any proposals in this document about changes to how Short Message Service ("SMS") or other data services are routed.
[2] Ofcom allocates blocks of telephone numbers to communications providers who assign telephone numbers to their subscribers. Other communications providers are notified that an allocated block of numbers is active on a particular communications provider's network so they can configure their networks to route calls to that provider.
[3] Call termination' describes the process of connecting ('terminating') a telephone call from a user on one network to a user on another network. When fixed and mobile operators offer their customers the ability to call UK mobile numbers, they pay mobile operators a wholesale charge to complete those calls. The rates that operators pay are known as "mobile call termination" charges.

The current review

1.7 We are considering the current arrangements for routing calls to ported numbers afresh following Vodafone's successful appeal against our decision in November 2007, which required that operators route calls directly to the network serving the subscriber (that is, to the network to which the number has been ported – termed 'direct routing').[4] Today, calls to ported mobile numbers are passed to the mobile provider who originally provided service on the number and are then forwarded ('onward routed') to the mobile provider serving the subscriber.

1.8 We consider that direct routing[5] of mobile-to-mobile calls is likely to serve subscribers' interests by improving efficiency and ultimately reducing prices through saving costs that would otherwise be incurred by the mobile industry. We are not making any proposals at this time about the routing of calls to ported numbers from or to fixed networks. Our assessment suggests that the costs of making such changes involving the fixed networks are likely to outweigh the benefits.

1.9 The inefficiency caused by onward routing costs around £14m per year now and could rise to around £19m per year by 2021[6]. We estimate the benefits of a move to direct routing for mobile-to-mobile calls to ported numbers (only) at £26m[7]. We have estimated high and low case new present value ("NPV") scenarios around the central case of £90m and -£15m over ten years respectively (see Annex 5 for further detail).[i] We consider the base case to be a conservative estimate as it assumes the costs industry had previously estimated based on our November 2007 Statement which required direct routing for calls to ported mobile numbers to be implemented by 1 September 2009. Mobile stakeholders have told us that the costs of implementation could be significantly lower if more time was allowed for implementation such that they can plan the necessary changes for direct routing to fit in with other planned network upgrade plans.

1.10 We have also published proposals on the *process* that is used by subscribers and by industry to port mobile numbers from one network to another. These proposals have been published separately by Ofcom and can be found at http://www.ofcom.org.uk/consult/condocs/gc18_mnp/. They are being considered separately from the proposals discussed in this document. However, should the consultation on changes to the mobile porting process result in a requirement for near-instant porting, then there may be linkages between the routing requirements and the process requirement (such as, for example, the need for a central database). We will consider the impact of any such linkages during our assessment of the consultation responses.

1.11 We invite comments on our analysis of the options to address the issue of routing inefficiency. In particular, we are providing an opportunity for mobile operators to indicate their interest in moving to direct routing within the next three to four years,

[4] We consulted on the issue of how calls to ported numbers are routed in 2006. We published a concluding statement called *'Telephone number portability for consumers switching suppliers'* on 29 November 2007 (the 'November 2007 Statement') requiring direct routing for mobile originated calls to ported mobile numbers to be implemented by 1 September 2009 and for all calls to all ported numbers by 31 December 2012.

[5] Note that there are instances where direct routing mobile calls to ported mobile numbers may not be cost justifiable. For example, newer entrants to the mobile market who do not have sufficient levels of ported traffic may be better off onward routing until such time as they have sufficient levels of ported traffic.

[6] 2008 prices.

[7] 2008 prices.

without any regulatory action by us. If the industry indicated a credible intention to adopt direct routing in any event, then that would secure benefits for subscribers without the costs or risks involved in regulation. If it is clear that there is no industry desire, we are proposing to require direct routing (through regulation). In the event that it is necessary to intervene, the likely route will be through a modification to General Condition 18 ("GC18").[8]

1.12 In addition to seeking views on our analysis and conclusions, we are interested in stakeholders' views on the proposed next steps we have identified for concluding our work in relation to routing of mobile-to-mobile calls to ported numbers.

Assessment

1.13 We have assessed the capital and operating cost of communications providers adopting direct routing and compared this against the cost saved by avoiding onward routing. We have undertaken our analysis for a range of call routing configurations including calls between fixed networks, calls between mobile networks and calls routed from fixed to mobile networks and vice versa.

1.14 Because the costs of implementing direct routing in fixed networks exceed the likely benefits, we make no proposals in this consultation document about calls to ported numbers made from or to fixed networks.

1.15 We estimate that the benefits of direct routing for mobile-to-mobile calls to ported numbers are likely to outweigh the costs in those cases where operators have sufficient scale to justify directly interconnecting their networks. In practice, this indicates that the five incumbent mobile network operators[9] ("MNOs") in aggregate are likely to benefit by implementing direct routing between their networks. Newer mobile entrants are unlikely to have sufficient traffic today to justify adopting direct routing unless their network has such inherent ability from the start.[10]

1.16 Given the maturity of the United Kingdom ('UK') mobile market, it is reasonable to expect that over time more subscribers will port as they switch between providers. If the onward routing system were to be maintained, then the resulting level of inefficiency would rise. We estimate that operators will benefit by around £26m (net) over ten years[11], if the five largest mobile network providers directly routed mobile-to-mobile calls to ported numbers by 2012. The net benefits could be higher if operators have more flexibility as to *when* they introduce direct routing, because then they are likely to be able to do so in a way that is less expensive – for example, by coordinating investments in direct routing with other network investments.

1.17 However, not all individual MNOs have an incentive to directly route calls as switching to direct routing results in winners and losers. To understand why, it is necessary to consider how operators pay each other to terminate calls. The provider who terminates a call that has been onward routed receives the termination rate of the provider who onward routed the call (and not their 'own' rate). Because, today, there is a different rate set for the four 2G/3G MNOs[12] on the one hand, and H3G on

[8] GC18 specifies the obligations communications providers are obliged to comply with in relation to number portability.
[9] H3G, O2, Orange, T-Mobile and Vodafone.
[10] By which we mean mobile entrants who use their own network to route calls as opposed to mobile virtual network operators who rely on other operators for the switching and transmission of calls.
[11] The capital outlay is in year zero followed by 10 years of operation. The discount rate used is the mobile real pre tax weighted average cost of capital (WACC).
[12] O2, Orange, T-Mobile and Vodafone.

the other, and because different providers have higher proportions of ported-in numbers than others, this can encourage certain MNOs to maintain onward routing as they are commercially better off, despite the fact that costs borne by subscribers overall would be lower were the calls in question routed directly. Therefore, despite there being an overall net benefit to the mobile industry associated with a move to direct routing, operators who, as a result of a switch to direct routing will have to pay more in termination rates, are not incentivised to change the current status quo.

1.18 However, following a determination by the Competition Commission in January 2009, which Ofcom was directed to adopt by the Competition Appeal Tribunal ("CAT") in April 2009, the difference between average mobile termination rates of the MNOs will reduce to 0.3p by 2011 from 1p currently.[13] Some commentators have noted their expectation that there will be further reductions in the difference between 2G/3G operators and H3G. Whether this is the case will depend on the outcome of our current review of mobile call termination.

1.19 If the termination rate was the appropriate rate applying to the terminating network, MNOs might face the right incentive to eliminate the inefficiency of onward routing, without regulation. There is a potential additional obstacle, however, because operators may be unable to co-ordinate their behaviour to switch to direct routing. This is because for an operator to switch to direct routing unilaterally would require that operator to make a significant investment in direct routing capability, while the beneficiary of this change would be the donor and terminating operator who would no longer incur porting conveyance costs or charges on ported number calls. Consequently, by moving to direct routing, the call originator does not benefit, but its competitors would (by avoiding porting conveyance charges). Therefore an operator may only wish to invest in direct routing if it has sufficient certainty that its competitors will do the same and in the same timescales.

Options

1.20 The options for responding to the productive inefficiency and coordination issues associated with onward routing against the counterfactual of a 'do nothing' option are set out below:

Option (1): do nothing

1.21 The first option would be to leave the rules as they are (prior to our November 2007 Statement, which was overturned in September 2008). This would mean that there would continue to be no regulation of the routing of mobile-to-mobile calls to ported numbers.

1.22 Whilst we are not in a position to say today whether there is likely to be coordination failure preventing the mobile industry from moving to direct routing in future, if we adopt a 'wait and see' approach, there is a risk that inefficient routing will persist for a long time and could deprive subscribers of the benefits which flow from a more efficient routing solution.

1.23 If we took this option, it is likely that this issue would arise for reconsideration in the future. If that were to happen, we and industry would likely incur further costs to re-

[13] The Competition Commission's judgement is available at: http://www.competition-commission.org.uk/appeals/communications_act/mobile_phones_determination.pdf. The Significant Market Power ("SMP") service conditions stating the termination rates can be found at http://www.ofcom.org.uk/consult/condocs/mobile_call_term/statement/CTMAmendment2009final.pdf

examine these issues in light of, for example, changes in network evolution and costs at the point at which we revisit these issues afresh.

1.24 If we considered that the industry was likely to achieve the benefits of direct routing without the need for regulation (for example, because there was a clear indication that this was likely to happen during the next three to four years) then this would be our preferred option.

1.25 If, however, industry was unlikely to take action without regulation, we believe that regulation to secure the benefits of direct routing within a more certain time-frame is likely to be in the interests of subscribers. We have considered three broad options as set out below.

Option (2): industry-led initiative to implement direct routing for mobile originated calls to ported mobile numbers

1.26 We consider that falling (and, as between operators, converging) mobile termination rates reduce a major barrier to an industry-led approach to this problem. If sufficient time was allowed to enable mobile network operators to coordinate a move to direct routing to coincide with planned network investments, it would reduce the cost and disruption of doing so – benefiting subscribers. We are open to an industry-led approach providing there is clear executive commitment from the five incumbent MNOs that they were prepared to implement direct routing within the next three to four years.

1.27 We consider this approach to be reasonable only if there is clear support from the highest levels of management within the mobile industry.

Option (3): changing the routing incentives for calls to ported mobile numbers

1.28 If the wholesale payment arrangements for routing ported calls were changed so that the cost is paid by the originating operator (whether this be a mobile or a fixed operator) instead of the terminating or range-holding operators, this would reduce or eliminate the coordination issue noted above. Originating operators could decide whether to:

a) look up whether the call has been ported and route the call directly, thereby avoiding paying the porting conveyance charge (subject to being able to access information about ported numbers); or

b) continue to onward route the call and pay the conveyance costs associated with this method of routing.

1.29 Conceptually, this option is very attractive, because it holds out the prospect of being able to change the incentives and enable operators to decide for themselves how best to reduce those costs in a way that they consider most efficient. This is consistent with our experience of competitive markets as an effective mechanism to drive efficiency and with our regulatory principles that commit us to regulate to the minimum extent necessary to achieve a clearly defined objective.

1.30 However, in practice, we do not favour this option because:

a) Calls to mobile numbers originate on both mobile and fixed networks and this change would shift some of the burden of mobile porting conveyance costs from

the mobile industry to the fixed industry.[14] Because we expect that fixed networks are unlikely to directly route calls to ported mobile numbers in the foreseeable future (because it is likely to be uneconomic), this change would likely result in some of the inefficient cost of onward routing simply being transferred from mobile to fixed operators and hence, from one group of subscribers to another;

b) fixing that problem, by restricting this option to mobile-to-mobile calls to ported numbers, creates a new problem, which is that calls could be re-routed from mobile to fixed networks to take advantage of the price differences between them ('arbitrage'). In effect, such a rule would encourage mobile operators to route traffic through fixed operators to avoid paying porting conveyance costs; and

c) in any event, it is uncertain whether existing wholesale billing systems can support this option and, if not, what the costs of implementing it might be.

Option (4): mandate direct routing for mobile originated calls to ported mobile numbers

1.31 The final option is to set a regulatory condition requiring direct routing of mobile-to-mobile calls to ported numbers. In the absence of an industry-led move to direct routing, this is our proposed option.

1.32 In these circumstances we would require mobile-to-mobile calls to ported numbers to be routed in the same way as all other (non-ported) traffic to mobile numbers. The likely route to effect this change will be through a modification to GC18.

1.33 Any new requirement for direct routing would take effect in accordance with a reasonable timescale that gives MNOs the opportunity to synchronise the network changes required with their broader network upgrade plans.

1.34 If we were to select this option, we have not, at this point, fixed our proposed timescale. We are seeking comments from stakeholders as to what period of time is reasonable. Based on discussions with mobile operators concerning their network upgrade plans and the lead times they consider to be required to introduce direct routing, our initial view is that direct routing should be in place during 2012. This would seem to strike a reasonable balance between the lead times required to effectively implement direct routing in coordination with existing systems upgrades which MNOs are planning and the scale of the benefit and the current price control period for mobile termination rates.

Next Steps

1.35 We invite comments by no later than **5.00pm on 26 October 2009**.

1.36 If we need to impose direct routing using regulation, we expect we will need to facilitate a process by which industry would settle the technical specification for direct routing. This is likely to involve an independent technical expert or consultancy firm to

[14] Under current arrangements, the costs of mobile porting conveyance are borne equally by the range-holder and terminating networks therefore confining the conveyance costs of mobile portability to the mobile industry. Changing these arrangements such that originating operators (whether fixed or mobile) bear some or all of the mobile porting conveyance costs would therefore transfer some of these costs from the mobile to the fixed industry.

work with industry to re-define the technical specification.[15] This is required, in our view, as Ofcom does not have the necessary technical skills or resources available in-house with experience of implementing similar solutions.

1.37 Industry stakeholders will be invited to participate fully in this process. In particular, we encourage and expect industry engagement in order to enable us to assess the reasonable costs of implementation of the redefined technical specification and associated individual operator costs. Our expectation is that, given the reduced scope of direct routing required relative to the November 2007 Statement and the somewhat longer proposed implementation timetable that the total costs will be lower than the current estimates that draw on the previous UKPorting[16] specification. Assuming the cost benefit assessment yields NPVs that are not materially lower than the estimates set out in this consultation document, we would then proceed to publish our final statement setting out our policy and paving the way towards implementation.

1.38 However, in the event that this consultation process indicates strong support for an industry-led solution, we would look to agree with industry a set of milestones that would map the process towards achieving an industry-led direct routing solution against which progress and success can be measured.

[15] Keeping in mind that there has already been some work done by UKPorting (see following footnote) on this issue, which we would seek to use to the maximum extent we reasonably can, to reduce overall costs.

[16] UKPorting was the industry group established in 2008 with the aim of implementing Ofcom's November 2007 statement. See: http://www.ukporting.org.uk/. The group disbanded following the CAT's decision on Vodafone's appeal to the 2007 statement. During the time UKPorting was in place, industry developed a technical specification for direct routing.

Section 2

Introduction and background

2.1 In this section, we introduce number portability and set out the context and background to this review of the routing of calls to ported telephone numbers.

Number portability

2.2 Number portability is the facility that enables subscribers to keep their telephone number(s) when they switch communications provider. It is recognised as a key facilitator of consumer choice and effective competition.

2.3 The United Kingdom (UK) was one of the first countries to introduce number portability. It was introduced for fixed line operators from 1996/97 and mobile operators from 1999 by the then Director General of Telecommunications using powers granted to him under the Telecommunications Act 1984.[17]

2.4 Many countries, both in Europe and elsewhere, have introduced number portability more recently. UK subscribers have had the advantage of being able to port before subscribers in other countries, a factor that has no doubt facilitated the development of competition in the UK communications market delivering more choice and lower prices to subscribers. But it also means that the UK's arrangements for routing calls to ported numbers are now at least ten years old and that other countries have had the benefit of seeing how number portability has been implemented in the UK and elsewhere before choosing their own solutions.

Today's regulatory framework for number portability

2.5 Number portability is described in Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services ("the Universal Service Directive") as "a key facilitator of consumer choice and effective competition in a competitive environment such that end-users who so request should be able to retain their number(s) on the public telephone network independently of the organisation providing the service".[18]

2.6 Article 30 of the Universal Service Directive provides that:

> "1. Member States shall ensure that all subscribers of publicly available telephone services, including mobile services, who so request can retain their numbers(s) independently of the undertaking providing the service:
>
> (a) in the case of geographic numbers, at a specific location; and
>
> (b) in the case of non-geographic numbers, at any location.

[17] Oftel, *Number Portability: Modifications to Fixed Operators' Licence*s - Statement April 1997. Available at: http://www.ofcom.org.uk/static/archive/oftel/publications/1995_98/numbering/port.htm. Oftel, *Number Portability in the Mobile Telephony Market; Explanatory Note*, 3 October 1997. http://www.ofcom.org.uk/static/archive/oftel/publications/1995_98/numbering/mobport.htm.

[18] See Recital 40 of the Universal Service Directive.

> This paragraph does not apply to the porting of numbers between networks providing services at a fixed location and mobile networks.
>
> 2. National regulatory authorities shall ensure that pricing for interconnection related to the provision of number portability is cost orientated and that direct charges to subscribers, if any, do not act as a disincentive for the use of these facilities.
>
> 3. National regulatory authorities shall not impose retail tariffs for the porting of numbers in a manner that would distort competition, such as by setting specific or common retail tariffs."

2.7 The requirements of Article 30 of the Universal Service Directive were implemented in the UK by setting GC18 pursuant to its powers under sections 45 and 48 of the Communications Act 2003 ("the Act"). In particular, under General Condition 18.1, Communications Providers are required to provide number portability "as soon as it is reasonably practicable on reasonable terms, including charges, to any of its Subscribers who so requests."

2.8 This document does not consider the porting process which is considered separately in our consultation entitled Mobile Number Portability which can be found at http://www.ofcom.org.uk/consult/condocs/gc18_mnp/.

Routing arrangements for calls to ported fixed and mobile numbers

2.9 In the UK, when a subscriber makes a voice call to a ported fixed or mobile number, that call is first routed to the communications provider which originally held that number (the number range holder or donor provider) and that donor provider is relied on to route the call to the communications provider to whom the telephone number has since been ported (the recipient or gaining provider). This arrangement is known as onward routing and is illustrated in Section 3.

2.10 Although onward routing has generally been an effective mechanism in enabling number porting thus far, we have previously identified a number of issues with its continued use, many or all of which have been well rehearsed and articulated in previous consultations. For completeness, we set these out in Section 3.

2.11 Technically, the alternative solution is direct routing which, in simple terms, comprises the following features.

- the originating provider identifies that the number dialled by the calling subscriber has been ported and to whom, and routes the call direct to the recipient provider as it would any other call to that recipient provider; and

- to facilitate this type of porting solution, communications providers typically maintain a common database which holds up-to-date details of ported numbers and their current providers which they can use as a source of routing information.

2.12 The UK now stands largely alone amongst Western European and North American countries in relying on the number range holder to onward route calls to the recipient provider. Other countries have typically chosen to "directly route" calls to ported numbers rather than follow the UK approach.

Ofcom's previous consultations and the CAT Judgment

2.13 We have previously considered the issue of how calls to ported numbers are routed and specifically whether the UK should change from onward routing to direct routing. Until the roll-out of Next Generation Networks ('NGNs') replacing today's circuit-switched telephone networks with packet-based networks which work similarly to the internet, the costs of making changes to routing arrangements for calls to fixed ported numbers had been found to outweigh the benefits, and so we had previously decided against intervention.[19]

2.14 In March 2006, we set out our view that as NGNs were deployed, there would be an opportunity to support an improved approach to number portability and that whilst our preference was for a co-regulatory approach towards an improved solution, it would consider later that year whether such an approach was sufficient or whether regulatory intervention might be required[20].

2.15 Also in March 2006, we published the statement, *Number Portability and Technology Neutrality*, concluding a consultation which started in November 2005. This decision modified GC18 to remove the requirement that communications providers had to provide portability in accordance with a defined functional specification. This specification included rules which required that onward routing be used for calls to ported numbers. However, we made no decision at that time which prescribed an alternative approach to routing calls to ported numbers.[21]

2.16 In November 2006, we published a consultation which reviewed the UK number portability regime and identified, amongst other things, policy objectives around protecting subscribers from the effects of network failure and to ensure the efficient use of networks.[22] The consultation proposed a number of changes to GC18 including that:

a) providers of communications services would be required to establish a common database for handling calls to ported numbers by 1 September 2008;

b) mobile providers would be required to achieve direct routing of calls to ported mobile numbers by 1 September 2009; and

c) all other calls to ported numbers would be directly routed by 31 December 2012.

2.17 The consultation also sought views on proposals to reduce mobile porting lead times from five working days to a period of less than one working day unless there was evidence that the costs of implementing this outweighed the benefits.

2.18 Having received and considered responses to this consultation, we published a further consultation document', *Arrangements for porting phone numbers when*

[19] Ofcom's policy statement *An assessment of alternative solutions for UK number portability*published on 21 June 2005 and can be found at http://www.ofcom.org.uk/consult/condocs/uk_numb_port/statement/261832.pdf

[20] Ofcom's publication of 7 March 2006 called *Next generation networks: Developing the regulatory framework* can be found at http://www.ofcom.org.uk/consult/condocs/nxgnfc/statement/ngnstatement.pdf

[21] This statement of 30 March 2006 can be found at http://www.ofcom.org.uk/consult/condocs/numport/mod/mod_statement.pdf

[22] A consultation published on 16 November 2006 entitled *Review of GC18 – number portability*found at http://www.ofcom.org.uk/consult/condocs/gc18/gc18r.pdf

customers switch supplier – a review of General Condition 18. [23] In this document and in relation to direct routing, we concluded that it was appropriate to require industry to establish a common database which would enable direct routing, but we did not amend GC18 as we did not consider that the timescales for implementation were sufficiently clear. We therefore sought further views from stakeholders around time-lines for establishing a common database, direct routing or in the absence of such timelines, how else the momentum for the delivery of a common database for direct routing could be achieved at the earliest practical date.

2.19 In the same document, we concluded that mobile providers should reduce the porting lead time to two working days by 31 March 2008. We also consulted on options requiring the provision of recipient-led near-instant (i.e. not longer than two hours) porting of mobile numbers based on an appropriate common database being in place.

2.20 In November 2007, we published our final statement on the arrangements for directly routing calls to ported numbers, concluding that:

a) communication providers would use all reasonable endeavours to establish a common database ready to be populated with data, as soon as reasonably practicable and, in any event, no later than 31 December 2008;

b) the common database would be populated with all ported mobile numbers as soon as reasonably practicable and, in any event, no later than 1 September 2009, and with all fixed numbers as soon as reasonably practicable and, in any event, no later than 31 December 2012;

c) all mobile providers would be required to directly route all calls to ported mobile numbers as soon as reasonably practicable and, in any event, no later than 1 September 2009; and

d) all other calls to ported numbers (fixed and mobile) would be directly routed as soon as reasonably practicable and, in any event, no later than 31 December 2012.

2.21 Further, we concluded that the mobile porting lead times should be reduced to no more than two hours and that the mobile porting process should change from being donor-led to recipient-led. Finally, we concluded that these changes should be made by no later than 1 September 2009.

2.22 This programme became commonly known as UKPorting and during the period from November 2007 to September 2008 industry undertook and completed a considerable amount of work toward the establishment of a common database.

2.23 Vodafone Limited – subsequently supported by interveners T-Mobile (UK) Limited, O2 (UK) Limited, Orange Personal Communications Services Limited and British Telecommunications PLC - appealed the November 2007 Statement to the CAT.

2.24 The CAT handed down its judgment on the 18 September 2008 ("CAT Judgment"). It found that the process by which Ofcom had reached its decision did not allow stakeholders to provide realistic estimates of the likely costs of adopting the modifications to implement direct routing and establish a central database. The CAT

[23] Further consultation published on 17 July 2007 which can be found at http://www.ofcom.org.uk/consult/condocs/gc18review/numberportability.pdf

set aside the November 2007 Statement and remitted the matter to Ofcom. In the light of the CAT Judgment, in this review we have fully set out our cost benefit analysis (see Section 4 and Annex 5) and are seeking stakeholder input on that analysis.

2.25 Further details on this appeal can be found on the CAT's website at http://www.catribunal.org.uk/238-657/1094-3-3-08-Vodafone-Limited.html

Ofcom's new review of the routing of calls to ported numbers

2.26 Following the CAT Judgment, we instigated a new review of how calls to ported numbers are routed and the mobile porting process. The two issues are being considered separately at this stage. A separate consultation on mobile porting processes called *Mobile Number Portability; Review of the porting process* has been published at www.ofcom.org.uk/consult/condocs/gc18_mnp]. However, should the consultation on changes to the mobile porting process result in a requirement for near instant porting, then there may be linkages between the routing requirements and the process requirement (such as, for example, the need for a central database). We will consider the impact of any such linkages during our assessment of the consultation responses.

Ofcom's statutory duties

2.27 The EU regulatory framework together with the Act and other relevant UK legislation provide a framework of statutory duties and powers within which Ofcom must make its decisions.

Ofcom's general duties

2.28 Section 3(1) of the Act sets out our general duties and provides that our principal duties are:

- to further the interests of citizens in relation to communications matters; and
- to further the interests of subscribers in relevant markets, where appropriate by promoting competition.

2.29 Section 3(3) of the Act provides that, in performing our principal duties, we must in all cases have regard to the principles of transparency, accountability, proportionality and consistency as well as ensure that our actions are targeted only at cases in which action is needed.

2.30 Section 3(4) of the Act requires us in performing our principal duties to have regard to a number of factors as appropriate, including the desirability of promoting competition, as well as encouraging investment and innovation in relevant markets.

2.31 Section 3(5) of the Act specifies that in performing our duty of furthering the interest of subscribers we must have regard, in particular, to the interests of those subscribers in respect of choice, price, quality of service and value for money.

The Community requirements

2.32 In carrying out our functions, we also have to comply with the six Community requirements set out in section 4 of the Act.

2.33 We consider that the following Community requirements are particularly relevant in relation to the routing solution which is chosen to route calls to ported numbers:

- the requirement to promote competition[24];
- the requirement to promote the interests of all persons who are citizens of the European Union[25];
- the requirement to adopt a technological neutral approach[26];
- the requirement to encourage the provision of network access and service interoperability to such extent as we consider appropriate for the purpose of securing –

    (a) efficiency and sustainable competition in the market for electronic communications network, electronic communications services and associated facilities and

    (b) the maximum benefit for the persons who are customers of communications providers and of persons who make such facilities available.[27]

Compliance with Ofcom's statutory duties

2.34 We believe that seeking to eliminate the productive inefficiency[28] associated with onward routing calls to ported numbers, where this is cost justified and in circumstances where the market may face potential coordination problems and financial disincentives in moving to a more efficient routing solution, is consistent with these general duties because we would expect the benefits of direct routing to flow to subscribers in the form of lower prices given that competition within the UK mobile market is generally working well.

2.35 As explained above, porting is currently regulated by GC18. Therefore, if we conclude, following the consultation process, that changes to the current regime are required, we would likely introduce these by means of a modification to GC18 pursuant to our powers under sections 45 and 48 of the Act and in accordance with the legal tests set out in Section 47 of the 2003 Act (namely, objective justification, no undue discrimination, proportionality and transparency). We also consider that, for the reasons outlined in this document, that the rationale for the required changes to the routing of ported mobile numbers would be to further the interests of end-users (in terms of lower prices) and to secure the proper and effective functioning of public electronic communications networks (be creating a more efficient routing solution) under section 51(1) of the Act.

2.36 Our preliminary view is that, subject to consultation, a modification of GC18 in order to change the current UK routing arrangements may meet the legal tests set out in section 47 of the Act, which requires that the revised condition is:

[24] This is the first Community requirement, set out in Section 4(3) of the Act.
[25] This is the third Community requirement, set out in Section 4(5) of the Act.
[26] This is the fourth Community requirement, set out in Section 4(6) of the Act.
[27] Section 4(7) and 4(8) of the Act.
[28] Productive efficiency may be defined as achieving a given output at the lowest possible cost per unit.

- **objectively justifiable -** because of the reduction in the inefficiency of onward routing and the likely consumer benefits in terms of lower prices;

- **non-discriminatory –** the requirement will apply equally to the five MNOs (it should be noted that new entrants and smaller mobile operators will be given additional flexibility to implement the required change once sufficient scale has been obtained);

- **proportionate -** we would seek to mandate direct routing if an industry-led solution is not forthcoming and on the basis that the benefits reasonably expected from direct routing are likely to exceed the costs of implementing this change; and

- **transparent** – because we will further consult stakeholders on any proposed change to GC18 and the requirement will be clearly set out in the revised General Condition together with the concluding statement.

2.37 Following consultation we will revisit our assessment of whether changes to the current UK routing arrangements for ported numbers will meet these legal tests.

Requirement to undertake an Impact Assessment and Equality Impact Assessment

2.38 The analysis presented throughout this consultation document (in particular Section 4 and Annex 5) satisfies our duty to conduct an Impact Assessment, as required by section 7 of the Act.

2.39 We considered whether we were required to undertake a full Equality Impact Assessment for this review. On the basis of our Initial Equality Impact Assessment Screening we determined that this was not required, because any changes to the routing of calls to ported numbers do not raise specific equality issues; they will affect subscribers equally, regardless of race, gender or disability.

Section 3

Rationale for change and the policy objective

3.1 This section considers the rationale for change to the current routing arrangements and our policy objectives.

What is the rationale for change?

The trade off between onward and direct routing solutions

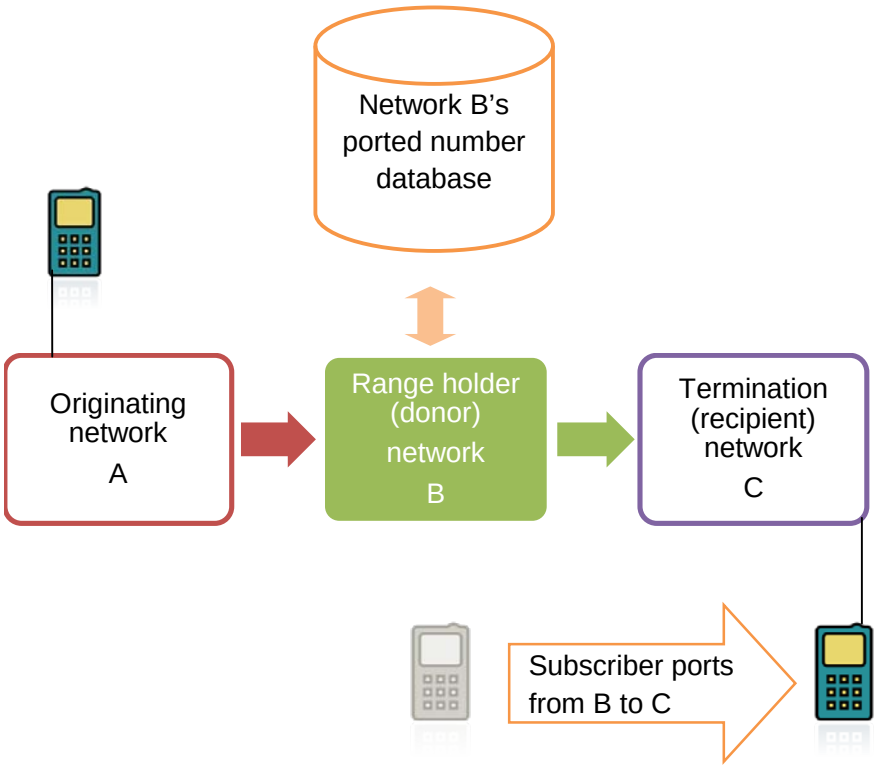
3.2 In Section 2 we explained that number portability was implemented in the late 1990s using a technical solution known as onward routing.

3.3 With onward routing, voice calls are routed by the originating network to the number range holder. The number range holder then recognises those calls made to telephone numbers which have been ported out of its network and onward routes those calls to the appropriate recipient network for termination.[29] Under this system, the originating network does not need to have any means of distinguishing between ported and non-ported numbers. In contrast, if the originating network were able to identify which telephone numbers had been ported and to whom, it could then route calls to those numbers directly to the appropriate terminating network. Therefore, in order to implement a direct routing scheme, the originating network needs to be able to identify ported numbers and the corresponding terminating network, rather than simply routing calls to the number range holder by default.

3.4 Figures 1 and 2 below illustrate the processes involved in onward routing and direct routing.

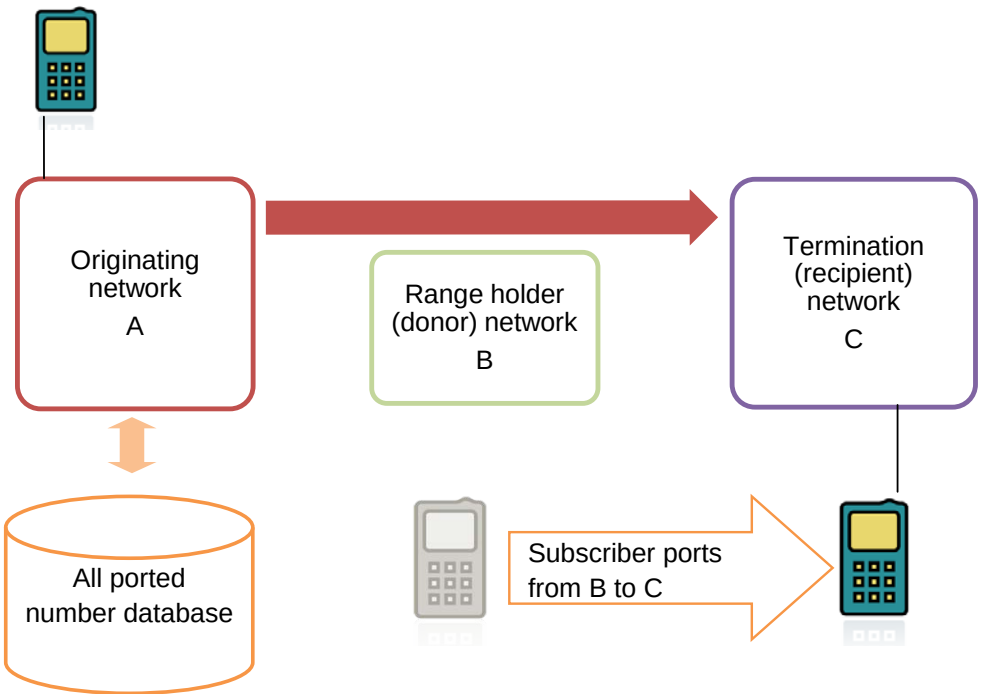
[29] For SMS, having initially queried the number range holder network for the relevant routing information, traffic is routed directly by the originating network to the recipient network. SMS therefore falls outside the scope of the proposals in this consultation. It is also worth noting, however, that in the absence of a centralised database, a similar arrangement could be adopted for voice.

Figure 1: Onward routing process



Source: Ofcom Internal

Figure 2: Direct routing process



Source: Ofcom internal

3.5 Figures 1 and 2 show that for calls to ported telephone numbers, onward routing involves a longer and more complex routing path than direct routing, with correspondingly higher switching and transmission costs. However, direct routing requires a means of ensuring that the originating network is able to determine whether the called number has been ported and the specific terminating network for each ported number. This is typically achieved through the establishment of a common database which records the details of ported telephone numbers as has been implemented in many countries both in Europe and elsewhere.[30] However, making changes to networks to be able to regularly upload this data on ported numbers, query it and make routing decisions, requires a potentially significant capital investment.

3.6 Therefore, to determine whether direct routing or onward routing is more cost effective, a trade off has to be evaluated between the lower capital costs associated with onward routing and the lower marginal routing costs associated with direct routing. Given this trade off, in generalised terms, onward routing is cost effective where the volume of calls to ported numbers is low and the savings made in routing each call directly do not, in total, justify the capital cost of investment in a direct routing solution. As the volume of calls to ported numbers increases, the higher benefits available from a direct routing solution tend to justify the capital investment costs.

Tipping point

3.7 Although the trade off described above is in reality rather more complicated to calculate, for reasons that we explore in some detail later in Section 4, it is necessary to summarise our findings at this point in order to explain the rationale for change. Our assessment is based partly on information supplied by stakeholders in response to a request for information under Section 135 of the Act, which we issued in December 2008.

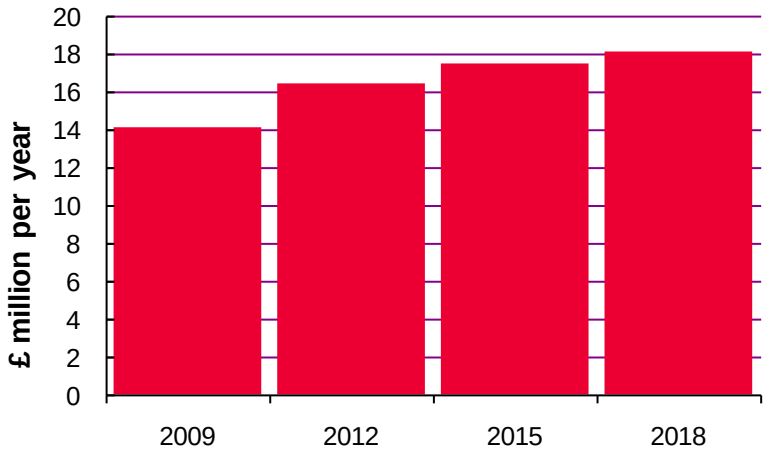
3.8 Our cost benefit analysis ('CBA')suggests that for calls to ported fixed telephone numbers, the relatively high costs reported to us of implementing direct routing in the fixed market, the volume of ported numbers and corresponding levels of traffic to those numbers do not currently justify the introduction of direct routing.

3.9 In contrast, the volume of mobile traffic to ported mobile numbers and lower costs associated with implementing direct routing in mobile networks suggest that it would be economically appropriate to move to direct routing. Our preliminary CBA shows a positive NPV for the introduction of direct routing under all but the most extreme set of assumptions. We calculate that for mobile to mobile traffic, the net inefficiency of onward routing mobile calls to ported mobile numbers is currently around £14m per year and that this level of inefficiency is likely to continue to rise as the number of ported mobile numbers and associated traffic increases in the future. This is shown in Figure 3.[31]

[30] For example see the ECC's report "*Implementation of Mobile Number Portability in CEPT countries*" report 31, April 2003. Available at: http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP031rev1.PDF

[31] Values are in 2008 real prices.

Figure 3: Annual inefficiency from onward routing



Source: Various

Absence of incentives to change

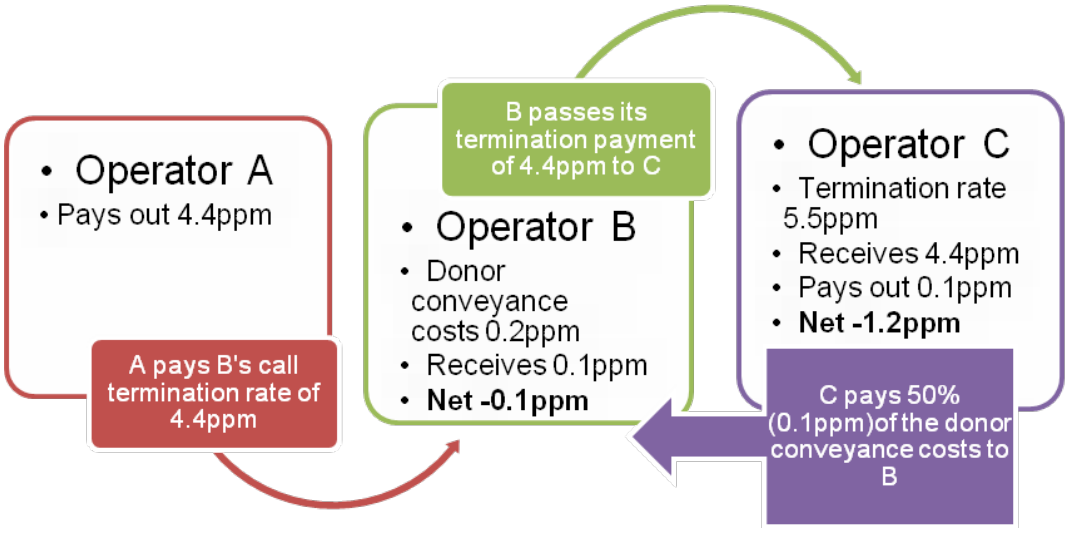
3.10 Despite this rising level of inefficiency, MNOs have not invested in direct routing. There appear to be two reasons for this:

i) Firstly, the wholesale billing regime for call termination of calls to ported numbers, most probably encourages certain operators to maintain onward routing. At present, the originating network routes calls to ported numbers to the number range holder and pays the termination rate of the number range holder, not of the terminating network. Where the terminating operator has a higher termination rate than the range holder, the call originator is not incentivised to route that call directly to the terminating operator.

ii) Secondly, at present, the porting (or, donor) conveyance costs of onward routing are borne equally by the mobile terminating network, who makes a payment of 50% of the donor conveyance costs, and mobile number range holder, who absorbs the remaining 50%, while the choice of whether to use onward routing or direct routing rests with the mobile originating network. As a consequence, since none of the additional conveyance costs of onward routing currently fall on the originating network, there is no commercial incentive for an individual MNO to move to direct routing in the absence of a simultaneous move to direct routing by all mobile operators. In fact the opposite may be true. An individual operator is unlikely to invest in direct routing since, in doing so, it would incur the investment costs from which its competitors will benefit in avoiding conveyance charges. However, since all MNOs originate, onward route and terminate calls to ported mobile numbers, our analysis suggests that collectively they are likely to have an incentive to move to direct routing. Nonetheless, there is a possible risk of coordination failure absent intervention or facilitation.

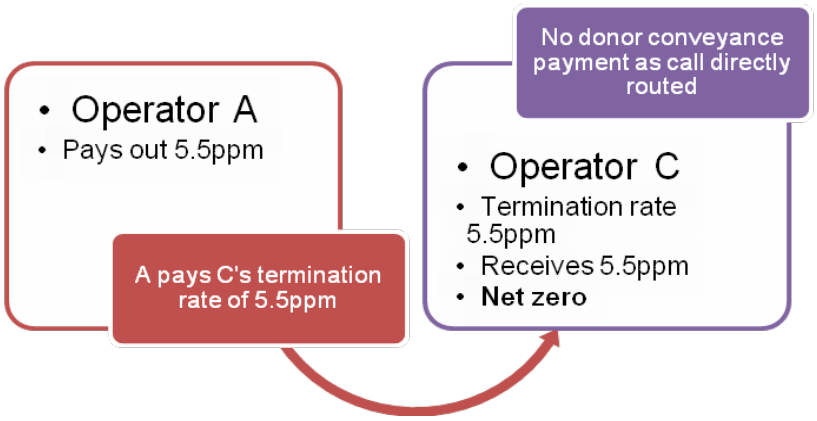
3.11 The payment flows described in the previous paragraph are shown in the following figures. Figure 4 provides an example where a call originated on Operator A's network, is onward routed through Operator B, and terminated on Operator C's network. Figure 5 is an example flow of monies for a directly routed call to a number ported from Operator A to Operator C.

Figure 4: Flow of monies for an onward routed call to a ported-out number (example)



Source: Ofcom internal

Figure 5: Flow of monies for a directly routed call to a ported number (example)



Source: Ofcom internal

3.12 As shown in these examples above, the call costs the originator 1.1 ppm (pence per minute) more under direct routing. In these circumstances, where the number range holder's termination rate is lower than the terminating network's termination rate, there is a strong commercial incentive on the originating network to maintain onward routing.

Reasons to intervene

3.13 When considering policies which involve intervening in markets, our starting point is that in the absence of market failures, a competitive market will lead to an efficient outcome. Absent market failures, static economic efficiency will be achieved when

prices reflect marginal resource costs[32] and cause per unit resource costs to be minimised.[33]

3.14 In the case of mobile originated calls to ported mobile numbers it appears that productive efficiency is not being met since the mobile industry maintaining the higher switching and transmission costs associated with onward routing rather than moving to the lower costs associated with direct routing. However, for newer entrants to the mobile market, who may not yet have sufficient volumes of ported traffic, onward routing may continue to be more economically attractive in the foreseeable future.

3.15 As we have observed, the obstacles to achieving an efficient outcome appear to lie with:

a) the current wholesale interconnection pricing scheme for calls to ported numbers; and

b) the current scheme for recovering the costs incurred in onward routing.

3.16 An unintended consequence of the existing regime for calls to ported numbers is to produce a disincentive to invest in direct routing which results in higher switching and transmission costs of calls to ported numbers.

3.17 It is worth observing that in the absence of the possible coordination failure and financial disincentives outlined above, it would likely be in individual operators' own interests to move to a more efficient method of routing of calls to ported numbers. This is illustrated by the fact that a number of mobile operators have implemented call trap. Call trap enables an operator to trap a call originated on its network to a number which has been ported-in and thus avoid the porting conveyance costs incurred through routing the call to the number range holder who onward routes it back again. Unlike direct routing, call trap can be implemented unilaterally, the call originator faces a price signal which it can act on (since the originator is also the recipient operator it is therefore liable to pay porting conveyance charges under the current scheme) and is not impacted by any differential in mobile termination rates.

3.18 We would expect the cost of mobile calls to fall as a result of more efficient routing and feed through into lower retail prices for mobile calls. The more competitive the market, the more we would expect a reduction in costs to feed through into prices. Our finding in the second 'Mobile Sector Assessment' consultation, *Mostly Mobile*)[34], was that competition within the mobile sector is generally working well and that competition in the mobile sector has, on the whole, been a success for UK subscribers.

Question 3.1: Do you agree that there is a problem in the way mobile originated calls to ported mobile numbers are routed? If not, why not?

[32] This is known as allocative efficiency – when the value that consumers place on a good (reflected in the price they are willing to pay) equals the costs of the resources used in production.
[33] This is known as productive efficiency – where production proceeds at the lowest possible per unit cost.
[34] http://www.ofcom.org.uk/consult/condocs/msa/msa.pdf, e.g. p.6.

Other possible advantages of direct routing

3.19 In addition to the issue of productive inefficiency and potentially higher prices for subscribers which may result, there are further factors that may make onward routing less desirable than direct routing. We consider each of these in turn.

Commercial or technical failure

3.20 At present, subscribers who port their number to a new network rely, indefinitely, on their original network to forward incoming calls to them. If the original network fails (commercially or technically), subscribers will no longer be able to receive calls on their ported numbers.

3.21 Since the commercial failure of Atlantic Telecom in 2001, which affected some 14,000 customers, we have questioned whether industry should move to direct routing because of the likelihood of future failures and the consequent risk of consumer harm. This was one of the main reasons for our decision to require calls to ported numbers to be directly routed in the November 2007 Statement.

3.22 During the consultation process which preceded the November 2007 Statement, some industry stakeholders argued that the circumstances surrounding Atlantic were exceptional, that the likelihood of commercial failure resulting in network closure was remote, that our estimates of the costs to subscribers arising from network failure were too high and that there were more proportionate and cost effective means of addressing such failures.

3.23 In the CAT Judgment, the CAT made the following comments with regard to commercial network failures:

> "109. Moreover, in the event of network failure of an MNO, it is likely that other problems, for example, the disruption faced by those customers still with the failed network and the ability of others to call those customers, would be of equal, if not greater, significance to issues relating to former customers of the failed MNO who had ported their number. In fact, anyone using the failed network for any part of their call conveyance would be adversely affected. The Tribunal does not consider that the decision of OFCOM to provide for direct routing sufficiently addressed these additional and potentially more significant problems...
>
> 111. Therefore, the Tribunal is far from persuaded by the arguments of OFCOM that circumstances at the time of the Decision were sufficiently altered as regards the risks of network failure to warrant the implementation of direct routing in order, as a key objective, to protect subscribers against the effects of network failure. Doubtless there will be new entrants into the industry, and OFCOM will have to take into account the protection of subscribers against commercial failures. However, the Tribunal is not persuaded that direct routing is a key means of defence against such failure."[35]

3.24 Commercial failure remains an area of key concern for Ofcom, particularly in the current economic climate. Nevertheless, we acknowledge that commercial failure would have a much broader impact on all customers of the failing network and not

[35] http://www.catribunal.org.uk/238-657/1094-3-3-08-Vodafone-Limited.html

just those customers who have ported out. There are already a number of existing industry processes in place which are designed to minimise customer service disruption in the event that a provider goes out of business. These processes cover many of the most common scenarios that arise across a range of services and are kept under constant review. The current economic climate raises the possibility that we will see more complex and unusual scenarios involving providers in commercial difficulty, some of which may stretch the existing process. We are, therefore, undertaking a separate project to consider whether there is a need to revise any existing processes, or create new ones, to deal with possible issues that could impact services, be they mobile, fixed, voice or data.

3.25 Nevertheless, we consider that by implementing direct routing there is a second order benefit in the event of a future network failure since the routing of ported traffic is no longer dependent on the original range holder. We have not endeavoured to quantify the impact of potential network failure on ported customers at this stage.

Quality of service

3.26 We have considered and discussed with stakeholders whether onward routing gives rise to any significant quality of service concerns. This could arise because:

a) the network responsible for onward routing traffic to ported numbers needs to ensure that it has sufficient capacity in place to carry ported traffic. Congestion could affect the quality of service experienced by the ported customer and those calling them; and

b) the additional transmission links and switching involved in calls to ported numbers could increase delay or echo.

3.27 However, we have found no evidence to suggest that either of these is or has been an issue of any significance. Operators have consistently claimed that there is generally no discrimination between the treatment of ported and non-ported traffic so any quality of service issues which might arise would not be particular to calls to ported numbers. Moreover, since any problems which might be reported to an onward routing network are likely to impact both onward routed calls and calls to non-ported numbers made by its own customers, it should be incentivised to resolve any quality of service issues.

3.28 We have no evidence to suggest that traffic forecasting and management arrangements between networks are not effective and hence result in quality of service or congestion issues in relation to ported traffic. The current porting arrangements place the onus upon recipient providers to inform the onward routing network of any significant change in circumstances which might impact traffic volumes to ported numbers.

3.29 However, as UK communications networks evolve and adopt new digital technologies, interworking with legacy systems requiring additional transmission links and switching[36] added to that associated with onward routing may compound concerns around end-to-end quality of service issues such as transmission delay and

[36] NICC (The Network Interoperability Consultative Committee) Recommended Standard for the UK National Transmission Plan (ND 1701) provides, amongst other things, planning rules and guidance for the evolution of networks to handle all-digital services (such as those provided by new switch and transport technologies, and data networks supporting voice), while maintaining compatibility with the current analogue and digital networks, thereby continuing high quality service to subscribers by the telecommunications industry.

echo control. The adoption of direct routing may therefore deliver some benefit in terms of quality of service by removing the additional transmission link and switching required by onward routing calls to ported numbers via the number range holder.

Service interoperability/inter-working

3.30 Where services are introduced by a recipient network, which require new technical features that are not supported by onward routing or other transit networks, calls to the recipient may fail. When some mobile operators introduced video calling services they were unable to offer this service to customers on their ported numbers where calls were onward routed or transited by networks which did not support the required signalling.

3.31 We have discussed this issue with stakeholders who generally perceived it to be, at worst, a temporary phenomenon which might persist for a few features or services while operators adopt the latest version of internationally agreed standards, in particular for service interworking. It is evidently not particular to onward routed calls to ported numbers but to any calls which transit a network which does not support the relevant signalling or service interworking. The adoption of direct routing might nevertheless lessen the effect of this issue.

Summary of issues

3.32 Our assessment in relation to this review is that these issues are probably secondary to the substantive matter of routing inefficiency. We have not therefore made any attempt in this document to further quantify the benefits surrounding these factors although they may, nevertheless, be potentially significant.

What is our policy objective?

3.33 Having established that our rationale for change is to correct imperfections in the workings of the market in order to produce a more efficient outcome, we can give a clear statement of our policy objective.

3.34 Our policy objective is to ensure that calls to ported numbers are routed efficiently to subscribers where the benefits outweigh the costs. Based on our analysis set out in this consultation document, we have found this to be the case for mobile originated to mobile ported numbers only. We consider that this objective can be achieved by ensuring mobile network operators route calls to ported mobile numbers in the same way as they route non-ported traffic.

3.35 However, in pursuing this policy objective we are mindful that:

a) no market ever works perfectly so whilst we want to address the inefficiency inherent in onward routing we are mindful to minimise outcomes that might be worse than the inefficiencies we are seeking to address; and

b) that the costs of any intervention do not give rise to costs which outweigh the benefits to be gained by attempting to correct the failure.

Question 3.2: Do you agree with our assessment of the issues associated with onward routing?

Section 4

Assessing the level of the inefficiency

Introduction

4.1 In the previous section we described our policy objective as being that calls to ported mobile numbers should be routed in the same manner as calls to non-ported mobile numbers.

4.2 In this section we quantify our assessment of the overall value of moving from onward routing to direct routing for a variety of call type configurations. In addition, we identify some of the key implications of making any changes to implement direct routing.

Calculating the net benefit of moving to direct outing

4.3 We have previously identified that onward routing of calls to ported numbers may be the most cost effective solution while the volume of calls to ported numbers is low. However, as the volume of ported numbers and the resulting traffic to ported numbers rises, so the cost of onward routing also rises. These costs include the switching and transmission costs associated with the additional routing stage that is inherent in onward routing. Ultimately a tipping point is reached in the traffic volumes above which direct routing of traffic to ported numbers becomes cheaper.

4.4 Therefore, to determine whether direct routing or onward routing is more cost effective, a trade off has to be evaluated between, on the one-hand, the low fixed cost but higher marginal cost associated with onward routing and, on the other, the high fixed cost but lower marginal cost associated with direct routing.

4.5 In order to assess this trade off, we have undertaken a CBA, comparing the overall benefit of moving to direct routing for a variety of traffic streams to ported numbers relative to maintaining the current onward routing arrangements.

Call type configurations assessed in the CBA

4.6 In order to assess the benefits of moving to direct routing, we have looked separately at five different call type configurations to determine whether moving from onward routing to direct routing would provide an overall net benefit.

4.7 These areas are:

- traffic to all ported numbers (i.e. both fixed and mobile numbers);
- fixed originated traffic to ported fixed numbers;
- fixed and mobile originated traffic to ported fixed numbers;
- mobile originated traffic to ported mobile numbers; and
- fixed and mobile originated traffic to ported mobile numbers.

The benefits of moving to direct routing

4.8 In Section 2, we identified that while onward routing requires a two stage call routing path (i.e. originating network – range holder network – terminating network), in contrast a directly routed call needs only a single stage call routing path (i.e. originating network – terminating network). Therefore with direct routing, both the onward routing function performed by the range holder and one of the two interconnection transmission paths are avoided in comparison with an onward routed call. Onward and direct routing arrangements are illustrated at Section 3 above.

4.9 But not all calls to ported numbers derive the benefits of switching to direct routing described above:

- where mobile operators have implemented call trap, we need to exclude calls made to numbers which have been ported-in to the same network (i.e. where the originating operator is also the recipient operator for a given call). These calls are not onward routed via the range holder but "trapped" on net and terminated. Although not all operators have deployed a call trap capability, for the purposes of our ten year cost benefit assessment we have assumed that they have; and

- we also need to exclude calls to ported numbers which originate on the range holder's network (i.e. where the originating operator is also the range holder). These calls are not onward routed but routed direct to the recipient operator. [37]

4.10 The benefits of moving to direct routing are the sum of the costs of onward routing that are avoided by moving to direct routing. Specifically there are two such costs:

- the porting conveyance costs, that is the cost incurred by the onward routing operator in performing the switching of an onward routed call through its network. This includes the cost of the necessary call look-up to determine if the number is ported, the switching costs, the relevant signalling costs and the port costs in and out of the network; and

- the incremental transmission cost of the additional interconnection transmission link that is required for an onward routed call relative to a directly routed call. This cost has to be treated as incremental, since typically the relevant interconnection link will be carrying a wide range of traffic, including direct calls between two interconnected operators.

4.11 In the NPV calculation, to assess the net benefit of moving to direct routing, we sum these costs for the relevant ported traffic in order to determine the overall avoided costs (i.e. the benefits) of moving to direct routing.

Question 4.1: Do you agree with our proposed approach for assessing the net benefit? If not please explain why not.

The costs of moving to direct routing

4.12 We have identified five principal sources of costs in moving to direct routing. These are:

- the additional capital costs incurred by each originating operator to make their network capable of performing direct routing. For calls to numbering ranges

[37] Whether passed to the recipient provider over a direct interconnect link or via a transit provider.

where direct routing is to be used, this involves adding the ability to perform a look-up on every originating call (commonly known as ”All Call Query”) in order to determine whether the called subscriber has ported or not, and if so, to identify the destination network, and then to route the call appropriately;

- the operating costs associated with the additional network functionality described above;
- the capital costs of a database of ported numbers that provides the information to each originating operator of which numbers have ported, and to whom;
- the ongoing operating costs associated with the operation of the database (including the ongoing requirement to populate this database with ported numbers); and
- the costs of administering a collective industry project including project management, legal fees for contract handling and other administrative support. This industry body would likely be a similar entity to that undertaken by UK Porting previously and that envisaged for PortCo.[38]

Question 4.2: Do you agree that we have identified the relevant cost drivers resulting from a move to direct routing? If not please explain why not.

4.13 Within the NPV calculation we have assumed that the individually estimated additional capital costs are incurred by each operator that is required to perform direct routing, while the database and administration costs are assumed to be shared across the same range of operators. For the avoidance of doubt, in the case of mobile originated calls we have only looked at the costs likely to be incurred by the five incumbent MNOs. Mobile virtual network operators (MVNOs) typically rely on a network partner (i.e. one of the five incumbent MNOs) for the routing and switching of calls. It is therefore unlikely that MVNOs would face any costs of change. In the case of the recent mobile entrants who are in the process of deploying their own networks, we have included neither their costs nor their corresponding traffic volumes (or resulting benefits) in our CBA. In our view, in the near to medium term, such newer operators are unlikely to have sufficient levels of ported traffic to justify a change to current routing arrangements.

The calculation of the NPV

4.14 The cost and benefits are discounted at the relevant weighted average cost of capital WACC and then netted to calculate the NPV for the relevant traffic types in order to determine the net benefit (cost) of moving to direct routing. The time horizon considered is ten years preceded by a one year implementation time. We think this is an appropriate period based on the anticipated productive lifetime of the assets required to implement direct routing. Where the lifetime of the equipment associated with the capital costs is less than the period over which the NPV has been calculated we have included relevant replacement capital expenditure. Further detail can be found at Annex 5.

[38] Whereas UKPorting was an independent unincorporated association of communications providers which was set up to establish a common porting database in compliance with decisions set out in the November 2007 Statement, it was intended that this would be superseded by a commercial entity ‘PortCo’ formed from participating industry members.

4.15 We are aware that further technological developments during the time horizon for our model could impact on the costs and benefits of direct routing. In particular the adoption of fourth generation technologies (e.g. Long Term Evolution or "LTE") may reduce the costs avoided (i.e. benefits) of direct routing and the lifetime for assets required to implement direct routing. At this stage, the costs and timescales of changes to either the core network or interconnection arrangements for next generation technologies are uncertain. However, we consider it unlikely that such developments will significantly affect the overall conclusions of our cost/benefit analysis within the timeframe we have considered for the following reasons:

- it is only changes to the LTE core network (as opposed to LTE access) that impact the switching and transmission costs;
- changes to the LTE core network may be focused initially on broadband data rather than voice services;
- the precise timing of any such development is uncertain (i.e. the new technology may be implemented only in the latter part of, or even beyond, our modelling period); and
- the base case NPV for mobile to mobile direct routing remains positive even over a shorter (i.e. seven year) time horizon.

The source of data for the NPV calculation

4.16 As far as possible, we have performed this calculation using information that has been provided by the relevant stakeholders. In particular:

- the operator specific costs for implementing direct routing are estimates provided by stakeholders, based on the UKPorting specification.[39] We collected this information as well as information on ported traffic volumes using our formal information powers under Section 135 of the Act. Formal information requests were issued at the end of December 2008 and submissions by industry were made in two tranches during January and February 2009;
- the common database costs are extracted from information supplied to us by UKPorting under a Section 135 information request that we issued in November 2008; and
- the initial costs associated with operating an industry porting coordination body are based on the actual costs incurred through UKPorting which Ofcom billed and collected on its behalf.

4.17 As regards the operator supplied specific costs for implementing the direct routing solution envisaged by UKPorting, we expect these to form an upper bound of costs associated with implementing direct routing solely for mobile originated calls to mobile ported numbers. The reasons for this are twofold:

a) a number of stakeholders have expressed the view that the specification developed by UKPorting was, in respect of some aspects, over-engineered and contained a number of capabilities that were inserted at the request of a minority

[39] We understand that the work to specify the direct routing aspects of the UKPorting technical specification (as opposed to the mobile porting process changes) was well developed at the point at which the project stopped in September 2008.

of operators. Nevertheless we understand that these aspects were retained in the final specification in order to expedite progress and there was insufficient time to consider how to optimise the solution due to the tight timescale. We have not adjusted the operator specific cost estimates which were based on the UK porting specification, thus the costs are likely to be overstated in particular if the requirement is to support only a limited set of call types; and

b) a number of operators have made representations to us that the timescales associated with implementing the previous UKPorting solution were tight, and as a result increased the complexity of simultaneously implementing and testing both the porting requirements and already planned network upgrades, and that this complexity would drive up costs.

The results of the NPV calculation.

4.18 Table 1 below summarises the results of our assessment, full details of which can be found at Annex 5.

Table 1: NPV results for each call type configuration

	NPV £m	
	7 Years	10 Years
All calls	-118	-108
Mobile to mobile	16	26
Fixed to fixed and mobile to fixed	-205	-215
Fixed to fixed	-130	-137
Mobile to mobile and fixed to mobile	-81	-86

Source: Ofcom internal model

4.19 Our analysis shows that in the case of mobile originated traffic to mobile ported numbers ("mobile to mobile traffic") there is likely to be an overall positive net benefit from introducing direct routing.

4.20 We calculate that for mobile to mobile traffic, the avoidable cost of onward routing is currently in the region of £14m per year. This represents the gross level of inefficiency from the current use of onward routing. This level of inefficiency is likely to increase as the number of ported mobile numbers and the associated traffic both rise in the future even after taking into account likely reductions in the costs of additional conveyance for example due to increased use of 3G. We predict that it will reach around £17m by 2015. Our consideration of mobile porting conveyance costs is set out in more detail at Annex 5.

4.21 We have estimated the NPV of direct routing for mobile to mobile traffic at £26m over a ten year period in our base case. We have subjected our analysis to sensitivity testing including the construction of a low case and high case NPV based around variations of +20% and -20% on key inputs (see Annex 5 for details). Under the low case scenario the NPV is negative at -£15m over ten years and -£16m over seven years while in the high case the NPV values are £66m and £90m for seven and ten years respectively. Therefore, we could not rule out the possibility of a negative NPV

if there was substantial downside variation to several key inputs simultaneously. However, we consider that scenarios which result in negative NPVs are unlikely, as they rely on all of the key inputs simultaneously taking values which reduce the benefits and increase the costs relative to the base case.

4.22 Based on the above analysis, we consider that the introduction of direct routing for mobile to mobile calls is likely to yield a positive net benefit.

4.23 In contrast, for all other call type configurations, our analysis shows that the likely costs exceed the benefits of introducing direct routing over the ten year time horizon we have been considering. This applies for traffic to all ported numbers (i.e. both fixed and mobile ported numbers together), for fixed traffic to ported fixed numbers, mobile and fixed traffic to ported fixed numbers and fixed traffic to mobile ported numbers.

4.24 In the context of the policy objective which we have articulated, we are minded not to consider the introduction of direct routing for these call type configurations at present. However, we will continue to re-examine this situation periodically, and if there appear to be significant changes either in the volumes of traffic or in the corresponding costs, then this could result in a further review.

Why does direct routing for some call type configurations return a negative NPV?

4.25 Our analysis suggests that there are several reasons why the costs of implementing direct routing for traffic configurations (other than mobile to mobile) yield a negative NPV.

4.26 The key reasons are:

- unlike mobile, there is no internationally agreed technical standard[40] for direct routing in fixed networks and thus standard upgrades for switches are not readily available. As a consequence, for both the fixed operators, and for mobile operators routing calls to ported numbers to the fixed network, each operator would require their switch vendors to design and implement proprietary solutions specific to their own network configuration. Thus the capital cost for implementing direct routing to fixed numbers is considerably more expensive than the equivalent implementations in the mobile network for direct routing to mobile numbers;

- the avoidable costs per minute for calls to ported fixed numbers are lower than the equivalent costs to ported mobile numbers; and

- with respect to fixed calls to fixed ported numbers, since there are many more operators in the fixed market this adds both to the complexity and costs of implementation.

[40] For mobile there is a 3GPP Technical Specification TS 23.066 entitled “Support of Mobile Number Portability (MNP); Technical realization.

Other implications of making the necessary changes to implement direct routing

4.27 At present, all traffic to ported numbers is onward routed except for traffic dealt with through call trap and where traffic originates on the range holder network. For mobile to mobile traffic this means that for a call to a ported number:

- a donor conveyance cost ("DCC") payment is made by the call terminator to the onward routing (number range holding) operator. This DCC payment is set at 50% of the measured donor conveyance cost with the remaining 50% being absorbed by the range holder; and

- the originating operator pays the termination rate of the range holder which is passed on to the terminating operator (sometimes referred to as "termination rate pass through" or "donor passes all" arrangement).

4.28 Given that there are currently differences between the respective termination rates of some of the incumbent MNOs, the fact that on a ported call the recipient receives the termination rate of the onward routing operator, and not its own termination rate, means that the payments for calls terminating on ported numbers and those terminating on non-ported numbers may be significantly different in certain circumstances.

4.29 As a consequence, some operators benefit substantially from this effect while other operators lose out. These effects flow directly from the current differentials between some termination rates. Thus an operator with a higher termination rate which has numbers ported in from an operator with a lower termination rate will receive less income for calls to ported numbers than for equivalent calls to non-ported numbers (and vice versa). Since ported numbers are not equally distributed between operators and traffic flows are not balanced this effect is likely to be further exaggerated.

4.30 If direct routing were to be adopted, then the DCC payments would cease (since there is no longer an onward routing operator involved in the call routing) and the termination rate payment would change such that the terminating operator was paid its own termination rate irrespective of whether the call is to a ported number or not.

4.31 As a consequence, making a change to direct routing will influence the balance of payments made for terminating traffic between the five incumbent network operators. Notwithstanding the efficiency improvement from direct routing, this effect will make the introduction of direct routing much more appealing to some MNOs than to others.

4.32 However, following a determination by the Competition Commission in January 2009, which Ofcom was directed to adopt by the CAT in April 2009, the difference between average mobile termination rates of the MNOs will reduce to 0.3p by 2011 from 1p currently.[41] Further reductions in the difference between 2G/3G operators and 3G only operators will depend on the outcome of our current review of mobile call termination.[42] The size of this commercial impact is therefore set to reduce until at

[41] The Competition Commission's determination is available at: http://www.competition-commission.org.uk/appeals/communications_act/mobile_phones_determination.pdf. The Significant Market Power ("SMP") service conditions stating the termination rates can be found at http://www.ofcom.org.uk/consult/condocs/mobile_call_term/statement/CTMAmendment2009final.pdf

[42] Ofcom's preliminary consultation on 'Wholesale mobile voice call termination' was published on 20 May 2009 and can be found at http://www.ofcom.org.uk/consult/condocs/mobilecallterm/mobile_call_term.pdf

least 2011. After 2011, the question of what regime will apply to mobile call termination in the UK will be determined by our current market review of wholesale mobile call termination.[43]

4.33 While we recognise that there are likely consequential distributional effects from the introduction of direct routing which flow from differentials in termination rates, we do not believe that these effects are relevant to the inefficiency identified and the decision whether or not to move to direct routing.

[43] Our preliminary consultation on *Wholesale mobile voice call termination* was published on 20 May 2009 and can be found at:
http://www.ofcom.org.uk/consult/condocs/mobilecallterm/mobile_call_term.pdf

Section 5

Policy options

Introduction

5.1 In this section, we set out the counterfactual and assess three other options given the policy rationale and analysis set out in the earlier sections. To re-state, our policy objective is to ensure that ported calls are routed efficiently where the benefits outweigh the costs, in order to deliver benefits to subscribers in the form of lower prices. These options are:

i) Option (1): the counterfactual or 'do-nothing';

ii) Option (2): industry-led initiative to implement direct routing for mobile originated calls to ported mobile numbers;

iii) Option (3): changing the routing incentives for calls to ported mobile numbers; or

iv) Option (4): mandate direct routing for mobile originated calls to ported mobile numbers.

Summary of the reasons for moving to direct routing

5.2 We have previously identified that while onward routing is appropriate when the number of ported numbers is low, there comes a tipping point above which it is economically rational to move to direct routing.

5.3 Absent making this move, there will be an inefficiency in onward routed calls to ported numbers caused by the additional transmission and switching stages inherent in the onward routing scheme (i.e. in comparison with direct routing). This inefficiency does not arise for calls made to non-ported numbers.

5.4 We have assessed that the current level of inefficiency for mobile to mobile traffic to ported numbers to be currently of the order of £14m per annum and that this routing inefficiency might increase to around £19m by 2021.

5.5 We have also shown that moving mobile traffic to mobile ported numbers from onward routing to direct routing would have a positive NPV of £26m over ten years using the base case in our model.

5.6 We also note that a majority of leading nations, including almost all European countries as well as the USA and Australia have already adopted direct routing for calls to ported mobile numbers.

5.7 Finally, maintaining onward routing has other consequences which we have not sought to quantify. However, we believe the most significant of these is that with onward routing each ported subscriber relies, in perpetuity, on their original numbering range holder to continue to forward all inbound calls to their ported number. This dependence has, from time to time, caused some problems in the past (including quality of service, service interoperability and network failure issues), and such problems may reoccur in the future.

5.8 We therefore conclude that there are grounds to take appropriate and proportionate action to implement direct routing. However, these options should be considered against a “do nothing” approach.

Option (1): do nothing

5.9 We consider a ’do-nothing‘ option in the context of this consultation to be the counterfactual i.e. our best estimate of what might happen if we do not introduce the proposed policy change to move to direct routing.

5.10 While it is not possible to state with absolute certainty that, absent any form of intervention, there is likely to be coordination failure preventing the mobile industry from collectively moving to direct routing in future, the evidence we have seen to date suggests that this is likely to be the case. We consider that the current arrangements place disincentives on individual call originators to move to direct routing. This is because for an operator to do so unilaterally would cause that operator to have to make a significant investment in direct routing capability (along with the need for the coordinated introduction of a ported number database in some usable form), while the beneficiary of this change would be the donor and terminating operator who would no longer incur porting conveyance costs or charges on ported number calls. Therefore we conclude that it is unlikely that any operators will unilaterally move to direct routing.

5.11 Further, the differences in mobile termination rates, and the current payment regime for calls to ported mobile numbers whereby the termination rate paid by the originator and received by the terminator is the termination rate of the onward routing operator, is likely to place a strong financial incentive on certain operators to reject any moves towards direct routing. Thus while some operators may be incentivised to move to direct routing in order to eliminate this effect, other operators may be equally strongly incentivised not to move.

5.12 Even if termination rates were to converge sufficiently such that they no longer influenced the decision, the coordination failure is likely to remain sufficiently strong that an unprompted industry initiated solution to implement direct routing (i.e. one without at least some initial regulatory involvement) is unlikely to emerge in the foreseeable future.

Initial assessment of Option (1)

5.13 If we adopt a do nothing approach, there is a significant risk that inefficient routing might perpetuate for a long time. This could deprive UK subscribers of benefits which would otherwise flow through to them if, the cost to industry of delivering calls to ported numbers, was lower.

5.14 Further, if we were we to adopt such an approach, then we may then have to review the situation at some future date.

5.15 Therefore, given the current level of inefficiency, and that doing nothing is unlikely to result in the inefficiency being removed in an acceptable timescale, we consider that the ’pure’ do nothing option may not be appropriate.

Question 5.1: Do you agree with our assessment of doing nothing?
If not, please explain why.

Option (2): industry-led direct routing

5.16 As an alternative to mandating direct routing, which is set out below as Option (4), we believe that there remains an opportunity for the five incumbent MNOs to agree to collectively implement direct routing with minimal intervention by Ofcom. Such an approach would be consistent with our principle of acting with a bias against intervention.[44]

5.17 We would expect any such initiative to be open to all mobile network providers who may wish to implement direct routing even if they do not have sufficient scale in terms of mobile ported traffic to potentially cost justify such a change at this time.

5.18 However, we are not persuaded that fixed providers should be an influencing party to this process since our cost benefit assessment suggests that they are unlikely to implement large scale direct routing for ported traffic over the ten year period we have considered. Nevertheless, we believe that it could be beneficial for fixed operators to be indirectly involved if they so wish (e.g. with observer status at the relevant meetings) to ensure that they are informed of the processes being developed. Given that a number of fixed operators also have mobile interests, they would in any event be party to the process by virtue of their activity in the mobile market.

Description

5.19 As differentials between the termination rates of mobile operators reduce over time, it is possible that any coordination issues the industry may currently face relating to a voluntary move to direct routing could be overcome. For Ofcom to consider this option as a viable alternative to mandating direct routing as a means of addressing it's policy objective, we would look for a firm commitment from the five MNOs by means of a public letter of commitment to us endorsed by the respective companies' chief executive officers ("CEOs"). This commitment would set out a reasonable timetable for implementation of direct routing. We would also look for a commitment from *all* mobile providers to provide information on ported numbers on a regular basis as this would be a key enabler of direct routing. We consider that if industry were to offer to implement direct routing no later than 2012, we would be minded to accept such a commitment. Our preliminary consideration of implementation timings suggests that some time during 2012 might strike a reasonable balance between minimising the costs and commercial impact of changing from onward to direct routing and realising the efficiencies for the benefit of subscribers generally.

5.20 Further, we would look for this declaration of intent to be backed up by an industry agreement to produce a project plan by Spring 2010. Industry would then be free to proceed with its implementation planning by agreeing the specifics of the solution and setting its own interim milestones. We would be willing to support such an industry-led process as appropriate.

5.21 We would consider undertaking a review of how industry plans were proceeding, probably in late 2010/early 2011. If, at that point, it becomes apparent that there is a genuine risk that direct routing will not be implemented by the committed date, we may need to intervene and mandate direct routing. This is further set out in the next section.

[44] Although this option may still require Ofcom to introduce an obligation for operators to share necessary information about ported numbers in order to facilitate direct routing, without necessarily specifying the method by which that occurs.

Benefits and risks of this option

5.22 The main benefit of this option over Option (4) below, in which we consider mandating direct routing, is that it provides industry with the opportunity for the relevant stakeholders to independently develop and implement a solution for direct routing. We recognise that there are a number or risks associated with this option. Firstly, there is a risk that some operators may seek additional specific requirements for any proposed industry solution that drive up the costs of a mobile-only solution and are not strictly relevant to mobile. If this is the case, we would be prepared to step in to facilitate the discussions. Secondly, there is a risk that the solution agreed by operators who take part in this process makes it difficult for future mobile market entrants to also take advantage of direct routing should they so wish. Again, this may require Ofcom to have a role in the process, potentially in an observer capacity initially, or further by acting as a facilitator on key decisions.

5.23 Thirdly, there is a risk that irrespective of the commitments given or intentions made in response to this consultation, we may need to intervene at some future point, for example if there is an impasse. In this sense the risks are the same as those associated with Option (1). Were we to revisit in future the need to mandate direct routing, further work would be required to review the arrangements before proceeding with any form of regulatory intervention.

Question 5.2: Do you consider that an industry agreed solution is likely to emerge that would deliver direct routing no later than 2012? If not, please explain your reasons. Would you be supportive of such a solution?

Question 5.3: What steps do you consider Ofcom should take to ensure that such an industry commitment is serious? Do you agree with the proposed steps set out by Ofcom or are there additional measures that should be taken?

Question 5.4: What steps do you consider should be taken to ensure that any industry solution that emerges does not foreclose the opportunity for other mobile operators to participate in the short term or longer term?

Question 5.5: If there was a firm commitment to an industry-led solution, what role would you expect Ofcom to play?

Question 5.6: Do you agree with Ofcom's proposal for a backstop to mandate direct routing in the event that an industry initiative fails? Do you agree that reviewing the situation in late 2010/early 2011 is appropriate before deciding on the need to mandate?

Initial assessment of Option (2)

5.24 Subject to the responses to this consultation and commitments which we think are necessary to underpin it, we favour an industry-led approach. We consider that industry is better placed than Ofcom to develop an implementation plan and technical specification that aligns with its business-as-usual operations and network upgrade plans. This option is also consistent with Ofcom's principle of acting with a bias against intervention.

Option (3): changing the routing incentives for calls to ported mobile numbers

5.25 In previous sections we identified the reasons why incumbent mobile operators have not, to date, moved to direct routing. In this sub-section, we describe an option we

have considered around changing the routing incentives in order to try and encourage individual operators to decide whether and when to move to direct routing. We also explain why we do not consider this option to be an effective means for resolving the issue of productive inefficiency caused by onward routing.

5.26 We have identified in earlier sections that the reason that the market itself is not removing the productive inefficiency of continuing to onward route mobile calls to ported mobile numbers is because the appropriate financial incentives are not in place. The most significant issue is the disincentive to directly route calls to a network which has a higher termination rate than the range-holding network. The second disincentive is that the network originating a call does not bear any of the cost of the additional conveyance which is incurred when the call is onward routed.

5.27 The first of these effects, namely the differential in certain mobile termination rates, is gradually reducing as differentials in average mobile termination reduce under the current price control (see paragraph 4.32 above). We have therefore considered ways in which the second of these effects could be addressed. The current conveyance charging regime means that the originating operator has no incentive to move to direct routing since to do so would involve the operator investing in new network capabilities, while the benefits of making this change would flow to the donor and terminating operators who would no longer have to pay the conveyance charge.

Changing who pays the costs of porting conveyance to create choice

5.28 We consider that a possible means for dealing with this issue is to adjust the wholesale payment arrangements of the porting conveyance charge such that the cost for an onward routed call is paid in full or part by the originating operator, not the terminating operator. This would mean that the call originator who determines the initial routing of the call would be faced with the decision on how to route the call in the most efficient manner.

5.29 This would form a departure from the current arrangements where the conveyance cost for an onward routed mobile call is split between the terminating operator and the onward routing operator. Changing the payment arrangements for call conveyance would result in the originating operator now having a choice of either onward routing the call and paying the range holder the additional conveyance charge or routing directly to the terminating operator. This option does not propose to prescribe a single routing option for all traffic, but allows operators a choice of routing. Therefore, since we would expect direct routing only to be introduced where it is economically rational to do so, this approach should automatically eliminate inefficiencies only in those areas where inefficiencies currently exist. Hence smaller mobile network operators who do not have sufficient levels of ported traffic to justify the additional capital expenditure required for direct routing could continue to rely on onward routing or use of transit providers.

5.30 Further, this option would likely require a new regulatory obligation on mobile operators to publish the necessary information relating to ported mobile numbers in order to facilitate direct routing. Originating operators would require access to information, currently held by their competitors, about which numbers had been ported, and to whom, in order to be able directly route calls to ported numbers if they chose to do so. We consider that such an obligation might need to apply to all mobile operators and not simply the incumbent MNOs as ultimately more operators may find that they have sufficient levels of ported traffic to cost justify a move to direct routing. There would also likely need to be some form of industry coordination required to agree how information on ported mobile numbers should be exchanged and updated

and/or agree whether it is desirable to have a common routing database of ported mobile numbers.

5.31 In summary, implementation of Option (3) would require two separate changes:

- changing the conveyance charge payee from the call terminator to the call originator for both mobile and fixed calls to ported mobile numbers which are onward routed[45]; and

- a requirement on all the mobile providers to exchange data on ported numbers.

Potential benefits of this approach

5.32 This option has the merit of being potentially less intrusive than mandating operators to implement direct routing, at least as far as the mobile industry is concerned. Individual operators would be faced with a build or buy decision regarding the choice of onward routing or direct routing. Our analysis suggests that some MNOs might face an incentive to move to direct routing even based on current volumes of mobile to mobile onward routed minutes (i.e. not factoring growth in porting through time), if we assume that average mobile termination rates converge and that the originator bears all of the costs of porting conveyance. Given the anticipated growth in porting and onward routed minutes, it is likely that more MNOs would face an incentive to switch to direct routing[46]. This option could therefore indirectly achieve the policy objective of eliminating routing inefficiency since by changing the incentives, operators would be encouraged to adopt whatever is the most appropriate routing regime for traffic to ported numbers.

5.33 The option also has merit in that operators who choose to introduce direct routing can do so at a timing of their own choosing, allowing each operator to coordinate its system changes with other network programmes that they may be planning. In some cases we understand that this may have a significant impact on the overall implementation costs of direct routing.

5.34 Our analysis also indicates that in other call type configurations making these changes would not cause any significant changes to the arrangements for routing traffic to ported numbers. This is because the costs of investing in direct routing outweigh the benefits of avoiding the costs of onward routing. Therefore, although we consider that making equivalent changes for other call type configurations (e.g. mobile to fixed or fixed to fixed) may have merits from a policy perspective, we believe that it would be disproportionally disruptive, and would cause operators to unnecessarily incur costs if as a result of the changes there is little or no change in the traffic routing arrangements.

5.35 Therefore, if we were to implement this option for calls to ported mobile numbers, we would propose to keep other areas under review and, should volumes and/ or costs

[45] We considered whether to apply the conveyance charging arrangements just to mobile originated traffic to ported mobile numbers but concluded that unless the change applied for fixed originated calls to ported mobile numbers, there would be unintended consequences (mobile operators might route calls to ported mobile numbers via fixed networks to avoid payment of the conveyance charge). Given the comparatively higher costs of implementing direct routing for calls originating on fixed networks, we recognise that such a change would not lead to fixed operators routing directly to ported mobile numbers.

[46] In aggregate across all MNOs there is a net benefit from implementing direct routing as described in the cost benefit assessment.

change sufficiently that similar action is appropriate and proportionate, then we would intervene at an appropriate stage.

Likely issues and risks

5.36 However, there are some potential concerns regarding this option.

Shifting some of the burden of mobile conveyance costs onto the fixed operators

5.37 As set out above, as a call originator, this option would also involve the fixed operators bearing some of the costs of onward conveyance for calls to ported mobile numbers. Our earlier analysis illustrates that in the near to medium term, it is unlikely that fixed operators could cost justify the implementation of direct routing, whether to fixed or mobile ported numbers. This therefore suggests that fixed operators would be faced with additional costs for no apparent benefit.

5.38 Further, under this option, fixed operators would have to incur costs for wholesale billing system changes to be able to audit conveyance costs for calls to mobile ported numbers.

Application of the principles of cost recovery

5.39 Under the current regime the donor conveyance charge is split between the donor and the recipient operators. The rationale for the recipient operator bearing part of the cost is that the majority of the benefits of porting fall to the called party (who has switched and kept their number) and the recipient operator who acquires a new subscriber. Thus under the current regime the party that benefits from porting bears a share of the costs associated with porting.

5.40 The rationale for the donor party bearing part of the donor conveyance costs is cost minimisation. Under the current regime the operator who can affect the size of the conveyance costs (i.e. the donor) also bears part of this cost and thus faces an incentive to minimise the costs.

5.41 One of the main benefits of changing the economic incentives so the originator pays part of the donor conveyance costs is that the originator then faces the costs associated with their routing decision. The originator thus faces a build or buy decision i.e. they can choose to directly route and avoid the costs of onward routing, or pay the donor to onward route calls to ported numbers (so incurring the costs caused by their decision to onward route). Conversely under the current system originating network operators have no incentive to directly route because they do not face the costs of onward routing. However, the drawback of this approach is the originator, who derives little benefit from the call recipient's decision to port, faces the costs associated with porting. This anomaly is most stark in the case where fixed operators originating calls to ported mobile numbers are required to pay the donor conveyance cost, when they clearly derive little benefit from mobile customers porting.

5.42 This change in routing incentives would have to be introduced into an established market with an existing scheme already in place. Moving from the current arrangements to the new arrangements may have some distributional effects due to differences in the proportions of ported in and ported out numbers and differences in traffic patterns.

Mobile termination rate differentials

5.43 Originating networks are likely to continue to face a disincentive from routing calls to ported numbers directly to a terminating network which attracts a higher mobile termination charge than a range-holding network. The current effects of these differences between the average mobile termination rates of some operators are greater than the costs of porting conveyance. This means that any changes to the scheme of payment of porting conveyance costs will not overcome the effect on routing decisions of mobile termination rates. While these differentials are declining under Ofcom's current price control which ends in 2011 (see paragraph 4.32 above), they may still have sufficient materiality to negate the case for any individual operator to move to direct routing in the longer term dependent upon our future consideration of wholesale mobile voice call termination markets.[47]

Developments to wholesale billing systems

5.44 Changing the incentives such that originators pay the costs of porting conveyance is likely to require changes to the wholesale billing systems of the range-holder networks. Range-holder networks have no current requirement to reconcile inbound traffic from other networks to outbound onward routed traffic to recipient networks. Therefore some development is likely to be required such that the range-holder could correctly charge originating operators for calls to ported numbers. Further, originators may also need to carry out some systems development work in order to be able to audit porting conveyance charges levied on them by range-holders. Initial discussions with industry stakeholders indicate that, at least for some operators, the impact of changes to billing systems could be relatively modest, but this could only be confirmed once the scheme has been fully specified.

Initial assessment of Option (3)

5.45 We do not favour Option (3) because we consider that, on balance, it carries significant risks that it might not achieve our stated policy objective of eliminating routing inefficiencies and therefore fail to deliver benefits to subscribers.

5.46 Further, in order to create the incentives to deliver such benefits (i.e. by encouraging mobile operators to direct route calls to ported mobile numbers), it may have a disproportionate effect on fixed operators who would necessarily incur costs without deriving any benefits.

5.47 Finally, this option relies on the originating operator facing most, if not all, of the costs of porting conveyance in order to have any significant effect on routing incentives. As discussed above, we are not convinced that it is appropriate for the originator to face the costs associated with porting when they derive little benefit from the call recipient's decision to port.

5.48 However, we would welcome further comments on this option.

Question 5.7: Do you agree with our assessment of Option (3)? Please set out your reasons.

[47] Our preliminary consultation on *Wholesale mobile voice call termination* was published on 20 May 2009 and can be found at: http://www.ofcom.org.uk/consult/condocs/mobilecallterm/mobile_call_term.pdf.

Question 5.8: If Ofcom was to take Option (3) forward, what would be the costs involved in (i) making changes to wholesale billing systems and (ii) other costs? Please explain the basis of your estimates.

Option (4): mandate direct routing

Introduction

5.49 Our CBA suggests that for mobile to mobile traffic, there is a positive NPV of £26m over ten years if calls to ported numbers were to change from the current onward routing scheme to a direct routing scheme.

5.50 We have also identified that for other call type configurations despite the potential current inefficiency of onward routing, changing to direct routing would not offer a positive benefit overall (i.e. for these traffic types, the costs of making the change exceed the benefits that would likely accrue as a result of the change). This applies whether we look at these call types individually or in combinations.

5.51 We therefore conclude that we would not be justified, at present, in mandating a change to direct routing for these call type configurations.

Mandating direct routing to eliminate inefficient onward routing

5.52 Therefore, under Option (4) we would propose to mandate that voice calls originating on mobile networks and terminating on ported mobile numbers should be routed in an identical way to voice calls to mobile numbers which are not ported. In other words, where mobile operators have sufficient levels of ported traffic to cost justify a move to direct routing, they would be expected to route their traffic in this manner. Today, we consider that the five incumbent MNOs have the necessary volumes to justify such a move. Conversely, whilst it would be open to other mobile operators to directly route if they so wished, they would not be required to do so absent sufficient traffic volumes.

5.53 If we are to mandate that calls from mobile networks to ported mobile numbers are routed in the same way as non-ported calls, this would imply that, for directly interconnected operators who have sufficient levels of ported traffic, starting from a given date, we would expect mobile to mobile traffic to ported numbers to be routed directly from the originating operator to the terminating operator in the same way as traffic to non-ported numbers.[48] At present, we consider that only the five incumbent MNOs fulfil the necessary ported volume threshold. We would look to set the volume threshold for other mobile operators once we finalise our CBA based on an agreed technical specification. The obligation to directly route would involve the originating mobile operator looking up, on a call by call basis, whether a called number had been ported and if so to which operator this number had been ported. The originating operator would then route the call directly to the relevant terminating operator. This would eliminate the additional costs of (i) switching the call through the range holder's network, and (ii) an additional transmission link in the routing path for traffic to ported numbers.

5.54 To implement this scheme of direct routing would require:

[48] Such arrangements are not therefore intended to prevent operators from routing calls to ported numbers via third party providers where required for reasons such as network resilience or traffic overflow provided such routing decisions make no distinction between ported and non-ported traffic.

i) that each qualifying mobile operator invest in the necessary network capability to be able to do a look-up to determine whether the called number has been ported or not, and to route the call appropriately; and

ii) a database to contain the necessary information about mobile ported numbers across all operators. Whilst the direct routing obligation would be placed on qualifying MNOs only at the start, the obligation to provide information on ported numbers / create a central database would apply to all mobile operators to allow for the implementation of direct routing between any pairs of operators, who want to do so, on a voluntary basis.

5.55 As a consequence of the implementation of direct routing, the terminating operator would receive its appropriate mobile termination rate. Under this option, we would not propose to change the current donor conveyance charge payment arrangements.

5.56 The technology to undertake direct routing for ported number traffic in mobile networks has been widely implemented in many other countries, and the call routing capability is internationally specified.[49]

5.57 Nevertheless it has to be recognised that the mobile operators do not currently have the capability to implement direct routing, and therefore that this capability would have to be implemented in their networks. This would take both capital investment and time.

5.58 Our understanding from the five incumbent MNOs is that the initial capital outlay to adapt their respective networks would collectively cost of the order of **[✂]** and would take some six to 18 months to achieve. Therefore, it is unlikely that direct routing could be fully implemented until sometime in 2011 at the very earliest given that allowance would have to be made for a provisional technical specification to be agreed in advance of any internal implementation.

Potential benefits

5.59 As well as removing the current inefficiencies associated with onward routing, mandating direct routing for all mobile to mobile traffic between all the relevant operators might also result in a number of other benefits.

5.60 By simultaneously introducing direct routing, the coordination of the ported number database is simplified since it would be required by all the relevant operators at the same time.

5.61 Secondly, the adoption of direct routing would directly address a number of second order concerns with ported numbers i.e. the current potential inequality in quality of service for calls to ported numbers relative to non-ported numbers (since with direct routing the routing would become identical), the elimination of the continuing dependence of ported subscribers on their numbering range holder to onward route calls and potential concerns about inter-operability of future new services for onward routing traffic.

5.62 Further, since with directly routed traffic the originating operator would pay the terminating operator its termination rate, the adoption of direct routing would remove the current disparity between the termination rates received by the terminating operator for a call to a ported number in comparison with a call to a non-ported

[49] 3GPP Technical Specification 23.066

number. Thus this would ensure that the terminating operator would always receive its own termination rate irrespective of whether the called number has been ported or not.

Likely issues and risks

5.63 We are also aware that different operators would be impacted significantly differently by a decision to mandate direct routing.

5.64 In particular, despite the converging glide path of average mobile termination rates over the current price control period, it is still likely that different operators will be financially affected in different ways by the impact the removal of the onward routing inefficiency has on the current wholesale pricing arrangements for calls to ported mobile numbers.

5.65 In addition, the costs to individual operators of implementing direct routing are likely to vary considerably depending upon their current network build and where they are in the cycle of network upgrades.

5.66 We understand that some operators may consequently be less able, or willing, to implement direct routing as quickly as others. The timing of a move to direct routing could therefore be somewhat contentious and will require careful consideration if this option is adopted. Our preliminary consideration of implementation timings suggests that some time during 2012 might strike a reasonable balance between minimising the costs and commercial impact of changing from onward to direct routing and realising the efficiencies for the benefit of subscribers generally. However, any consideration of timings would need to take account of any decisions made in relation to the mobile porting process. If, for example, as a result of our separate consultation on the mobile porting process, a requirement for near-instant porting emerges, this could lead to a requirement for a common database.[50] This would effectively require coordination between these two projects.

5.67 We also recognise that implementation of direct routing would require the exchange of data about ported numbers in order that correct routing decisions could be made during the call set-up. We can foresee a number of different ways in which this could be achieved and we expect industry is best placed to agree how this data can be exchanged in an effective manner. The decision on information exchange will be a critical input into the process of specifying and costing the preferred technical solution and agreeing the necessary timings for implementing direct routing[51]. This work would need to be completed before we reach a final decision on modifications to GC18. We have set out how this process might proceed in the Section 6.

5.68 We are also conscious that mandating direct routing only for mobile to mobile traffic would need to be structured carefully to avoid unintended consequences. In particular, a careful balance will need to be struck between ensuring that operators for whom direct routing is currently not financially viable (whether for calls to ported or non-ported numbers) can continue to make use of transit, whilst ensuring that MNOs with established interconnection routes do not use transiting as a way to by-pass any requirement to directly route mobile to mobile traffic.

5.69 One approach to overcome this problem could be that, rather than mandating direct routing per se, we mandate that calls to ported numbers are routed in the same way

[50] http://www.ofcom.org.uk/consult/condocs/gc18_mnp/
[51] Much of this ground was covered by UK Porting before September 2008

as calls to non-ported numbers. This would allow operators' existing routing arrangements to be maintained (including provision for traffic overflow and resilience etc), whilst ensuring that where direct routing for calls to non-ported numbers already exists, calls to ported numbers are similarly routed.

Initial assessment of Option (4)

5.70 Aside from the industry-led option above, we consider that Option (4) may be the most effective in terms of delivering the stated policy objective. This option is likely to deliver the £26m benefits that we have identified with greater certainty than any of the other three options we have discussed above. This is because the timelines for implementation would be pre-set by Ofcom not industry. This option would also address in a more effective manner one of the key disincentives for some operators to implementing direct routing as it would effectively require that the terminating operator always receives its correct termination rate.

Question 5.9: Do you agree with Ofcom's assessment that mandating direct routing for mobile originated calls to ported mobile numbers is likely to be the most effective way of removing routing inefficiencies? If not, what other factors that we should take into consideration, and why are they relevant to our analysis?

Question 5.10: Do you agree that if Ofcom were to mandate direct routing, the obligation should be designed in a way that would avoid mobile operators having to use direct routing where the scale of ported traffic is not sufficient to justify the up-front investment to implement direct routing?

Question 5.11: Do you agree that by framing the obligation in a way that obliges mobile operators to route calls to mobile ported numbers in the same way as non ported traffic should avoid the risks of any unintended consequences? If not, please comment on how this obligation could best be framed.

Question 5.12: Do you agree that the obligation to provide information on ported mobile numbers should apply to all mobile network operators from the start and not just the five incumbent MNOs? Do you agree that if there is a central database of ported mobile numbers, this should contain all ported mobile numbers including those of newer entrants who would not be obliged to implement direct routing from the start?

Question 5.13: What do you consider to be an appropriate timescale for implementation of direct routing from the point at which Ofcom issues a final decision? Please provide a full and detailed explanation as to why you agree or disagree with the 2012 target date proposed by Ofcom.

Section 6

Next steps

6.1 In the last section we outlined our preferred option for an industry-led project to move to direct routing for mobile calls to ported mobile numbers or, if there is insufficient support for this approach, to mandate direct routing. In this section we explain how we propose to take forward either of these options.

Industry-led direct routing

6.2 If the evidence in the responses to this consultation suggests a credible commitment to an industry-led solution then we would subsequently ask the mobile industry to work together to produce and submit an agreed project plan to deliver direct routing. We would expect the MNOs, represented by their CEOs, to commit publically to the plan and the related implementation timetable.

6.3 The plan should detail the key milestones including a reasonable end-date by which the new system will be fully operational. We believe that this end-date should be during 2012 but we would, within reason, consider a different date if industry can demonstrate sound reasons for this. For example, it may be that a different date allows capital costs of implementing direct routing to be materially reduced by better sequencing with other network upgrade programmes.

6.4 We think that Spring 2010 is a reasonable deadline for submitting an agreed project plan to Ofcom. It will provide the mobile industry several months to agree and produce a high level plan.

6.5 If industry is able to produce such a project plan by Spring 2010, we would expect to be able to issue a statement subsequently to confirm our agreement with the proposed plan. We would then, from time to time, monitor industry progress against the plan, including the achievement of the plan milestones to ensure that direct routing will be delivered within the planned timescales. We would be prepared to assist during the implementation planning and technical specification development phase or on an ad-hoc basis as and when industry needs to agree on certain key decisions. If required, we may also consider appointing an independent third party to facilitate this process. If, however, it becomes apparent that the industry-led process is not working effectively, then we will consider reverting to the process, described below, to mandate direct routing.

Mandating direct routing

6.6 In order to bring this approach to a conclusion there are three main activities that need to be completed:

i) produce and agree a provisional technical specification for direct routing;

ii) test and confirm that the likely costs to stakeholders of implementing the provisional technical specification still result in a positive NPV in respect of direct routing; and

iii) consult on the necessary changes before implementation including statutory consultation on modifications to GC18.

Provisional technical specification

6.7 In order to produce the CBA set out in Section 4 and, in more detail, at Annex 5, we used source data provided by communications providers and third parties on the actual, quoted or estimated costs associated with the solution commonly known as UKPorting. This sought to deliver a porting solution in accordance with the November 2007 Statement which required, ultimately, an all-calls (fixed and mobile) solution for calls to fixed and mobile ported numbers which complied with the industry-agreed standards published by the NICC[52] within a short timetable.

6.8 Although we believe that the estimates used in our analysis are more likely to over-state than under-state costs, because they are derived from a more complex and costly specification, we need to be confident that the estimated costs of the solution to enable the direct routing of mobile originated calls to ported mobile numbers are robust and do not understate the actual level of costs that the technical solution is likely to involve. This will require engagement from the mobile industry to agree a provisional technical specification and submit cost estimates based on this specification.

6.9 We do not believe that it is necessary or appropriate to specify those parts of the process which are specific to individual operators. In particular, we do not wish to specify the technical implementation of direct routing for each operator, except insofar as it is necessary to enable interworking between operators. Therefore, we propose that this specification should cover only those areas where mutual arrangements are necessary between operators, including (if required) the specification of a porting database.

6.10 New proposals on the process for porting mobile numbers have been published separately by Ofcom and can be found at www.ofcom.org.uk/consult/condocs/gc18_mnp/. They are being considered separately from the proposals discussed in this document. However, should the consultation on changes to the mobile porting process result in a requirement for near instant porting, then there may be linkages between the routing requirements and the process requirement (such as, for example, the need for a central database) We will consider the impact of any such linkages during our assessment of the consultation responses.

6.11 We recognise that producing a provisional technical specification will require expertise in, and knowledge of, the technical operations for directly routing mobile calls to ported mobile numbers.

6.12 We consider that an independent expert/consultancy may be better placed than Ofcom to undertake this work given the requirement for detailed technical expertise and knowledge of mobile networks. Further, for this work to produce any meaningful results, it is important for such an expert/consultancy to have access to industry stakeholders to understand their existing systems and what might be involved in terms of implementing any change.

[52] NICC (The Network Interoperability Consultative Committee) is a technical forum for the UK communications sector that develops interoperability standards for public communications networks and services in the UK. NICC ND 1631 'NGN; PSTN/ISDN Service Interconnect; Architecture for usage of Common Numbering Database' is published on the NICC's website (www.niccstandards.org.uk) at http://www.niccstandards.org.uk/files/current/ND1631%20V1.1.2.pdf?type=pdf

6.13 We therefore consider the appointment of an independent expert would prove helpful in enabling industry to develop, agree and document a provisional technical specification which would provide for mobile calls to ported mobile numbers to be directly routed.

6.14 We of course recognise the importance of identifying the right expert/consultancy to conduct this work. The experience we would look for this third party to bring includes:

a) experience of multi-disciplinary project management;

b) experience of developing routing arrangements for mobile number portability;

c) ability to liaise with third party suppliers of a porting database;

d) knowledge of the commercial and operational aspects of the mobile industry;

e) technical systems knowledge;

f) strong analytical skills; and

g) strong communications and facilitation skills.

6.15 This third party will also be clear of any conflict of interest.

Question 6.1: Do you agree that it is appropriate for Ofcom/industry to appoint a qualified independent third party to work with industry to develop a provision technical specification for direct routing? If not, please state why.

Question 6.2: Do you agree with the criteria for selecting an independent expert/consultancy? If not, please state what different/additional skills or qualities this independent party should bring?

Question 6.3: If you would like to recommend suitable experts/consultancies to Ofcom, please do so, on a confidential basis.

6.16 For this process to work effectively, we consider that the following conditions will likely need to be in place:

- the process should be time-bound. We consider that this work should complete within three months from commencement. Where appropriate and relevant this process should draw on material produced by UKPorting; and

- the mobile industry should look to engage with the independent third party/consultants in a constructive way by:

    - ensuring the appropriate experts within each organisation are engaged in the process and contribute in an effective and timely manner;

    - that a senior level commercial/ operational sponsor within each stakeholder oversees and is responsible for the work of his/her team;

    - that reasonable requests for access and information by the independent third party/consultants are complied with; and

- participation and contribution to cross-industry workshops facilitated by the consultants is approached in a positive and constructive way and with a view to identifying solutions to problems.

6.17 We propose that an independent third party or consultants are appointed once we have received and considered responses to this consultation.

6.18 Once the provisional technical specification is agreed, industry stakeholders will be requested to develop internal cost estimates for implementing the agreed solution as well as estimate the likely level of common industry costs. We propose to give stakeholders a further three months to estimate the likely shared and internal capital and operational costs of implementing direct routing in line with the provisional technical specification.

Question 6.4: Do you agree that three months is an appropriate period of time to produce a provisional technical specification from which stakeholders can derive reasonable accurate cost estimates? If not, explain why and detail what you consider to be an appropriate time scale.

Question 6.5: Do you agree that a further three months is a sufficient period of time to derive cost estimates based on the provisional technical specification? If not, please explain why and detail what period you think would be appropriate.

Question 6.6: Do you agree that the conditions we have set out as being necessary to make this process successful in its aims are appropriate?

Question 6.7: Do you have any other suggestions which would help to make this process constructive and effective?

Confirming the final cost estimates

6.19 Once industry has submitted its cost estimates to Ofcom and, assuming the benefits of direct routing continue to yield a positive NPV, Ofcom will decide if there is a case for mandating direct routing and will then proceed to implementing the necessary changes to GC18 as appropriate.

Consultation on modifications to GC18

6.20 In order to conclude this work and implement the necessary policy changes, we will have to complete the following steps:

- publish a final statement on our decision on whether to mandate direct routing. We may do this either by:
  - publishing a provisional statement at the end of this consultation process (i.e. once we have considered the responses to this consultation) but prior to the finalisation of the technical specification. We would then publish a short final statement at the very end of the process once the technical specification is complete and we have confirmed that the costs of implementing direct routing are not higher than the cost estimates presented in this consultation document; or
  - publishing a short update and proposed next steps at the end of this consultation period but waiting for the process of specifying and costing the technical specification before publishing a final statement.

- conduct a statutory consultation on proposals to modify GC18 to provide for the direct routing of calls to ported mobile numbers. We would expect this consultation period to run for at least the minimum of six weeks (including the not less than one month requirement for consultation on proposals to modify General Conditions pursuant to Section 48(3) of the Act); or

- if the responses to this consultation suggested strong support for an industry-led initiative, we would aim to publish a final statement as soon as possible once we had fully considered all the responses.[53]

Question 6.8: Do you agree with Ofcom's proposed next steps following responses to this consultation? If not, how do you think Ofcom should proceed to bring this assessment of calls to ported numbers to a final decision?

[53] However, if the industry-led approach still required Ofcom to introduce an obligation for operators to share necessary information about ported numbers in order to facilitate direct routing, we would need to issue a further consultation on the required modification to GC18 to introduce that obligation.

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 26 October 2009.**

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://www.ofcom.org.uk/consult/condocs/gc18_routing/, 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 warwick.izzard@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

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

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

Fax: 020 7783 3574

A1.4 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.

A1.5 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

A1.6 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Warwick Izzard on 020 7783 4127.

Confidentiality

A1.7 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.

A1.8 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.

A1.9 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

A1.10 Following the end of the consultation period, Ofcom intends to publish a further consultation in the first half of 2010.

A1.11 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

A1.12 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.13 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 subscribers, who are less likely to give their opinions through a formal consultation.

A1.14 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.

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 Here are a list of our consultation questions by Section:

Section 3

Question 3.1: Do you agree that there is a problem in the way mobile originated calls to ported mobile numbers are routed? If not, why not?

Question 3.2: Do you agree with our assessment of the issues associated with onward routing?

Section 4

Question 4.1: Do you agree with our proposed approach for assessing the net benefit? If not please explain why not.

Question 4.2: Do you agree that we have identified the relevant cost drivers resulting from a move to direct routing? If not please explain why not.

Section 5

Question 5.1: Do you agree with our assessment of doing nothing?
If not, please explain why.

Question 5.2: Do you consider that an industry agreed solution is likely to emerge that would deliver direct routing no later than 2012? If not, please explain your reasons. Would you be supportive of such a solution?

Question 5.3: What steps do you consider Ofcom should take to ensure that such an industry commitment is serious? Do you agree with the proposed steps set out by Ofcom or are there additional measures that should be taken?

Question 5.4: What steps do you consider should be taken to ensure that any industry solution that emerges does not foreclose the opportunity for other mobile operators to participate in the short term or longer term?

Question 5.5: If there was a firm commitment to an industry-led solution, what role would you expect Ofcom to play?

Question 5.6: Do you agree with Ofcom's proposal for a backstop to mandate direct routing in the event that an industry initiative fails? Do you agree that reviewing the situation in late 2010/early 2011 is appropriate before deciding on the need to mandate?

Question 5.7: Do you agree with our assessment of Option (3)? Please set out your reasons.

Question 5.8: If Ofcom was to take Option (3) forward, what would be the costs involved in (i) making changes to wholesale billing systems and (ii) other costs? Please explain the basis of your estimates.

Question 5.9: Do you agree with Ofcom's assessment that mandating direct routing for mobile originated calls to ported mobile numbers is likely to be the most effective way of removing routing inefficiencies? If not, what other factors that we should take into consideration, and why are they relevant to our analysis?

Question 5.10: Do you agree that if Ofcom were to mandate direct routing, the obligation should be designed in a way that would avoid mobile operators having to use direct routing where the scale of ported traffic is not sufficient to justify the up-front investment to implement direct routing?

Question 5.11: Do you agree that by framing the obligation in a way that obliges mobile operators to route calls to mobile ported numbers in the same way as non ported traffic should avoid the risks of any unintended consequences? If not, please comment on how this obligation could best be framed.

Question 5.12: Do you agree that the obligation to provide information on ported mobile numbers should apply to all mobile network operators from the start and not just the five incumbent MNOs? Do you agree that if there is a central database of ported mobile numbers, this should contain all ported mobile numbers including those of newer entrants who would not be obliged to implement direct routing from the start?

Question 5.13: What do you consider to be an appropriate timescale for implementation of direct routing from the point at which Ofcom issues a final decision? Please provide a full and detailed explanation as to why you agree or disagree with the 2012 target date proposed by Ofcom.

Section 6

Question 6.1: Do you agree that it is appropriate for Ofcom/industry to appoint a qualified independent third party to work with industry to develop a provision technical specification for direct routing? If not, please state why.

Question 6.2: Do you agree with the criteria for selecting an independent expert/consultancy? If not, please state what different/additional skills or qualities this independent party should bring?

Question 6.3: If you would like to recommend suitable experts/consultancies to Ofcom, please do so, on a confidential basis.

Question 6.4: Do you agree that three months is an appropriate period of time to produce a provisional technical specification from which stakeholders can derive reasonable accurate cost estimates? If not, explain why and detail what you consider to be an appropriate time scale.

Question 6.5: Do you agree that a further three months is a sufficient period of time to derive cost estimates based on the provisional technical specification? If not, please explain why and detail what period you think would be appropriate.

Question 6.6: Do you agree that the conditions we have set out as being necessary to make this process successful in its aims are appropriate?

Question 6.8: Do you agree with Ofcom's proposed next steps following responses to this consultation? If not, how do you think Ofcom should proceed to bring this assessment of calls to ported numbers to a final decision?

Annex 5

Question A6.1: Do you have any comments on the assumptions used in the CBA?

Annex 5

Direct routing CBA model

Introduction

A5.1 The purpose of this annex is to outline the assumptions and methodology used to construct the direct routing ("DR") CBA. We use this CBA to assess the case for mandating DR. The benefits of DR are the costs of onward routing ("OR") which could potentially be avoided if traffic was directly routed. These avoided costs comprise both conveyance and transmission costs and are discussed in the 'benefits' section below. The costs of DR comprise both capital and ongoing costs associated with the systems and processes required to implement direct routing – these are discussed in the 'costs' section below. In the final section the results and sensitivity analysis are presented.

A5.2 Wherever possible and appropriate we have used inputs based either on information supplied by the operators and other third parties or from other Ofcom models which have been made publically available as part of previous consultations. We have made it clear in the text below where we have used data from previous models and the models we have used.

Call type configurations

A5.3 As part of this assessment we have considered the costs and benefits of DR for a number of different call type configurations as follows:

a) all calls (fixed and mobile originated and terminated traffic);

b) mobile originated calls to ported mobile numbers only;

c) fixed originated calls to ported fixed numbers only;

d) fixed and mobile originated calls to ported fixed numbers i.e. all calls terminating on fixed networks; and

e) mobile and fixed originated calls to ported mobile numbers i.e. all calls terminating on mobile networks.

Timing of cash flows

A5.4 For the purpose of our modelling the proposed implementation date for DR is 2012, and capital spend incurred to build necessary systems/process is assumed to arise in the year prior to implementation (i.e. 2011). We have calculated the NPV over a ten year horizon in the base case treating 2011 as year 0 (therefore costs and benefits are projected to 2021 and the NPV is calculated over 2011-2021). The decision to use a ten year horizon for the NPV is based on the anticipated life time of the assets required to implement direct routing (e.g. the operator specific capital investment is assumed to have a life productive life of ten years).[54]

[54] We recognise that operators may use different time horizons when assessing projects as part of their internal decision making. However, providing our analysis builds in the correct reward for risk (i.e. the correct discount rate) then the appropriate investment horizon is the economic life time of the

A5.5 We are aware that further technological developments during the time horizon for our model could impact on the costs and benefits of direct routing. In particular the adoption of fourth generation technologies (e.g. Long Term Evolution or "LTE") may reduce the costs avoided (i.e. benefits) of direct routing and the lifetime for assets required to implement direct routing. At this stage the costs and timescales of changes to either the core network or interconnection arrangements for next generation technologies are uncertain. However, we consider it unlikely that such developments will significantly affect the overall conclusions of our cost/benefit analysis within the timeframe we have considered for the following reasons:

- it is only changes to the LTE core (as opposed to LTE access) that impact the switching and transmission costs;
- changes to the LTE core may be focused initially on broadband data rather than voice services;
- the precise timing of any such development is uncertain (i.e. the new technology may be implemented only in the latter part of, or even beyond, our modelling period); and
- the base case NPV for mobile to mobile direct routing remains positive even over a shorter (i.e. seven year) time horizon.

A5.6 In addition, we have conducted a sensitivity analysis around our base case assumptions and created low and high case scenarios to assess how changes in our assumptions might impact on the NPV.

A5.7 The costs and benefits are discounted back to the current year (2009), but expressed in 2008 prices (since the cost and benefit data was mainly obtained in 2008).

Discount rate

A5.8 The discount rate used is the fixed or mobile real pre tax WACC on the basis that the operators will be incurring the costs and receiving the benefits of DR.[55] When a model configuration involves costs to both fixed and mobile operators, where possible, the costs and benefits arising from DR are identified and allocated separately to fixed and mobile operators and discounted at the appropriate rate. Where costs are shared between fixed and mobile operators (e.g. porting programme office costs) then a blended WACC is used based on a 50:50 weight for the fixed and mobile WACC. This is based on the fact that total revenues generated by fixed and mobile operators were approximately equally split between

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asset. The ten year assumed asset life of operator specific investment in based on information from the mobile call termination cost model. The CDB is assumed to have an asset life of seven years and additional reinvestment capex is included from years 8-10.

[55] Our NPV analysis has used the appropriate operator weighted average cost of capital (WACC) as the basis for discounting future cashflows. In assessing whether intervention is in the interests of society as a whole, the appropriate discount rate would normally be the social time preference rate (STPR) as set by HM Treasury in the Green Book (see http://www.hm-treasury.gov.uk/data_greenbook_index.htm) – i.e. a real discount rate of 3.5% (as used in the Review of the Mobile Number Portability Process). However, because we think that the immediate beneficiaries of change will be operators as a whole, we have conservatively used the WACC as the discount rate, even though we expect that the benefits of change will ultimately feed-through to consumers. Where negative cash flows (e.g. initial investment) occur before positive cash flows (e.g. annual benefits exceeding annual ongoing costs), using the STPR will result in a higher NPV.

fixed and mobile for the period Q4 2007 to Q3 2008[56] and this seems a reasonable mechanism to allocate costs.

A5.9 We have used the BT WACC as a proxy for the average fixed network operator ("FNOs"). An assessment of BT's WACC is provided in the statement *A new pricing framework for Openreach* published in May 2009.[57] The 'rest of BT' pre tax real WACC of 8.29%[58] (i.e. BT excluding Openreach) is considered the most appropriate as this will cover the voice switched network.

A5.10 For MNOs we have used the pre tax real WACC published in the March 2007 Statement on 'Mobile call termination' of 11.5%.[59]

Benefits

A5.11 The benefits of DR are the costs of OR which could potentially be avoided. This is calculated as avoidable costs associated with OR (on a pence per minute ("ppm") basis) multiplied by the volume minutes which are OR. This can be represented as:

> Benefit of DR = Avoided costs associated with OR = (ppm donor conveyance costs + ppm transmission costs) *OR minutes

A5.12 Each aspect of the calculation is considered in turn for mobile and fixed operators.

Porting or donor conveyance costs

A5.13 The donor conveyance cost relates to the additional costs within a mobile or fixed network for handling a call to a ported number. Our analysis considers the incremental costs which would be avoided by DR, therefore we are concerned with conveyance costs rather than conveyance charges (which may be above incremental costs). First we estimate the current value for the conveyance cost, and then we consider how this cost is likely to evolve over the modelling period.

Mobile donor conveyance costs

A5.14 In 2007, we asked consultants Analysys to estimate the additional costs arising from a call to a ported number. Analysys used our 2G/3G mobile call termination cost model to construct a benchmark for the efficient donor conveyance unit costs separately for 2G and 3G operators. These figures were used to calculate cost based charges. Analysys estimated the 2G and 3G conveyance charges at 0.22ppm and 0.11ppm respectively (real 2007/8 prices). The difference in the conveyance charge for 2G versus 3G is driven by the lower mobile switching centre (MSC) costs for the 3G network. The blended conveyance charge for a 2G/3G combined operator was 0.20ppm (the blended charge is based on the proportions of traffic carried on each network).

A5.15 We have used the Analysys 2007/8 figures as base values to project the conveyance costs going forward. Our forecast for conveyance costs considers three factors:

[56] This is based on information provided in the Ofcom telecommunication market data tables – see http://www.ofcom.org.uk/research/cm/tables/q3_2008/q32008.pdf
[57] see http://www.ofcom.org.uk/consult/condocs/openreachframework/statement/annexes.pdf p157-8
[58] This assumes inflation at 2.5%.
[59] see http://www.ofcom.org.uk/consult/condocs/mobile_call_term/statement/statement.pdf p. 374

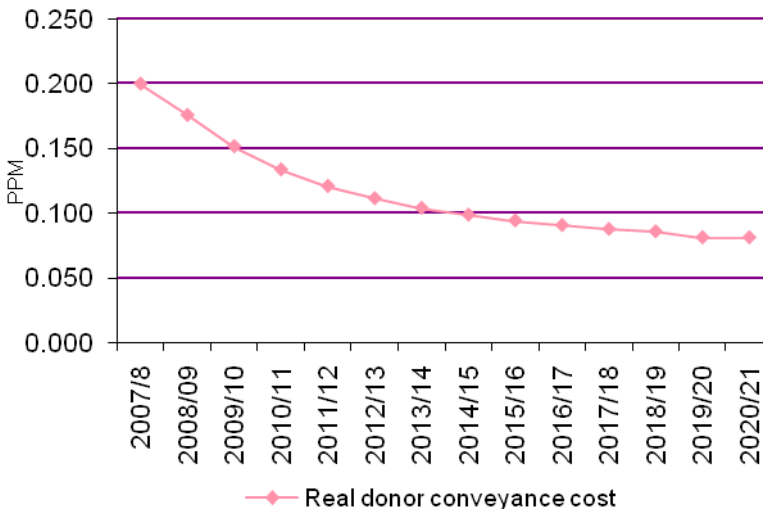
a) incoming call costs are forecast to fall over time e.g. as equipment costs fall. We have assumed that conveyance costs will decline in line with the annual percentage reduction in 2G and 3G voice call costs as forecast in the mobile call termination cost model;[60]

b) we anticipate that the proportion of traffic carried over 3G networks will increase over time (with a decrease for 2G networks). As donor conveyance costs less on 3G networks (based on the Analysys calculations above) this means the average conveyance costs will decrease over time for 2G/3G operators. We have taken the expected path for the proportions of 2G and 3G traffic from the mobile call termination model and used this to calculate the blended 2G/3G conveyance cost over time; and

c) the market share for the 3G only operator is predicted to increase over the period we are modelling. We have taken the expected market share for the 3G only operator from the mobile call termination cost model.

A5.16 By taking the initial conveyance costs estimated by Analysys, and making the adjustments described above, we have derived a path for conveyance costs over time. The conveyance cost is estimated separately for the 2G/3G operators and the 3G operator, and a weighted average conveyance cost is calculated based on the forecast market shares of the 2G/3G and 3G only operators. For 2019/20 and 2020/21 we have assumed that all traffic will be carried on a 3G network. The path for the weighted average real donor conveyance cost (in 2008 prices) is shown in the graph below:

Figure A5.1: Donor conveyance costs (mobile)



Source: Various

[60] http://www.ofcom.org.uk/consult/condocs/mobile_call_term/statement/info/

Fixed donor conveyance costs

A5.17 We have used the Average Porting Conveyance Charge ("APCC")[61] as a proxy for costs of donor conveyance in a fixed network. APCC charges are agreed bi-laterally and vary for each combination of operators. We decided to use BT's APCCs as a proxy for the market because BT was able to provide the most complete set of relevant information (i.e. APCCs and incoming minutes received for the most significant operators).

A5.18 To estimate an average cost, the operator specific APCCs were weighted by the volume of incoming minutes which BT terminated[62] for that operator (the volume of incoming minutes is used as a proxy for the proportion of traffic which BT is likely to onward route for that operator). The weighted average BT APCC was 0.042ppm.[63] As a comparison we also calculated the weighted average APCC across all operators providing us with relevant information.[64] The charge in this case was within 5% of BT's weighted average charge, which gives us some confidence that BT's charge is a good proxy for the market.

A5.19 We have identified two factors which are likely to impact on the cost of fixed network conveyance over time:

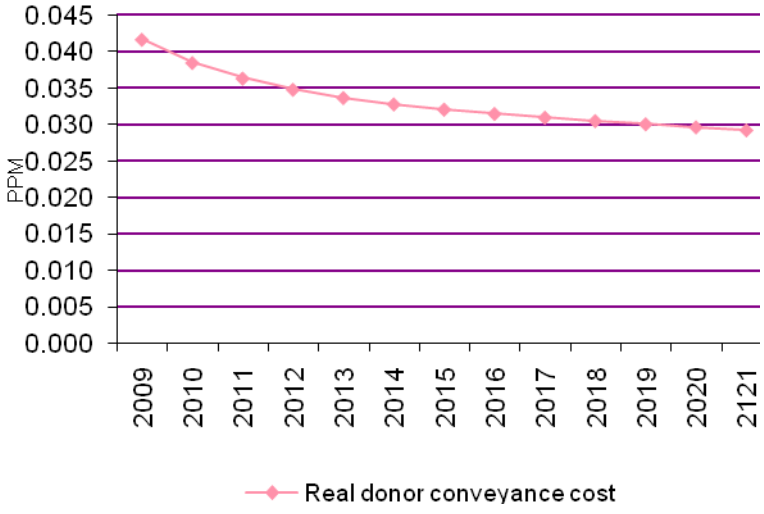
a) real asset price trends – in general terms the real price for the types of assets involved in conveyance has fallen over time which will decrease the conveyance costs over time. We have taken the trend in real asset prices from the Network Charge Control ("NCC") model[65] and thus assumed that asset prices will decline by 2.4% per year (for a given volume of traffic); and

b) change in volume of OR minutes – the APCC recovers both fixed and variable costs associated with conveyance. The presence of fixed (i.e. volume invariant) costs means that the total cost of OR will not vary one to one as volumes change. We have assumed a cost volume elasticity of 0.4 based on the NCC model. This means that for a 1% rise in volumes the total cost of conveyance will increase by 0.4% (all other factors constant). On a cost per minute basis this means that the APCC falls as volumes rise (and vice versa). The forecast for the volume of OR minutes is described later.

A5.20 Including these factors in the forecast results in a path for the weighted average APCC as shown in the graph below:

[61] The APCC is the donor network charge to the recipient network for onward routing traffic where a number is ported from the donor to the recipient (i.e. where the traffic originates off-net and is, in effect, transited over the donor network.)
[62] The volume of minutes was based on information provided from Q4 2007 to Q3 2008.
[63] 2008 prices, the APCC information was effective at the end of 2008.
[64] Note that some operators were not able to provide incoming minutes for all significant operators.
[65] http://www.ofcom.org.uk/consult/condocs/review_bt_ncc/reviewbtncc.pdf

Figure A5.2: Donor conveyance costs (fixed)



Source: Various

Transmission costs

A5.21 Onward routing of ported traffic results in additional incremental transmission costs because (at least) two interconnection links are required for a given call to a ported number (one for originator to donor and one for donor to recipient) whereas DR requires only one interconnection link from the originator to the recipient. While operators are likely to have interconnect links already established, OR means these links carry more traffic (thus possibly leading to a requirement for higher capacity) relative to a scheme where the majority of traffic is DR.

A5.22 The conveyance costs outlined above do not include the cost of interconnection necessary to pass onward routed traffic from the donor to the recipient party. We have estimated this transmission cost for fixed and mobile networks based on the cost of interconnection links.

A5.23 The cost of an interconnection link has been estimated using the BT price list[66] for an STM-1 (155Mbit/s) leased line (including both connection and annual rental charges). To calculate a per annum cost the one off connection charges have been annuitised using a five year asset life. We have conservatively assumed that the maximum available volume discount is attained, which means the annual cost of an interconnection link is approximately £245,000.

A5.24 To calculate a ppm cost of transmission we have estimated the total amount of traffic that can be carried by each STM-1 link per year. We have assumed that:

a) the link supports 1920 voice channels;

b) the link is fully utilised in the busy hour;

c) 10% of the daily traffic is carried in the busy hour;

d) the busy hour is driven by business traffic and there are 253 business days per year; and

[66] See http://www.serviceview.bt.com/list/public/current/Prime_Service_boo/1371_d0e1.htm

e) each business day is equally busy.

A5.25 We calculate that the link will carry 291m minutes annually on business days which equates to a cost of 0.085ppm. We have adjusted this figure to reflect traffic carried on non business days (i.e. weekends and bank holidays) because the total avoided costs are calculated based on all onward routed traffic. As a proxy for the distribution of traffic between business and non business days for the industry as a whole, we used BT's regulated accounts to work out the proportion of total minutes terminating on BT's network which are carried on business days (i.e. day + evening minutes/ day + evening + weekend minutes). Applying the resulting proportion (81%) to the ppm charge results in a final unit cost of 0.068ppm in 2009 (2008 price).

A5.26 As noted for the APCC above, we expect real prices for assets associated with transmission to fall over time. To proxy the decline in transmission costs over time we have used the leased line charge control for the basket of services which includes 155Mbit/s services which is RPI-3.25% until 2013. We have assumed that the transmission cost will continue to fall after the current charge control elapses. Therefore the transmission cost is assumed to decline by 3.25% in real terms from 2010 onwards.

Volume of OR minutes

A5.27 We need to forecast the volume of OR minutes through time to calculate the total cost which would be avoided by DR. One approach would have been to extrapolate OR minutes based on a simple growth projection for ported traffic. However, it is possible such an approach would miss dynamics relating to the growth in ported numbers (which we explore below). Therefore we have taken a more sophisticated approach where the forecast for OR minutes depends critically on three factors:

a) the forecast for total traffic volumes (i.e. calls to both ported and non-ported numbers) for each traffic category;

b) the proportion of people with ported numbers; and

c) calls to ported numbers which are not onward routed (including call trap[67] and where the originator and range holder are the same operator). See discussion in paragraphs A5.36 to A5.40 below.

A5.28 We have calculated OR minutes separately for each of the four traffic categories i.e. mobile to mobile[68], fixed to mobile, fixed to fixed[69] and mobile to fixed.[70] The volume on OR minutes is calculated as:

OR minutes = (Total traffic minutes * % of people with ported number) – calls to ported numbers which are not onward routed

[67] Call trap is when an operator identifies calls made on-net to ported in numbers and stops them from being inefficiently routed by the range holder.
[68] On and off net mobile calls, excluding roaming calls.
[69] UK geographic and other calls. Other calls includes freephone, special services, premium rate, directory enquiries and all other call types. Figures include calls made to non BT internet service providers via FRIACO.
[70] Including calls to landlines, premium rate services and other calls but excluding international and roaming calls.

A5.29 Implicit in this calculation is the assumption that people with ported numbers receive, on average, the same number of call minutes as people with non ported numbers.

A5.30 Each aspect of the calculation is considered in turn.

Forecast for traffic volumes

Base year volumes 2008

A5.31 For each traffic category we have used actual minutes over Q4 2007-Q3 2008[71] to form a base year estimate for traffic, and then forecast the evolution of traffic over time (described below). For mobile to mobile and mobile to fixed traffic the actual minutes are based on information provided from the four largest MNOs to Ofcom to compile the Ofcom telecommunications market data tables.[72] For fixed to fixed and fixed to mobile minutes the volumes are those collected from FNOs and reported in the Ofcom telecommunication market data tables.[73]

Forecasting traffic

Mobile originated calls

A5.32 We have forecast mobile originated minutes in a manner consistent with the mobile call termination model which forecast mobile traffic volumes to 2021 and beyond. The model forecast that average compound growth in mobile originated traffic would be 1.77% per annum over the period 2009-2021. This applies both to mobile to mobile and mobile to fixed traffic (the mobile call termination model did not differentiate between these traffic types).

A5.33 We have applied a compound growth assumption to the base year estimate of volumes to forecast traffic in each year (i.e. $VOLn = VOL_{base} * (1+G)^n$, where n is the number of years from the base year). The forecast path for mobile originated traffic is shown in Figure A5.3.

Fixed originated calls

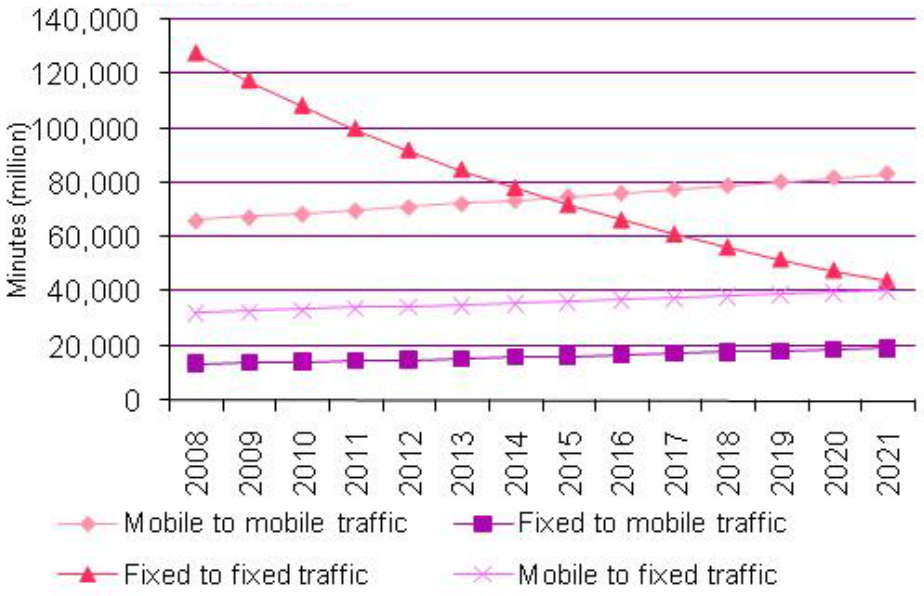
A5.34 We have forecast fixed originated calls in a manner consistent with the NCC model[74] which was used to derive charge controls for BT for the period 2009-2014. In this model fixed to fixed[75] and fixed to mobile minutes were separately identified and forecast. Therefore a separate growth rate has been calculated for each traffic category. The NCC model forecasts traffic from 2009/10-2013/14. Over this period the forecast growth in fixed to fixed traffic is -7.85% per year (compound average). The corresponding figure for fixed to mobile traffic is 2.73% per year. For the period

[71] This time period was chosen to be consistent with the base period for actual OR minutes (which is based on S135 information).
[72] We have used this information source because it has the most complete data available. We note that H3G does not provide data for the market data tables. This means the base year traffic volumes are understated which (other things equal) will lower the NPV of DR (i.e. this is a conservative approach).
[73] Available at http://www.ofcom.org.uk/research/cm/tables/q4_2008/q4_2008.pdf
[74] See http://www.ofcom.org.uk/consult/condocs/review_bt_ncc/
[75] Fixed to fixed includes BT to BT and BT to communication provider (CP) and CP to BT local and national calls, BT hosted number translation and premium rate services, data dial, payphones, indirect access and carrier pre select, incoming international calls and other calls. It excludes directory enquiry calls, operator assistance, FRIACO, Transit, outgoing international calls.

we are forecasting beyond the scope of the NCC model (i.e. 2015-2021) we have assumed that traffic will continue to grow at the same annual rate as predicted by the NCC model.

A5.35 The forecast path for fixed originated traffic is also shown in below.

Figure A5.3: Mobile and fixed traffic projections



Source: Ofcom

The proportion of people with ported numbers

Base year

A5.36 We do not have a direct measure of the total number of people with a ported (mobile or fixed) number. Therefore we have estimated the proportion of people who currently have a ported number by taking total ported minutes as a proportion of total traffic. Based on the assumption that people with ported numbers receive, on average, the same volume of calls as people who have not ported, we can use the volume of ported minutes in relation to total traffic[76] as a proxy for the percentage of people who have ported.

A5.37 We estimated total OR minutes by asking fixed and mobile operators (as part of a Section 135 request) to provide quarterly information on the number of incoming minutes for which they were the number range holder but had to onward route the calls to an alternative recipient operator. Onward routing arises when the call originator, range holder and recipient are three different parties.[77] This means that not all calls to ported numbers necessarily get onward routed, and onward routed minutes need to be adjusted to capture all calls to ported numbers.

[76] Total traffic being defined as total terminating traffic for the operators which provided information on OR minutes.
[77] This is the case where 'call trap' (described below) has been implemented. Where call trap has not been implemented calls to ported numbers where the originator and the recipient are the same are still OR.

A5.38 When the originator and recipient are the same party (i.e. the call recipient's number has been ported into the same network as the person making the call) the call can be directly routed if the originator/recipient has implemented 'call trap'.[78] Call trap means that an operator can avoid the costs of OR by stopping calls made on-net to ported-in numbers from being inefficiently routed via the number range holder. Because some operators have call trap systems the volume of OR minutes understates the total number of call minutes to ported numbers. We obtained information on mobile call trap minutes through the Section 135 request to MNOs.

A5.39 We also asked FNOs for call trap information, but not all FNOs were able to provide an accurate estimate for the volume of minutes call trapped. Our working assumption is that 30% of calls to ported numbers are trapped which is a proxy based on the call trap information for MNOs (discussed further below).

A5.40 When the call originator and range holder[79] are the same operator then the call is automatically directly routed. However, in their estimates of onward routed minutes the MNOs were not able to split out calls where they were both the range holder and originator for calls to ported numbers, so the estimates provided already include calls to ported numbers where the originator and the range holder are the same operator (meaning no further adjustment is required to capture calls to ported numbers).[80]

A5.41 When the range holder and recipient are the same the call is clearly directly routed since the number is no longer ported out[81] (see description on unports below).

A5.42 Adding together OR minutes and minutes to ported numbers which are not OR provides an estimate for total minutes to ported numbers. We estimated the proportion of people with a ported number by dividing minutes to ported numbers by total traffic (calculated above) as follows:

> % of people who have ported number (2008) [82] = (total OR mins + calls to ported numbers which are not OR) / total terminating mins

A5.43 Using the information provided by operators and assumptions outlined above we estimate that the stock of ported numbers as at 2008 was 15% for mobile and 13% for fixed.

Forecasting porting over time

A5.44 When forecasting the proportion of people who will have a ported number in the future we have taken into account a number of factors:

[78] Call trap is only possible where a call originates and terminates on the same network i.e. for mobile to mobile or fixed to fixed traffic categories. It is not possible to trap calls from fixed to mobile operators or vice versa.
[79] Note this can only be the case for mobile to mobile or fixed to fixed calls. For mobile to fixed and fixed to mobile calls the originator and range holder are different by definition.
[80] For fixed to fixed calls, some operator's estimates of onward routed minutes apparently did not include calls where the originator and range holder are the same operator. In this case we have not made any further adjustment to estimate total minutes to ported numbers. Making an adjustment would not affect our proposals since the NPV for fixed to fixed calls is negative, and making such an adjustment would not bring the NPV near to positive territory. For fixed to fixed calls we lack information to estimate the proportion of originated calls where the originator and the range holder are the same party.
[81] As such these are not ported calls.
[82] Information on OR, mobile call trap and terminating minutes was taken over Q4 2007 to Q3 2008.

a) new ports N(t) - people who switch provider and port their number for the first time;

b) abandon ports A(t) - people who have previously ported their number but abandon the number e.g. because they move abroad;[83]

c) stop ports S(t) – people who have previously ported but decide they want a new number when they switch provider again (i.e. they discontinue the ported number when they switch);

d) unports U(t) - people who have previously ported and port again back to the original rangeholder, meaning that the number is no longer ported out; and

e) reports R(t)- people who previously ported and port again but NOT back to the rangeholder.

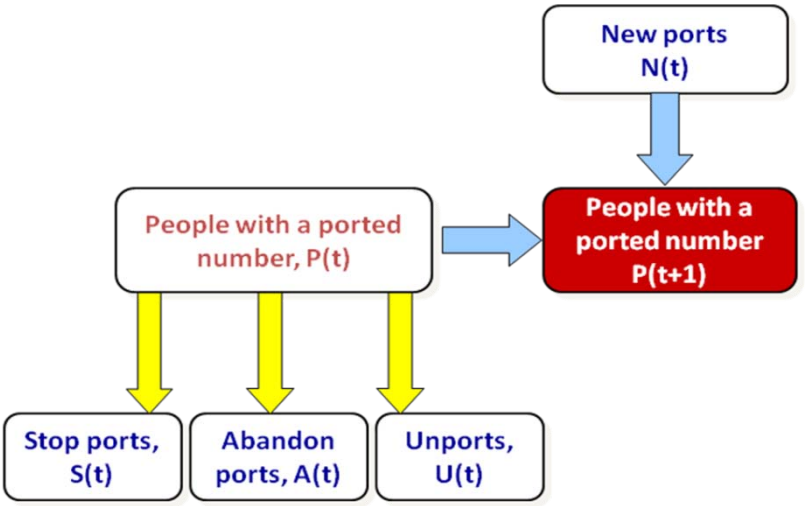
A5.45 The stock of people with a ported number (P) is calculated by the following recurrence relation:

$$P(t+1) = P(t) – A(t) – U(t) + N(t)$$

(t=0 is the base year where P(0) is determined by ported minutes as explained in the previous sub-section).

A5.46 This model can be represented by the following diagram:

Figure A5.4: Diagrammatic representation of a porting model



A5.47 Reports (R(t)) do not feature in the diagram above because reporters do not add to or decrease the stock of porters.

A5.48 In explaining the above recurrence relation it is intuitive that people abandoning their ported number or unporting reduces the stock of porters.

A5.49 New ports clearly add to the stock of porters. However, as defined above, new ports are not **all** ports each year but **only** those who are porting a given number for the **first time**. This means we need to strip out people who have ported their

[83] We assume that the overall population of mobile subscribers is constant i.e. abandon ports excludes mortality.

number two (or more) times i.e. reports and unports, which we define collectively as $\varrho(t)$. Reporting and unporting has an important implication for the stock of porters:

a) reporters continue to result in onward routed calls but **do not add** to the stock of porters (i.e. reporting leaves the volume of OR traffic unaffected); and

b) unporters reduce the stock of porters (i.e. unporting reduces the volume of OR traffic)

A5.50 Thus:

N(t) = Number of people who port per year[84]– $\varrho(t)$

A5.51 The pool of people who could possibly report and unport in a given year is given by the stock of porters P(t) minus the number of people who abandon port in each year.

Pool of people available to report and unport[85] = P(t) - A(t)

A5.52 We assume that reporters and unporters switch provider with the same frequency as the total population of mobile subscribers. We also assume that all reporters and unporters who switch in a year **will port** their number, with the exception of the small group who actively want to change number (so called stop ports (S(t))). This assumption is based on the fact that reporters and unporters have previously ported which indicates that they value keeping their number, and so are likely to continue to port in the future unless they actively want a new number.[86] Therefore reporters and unporters are calculated as follows:

Reporters and unporters = $\varrho(t)$ = pool of people available to report and unport * (% of people who switch per year – % of people who stop port)

A5.53 From the above, the expression of true new ports per year can be reduced to:

N(t) = number of people who port per year – [(P(t) – A(t)) * (% of people who switch per year - % of people to stop port per year)]

A5.54 The final step in the calculation is the calculation of unports. In our model we have considered a simplified world where there are five mobile service providers with roughly equal market share. Thus a previous porter who switches again has four providers to choose from (including the original rangeholder of the number). We assume that each provider has an equal probability of being picked (i.e. the subscriber is not biased for or against the original rangeholder). This means there is a 25% chance that the subscriber will unport (go back to the rangeholder) and a 75% that they will report. Therefore unports are calculated as follows:

U(t) = $\varrho(t)$ * 25%

A5.55 With the exception of unports, the methodology described above applies to both mobile and fixed porting. However, we have sourced different input values specific

[84] We assume that a constant proportion of the population of subscribers ports each year.
[85] Note that reports and unports will increase over time as the stock of porters grows.
[86] i.e. we assume that reporters and unporters will not fail to port because they are not aware of the porting process.

to the mobile and fixed markets where possible. This is described in the next two sub-sections.

Mobile porting

A5.56 In addition to describing the inputs for the mobile porting model below we have included a simple worked example to illustrate how this aspect of the model works. In this example we assume that there are 100 mobile subscribers (constant over time) and 15 of these subscribers have already ported their number i.e. the stock of porters, P(t), is 15. We set out below the workings to calculate P(t+1) i.e. the stock of porters one year on.

A5.57 We conducted a market research survey on mobile switching and porting in December 2008 and used this information to estimate the number of people porting each year.[87] The research suggested that 28% of people had switched network in the last two years (we have assumed that 14% of people switched in each year). Of those who had switched, 45% had ported their number and 52% had not ported their number (3% did not know). This suggests that around 6% (=14% * 45%) of mobile subscribers switch and port each year. We assume a constant proportion of subscribers port each year.

A5.58 We have assumed that 1% of the stock of porters abandon their number each year (i.e. A(t) = 15 * 1% = 0.15). The survey suggested that around 15% of non–porting switchers didn't mind having a new number. We assume that these people actively want to change their number when they switch network and have used this as a proxy for the proportion of previous porters who 'stop port' in a given year. Thus the proportion of previous porters who stop port is 1%.[88]

A5.59 To calculate the number of new ports per year we need to account for reporting and unporting as set out above:

Pool of people available to report and unport = P(t) - A(t) = 15 - 0.15 = 14.85

$\varrho(t)$ = Pool of people available to report and unport *(% of people who switch per year - % of people who stop port) = 14.85*(14% - 1%) = 1.93

A5.60 This allows us to calculate N(t):

N(t) = People who port each year – $\varrho(t)$ = 6 – 1.93 = 4.07

A5.61 The final step in the calculation is the calculation of unports.

U(t) = $\varrho(t)$ * 25%

U(t) = 1.93 * 25% = 0.48

A5.62 Thus in our example P(t+1) can be constructed as follows:

[87] We have not used the switching statistics from the Mobile Sector Assessment published in July 2009 because these statistics are based on an older survey (July 2008), and the survey used for this consultation was commissioned specifically to elicit information on mobile switching and porting.
[88] Calculated as % who switch * % who don't port * % who want a new number = 14%*52%*15% = 1%

$$P(t+1) = P(t) – A(t) – U(t) + N(t)$$

$$P(t+1) = 15 – 0.15 – 0.48 + 4.07 = 18.4$$

A5.63 Given that the population of mobile subscribers is constant (at 100) in this example the proportion with a ported number is 18.4% in t+1, up by 3.4 percentage points from the previous period. Note that each year of growth would not be 3.4 percentage points, but will diminish through time though remain positive.

A5.64 We have followed the methodology outlined above to estimate the proportion of mobile subscribers with a ported number in each year to 2021.

Fixed porting

A5.65 The methodology and calculations for fixed porting follow the same model as above. As described above, in the base year we estimated that 13% of the stock of fixed numbers had been ported. Some of the input assumptions differ, for example, we have used separate market research conducted for the *Consumer Experience Report* 2008 to estimate the number of fixed subscribers who switch provider each year. This report suggested that 12% of fixed subscribers had changed their provider in the last year.[89]

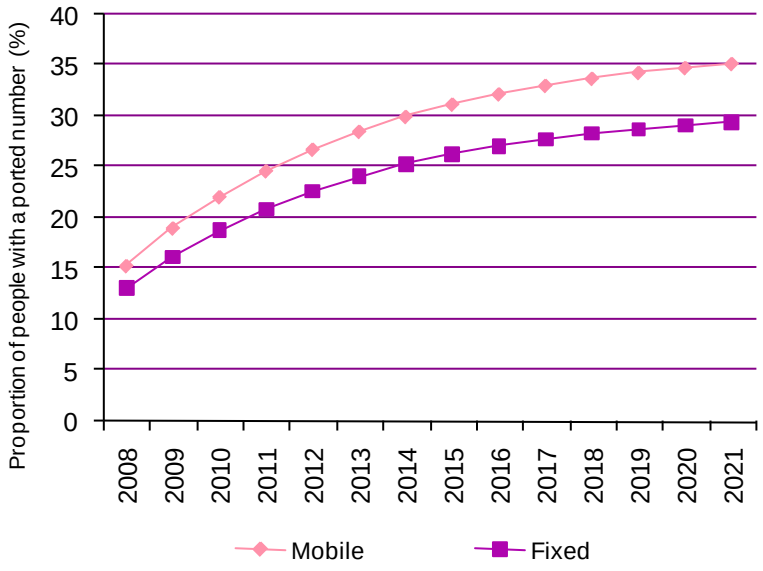
A5.66 We do not have specific information on the number of fixed subscribers who ported their number when they changed provider. Therefore we have used the level of porting in mobile as a proxy for fixed porting (i.e. 45% of switchers port). We have also assumed 1% of previous porters 'abandon port', and 15% of previous porters actively want to change number when they switch again. Following the methodology outlined above this means the percentage that stop port in a given year is 1%.[90]

A5.67 Estimating the proportion of reporters and unporters who unport is more difficult for the fixed market because the market structure is characterised by a large firm (BT) with around 63% market share of exchange lines, followed by Virgin on 15% and a larger number of smaller providers.[91] We have assumed that there is a 50% chance that a previous porter will unport, on the basis that a large number of subscribers may move to and from BT.

A5.68 Based on the above methodology and input assumptions the forecast for the proportion of fixed and mobile subscribers with a ported number is presented below:

[89] See http://www.ofcom.org.uk/research/tce/ce08/research.pdf, Figure 110
[90] Calculated as % who switch * % who don't port * % who want a new number = 12%*52%*15% =1%
[91] Markets shares of exchange lines are taken from the telecommunications market data tables see http://www.ofcom.org.uk/research/cm/tables/q4_2008/q4_2008.pdf Table 2.

Figure A5.5: Proportion of fixed and mobile subscribers with a ported number



Source: Various

Minutes to ported numbers which are not OR

A5.69 The calculations above allow us to estimate total traffic and the percentage of people who have ported. This gives us an estimate for total minutes to ported numbers. However, as noted previously we need to adjust this for calls to ported numbers which are not OR (i.e. call trap minutes and traffic where the originator and the range holder are the same) in order to obtain total OR minutes.

Call trap minutes

A5.70 The Section 135 information we collected showed that three of the five MNOs currently have call trap in place, with one further MNO expected to implement call trap before 2012. The information received from FNOs (where provided) suggested that they had implemented call trap for parts of their networks e.g. [✂].

A5.71 To estimate the impact of call trap on mobile to mobile calls we have used actual information from one operator which was provided in response to the July 2007 statement and consultation on number portability. The operator reported that total ported in volumes fell by around 30% when they implemented call trap functionality. Based on this operator's experience, we assumed that all MNOs will experience a similar reduction in ported-in volumes (and thus onward routed traffic) through the implementation of call trap.[92] Furthermore we have made the conservative assumption that all MNOs will have implemented call trap by 2012. (As noted above, it is possible that only four MNOs will have call trap in place by 2012). Therefore, in aggregate, we assume that 30% of mobile originated minutes to mobile ported numbers will be call trapped.

A5.72 We do not have enough information from FNOs to estimate fixed call trap across the industry. This is because FNO call trap arrangements apply to parts of the fixed

[92] This implies that other mobile networks have a similar proportion of on-net minutes.

network and differ from operator to operator. In the absence of actual call trap figures we have assumed that the same proportion of fixed to fixed ported minutes will be trapped as for MNOs above. Further we have assumed that all FNOs have call trap. Therefore we assume that 30% of fixed to fixed minutes to ported numbers will be call trapped.

Calls where the originator and the range holder are the same operator

A5.73 As noted above, when the call originator and range holder are the same a call to a ported number will not be onward routed. We have assumed that 20% of mobile originated minutes to mobile ported numbers will have the same originator and range holder. (Based on the fact that there are five large MNOs and the originator of a call to a ported number has a one in five chance of also being the donor). Therefore, in aggregate, we assume that 20% of mobile originated minutes to mobile ported numbers will have the same originator and range holder and thus not be onward routed.

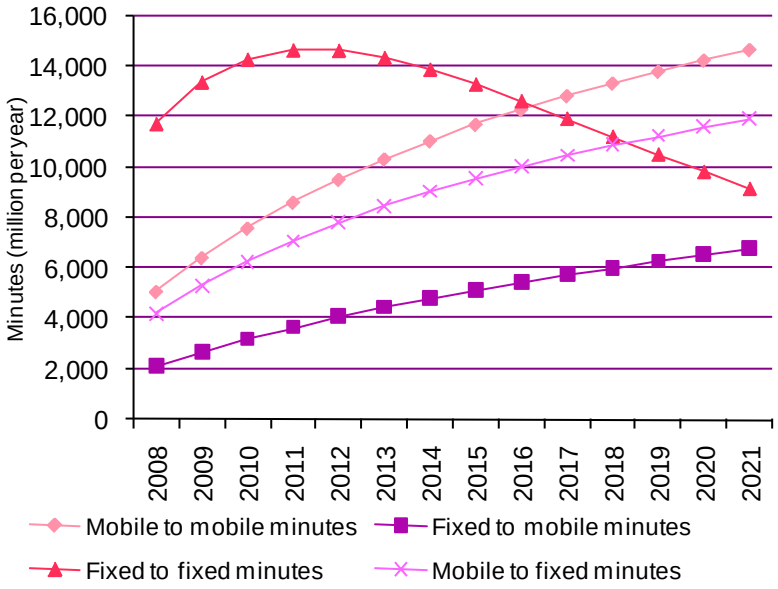
A5.74 This means that in total (i.e. including call trap as described above) 50%[93] of mobile originated minutes to mobile ported numbers are not OR.

A5.75 For fixed to fixed calls we have not made an adjustment for minutes to ported numbers where the originator and the range holder are the same operator. Making this adjustment would not affect our proposals since the NPV for fixed to fixed calls is negative (see figure A5.10), and making such an adjustment would make the NPV more negative. For fixed to fixed calls we lack information to estimate the proportion of originated calls where the originator and the range holder are the same party.

A5.76 Combining the projections for traffic, porting and minutes to ported numbers which are not OR enables us to forecast OR minutes over time.

[93] This comprises 30% of minutes which are call trapped plus 20% of minutes where the originator and the range holder are the same operator.

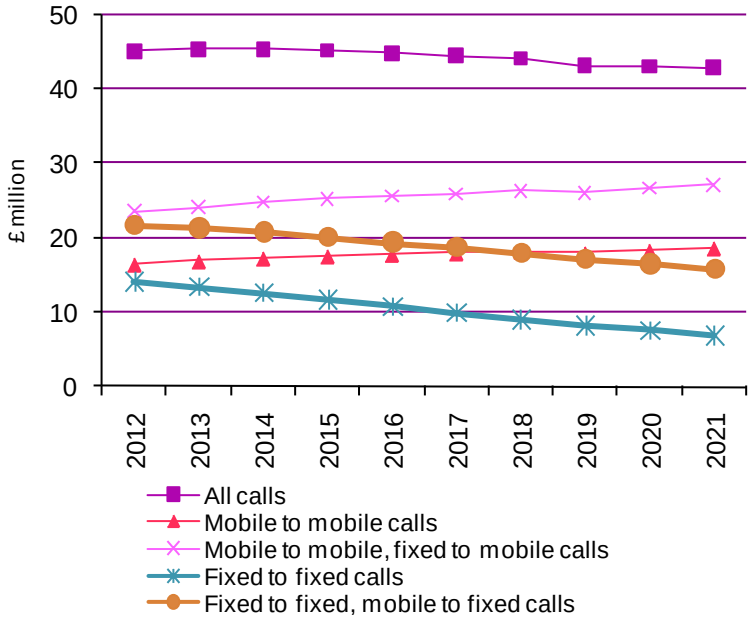
Figure A5.6: Onward routed minutes per year



Source: Various

A5.77 Multiplying OR minutes by the costs of OR allows us to calculate the costs which would be avoided by DR. These are shown in the chart below for each call type configuration.

Figure A5.7: Costs avoided by direct routing per year



Source: Various

Costs of direct routing

A5.78 We have identified three types of cost associated with DR:

a) cost of building, maintaining and operating a database of ported numbers (CDB);

b) porting programme office costs – administrative costs of setting up and managing the CDB; and

c) operator specific costs of adapting systems to incorporate CDB and DR.

A5.79 Each cost is considered in turn.

Costs of building and maintaining a CDB

A5.80 In response to the November 2007 Statement, fixed and mobile network operators set up a UKPorting group to discuss the specification of a CDB for DR of fixed and mobile calls to ported numbers. Prior to the group disbanding some information was provided from third party providers on the proposed database build and operating costs for an 'all call' CDB[94]. The estimates for the total capital and operating costs [✂].[95]

A5.81 We have used this information to estimate the capital and operating costs for each of the call type configurations up to year [✂]. We have made some adjustments to the costs where the UKPorting specification differed from that required for the particular call type configuration (e.g. related to the removal of the real-time query interface and a reduction in the scale of the database). [✂] The capital and operational costs for each model configuration are summarised below:

Figure A5.8: CDB capital and operating costs[96] (2008 prices)

[✂]

Porting programme office costs

A5.82 As noted above, following the November 2007 Statement a UKPorting group was formed to administer the UK porting solution. For the nine months this group was in operation the total billed costs to participants were [✂].[97] We have assumed that the average monthly costs for the new porting programme office will be the same as previously in the initial setup year. Therefore the total initial cost (or capex) for the porting programme office is estimated at [✂]. This is probably a conservative assumption because the original UKPorting group was dealing with both changes to the mobile porting process and changes to the routing arrangements. We assume this cost is the same regardless of the call type configuration.

A5.83 We have also assumed that the porting programme office (or another organisation) would need to hold the contract for the CDB on an ongoing basis after the CDB is operational to perform functions including collecting the money from the stakeholders, paying the invoices from the CDB vendor, checking that the service level agreements are being met and dealing with any disputes that arise. We have

[94] To DR all mobile and fixed calls.
[95] Information redacted to protect commercial confidentiality.
[96] These are actual costs not net present values.
[97] The UKPorting costs have been redacted to protect commercial confidentiality.

approximated that the ongoing costs will be around [✂] per year. Again, we assume this cost is the same regardless of the call type configuration.

Operator specific costs

A5.84 We asked FNOs and MNOs to provide an estimate of their operator specific costs of implementing DR based on the UKPorting specification drawn up in 2007/8 as part of a wider Section 135 request.

Capital costs

A5.85 Most operators were able to provide an estimate for the initial capital costs associated with implementing DR. Where an operator provided a range for the estimated costs we have used the midpoint. For MNOs the costs ranged from [✂] with a total capital cost of £28m. Some MNOs commented that these costs were only applicable for DR of mobile to mobile calls and additional costs would be incurred should DR be implemented for mobile to fixed calls. The total additional costs were estimated at £53m. These additional costs have been factored in for the relevant call type configurations.

A5.86 For FNOs the initial capital costs ranged from [✂]for DR of all calls (as per the UKPorting specification). The FNO costs were wider ranging than those for the MNOs due to the large differences in operator size and the types of technology used.

A5.87 We only requested cost information from the main FNO market players. We have scaled up the estimated costs to reflect the rest of the industry by estimating a cost per originated minute[98] across all those providing information, and then multiplying the resulting per minute cost by total fixed originated minutes per year (as taken from the Ofcom telecommunication market data tables[99]). The information we received from FNOs did not suggest a clear relationship between scale and cost so we have assumed that the cost per minute does not vary significantly with size of operator. Thus, we estimate the total capital costs for FNOs to be £122m (including scaling up for the fixed industry as a whole).

A5.88 Separately we estimated internally the costs for DR of fixed to mobile calls alone, which we conservatively assume to be £80m.[100]

A5.89 The table below summarises the operator specific capital costs for FNOs and MNOs under each model configuration.

[98] We took annual originated minutes for calls to geographic UK numbers and calls to mobiles.
[99] We took annual originated minutes for calls to geographic UK numbers and calls to mobiles.
[100] We consider this estimate to be conservative because fixed to mobile traffic comprises a relatively small proportion of total fixed originated traffic (around 10% in 2008), thus if we pro rata the total costs based on based volumes the fixed to mobile costs would be much lower. In addition, fixed to mobile routing is simpler (and less costly) than fixed to fixed routing because, amongst other things, there are fewer mobile operators and there is less complexity in the numbering scheme. Furthermore, this does not imply that the cost for fixed to fixed calls alone is 122m-80m = 42m since there are significant shared and common costs.

Figure A5.9: Operator specific capital costs

Model configuration. DR for:	FNO capital costs £m	MNO capital costs £m	Total costs £m
All calls	122	81	203
Mobile to mobile	-	28	28
Fixed to fixed	122[101]	-	122
Fixed to fixed and mobile to fixed	122	81[102]	203
Mobile to mobile and fixed to mobile	80	28	108

A5.90 We believe the costs provided will be an upper bound for the following reasons:

a) a number of stakeholders have expressed the view that the specification developed by UKPorting was, in respect of some aspects, over engineered and contained a number of capabilities that were inserted at the request of a minority of operators. Nevertheless we understand that these aspects were retained in the final specification in order to expedite progress and there was insufficient time to consider how to optimise the solution due to the tight timescale. We have not adjusted the operator specific cost estimates which were based on the UKPorting specification, thus the costs are likely to be overstated in particular if the requirement is to support only a limited set of call types.

b) a number of operators have made representations to us that the timescales associated with implementing the previous UKPorting solution were tight, and as a result were increasing the complexity of simultaneously implementing and testing both the porting requirements and already planned network upgrades, and that this complexity was driving up costs.

A5.91 Both of the above factors are likely to result in our estimates above being upwardly biased.

Operator specific operating costs

A5.92 Operators were not able to provide sufficient information in response to the Section 135 request to accurately estimate operator specific operating costs. To calculate operating costs we looked for a proxy which would enable us to estimate operating costs using the available information on capital costs. We have therefore used the

[101] We have taken a conservative approach to the estimation of capital costs for DR of fixed to fixed calls.
[102] We have taken a conservative approach and assumed that, in DR mobile to fixed calls, MNOs incur the full mobile to mobile and mobile to fixed capital costs (i.e. the mobile to fixed capital cost is required over and above that required for DR of mobile to mobile calls alone). This is because the mobile to mobile costs include some of the enabling capabilities for direct routing.

mobile call termination cost model for this purpose because it has information on single asset capital and operating costs over time. We have calculated the ratio of operating to capital costs for relevant assets in the mobile call termination model, and applied this ratio to the capital cost figures supplied by Section 135 respondents to estimate operating costs.

A5.93 We identified the switching and software assets in the mobile call termination cost model which are similar to those required for DR (these are the mobile switching centre (MSC) processor and software for a 2G network and the MSC server and media gateway for a 3G network). We summed the 2G and 3G capital and operating costs separately over the period 2009/10-2020/21. Then we divided the summed operating costs by the summed capital costs to calculate the opex:capex ratio for 2G and 3G assets. The resulting 2G and 3G ratios were weighted by the average proportion of traffic forecast to be carried on 2G and 3G networks over 2009/10-2020/21 (also from the mobile call termination cost model) to estimate a combined 2G/3G ratio. The traffic forecast was lagged two years i.e. the 2007/8 forecast was used for 2009/10 to reflect the fact that it takes some time for the benefits of falling traffic to flow through to operating costs. The resulting 2G/3G ratio was 13%.

A5.94 We have also factored in that operating costs will change in line with the volume of DR minutes for each call type configuration. The rationale here is that costs will increase as the equipment has to handle more ported minutes. Therefore the opex:capex ratio changes in line with the percentage change in ported traffic in each year (with 2012 as the base year) e.g. if the volume of ported traffic rises by 10% then the opex:capex ratio rises by 10%. We have conservatively assumed that the cost volume elasticity is 1 which could mean the operating costs are overestimated (it is possible that operating costs will not rise 1:1 with volumes due to the presence of traffic invariant fixed costs).

A5.95 This methodology was applied to calculate mobile and fixed operator operating costs.

Results

A5.96 Following the methodology and assumptions outlined above, the NPV for each of the call type configurations over a horizon of seven and ten years is as follows:

Figure A5.10: NPV for each call type configuration

Call type configuration Direct routing for:	NPV £m	
	7 Years	10 Years
All calls	-118	-108
Mobile to mobile	16	26
Fixed to fixed and mobile to fixed	-205	-215
Fixed to fixed	-130	-137
Mobile to mobile and fixed to mobile	-81	-86

A5.97 The only model configuration which produces a positive NPV is the mobile to mobile variant. The other configurations have negative NPV's due to a combination of higher costs and lower benefits:

a) FNOs reported higher operator specific costs than MNOs. In addition MNOs reported high operator specific costs for mobile to fixed calls (relative to mobile to mobile only);

b) the volume of fixed to fixed calls is forecast to decrease over the model horizon which reduces the potential avoidable costs for this variant; and

c) including fixed to mobile calls with mobile to mobile calls results in a large increase in the operator specific costs (initial capital costs are almost four times higher) but a smaller increase in benefits (avoidable costs increase by only around 40% in 2012).

Sensitivity testing – mobile to mobile configuration

A5.98 We have only conducted sensitivity and scenario analysis for the call type configurations which generate a positive NPV (i.e. for mobile to mobile calls). Throughout this analysis we have generally used our best central estimates for the input parameters. Where there has been significant uncertainty around specific inputs we have generally taken a conservative approach which is likely to have understated the benefits of implementing DR. We recognise that there is uncertainty around the input values so we have created some sensitivity scenarios in order to show how changing specific inputs will affect the NPV. We have conducted two types of analysis:

a) we have conducted the sensitivity analysis changing one input at a time, while holding the other inputs constant at the 'base' values. We refer to this exercise as the 'individual sensitivity scenarios'. The approach taken is to vary each input by +/-20%. Most of the inputs are associated with forecast values projected out to 2021. In this case the sensitivity testing shifts the entire forecast path for the input by +/-20%. This analysis enables us to determine which inputs the NPV is most sensitive to (the 'key inputs'); and

b) we have constructed low case and high case scenarios by taking the key inputs and varying them simultaneously. As a result, the range of NPVs between the low and high cases is significantly wider than for the individual sensitivity scenarios.

Individual sensitivity scenarios for mobile originated calls to mobile ported numbers

A5.99 The individual sensitivity scenarios allowed us to identify the five key inputs to which the NPV is most sensitive. The results are presented in the table below for the base case time horizon of ten years:

Figure A5.11: Individual sensitivity scenarios

Input	Sensitivity, base +20%		Sensitivity, base -20%	
	NPV £m	Change relative to base case £m	NPV £m	Change relative to base case £m
Base case NPV	26			
% of subscribers with a ported number	42	+16	10	-16
Conveyance cost (excl transmission)	36	+10	16	-10
Call trap	16	-10	36	+10
Operator specific capex	17	-9	35	+9
WACC	21	-6	33	+7

Low and high case scenarios

A5.100 The sensitivity scenarios capture the impact of changing one input at a time. We have also created a 'low case NPV' and a 'high case NPV' by changing the five key inputs simultaneously.

A5.101 In the construction of the low and high case scenarios we would prefer to use actual information for the plausible low and high values of the inputs. In this case the information available does not allow us to specify low and high value with sufficient confidence. Therefore, in the absence of better information, we regard +/-20% as a reasonable variation in input values to construct the low and high cases. Although larger variations in the input values are possible, the low and high cases involve simultaneous variation in the values of five inputs. In practice, the greater the variation in each input value, the less likely that such simultaneous variation would occur at the assumed low and high values away from the base case.[103]

A5.102 The 'low case' scenario is created by setting the key inputs to the values that imply lower benefits and higher costs. The 'high case' scenario reflects more optimistic values for the key inputs: larger benefits and lower costs. The results are set out in the table below:

[103] We have not attempted to construct probability distributions for each input value, but we generally consider it reasonable to regard the probabilities as being larger in the region of the base case value and lower for values further away (e.g. in the tails of the distribution).

Figure A5.12: Low and high case NPV scenarios for mobile originated calls to mobile ported numbers (based on 7 and 10 year horizon)

Scenario:	NPV £m	
	7 Years	10 Years
Base case	16	26
Low case	-16	-15
High case	66	90

A5.103 Under the high case scenario the NPV is significantly greater at £90m over ten years and £66m over seven years. Under the low case scenario the NPV is negative at -£15m over ten years and -£16m over seven years. Therefore, we could not rule out the possibility of a negative NPV if there was substantial downside variation to several key inputs simultaneously. However, we consider that scenarios which result in negative NPVs are less likely, as they rely on all of the key inputs simultaneously taking values which reduce the benefits and increase the costs relative to the base case.

A5.104 Therefore, based on the above analysis, we consider that the introduction of DR for mobile to mobile calls is likely to yield a positive net benefit.

Question A6.1: Do you have any comments on the assumptions used in the CBA?