OFFICE OF COMMUNICATIONS

Review of General Condition 18 – Number portability

Consultation

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Consumer objectives

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1.3 This objective, to make it easy and swift for consumers to switch provider, is central to Ofcom's proposals in relation to port lead times. Ofcom considers that excessively long port lead times may discourage consumers from switching provider, which in turn may have an adverse impact on competition between providers.

1.4 In relation to the routing of calls to ported numbers, Ofcom's key objectives concern the protection of consumers against network failure and ensuring the efficient use of networks. Ofcom recognises that in respect of the existing routing system for mobile ported numbers there may also be a misalignment of incentives for operators to port numbers.

The purpose of this consultation

1.5 Ofcom is considering the implementation of number portability in the context of the development of Next Generation Networks ("NGNs") in the UK and in relation to mobile networks. BT has announced its 21CN plans, which set out to replace progressively its core network with an architecture based on NGN technology. Many other network operators are either planning or have begun implementation of networks based on NGN designs.

1.6 Ofcom is also using the opportunity of this consultation to consider and review the issue of mobile port lead times. Ofcom is considering whether the current industry agreed five day process should be reduced to a shorter period.

Proposals

Routing of calls to ported numbers

1.7 The present analysis appears to favour transition from the current onward routing solution for routing of calls to ported numbers to an all-call query of a common database of numbers ("ACQ/CDB") solution for both fixed networks, in the course of their transition to NGN technology, and for mobile networks. Ofcom considers that such a solution would be likely to achieve independence

of the routing of calls to ported numbers from Donor Networks[1] and maximum efficiency gains from all forms of calls, however originated or terminated. This solution would also eliminate potential imbalances in the mobile industry's distribution of revenues.

1.8 The analysis of the costs and benefits of the transition in the mobile industry suggests that, while migrating to a common solution for both fixed and mobile networks should deliver the optimal outcome, this may be best achieved by migration of the mobile industry to the ACQ/CDB solution ahead of that in fixed networks because switches employed in mobile networks are likely to already be capable of carrying out queries on their databases on every call. Ofcom considers that the completion of such a transition should be achievable by September 2009. It could, in addition and subject to analysis of detailed information from industry on costs and benefits, be appropriate to require the mobile industry to complete a comprehensive transition to direct routing using Network Interoperability Consultative Committee ("NICC") Service Description 8[2] or other agreed standard, within one year from the date of Ofcom's final notification.

1.9 Ofcom considers that a full transition of fixed networks to an ACQ/CDB solution should be achievable by the end of 2012.

1.10 Ofcom has identified the following as feasible intermediate milestones for a possible transition to ACQ/CDB:

a) Stable standards agreed by the NICC – June 2007

b) Governance arrangements for the database agreed by industry – July 2007

c) Common database established, available for voluntary use – September 2008

d) Records of all ported numbers hosted on NGN nodes to be populated in the database – September 2009.

Mobile port lead times

1.11 The benefits of shorter port lead times ensure that consumers are able to switch providers as quickly and as easily as possible. Excessively long port lead times may discourage consumers from switching providers or potentially delay consumers from commencing service on better terms with a new provider.

1.12 In Ofcom's view the shorter the process, the better it is for competition and consumers. Therefore Ofcom is proposing to reduce mobile port lead times to a period of less than one working day. However, if Ofcom receives evidence that shows that the costs involved in moving to a lead time shorter than one working day outweigh the benefits then Ofcom will need to consider whether a three working day period is more appropriate in light of the evidence received. It would currently appear that the current mobile porting process can be reduced to three working days without the mobile operators incurring significant costs.

1.13 This review is not considering port lead times for fixed networks as these are currently being considered by Ofcom's project looking at migration, switching

[1] The network to which the consumer originally subscribed.
[2] http://www.nicc.org.uk/nicc-public/Public/interconnectstandards/ser/nd1208_2005_08_2.pdf

and mis-selling. Ofcom consulted on its proposals for the establishment of common principles on migrations, switching and mis-selling across transferable products in early 2006[3]. A further consultation document on this is expected to be published in the early part of 2007.

Modification of General Condition 18

1.14 Ofcom is proposing to modify General Condition 18 to give effect to its proposals as set out above. The formal notification is set out at Annex 9.

[3] The document entitled *Migrations, switching and mis-selling* can be found at http://www.ofcom.org.uk/consult/condocs/migrations/migrations.pdf

Section 2

Introduction and background

Introduction

2.1 Number portability is a facility that enables subscribers, who so request, to be able to retain their telephone number(s) when they change from one provider to another provider.

2.2 Number portability is important both as a facilitator of consumer choice and effective competition; many subscribers are reluctant to consider changing their provider if this means they have to change telephone numbers. The importance of its role in competition has been recognised by the European Union ("EU") and has been a requirement under EU law in respect of fixed services since January 2000 and mobile services since July 2003.

2.3 The UK recognised the benefits to competition of requiring number portability in the early 1990s and was one of the first countries to introduce rights to port. Under the Telecommunications (Interconnection) Regulations 1997[4], the Director General of Telecommunications (the "Director") was required to ensure number portability. Accordingly, fixed line operators were required to provide portability, on a reciprocal basis, from 1997 and, on a similar basis, mobile operators were required to provide mobile portability from 1999.

Consumer objectives

2.4 There are a number of consumer benefits associated with number portability. As stated above, number portability facilitates consumer choice and effective competition by allowing consumers to retain their telephone number when they switch provider. This makes switching a more attractive proposition as consumers may be reluctant to switch if they have to go through the inconvenience and possible expense of changing their telephone number.

2.5 This objective, to make it easy and swift for consumers to switch provider, is central to Ofcom's proposals in relation to port lead times. Ofcom considers that excessively long port lead times may discourage consumers from switching provider which in turn may have an adverse impact on competition between providers.

2.6 In relation to the routing of calls to ported numbers, Ofcom's key objectives concern the protection of consumers against network failure and ensuring the efficient use of networks. Ofcom recognises that in respect of the existing routing system for mobile ported numbers there may also be a misalignment of incentives for operators to port numbers.

2.7 The relevant consumer objectives in relation to the proposals set out in this document are discussed in more detail in Sections 3 and 4.

[4] at Regulation 11

The legal basis for number portability

2.8 Currently, the UK is required to ensure the provision of number portability to subscribers of publicly available telephone services, including mobile services, by Article 30 of the Universal Services Directive (2002/22/EU).

2.9 Sections 45 and 58 of the Communications Act 2003 (the "Act") provide Ofcom with the power to set general conditions requiring UK communications providers to provide number portability.

2.10 Obligations imposed on a communications provider to provide number portability to its subscribers and to provide portability to other communications providers are set out in General Condition 18[5].

2.11 General Condition 18 was recently amended to remove the formal requirement for portability to be provided in accordance with the Number Portability Functional Specification[6]. This was in order to permit portability between different types of network thus facilitating inter-platform competition.

Implemented solutions

2.12 The costs and benefits of implementing geographic number portability were first explored in 1994. The chosen method of implementation, developed by industry through the Network Interoperability Consultative Committee (NICC), was Onward Routing. With Onward Routing calls are first routed to the network to which the consumer originally subscribed, known as the Donor Network. The donor is responsible for routing the call onward to the network to which the consumer now subscribes, known as the Recipient Network. The network on which a call originates need not be aware of the fact that the called number has been ported from the Donor Network, and can treat it like any other call, routing it based solely on analysis of the digits of the dialled number. Since the introduction of number portability in the UK in 1997, fixed networks have used Onward Routing to route calls to ported numbers.

2.13 In the mobile sector, number portability was introduced in 1999. In principle, the implemented solution for mobile number portability is similar to that used in fixed networks and can be described as Onward Routing. A call to a ported number is usually delivered by the originating network to the Donor Network, which identifies that the number has been ported, to which network the number has been ported and subsequently "onward routes" the call to the appropriate Recipient Network for termination to the called subscriber.

Failure of a network

2.14 In the event of failure of a network, for example if it ceases trading, there is a risk that its customers lose the right to number portability, because it will no longer be able to forward calls. Therefore, unless arrangements can be made for an alternative operator to take over either the assets of the failed network or

[5] General Condition 18, which came into force on 25 July 2003, was set by the Director by way of a publication of a Notification pursuant to section 48(1) of the Act dated 22 July 2003 and was contained in the Schedule to that Notification[5]. The Notification can be found at www.ofcom.org.uk/licensing_numbering/numbers/num_port_info/section48.pdf.

[6] The statement entitled *Number portability and technology neutrality* containing the formal notification can be found at http://www.ofcom.org.uk/consult/condocs/numport/mod/

its number range, customers would have to accept a new telephone number when changing provider. In addition, once a network has failed, its former customers who had ported their number to another provider before the failure would not only need to change their phone number, but, until they do so, would also lose all their incoming calls. This happened when the loss of Atlantic Telecom in 2001 resulted in Atlantic customers, and customers of other communications providers who had ported their telephone numbers from Atlantic, losing service on their numbers.

Previous proposals to change the framework for portability

The 2002 consultation

2.15 In June 2002, Oftel consulted on issues with the current Onward Routing system of number portability and specifically in relation to the failure of this approach to protect the number portability rights of customers of failed networks[7]. Oftel identified that a common database of telephone numbers could remove the need for onward routing, allowing any originating network to look up the current hosting network for each called number, and use this information to route calls to ported numbers directly to their Recipient Networks. This approach, known as direct routing using all-call query would remove dependence on the Donor Network.

The 2004 consultation

2.16 In August 2004, Ofcom consulted on alternative solutions for UK number portability[8]. The consultation sought the views of stakeholders on Ofcom's economic assessment of CDB solutions, such as those adopted in several EU countries, the US and elsewhere. Ofcom's assessment was informed by a report commissioned from Mason Communications Limited ("Mason") which was published alongside the consultation[9]. In its statement of June 2005[10], Ofcom considered that, looking over a ten year period, the costs of CDB solutions in the context of currently deployed circuit-switched network technology were likely to exceed the benefits. The switches in existing networks would require extensive adaptation to enable them to query a database on every call, and this was a major contributory factor to high costs. An ACQ solution, where all calls are queried against a porting database and routed directly to the network serving the subscriber, was shown to carry a net cost of £200.6 million.

2.17 Ofcom highlighted that migration to NGNs over a five to ten year time frame offered opportunities to migrate to a new solution for number portability. But investment now in legacy circuit-switched infrastructure risked assets becoming obsolete in only a few years time.

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[7] The document entitled *Proposals to change the framework for number portability* can be found at http://www.ofcom.org.uk/static/archive/oftel/publications/numbering/2002/nupo0602.htm

[8] This document is available on the Ofcom web site at http://www.ofcom.org.uk/consult/condocs/uk_numb_port/uk_numb_port_cons/?a=87101

[9] This report can be found at http://www.ofcom.org.uk/consult/condocs/uk_numb_port/uk_numb_port_cons/mason/mason_report.pdf

[10] This document can be found at http://www.ofcom.org.uk/consult/condocs/uk_numb_port/statement/261832.pdf

Next generation networks

2.18 NGNs are based on the Internet Protocol (IP). Routing in such networks is based on processing of IP addresses rather than of telephone numbers. It is inherent in the way NGNs operate that they must translate all telephone numbers to IP addresses, and this requires the querying of appropriate databases on every call.

2.19 Ofcom noted in its 2004 consultation that the move to NGNs would be a timely opportunity to revisit the implementation of number portability and stated its expectation that a more robust solution should be adopted in an NGN environment. This position was re-iterated in March 2006, in Ofcom's Statement entitled *Next Generation Networks: Developing the Regulatory Framework*[11] ("the NGN statement").

2.20 As part of the present consultation Ofcom proposes to re-examine the implementation of number portability in the context of the development of NGN's in the UK. BT has announced its 21CN plans, which set out to replace progressively its core network with an architecture based on NGN technology. Many other network operators are either planning or have begun implementation of networks based on NGN designs.

Port lead times

2.21 In accordance with Ofcom's commitment set out in the NGN statement, Ofcom is also using the opportunity of this consultation to consider and review the issue of mobile port lead times. Ofcom considers that excessive port lead times may have the potential to act as a disincentive to switching providers and be detrimental to consumers. Ofcom is therefore considering whether it should reduce the current five day process to a shorter period.

Process

2.22 Ofcom's consultants, Sagentia, have carried out a pre-consultation with both fixed and mobile operators. The work of the consultants is set out in more detail in Section 3. In addition, Ofcom has also received submissions from interested third parties in relation to both the issue of routing of calls to ported numbers and port lead times. However, as detailed in Sections 3 and 4, Ofcom is likely to need further evidence from stakeholders before concluding on the issues and amending General Condition 18. Therefore, there may need to be a short supplemental consultation early next year where Ofcom sets out its final proposals in light of all the evidence it has received.

[11] This can be found at http://www.ofcom.org.uk/consult/condocs/nxgnfc/statement/, at paragraph 5.16

Section 3

Routing of calls to ported numbers

Introduction

3.1 As part of the present consultation, Ofcom is considering the implementation of number portability by communications providers. In particular, Ofcom has considered whether existing routing arrangements remain appropriate in the context of the development of NGNs and in relation to mobile networks.

Achieving Ofcom's objective for Direct Routing – ACQ/CDB

3.2 Ofcom's objective in relation to the routing calls to ported numbers is to remove the dependence on the Donor Network. Such dependence can leave consumers exposed to certain impacts from network failures which may be avoidable, as explained further below. It can also affect quality of service if congestion occurs on the Donor Network, as a result of increased traffic passing through the Donor Network. In addition, it can delay the effective introduction of new services and features by one or more competing operators. For example, when certain mobile operators introduced video calling services, they were unable to offer this service to customers who had ported their numbers if the Donor Network did not offer video calling itself.

3.3 As explained in Section 2, with Onward Routing only the Donor Network needs to change its routing when a number is ported. All other networks need take no action specific to calls to a ported number and can route them like every other call according to analysis of the dialled digits. Calls to a ported number are routed automatically to the Donor Network, which then routes them to the Recipient Network.

3.4 The removal of dependence on the Donor Network in routing calls to ported numbers requires that a network routing a call identify the Recipient Network without reference to the Donor Network. This in turn requires the existence of a common database storing at least each ported number and the identity of the corresponding Recipient Network. A network can only determine if a called number is ported by looking that number up in the database, and a query to the database is therefore required for the routing of all calls. Solutions based on this approach are described as all-call query to a common database, or ACQ/CDB. Based on the foregoing, Ofcom's view is that ACQ/CDB is necessary if removal of dependence on the Donor Network is to be realised. Such a solution would also deliver the conveyance efficiency benefits of direct routing, and other benefits which are explained further under the options below.

3.5 It is important to clarify that the design of an ACQ/CDB does not require the querying of a common database infrastructure on all calls in real time by all UK networks. Considerations of network resilience, integrity, technology neutrality and cost are likely to require that a common infrastructure is used as a master source, whose data is replicated from time to time in the networks' own real-time databases, which in turn are queried on all calls by their respective networks. In other words, the use of ACQ/CDB need not compromise the security, integrity and reliability of any network.

3.6 In light of the above, Ofcom considers that an ACQ/CDB solution is the appropriate means by which to remove the dependence on the Donor Network in routing calls to ported numbers.

Consultancy study

3.7 To inform its work on this consultation, Ofcom has asked the consultancy firm Sagentia to examine the costs and benefits of the implementation of a solution for number portability based on the use of a CDB for both fixed and mobile networks. In conducting this exercise, Sagentia interviewed a number of network operators during August and September 2006 to inform its analysis.

3.8 As a starting point, Sagentia has used the work carried out by Mason in 2004, described in Section 2 above, which it has revisited in light of the current costs of a CDB solution in TDM networks. Sagentia has also extended the work to assess the costs and benefits in the context of the transition to NGN architectures, and amplified the work on solutions to number portability in the mobile sector. Sagentia's report can be found at Annex 6.

Routing of calls to ported fixed numbers

3.9 Sagentia's report finds that implementation of ACQ/CDB in the fixed network in the context of migration to NGNs is considerably less costly than such implementation in current fixed networks. The report assesses that the net present value over ten years of the savings of conveyance costs through Donor Networks would outweigh the costs of implementation using NGN technology by £15M.

3.10 Sagentia concludes that the net present value of costs of an equivalent implementation of ACQ/CDB in current fixed TDM networks would outweigh the savings by £215M. These findings in respect of fixed TDM networks were similar to those of the previous report by Mason.

Routing of calls to ported mobile numbers

3.11 Sagentia's report also analyses the costs and benefits of implementing direct routing in mobile networks. It assesses that the net present value of donor conveyance costs saved by implementing direct routing of mobile-to-mobile calls to ported numbers outweigh the overall costs of such implementation in current mobile networks by £189M. This analysis uses the donor conveyance charge of 0.8 pence per minute as the cost of conveyance of calls to ported numbers through Donor Networks. The donor conveyance charge was determined by Oftel in 1999 and represented half the cost of conveyance of calls to ported numbers as assessed at that time. While it is likely that the costs of conveyance have fallen since 1999, the charge has not changed. Sensitivity analysis shows that the net present value remains positive even when the conveyance cost is set to 0.1 pence per minute.

Options for the routing of calls to ported numbers

3.12 The costs and benefits are considered for the following options:

- Option 1: No change – maintain Onward Routing
- Option 2: Implementation of ACQ/CDB for fixed TDM networks

- Option 3: Implementation of ACQ/CDB for fixed NGN networks
- Option 4a: Implementation of ACQ/CDB for mobile networks only by 2009
- Option 4b: Implementation of direct routing for mobile networks only within one year
- Option 5: Implementation of ACQ/CDB for both fixed and mobile networks

Option 1: No change – maintain Onward Routing

3.13 The benefit of maintaining Onward Routing is that network operators will not have to incur the costs of switching to ACQ/CDB. It should be noted, however, that network operators would incur some costs in migrating the Onward Routing solution from TDM to NGN architectures. Information gathered during Sagentia's study suggests that these costs are likely to be smaller than the costs of implementing ACQ/CDB. Respondents' views on these costs would be welcome.

3.14 As set out above, a weakness of Onward Routing is that the dependence on the Donor Network leaves consumers exposed to the impact of a network failure of the Donor Network (unless an alternative communications provider takes responsibility for the relevant number blocks). This results in significant inconvenience and cost to consumers who have to invest in promoting their number (for example advertising and stationery) and who face loss of business as a result of having to change the number.

3.15 In addition there are a number of inefficiencies associated with the system of Onward Routing including the additional conveyance capacity required for routing each call to numbers that have been ported from the original provider, the potential for congestion on a Donor Network if the numbers of consumers who port their number is high, the potential for delay in the introduction of new services or features and the costs associated with reallocation of number blocks assigned to failing networks.

3.16 Both fixed and mobile networks incur costs as they invest in and operate donor conveyance capacity in their networks. Since the charges customers pay for calls to ported numbers do not differ from charges for calls to numbers that have not been ported, the industry as a whole recovers its consolidated costs of donor conveyance from overall revenues from customers.

3.17 Under the arrangements in place in the mobile sector, the originating network pays the Donor Network's termination charge to the Donor Network, who then deducts donor conveyance charges and passes the remainder on to the Recipient Network. The net payment to the Donor Network is therefore the donor conveyance charge for the call, while the net payment to the Recipient Network is the Donor Network's termination charge less the donor conveyance charge.

3.18 While customer charges are not directly affected by the current inter-operator settlement arrangements. One impact of these arrangements, however, is that the donor conveyance charge component of inter-operator payments can lead to over- or under-recovery by an operator of its donor conveyance costs. For example, a net exporter of numbers, that is a mobile operator which has cumulatively exported more numbers than it has imported, may enjoy net donor

conveyance payments that exceed its donor conveyance costs. Ofcom estimates, on the basis of information received from mobile operators, that currently the largest net sum of donor conveyance charges paid to an operator is £1.3M per quarter, while the largest net sum of donor conveyance charges paid by an operator is £1.4M per quarter[12].

3.19 In previous statements, Ofcom (and Oftel before it) have concluded that the no change option is appropriate primarily on the basis that the cost-benefit analysis for the implementation of ACQ/CDB in TDM networks did not demonstrate a compelling case for change[13]. Since that time, significant developments have occurred, notably in relation to the introduction of NGNs and, for the reasons set out below, Ofcom is no longer of the view that the no change option is appropriate given the benefits arising from a change to ACQ/CDB.

3.20 In considering options for a change in the routing of calls to ported numbers, for the reasons set out above, Ofcom is of the view that ACQ/CDB is the appropriate means of achieving its objectives. Ofcom has therefore considered how ACQ/CDB could be implemented both within existing network architectures and following the introduction of NGNs and has assessed the impact of each option.

Option 2: Implementation of ACQ/CDB for fixed TDM networks

3.21 The analysis by Mason estimated the capital investment required to implement ACQ/CDB in TDM fixed networks at £267M, with additional operating expenditure at £9M per annum. Sagentia's recent review with operators agreed with these estimates. In addition, the work by both Mason and Sagentia found that the substantial upgrade required for a comprehensive implementation of ACQ/CDB on current fixed network infrastructure could turn out to be impractical because the manufacturers of equipment restrict their support of this legacy technology to maintenance updates only, and the introduction of new features is not available.

3.22 Both Mason and Sagentia assessed the value of the benefits derived from efficiency of conveyance resulting from implementation of ACQ/CDB. By enabling direct routing, conveyance through Donor Networks of calls to ported numbers is avoided. In this part of their work, both consultants restricted their traffic volume projections to calls that both originate and terminate on fixed networks, in other words excluding calls to or from mobiles. The method first adopted by Mason of comparing costs with benefits was carried forward for consistency by Sagentia. This evaluated the net present value of the costs and the benefits over 10 years. The results were similar: Masons calculated a net present value of -£200.6M while Sagentia calculated -£215M. Sagentia's lower figure arises from a fall in porting conveyance charges which have occurred since the Mason's study.

3.23 Even this large negative outcome could underestimate the extent to which costs outweigh the efficiency benefits in this case. Evaluating the costs and benefits over 10 years assumes that the implementation remains effective without

[12] If termination rates among operators were equal the finanancial impact of current arrangements would be confined to the effect described. However, if, as is the case at the moment, the termination rates among mobile providers vary significantly, the settlement arrangements can have a larger financial impact. Ofcom has received submissions from one operator describing and quantifying this impact on its business.

[13] See Section 2 above.

further investment over that time. Since major investments in NGN infrastructure are either planned or in progress by several fixed network operators, it is more likely that any eventual investment in TDM infrastructure would have to be recovered over a significantly shorter period, which would reduce the accrued value of the benefits, and further reduce the net present value. For example, Sagentia's evaluation results in a net present value over 5 years of -£245M.

3.24 In addition to improving efficiency of conveyance, implementation of ACQ/CDB would deliver benefits by mitigating the impacts of network failure on consumers. Such impacts include the loss of the right of number portability by customers of the failed network, and the loss of both incoming calls and the right to number portability by former customers of the failed network who, before the failure, had switched their service to another provider.

3.25 Customers of smaller new entrants are likely to be more exposed to the risk of network failure, and to the impacts described above. The eventual failure of a large network, while not impossible, is unlikely because its customer base should be valuable enough for another company to take it over and provide service to its customers

3.26 Accordingly, it would appear that while there are benefits of mitigating the effects of the loss of number portability to customers and ex-customers of failed networks, they are unlikely to outweigh the net costs of implementation of direct routing in TDM networks of £245M over 5 years. Using the same method as that used for the 2004 consultation, Ofcom's assessment of the benefit per customer resulting from protection against Donor Network failure, based on initial (1993) estimates of £220 per ported subscriber provided by NERA[14], is £296 per ported subscriber in 2005 prices. Using this figure to recover the required investment of £245M for ACQ/CDB would require 827,700 customers to be directly affected over the next five years. The collapse of Atlantic Telecom in 2001 affected 14,000 customers, so justifying the investment would require an expectation of more than 59 network collapses of similar magnitude to Atlantic's to occur over 5 years, which would be very unlikely.

3.27 On the basis of the above, Ofcom remains of the view set out in the June 2005 statement that, at present, all the available evidence shows that the costs of a *comprehensive* transition of fixed TDM networks to ACQ/CDB would be disproportionate to its benefits.

Option 3: Implementation of ACQ/CDB for fixed NGN networks

3.28 Under this option Ofcom has examined the costs and benefits that would arise from mandating a transition to ACQ/CDB in fixed networks to occur in the course of the migration of those networks to NGN architectures.

3.29 The analysis in Annex 6 estimates capital costs for this option of £61.5M, with ongoing incremental operating costs of £1.4M per annum.

3.30 The efficiency benefits derived from saving the costs of conveyance through Donor Networks are assessed in Annex 6 in the same manner as that

[14] A report entitled *Cost-benefit analysis of number portability* prepared for the Office of Telecommunications by NERA, January 1994

described under Option 2. In this case an assessment period of 10 years is considered to be appropriate due to the fact that NGN technology is comparatively new and is therefore unlikely to become obsolete within such a period. The analysis set out in Annex 6 concludes that the net present value of the efficiency benefits exceeds the costs by £15M. This analysis does not take into account the avoided costs of implementing onward routing in NGN networks. The cost estimates used in the analysis are necessarily still subject to uncertainty while detailed designs have not been carried out. Broadly Ofcom considers that the findings of the report justify the conclusion that the costs of implementation and the benefits in saved donor conveyance costs alone result in a cost neutral position under this option.

3.31 As explained earlier, the benefits of mitigating the direct impacts of network failure, as they relate to number portability, has been estimated to be £296 per ported subscriber. These benefits would accrue in addition to the savings in donor conveyance costs and the cost benefit analysis of this option would therefore show a positive net present value.

3.32 This option would take effect progressively over time as fixed network transition to NGN architecture occurs. To the extent that the benefits would therefore be delivered later than a transition to ACQ/CDB under Option 2, this is a disadvantage. However, under this option the cost estimates are proportionate to the benefits and, since it is based on up-to-date technology, carries far less risk of wasted investment. The case for requiring a transition to ACQ/CDB in fixed networks to occur in the course of migration of fixed networks to NGN architectures therefore appears justified.

Option 4: Implementation of ACQ/CDB for mobile networks only

3.33 The equipment used in mobile networks is at present often more modern than that of fixed networks. The switches employed in a mobile network process calls to a mobile phone by looking up the location of the called phone in a database known as the “Home Location Register”, or “HLR”. The location information enables the network to route the call to the switch serving the area in which the phone is located at the time of the call. Therefore, unlike a typical TDM fixed network, a mobile network must be capable of querying its own database of numbers on every call.

3.34 A technical standard, NICC Service Description 8[15], has been developed by the mobile industry to facilitate direct routing between mobile networks. Rather than relying on a common database, the standard defines protocols for the exchange of information during call set-up between the HLR’s of the originating network, Donor Network and the Recipient Network to allow a call to a ported number to be routed directly from the originator to the Recipient Network. It should be noted that, while the full implementation of this standard would avoid the inefficient conveyance of onward routing of mobile-to-mobile calls, it does not eliminate dependence on the Donor Network in the routing of calls to ported numbers, because the Donor Network’s HLR needs to participate in the exchange of information during call set-up.

[15] http://www.nicc.org.uk/nicc-public/Public/interconnectstandards/ser/nd1208_2005_08_2.pdf

3.35 The evidence gathered in the course of Sagentia's study[16] shows that the implementation of this standard has so far been limited. It appears that no network has so far implemented this standard in full.

3.36 Two of the mobile operators interviewed in the study have implemented part of the standard known as **"Call Trap"**. This treats the special case of calls to a ported number whose Recipient Network is also the originating network for the call. Without the call trap function, such a call would first be routed to the Donor Network, only to be routed back to the originating network. The call trap function queries the originator's internal database on every call. If the result shows that the called party's number has been ported into the originator's network, the call is completed by routing entirely within that network, avoiding Onward Routing. If the called party's number has not been ported into the originator's network, the call is routed according to analysis of the dialled digits (which could in turn result in onward routing if the called party's number had been ported to another network).

3.37 Sagentia's report indicates that at least two mobile operators currently implement Call Trap. Therefore, at least two mobile networks already query an internal database of ported numbers on every call. In light of this, the costs of implementation of ACQ/CDB in the mobile industry using current technology may be expected to be lower than implementation costs in fixed TDM networks.

3.38 The analysis set out in Annex 6 estimates the costs of implementing this option as £20M, with ongoing annual operating costs of £2.1M.

3.39 The analysis goes on to assess the benefits due to routing efficiency and concludes that the benefits in reduced routing costs outweigh the capital and operating costs of such a system, with a 10-year net present value of £189M. This analysis uses the donor conveyance charge of 0.8 pence per minute as the cost of conveyance of calls to ported numbers through Donor Networks. The donor conveyance charge was determined by Oftel in 1999 and represented half the cost of conveyance of calls to ported numbers as assessed at that time. While it is likely that the costs of conveyance have fallen since 1999, the charge has not changed. Sensitivity analysis shows that the net present value remains positive even when the conveyance cost is set to 0.1 pence per minute, underlining the robustness of the conclusion of positive benefit.

3.40 Ofcom recognises that the benefits of a full implementation of a direct routing solution such as NICC Service Description 8 would not be distributed evenly between the operators, given existing revenue distribution arrangements under the present Onward Routing arrangements as explained under Option 1.

3.41 By contrast, under direct routing, whether implemented using the mobile industry's standard or using ACQ/CDB, the Donor Network would not receive any payment but would no longer be involved in the process and so incur no extra cost. At the same time, the Recipient Network would receive its own termination charge in full. Therefore, a direct routing method for calls to ported numbers could be expected to yield the same revenues for the terminating operator as calls to non-ported numbers, because terminating operators would

[16] See Annex 6, Section 5.2

receive the termination charges set by them irrespective of whether the number had been ported[17].

3.42 Since the benefits overall appear attractive, it seems appropriate to consider whether they could be achieved in the mobile industry more rapidly than in fixed networks. Two sub-options for transition of the mobile industry are therefore considered below.

Sub-option 4a: Implementation of ACQ/CDB for mobile networks only by 2009

3.43 Under this sub-option the mobile industry would ensure that all mobile-to-mobile calls used ACQ/CDB, using a solution according to a new agreed standard defined by the NICC. Ofcom anticipates that such a standard could be agreed by mid 2007. Industry would then need sufficient time to procure, build and test the solution after the standard is defined and additional time to migrate its operations to use the new solution. Ofcom's assessment of the time required to complete these steps suggests that the solution could be fully operational by September 2009.

3.44 This sub-option would achieve the efficiency benefits of direct routing, drive efficient operator behaviour in respect of number portability as described above, as well as independence of the Donor Network for routing of calls to ported mobile numbers.

3.45 However, since the solution would be confined to mobile networks, additional measures would be required if improvement to the routing of calls to ported numbers in fixed networks is to be achieved.

Sub-option 4b: Implementation of direct routing for mobile networks within one year

3.46 Ofcom recognises that NICC Service Description 8 is already an agreed standard and therefore it might be reasonable to require the mobile industry to complete its transition to direct routing within a timescale of one year from the date of Ofcom's final notification. This could be based either on NICC Service Description 8 or another standard agreed by industry.

3.47 This sub-option could achieve efficiency improvements, avoid the risk of Donor Network congestion, avoid the risk of delay of introduction of new services in mobile networks and drive efficient mobile operator behaviour in respect of number portability within a shorter time frame than Sub-option 4a. However, it would not achieve the consumer protection benefits of independence from the Donor Network in mobile networks. Additional measures would also be required if improvement to the routing of calls to ported numbers in fixed networks is to be achieved.

3.48 In addition, if this sub-option was implemented as an interim step to Sub-option 4a, Ofcom recognises that the costs associated with the implementation of the

[17] One operator has made submissions to Ofcom to the effect that a direct routing system can be expected to allow the Recipient Network, in offering to port customers' numbers, to recover its own efficiently incurred termination costs, in contrast to the current situation where mobile operators can over- or under-recover such costs.

two changes in succession could be substantially higher than the costs of the implementation of each option individually. Ofcom would welcome respondents' views on what these costs are and whether they could be proportionate to the benefits.

Option 5: Implementation of ACQ/CDB for both fixed and mobile networks

3.49 The solution in this option would, as its ultimate objective, target the use of a common database by all fixed and mobile networks in the UK. This would ensure that, once the transition was completed, all calls to ported numbers, no matter how they were originated or terminated, utilised a robust and efficient method of routing. In view of Ofcom's conclusion on the balance of cost and benefits analysed for Option 2 (implementation in TDM networks), consideration of the transition of fixed networks in this option is limited to implementation in the course of migration of those networks to NGN technology.

3.50 The analysis of this option appears in Annex 6. It estimates implementation costs consisting of £73.5M in capital expenditure and recurring operating costs of £2.7M per annum.

3.51 The efficiency benefits of this option include avoidance of routing of all calls through Donor Networks, encompassing not only wholly fixed-to-fixed and mobile-to mobile calls, but also including calls from fixed networks terminated on mobiles, and calls from mobiles terminated on fixed lines.

3.52 The overall comparison of the savings in conveyance costs under this option relative to its implementation costs concludes with a net present value over 10 years of £297M.

3.53 The conclusion of a positive net present value for this option is robust against a reduction of the cost assumption of donor conveyance through mobile networks from 0.8p/min to 0.1p/min, while also being simultaneously robust against increasing the capital costs estimate by £30M.

3.54 The direct benefits to customers of failed networks and the further benefits to competition would accrue in addition under this option.

Preferred Options

3.55 Table 3.1 below summarises the options examined, their estimated costs and their benefits.

Option	Description	Estimated Capex (£M)	Estimated Opex (£M)	NPV of efficiency vs costs	Donor Independence?	Eliminate distortions?
1	No change	0	0	0	No	No
2	ACQ/CDB in current fixed networks	267	9	-215	Calls within fixed networks	No
3	ACQ/CDB in fixed NGNs	61.5	1.4	15	Calls within fixed networks	No
4a	Direct routing in mobile networks	20	2.1	189	No	Yes
4b	ACQ/CDB in mobile networks	20	2.1	189	Calls within mobile networks	Yes
5	ACQ/CDB in mobile and fixed NGNs	73.5	2.7	297	All calls	Yes

3.56 The present analysis appears to favour a phased transition to a common ACQ/CDB solution for both fixed networks in the course of their transition to NGN technology and for mobile networks. The first stage of work of this transition would establish the database using standards consistent with NGN technology. The mobile sector, whose networks are currently more capable of adaptation to ACQ/CDB than fixed networks, would then begin its transition to ACQ/CDB and fully implement ACQ/CDB for all mobile to mobile calls no later than September 2009. Subject to more complete information from industry, an interim additional transition to direct routing, using NICC Service Description 8, or other standard to be agreed by industry, could yield efficiency benefits in the mobile sector within one year of Ofcom requiring the implementation of direct routing. The fixed network sector could begin its transition to use the same database, as NGN infrastructure is deployed over the coming years. A deadline of 2012 would be set to ensure that the transition is not protracted indefinitely, and that all calls use the ACQ/CDB solution, even by networks whose migration to NGN had not been completed by the deadline date.

3.57 Ofcom considers that such a solution would be likely to achieve maximum efficiency gains from all forms of calls, however originated or terminated, and independence of the routing of calls to ported numbers from Donor Networks. This solution would also deliver the other benefit of direct routing, by eliminating over or under recovery of donor conveyance costs in the mobile industry's distribution of revenues for calls to ported numbers. Analysis of the costs and benefits of the transition in the mobile industry suggests that, while migrating to a common solution for both fixed and mobile networks should deliver the optimal outcome, this could be best achieved by migration of the mobile industry to ACQ/CDB ahead of that in fixed networks because switches employed in mobile networks are likely to be already capable of carrying out queries on their databases on every call. A target date of September 2009 seems reasonable for the mobile industry to complete migration to a standards-based ACQ/CDB solution. Ofcom would be interested in respondents' views on such a target date, including assessment as to whether an earlier target date could be achieved.

3.58 In addition, it is appropriate to examine whether a requirement for earlier interim migration of the mobile industry to direct routing, based on the existing standard (NICC Service Description 8) or other suitable standard would be proportionate. While the benefits of consumer protection from some effects of mobile network failure could not be delivered in this way, such interim migration could, among other benefits, deliver the efficiency savings in mobile-to-mobile calls to ported numbers earlier. It is also likely that the mobile industry could implement this method rapidly, because a well-understood standard exists, and implementation within one year of the date of Ofcom's final notification seems feasible. It is not clear to Ofcom whether the additional costs the mobile industry would need to incur in implementing direct routing in this manner ahead of implementing ACQ/CDB would be proportionate to the benefits. Ofcom would welcome respondents' analyses of both costs and benefits of this earlier potential transition.

3.59 The costs of implementing Option 5 – implementation of ACQ/CDB for both fixed and mobile networks - are estimated as £73.5M in capital expenditure, with ongoing operating costs of £2.7M per annum. The efficiency gains, in saved costs of conveyance through both fixed and mobile networks, are assessed as offsetting the costs over ten years by a net present value of £297M. This assessment is robust against a reduction in the assessment of the costs saved in mobile network conveyance by a factor of 8 relative to the current value of the donor conveyance charge, and simultaneously robust against an increase in the estimated capital costs by £30M. The direct benefits to customers of failed networks, and potential benefits to competition as identified above would accrue in addition.

3.60 Comparing the findings of Sagentia's report at Annex 6 with the work previously carried out by Mason, the single largest change favouring an ACQ/CDB solution is that implementation costs in the course of migration of fixed networks to NGN architectures appear to be considerably lower than the costs of comprehensive implementation in TDM networks. The additional benefits that could be achieved by establishing a common solution for both fixed and mobile networks appear to be significant, because fixed-to-mobile and mobile-to-fixed traffic would no longer incur the cost of donor conveyance.

3.61 Since the consolidated financial value of benefits of the common ACQ/CDB solution appear to outweigh the costs to industry as a whole, it is appropriate to question whether intervention by Ofcom is necessary to ensure its implementation. Ofcom's view is that its intervention may be required for the following reasons. Firstly, although industry as a whole will benefit from direct routing, operators are likely to consider only the porting on their own networks and may be less inclined to invest on this basis. Secondly, the manner in which costs and benefits of routing to ported numbers in the mobile industry are currently distributed means that some mobile operators would gain financially from an ACQ/CDB solution while others would lose, and this misalignment of incentives may mean that agreement on a common way forward will not be easily reached by commercial negotiations by the industry. For these reasons, as well as the additional benefits to competition and consumers as described earlier in the section, Ofcom considers that its intervention is necessary.

Question 1: Do you agree that an ACQ/CDB solution is required to achieve independence of Donor Networks?

Question 2: Do you agree that an ACQ/CDB solution common to both fixed and mobile networks is the preferred option?

Question 3: Do you agree that any transition to ACQ/CDB should occur in the course of migration of fixed networks to NGN architectures?

Question 4: Do you agree that it would be beneficial to require the mobile industry to complete its transition to an ACQ/CDB solution by September 2009?

Question 5: Ofcom would welcome respondents' analyses of the costs and benefits of a comprehensive transition of the mobile industry to direct routing using NICC Service Description 8 or other suitable standard within one year, ahead of a further transition to ACQ/CDB.

Transition milestones

3.62 NGN design and planning activities would need to be informed early of a plan for transition to ACQ/CDB. This would require timely agreements of technical standards, and of a commercial framework for designing, building and in-life management and administration of the infrastructure of the common database.

3.63 A possible commercial framework could provide for the formation of an industry body, for example a company limited by guarantee, owned and governed formally by participating network operators. A suitably qualified organisation could be contracted by competitive tender for the design, implementation and in-life management and administration of the database, accountable to the industry body.

3.64 A standard commercial agreement could be developed to ensure that operators not participating in the formal governance of the database could still use it. This type of arrangement could help relieve the burden on new entrants in developing a large number of bi-lateral agreements with other operators for number portability.

3.65 Ofcom considers that the most effective way of achieving the milestones set out in the preceding paragraphs will necessarily require co-operation between operators who are also competitors. Subject to proper arrangements being put in place in order to ensure that no exchange of sensitive commercial information takes place during such co-operation, Ofcom considers that it is appropriate for industry as a whole to agree on the form of implementation of ACQ/CDB. In particular such co-operation will be necessary to ensure that the establishment of ACQ/CDB is consistent with the design of NGN architectures and the governance of the common database.

Question 6: Ofcom welcomes views from stakeholders as to the appropriate approach to be adopted in achieving the implementation of ACQ/CDB whilst ensuring that such co-operation is limited to technical matters directly related to the ACQ/CDB solution.

3.66 Ofcom has identified the following as feasible intermediate milestones for a possible transition to ACQ/CDB:

a) Stable standards agreed by the NICC – June 2007

b) Governance arrangements for the database agreed by industry – July 2007

c) Common database established, available for voluntary use – September 2008

d) Records of all ported numbers hosted on NGN nodes to be populated in the database – September 2009.

Question 7: Do you have any comments on the transition milestones and their corresponding dates? Could the dates be achieved earlier? Alternatively, could any of the dates be at known significant risk of being missed?

Section 4

Mobile port lead times

Introduction

4.1 This section examines the time it takes to port a number from one mobile provider to another and considers whether it is appropriate for there to be a maximum period for mobile porting.

4.2 As set out in Section 2, number portability facilitates consumer choice and effective competition by allowing consumers to retain their telephone number when they switch provider. This makes switching a more attractive proposition as consumers may be reluctant to switch if they have to go through the inconvenience of changing their telephone number.

4.3 It is therefore important that the actual process for switching between providers is swift and easy and does not of itself hinder or discourage consumers from switching. In particular, Ofcom considers that excessively long port lead times may discourage consumers from switching provider. Ofcom is therefore considering whether it is appropriate to require that the current five day process is reduced to a shorter period.

4.4 This review is not considering fixed port lead times as these are currently being considered by Ofcom's project looking at migration, switching and mis-selling. Ofcom consulted on its proposals for the establishment of common principles on migrations, switching and mis-selling across transferable products in early 2006[18]. Given that fixed portability is closely linked to other fixed products such as local loop unbundling and wholesale line rental, it is more appropriate that the migration and switching processes for these products are all considered at the same time. Since the consultation closed on 28 April 2006, Ofcom has engaged with a Migrations Industry Working Group, which was set up with the principal aim of making recommendations to Ofcom that would lead to a single process for all migrations. Ofcom intends to use the formal output of the Group in order to feed into a further consultation document to be published in the early part of 2007.

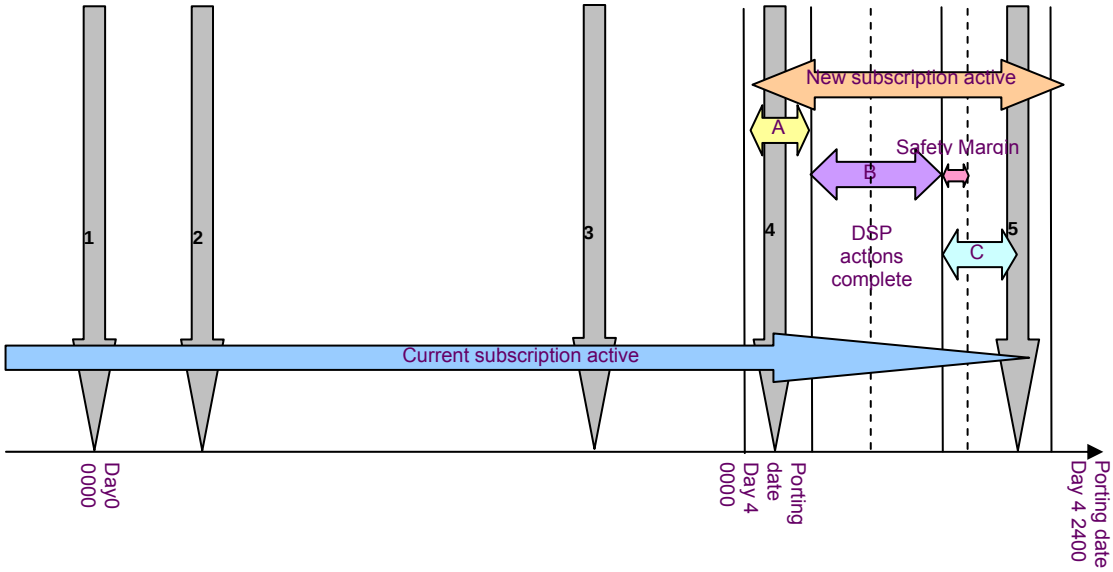
The porting process

4.5 The current mobile porting process was agreed by the mobile industry in October 2001. General Condition 18 does not currently specify a maximum period for mobile number portability to take place. The current mobile porting process has a port lead time of five working days.

4.6 Figure 4.1 sets out the stages of the porting process.

[18] The document entitled *Migrations, switching and mis-selling* can be found at http://www.ofcom.org.uk/consult/condocs/migrations/migrations.pdf

Figure 4.1: Porting process detailed schematic diagram



4.7 There are 5 distinct stages to the porting process:

1 Consumer contacts new provider (Recipient Network) with PAC

2 Recipient Network submits port-out request to Donor Network

3 Donor Network processes port-out request

4 Recipient Network performs port-in of mobile number on port date

5 Donor Network performs port-out of mobile number on port date

A Recipient Network activates the new subscription for the porting number

B Original Network (on which the consumer was first assigned the mobile number) modifies residual subscription this re-routes traffic to the Recipient Network (using Onward Routing)

C Donor Network terminates the current subscription for the porting number

Note: the Original and Donor Network operator will be the same if this is the first port for the mobile number

International benchmarking

4.8 Ofcom has commissioned an independent international benchmarking study to inform its consideration of port lead times. This is set out at Annex 7. That study indicates that there are a range of port lead times across Europe and around the world ranging from as little as 2 hours in Ireland to 31 days in Germany. European best practice would suggest a mobile port lead time of within one working day.

4.9 The study also indicates that countries that have introduced short port lead-times have experienced an increased level of porting between network operators. In countries like Spain, Italy and the USA, where port lead times are short, the levels of porting and churn between operators is relatively high. Whereas in countries where there are particularly long port lead times, such as France and Germany, levels of porting and churn are relatively low.

Consumer research

4.10 Ofcom has commissioned consumer research to obtain consumer views on mobile number portability. The detailed report is set out at Annex 8.

4.11 In summary, Ofcom's consumer research suggests the following:

- Switchers tend to recall, and non-switchers predict, that the number porting process will be quicker than the maximum time the process should take. Expectations are that the process typically takes a day or two.

- Eight in ten of those who have ported their number were satisfied with the time the process took – but they often think it was completed in a day or two.

- Of the two-thirds of mobile phone customers who have not switched provider in recent years, most have stayed as they see no reason to change and are satisfied with their current service. Only 3% of those who answered this question spontaneously raised 'the time taken to transfer their number to a new network' as a reason for not switching supplier.

4.12 This research suggests that consumers might think that the current porting period is too slow. Ofcom is aware of other consumer research which also indicates that consumers consider that one week to port is too long[19].

4.13 Ofcom's research indicates that port lead times are a barrier to switching for a small number of consumers. However, the research does not indicate that port lead times are not a barrier to switching, given that most often consumers are content with their current service and see no reason to switch.

4.14 Ofcom considers that its current consumer research may not be conclusive and intends to conduct qualitative research to further understand consumers' views. This research will take place during the consultation period and the conclusions will be detailed later next year.

Port lead-times options

4.15 The costs and benefits are considered for the following options:

- Option 1: No immediate change

- Option 2: Require a reduction of port lead times to three working days

[19] Consumer research commissioned by Hutchison 3G UK Limited, December 2004, see response to Ofcom's consultation on Number Portability and Technology Neutrality at http://www.ofcom.org.uk/consult/condocs/numport/responses/h3g.pdf

- Option 3: Require a reduction of port lead times to less than one working day

Option 1: No immediate change

4.16 While this option would involve no immediate change to the current process, the move to ACQ/CDB in 2009 and/or direct routing earlier, as proposed in Section 3, will necessitate a new porting process. It is therefore possible that the establishment of that process in 2009 would offer an opportunity for a new porting process to be developed that is significantly shorter than currently and in line with European best practice.

4.17 This option would not achieve Ofcom's objective of ensuring that consumer switching between providers is as easy and as quick as possible. The benefits of shorter mobile port lead times are discussed further under Option 2 below.

Option 2: Require a reduction of port lead times to three working days

4.18 Ofcom considers that a reduction in port lead times will be, in principle, beneficial to consumers, as this will mean that numbers can be ported and services with a new provider can commence within the shortest possible period. Number portability is designed to make switching provider as easy as possible by allowing consumers to retain their telephone number when they switch. Reducing port lead times should ensure that switching providers is swift and easy. Conversely, a longer porting process may discourage consumers from switching altogether or potentially delay consumers from commencing service on better terms with a new provider. Both of these outcomes would prevent consumers benefiting fully from effective competition between mobile providers.

4.19 On the basis of discussions with the mobile operators, Ofcom understands that the current porting process could be shortened fairly easily. Ofcom's initial analysis indicates that the process could be reduced to three working days without any significant changes to the overall process or additional costs being incurred.

4.20 As set out above, the current porting process allows around three working days for a subscriber to request a new service from the Recipient Network, the Recipient Network to submit a port-out request to the Donor Network and the Donor Network to process the port-out request. In Ofcom's view these activities could reasonably take one working day within the current process without the mobile operators incurring significant costs. If these processes only take one working day then the overall port time could be reduced to three working days. Ofcom recognises that issues could arise in relation to porting service levels if porting times with the current process are reduced and therefore would welcome views from stakeholders as to whether they consider that this is likely.

4.21 Given that a three day process should not involve significant process changes, Ofcom considers that the mobile operators should be able to shorten the current process to three days within 6 months. Ofcom welcomes views from stakeholders as to whether this is a realistic timeframe.

4.22 As set out above, in the long term, the proposed move to ACQ/CDB in 2009 and/or direct routing at a sooner date will necessitate a new porting process and, therefore, Ofcom expects that the new process in 2009 to be less than one working day and in line with European best practice.

Option 3: Require a reduction of port lead times to less than one working day

4.23 Ofcom understands that a further reduction of the period to less than one working day could be achieved sooner than 2009 with a revised porting process. A process shorter than one day has benefits in terms of ensuring that consumers can take advantage of number portability as quickly as possible. Therefore the same benefits as set out under Option 2 apply here, except that they should be greater with an even shorter porting period.

4.24 Ofcom has little information about the costs involved in implementing a new process but understands that it would involve changes to the processes and procedures and modifications to the computer system run by Syniverse. In order that Ofcom can balance the benefits against relevant costs, Ofcom needs further evidence and therefore welcomes views from stakeholders as to what such a process would look like and whether the costs of implementing such a process are likely to be significant.

4.25 If and when the mobile sector of the industry migrates to a solution for the direct routing of calls to ported numbers, this is likely to require further changes to the porting process (in addition to those required to shorten the process to less than one working day). Ofcom would also welcome views on the likely costs of such further changes.

Preferred options

4.26 The benefits of shorter port lead times ensure that consumers are able to switch providers as quickly and as easily as possible. Excessively long port lead times may discourage consumers from switching providers or potentially delay consumers from commencing service on better terms with a new provider.

4.27 In Ofcom's view the shorter the process, the better it is for competition and consumers. Therefore, Ofcom is proposing to reduce mobile port lead times to a period of less than one working day. However, if Ofcom receives evidence that shows that the costs involved in moving to a lead time shorter than one working day outweigh the benefits then Ofcom will need to consider whether a three working day period is more appropriate in light of the evidence received. It would currently appear that the current mobile porting process can be reduced to three working days without the mobile operators incurring significant costs.

Question 8: Do you agree that Ofcom should require port lead times to be reduced to less than one working day? If you do not agree, please provide evidence that shows otherwise.

Question 9: Alternatively, do you agree that Ofcom should require port lead times to be reduced to three working days?

Question 10: What is a reasonable timeframe for the implementation of a one working day process?

Question 11: Do you consider that a three working days port lead time process could be implemented within 6 months?

Section 5

Summary of conclusions and proposed modification to General Condition 18

Summary of conclusions

Routing of calls to ported numbers

5.1 Ofcom is proposing that fixed networks migrate to an ACQ/CDB solution by no later than 2012 and mobile networks migrate by September 2009.

5.2 In addition, Ofcom is proposing that mobile networks implement direct routing at the earliest opportunity. Ofcom considers that mobile operators should be required to provide direct routing using NICC Service Description 8 or other suitable standard within one year of Ofcom's final notification, unless evidence is presented to Ofcom that indicates that the additional costs the mobile industry would need to incur in implementing direct routing in this manner ahead of implementing ACQ/CDB is not proportionate to the benefits.

Port lead times

5.3 Ofcom is proposing to require that mobile port lead times be reduced to less than one working day. If Ofcom receives evidence that shows that the costs involved in moving to a lead time shorter than one working day outweigh the benefits then Ofcom will need to consider whether a three working day period is more appropriate in light of the evidence received. It would currently appear that the current mobile porting process can be reduced to three working days without the mobile operators incurring significant costs.

Modification to General Condition 18

5.4 The notification of the proposals to modify General Condition 18 is set out at Annex 9.

5.5 Ofcom is also taking this opportunity to ensure that the drafting of General Condition 18 is not overly cumbersome. In this regard, to the extent that the definition of Communications Provider is replicated in the definitions and interpretation section of Part 1 of the General Conditions, Ofcom considers that there is no need for that definition to be retained in General Condition 18 itself. Ofcom is therefore proposing, in order to ensure that no confusion arises, to remove that definition.

Legal tests

5.6 Ofcom must not modify the General Conditions unless the modification meets the tests set out in section 47(2) of the Act.

5.7 The tests in section 47(2) are that the modification must be:

- objectively justifiable in relation to the networks, services, facilities, apparatus or directories to which it relates;

- not such as to discriminate unduly against particular persons or against a particular description of persons;

- proportionate to what the condition or modification is intended to achieve; and

- in relation to what it is intended to achieve, transparent.

5.8 Ofcom considers that the proposed modifications to the General Condition 18 are:

- objectively justifiable because requiring operators to implement an ACQ/CDB solution will protect consumers from network failure and ensure efficiency of routing of calls to ported number. Reduced port lead times will benefit consumers in terms of allowing them to commence service with a new provider in the shortest time possible, which will in turn ensure that switching provider is not discouraged in anyway. This will promote consumer choice in accordance with Ofcom's policy aims and statutory duties;

- not such as to discriminate unduly against particular persons or against a particular description of persons in that all communications providers offering PATS will be subject to, and be affected by, the proposed modifications to General Condition 18;

- proportionate to what the modifications are intended to achieve in that they are the revisions to General Condition 18 regarded by Ofcom as necessary to ensure that number portability policy continues to meet Ofcom's policy aims and statutory duties given the evolving nature of networks and services; and

- in relation to what it is intended to achieve, transparent as the reasoning for the proposals and effect are set out in this consultation document.

5.9 Ofcom considers that its proposals are consistent with its general duties in carrying out its functions as set out in section 3 of the Act and the Community obligations set out in section 4 of the Act. The proposals further the interests of citizens in relation to communications matters and consumers in relevant markets where appropriate by promoting competition, as they ensure that the switching of providers is not discouraged by long port lead times. Furthermore, the proposals ensure that consumers will be protected against a loss of number and service in the event of a network failure. The proposals are also consistent with ensuring efficiency in relation to electronic communications networks and services and associated facilities, by ensuring the efficient routing of calls to ported numbers.

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 January 2007**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://www.ofcom.org.uk/consult/condocs/gc18/howtorespond/form, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response (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 gideon.senensieb@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

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

Gideon Senensieb
Competition Group
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 020 7783 4103

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

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document. It would also help if you can explain why you hold your views.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Gideon Senensieb on 020 7981 3545.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt (when respondents confirm on their response coversheet that this is acceptable).

A1.9 All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please place any confidential parts of a response in a separate annex so that non-confidential parts may be published along with the respondent's identity.

A1.10 Ofcom reserves its power to disclose any information it receives where this is required to facilitate the carrying out of its statutory functions.

A1.11 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use in order to meet its legal requirements. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A1.12 Following the end of the consultation period, Ofcom intends to publish a statement in Spring 2007.

A1.13 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

A1.14 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.15 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.16 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 version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will normally allow ten weeks for responses to consultations on issues of general interest.

A2.6 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organizations interested in the outcome of our decisions. This individual (who we call the 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. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

After the consultation

A2.8 We will look at each response carefully and with an open mind. 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, we will publish all consultation responses in full on our website, www.ofcom.org.uk, unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, without disclosing the specific information that you wish to remain confidential.

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 by allowing you to state very clearly what you don't want to be published. We will keep your completed coversheets confidential.

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 confidential parts of your response in a separate annex to your response, so that they are clearly identified. 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 coversheet 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

What do you want Ofcom to keep confidential?

Nothing	☐	Name/contact details/job title	☐
Whole response	☐	Organisation	☐
Part of the response	☐	If there is no separate annex, which parts?	

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response. It can be published in full on Ofcom's website, unless otherwise specified on this cover sheet, and I authorise Ofcom to make use of the information in this response to meet its legal requirements. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

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

Name Signed (if hard copy)

Annex 4

Consultation questions

Question 1: Do you agree that an ACQ/CDB solution is required to achieve independence of Donor Networks?

Question 2: Do you agree that an ACQ/CDB solution common to both fixed and mobile networks is the preferred option?

Question 3: Do you agree that any transition to ACQ/CDB should occur in the course of migration of fixed networks to NGN architectures?

Question 4: Do you agree that it would be beneficial to require the mobile industry to complete its transition to an ACQ/CDB solution by September 2009?

Question 5: Ofcom would welcome respondents' analyses of the costs and benefits of a comprehensive transition of the mobile industry to direct routing using NICC Service Description 8 or other suitable standard within one year, ahead of a further transition to ACQ/CDB.

Question 6: Ofcom welcomes views from stakeholders as to the appropriate approach to be adopted in achieving the implementation of ACQ/CDB whilst ensuring that such co-operation is limited to technical matters directly related to the ACQ/CDB solution.

Question 7: Do you have any comments on the transition milestones and their corresponding dates? Could the dates be achieved earlier? Alternatively, could any of the dates be at known significant risk of being missed?

Question 8: Do you agree that Ofcom should require port lead times to be reduced to less than one working day? If you do not agree, please provide evidence that shows otherwise.

Question 9: Alternatively, do you agree that Ofcom should require port lead times to be reduced to three working days?

Question 10: What is a reasonable timeframe for the implementation of a one working day process?

Question 11: Do you consider that a three working days port lead time process could be implemented within 6 months?

Annex 5

Impact assessment

Introduction

A5.1 The analysis presented in this annex, together with Sections 3 and 4 and the consultant's report set out at Annex 6 of this consultation document, represent an impact assessment, as defined in section 7 of the Act.

A5.2 You should send any comments on this impact assessment to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals.

A5.3 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on our website: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf

Ofcom's policy objectives and the citizen/consumer interest

A5.4 There are a number of consumer benefits associated with number portability. As stated above, number portability facilitates consumer choice and effective competition by allowing consumers to retain their telephone number when they switch provider. This makes switching a more attractive proposition as consumers may be reluctant to switch if they have to go through the inconvenience and possible expense of changing their telephone number.

A5.5 This objective, to make it easy and swift for consumers to switch provider, is central to Ofcom's proposals in relation to port lead times. Ofcom considers that excessively long port lead times may discourage consumers from switching provider which in turn may have an adverse impact on competition between providers.

A5.6 In relation to the routing of calls to ported numbers, Ofcom's key objectives concern the protection of consumers against network failure and ensuring the efficient use of networks.

A5.7 These objectives are set out in more detail in Sections 3 and 4.

Analysis of the different options

Options for the routing of calls to ported numbers

A5.8 Ofcom has identified 5 options for addressing the routing of calls to ported numbers:

- Option 1: No change – maintain onward routing
- Option 2: Implementation of ACQ/CDB for fixed TDM networks
- Option 3: Implementation of ACQ/CDB for fixed NGN networks
- Option 4a: Implementation of ACQ/CDB for mobile networks only by 2009
- Option 4b: Implementation of direct routing for mobile networks only within one year
- Option 5: Implementation of ACQ/CDB for both fixed and mobile networks

A5.9 The cost benefit analysis for each option is considered in Section 3 and the consultant's report set out at Annex 6.

Options for mobile port lead-times

A5.10 Ofcom has identified 3 options for addressing mobile port lead times:

- Option 1: No immediate change
- Option 2: Require a reduction of port lead times to three working days
- Option 3: Require a reduction of port lead times to less than one working day

A5.11 The cost benefit analysis for each option is considered in Section 4.

The preferred options

Routing of calls to ported numbers

A5.12 The present analysis appears to favour transition from the current onward routing solution for routing of calls to ported numbers to an all-call query of a common database of numbers ("ACQ/CDB") solution for both fixed networks, in the course of their transition to NGN technology, and for mobile networks. Ofcom considers that such a solution would be likely to achieve independence of the routing of calls to ported numbers from Donor Networks[20] and maximum efficiency gains from all forms of calls, however originated or terminated. This solution would also eliminate potential imbalances in the mobile industry's distribution of revenues.

A5.13 The analysis of the costs and benefits of the transition in the mobile industry suggests that, while migrating to a common solution for both fixed and mobile networks should deliver the optimal outcome, this may be best achieved by migration of the mobile industry to the ACQ/CDB solution ahead of that in fixed networks because switches employed in mobile networks are likely to already be capable of carrying out queries on their databases on every call. Ofcom considers that the completion of such a transition should be achievable by September 2009. It could, in addition and subject to analysis of detailed information from industry on costs and benefits, be appropriate to require the mobile industry to complete a comprehensive transition to direct routing using

[20] The network to which the consumer originally subscribed.

Network Interoperability Consultative Committee ("NICC") Service Description 8[21] or other agreed standard, within one year from the date of Ofcom's final notification.

A5.14 Ofcom considers that a full transition of fixed networks to an ACQ/CDB solution should be achievable by the end of 2012.

A5.15 Ofcom has identified the following as feasible intermediate milestones for a possible transition to ACQ/CDB:

a) Stable standards agreed by the NICC – June 2007

b) Governance arrangements for the database agreed by industry – July 2007

c) Common database established, available for voluntary use – September 2008

d) Records of all ported numbers hosted on NGN nodes to be populated in the database – September 2009.

Mobile port lead times

A5.16 The benefits of shorter port lead times ensure that consumers are able to switch providers as quickly and as easily as possible. Excessively long port lead times may discourage consumers from switching providers or potentially delay consumers from commencing service on better terms with a new provider.

A5.17 In Ofcom's view the shorter the process, the better it is for competition and consumers. Therefore Ofcom is proposing to reduce mobile port lead times to a period of less than one working day. However, if Ofcom receives evidence that shows that the costs involved in moving to a lead time shorter than one working day outweigh the benefits then Ofcom will need to consider whether a three working day period is more appropriate in light of the evidence received. It would currently appear that the current mobile porting process can be reduced to three working days without the mobile operators incurring significant costs.

[21] http://www.nicc.org.uk/nicc-public/Public/interconnectstandards/ser/nd1208_2005_08_2.pdf

Annex 6

Report by Sagentia

Number Portability Study

This document is prepared for Ofcom

SAGENTIA

Patrick Mitchell
Leigh Carter
Mike Reynolds
Stella Wooder
Tony Chambers
David Jackson
26 October 2006

Ref OF009

SAGENTIA

Contents

1 Executive Summary

Background

A study was carried out for Ofcom in 2004 which considered the costs and benefits of solutions for routing of calls to ported numbers for the UK, based on a Common Database (CDB) and an All Call Query (ACQ) method for determining the routing of ported numbers. The results of this study were that although a CDB/ACQ system should give benefits to users and operators, the costs of implementation could not be justified at that time.

Objectives of the Present Study

Ofcom are re-examining the issue in the context of the moves that network operators are making from their existing Time Division Multiplex (TDM) networks towards Next Generation Networks (NGNs). The present study was commissioned to update the previous work in the light of NGNs, architecture changes or revised approaches by the operators, and to determine whether there had been any changes in the costs and benefits of different approaches to implementing number portability. The study also considers mobile networks and extends the previous cost modelling work to cover the mobile case. The study will provide background information for the consultation process that Ofcom is planning to run towards the end of 2006.

Methodology

We investigated ways in which Number Portability (NP) may be implemented in future fixed and mobile networks primarily by holding interviews with a number of UK operators in the period from August-September 2006. This research has been supplemented by a small number of interviews with equipment suppliers to understand how their equipment roadmaps will support changes to UK networks. We have also spoken with some overseas regulators to determine whether their experience could be applied to the UK.

Current Routing Methods

In the absence of a CDB/ACQ system, UK operators use a technique called Onward Routing (OR) in both fixed and mobile networks. This technique has been established over a number of years and from our interviews, operators reported that it works well in most cases. A disadvantage of OR is that the original network provider (donor network) is still required to carry traffic for numbers which have been ported away from the donor network. These numbers are subject to service failure if the donor network operator fails or suffers congestion.

UK Mobile networks have introduced (or are in the process of introducing) Direct Routing (DR) which gives more efficient routing although they are still dependent on the donor network for location information. These systems have the characteristics of ACQ but they do not use a common database. This brings out the difference between:

- a CDB, where there is a single master reference database of ported numbers that is used by all operators,
- Direct Routing where the call is routed directly to the recipient operator without passing through the donor operator.

Views on the General Principle of a Donor Independent Solution

A CDB/ACQ system is an implementation architecture which provides routing independently from the donor network. Without wishing to state a specific implementation, interviewees were asked if in general they thought that donor independence, for example as provided by CDB/ACQ, was a good principle.

Most operators felt that CDB/ACQ was the ideal technical solution, but the time for a network-wide implementation had passed. This was because they had already implemented the alternative OR approach and many operators made the point that, in practice, the loss of service to ported numbers through donor failure was low and additional expenditure to protect against infrequent events would be hard to justify.

Incentives to Move to a New NP Solution

Ofcom wished to establish whether there are sufficient incentives for industry to move to a new NP system without regulatory intervention. In general, in the fixed network, we find it extremely unlikely that operators will move to Direct Routing of fixed or mobile calls by natural evolution.

Ofcom hypothesised that changes to network architectures, including in particular the move to NGNs, could tip the balance of costs and benefits towards a CDB solution. We asked operators about expected changes to their networks. We found that fixed operators said that ACQ type processes fit more naturally with NGN architectures, and so NP in principle could be provided without the need for OR. However, in the absence of Industry standards they will not be adopting new solutions and will therefore still use OR in early implementations of NGNs. This seems unfortunate as the Industry will incur costs for introducing the old system on NGNs, while missing the opportunity to implement directly the donor independent ACQ system.

The mobile operators appear to be moving slowly to the Direct Routing of calls based on the interrogation of donor network location registers. Some mobile operators have already implemented Call Trap to improve the routing to numbers that have been ported in to their own networks. Modification of these architectures, to use a CDB, appears to be less expensive than equivalent upgrades in the fixed networks, because mobile networks are more capable.

Mobile operators have pointed out that current billing and settlement systems will not support Direct Routing but if they do in future they will move to Direct Routing, without a CDB.

Benefits of Migrating to a CDB/ACQ Solution

Operators had varied views on the general benefits resulting from a system such as CDB/ACQ, and there was no consistent result across all operators.

There were no significant concerns that NP issues affected service innovation.

Migration Timetable

A strawman timetable for implementation was proposed as part of this study, with the following key milestones:

- NGN standards for number portability agreed by the Network Interfaces Consultative Committee (NICC): January 2007.
- Common Database established, available for voluntary live use by network operators: April 2008.
- Records for all ported telephone number hosted on NGN nodes must be populated in the common database: April 2009.
- All Calls to ported numbers to be resilient against failure of the donor network: 2012.

This timetable was tested with operators. They considered it to be too optimistic in the early steps owing to the uncertainty over standards. An end point of 2012 was still felt to be achievable if standards were produced in time.

Our view is that the operators are currently waiting for clear direction from Ofcom as to whether a CDB is going to be required and in what timescales it should be implemented.

Implementation Issues

Implementation of a CDB/ACQ system was felt, in the fixed network, to be only achievable on NGNs. No operator was willing to update existing TDM equipment. Mobile operators were more willing to upgrade in principle, but not from a cost point of view as they had already invested in

solutions in the absence of any new NP standards. One mobile operator would be willing to invest in order to significantly reduce port lead times.

Fully evolved NGNs can look up routing information for every call whether NP is implemented or not. NP should therefore be achievable without significant infrastructure change by updating routing information in the event of a port.

Mobile operators pointed out that Message Service (SMS/MMS) porting is an important issue that must be considered alongside other services. For example, internationally originated messages would need access to the CDB. There are no standards here at present so the signalling relay would have to continue to support international messaging in the medium term. This is a serious issue as it affects SMS and MMS services now, as well as new services that may be deployed in the future. Significant changes would be required to the international mobile interconnect architectures to introduce donor network independence, and new agreements and standards would be required internationally.

Cost Benefit Analysis

The previous study produced a model that estimated cost for a fixed network TDM solution. We found that there have been no significant changes to the costs of upgrade to existing TDM systems, as used in the previous study. Since TDM systems are nearing the end of their lifetime, they are now unable to be upgraded at any cost due to the lack of available upgrades from the associated vendors.

We have reviewed and extended the model to consider the costs and benefits of introducing NP for a range of new scenarios. These scenarios now include the mobile network case, a fixed network case based on NGNs, and we consider the termination of both fixed and mobile traffic. On costs, we have estimated both the capex and opex elements for introducing network changes and number portability databases. On benefits, we have calculated the savings which result from the elimination of Onward Routing. We have not tried to place a monetary value on the more qualitative benefits which can result from Direct Routing (e.g. the elimination of quality issues due to reduced congestion).

We have made our own estimates on mobile network costs, with some guidance from operators. Our results show that the Net Present Value (NPV) is positive for the mobile case (e.g. an NPV of £193.1m when mobile to fixed and mobile to mobile terminations are taken into account).

For the NGN scenario, operators have been unable to derive NGN-related NP costs in detail without standards and a more detailed understanding of what is required. However, most believe that the costs for NGN implementation will be less than for TDM. We have made our own estimates of network costs. Our model shows that the NPV for the fixed network case improves from -£200m to £15.3m.

For a combined NGN and Mobile case, including Direct Routing of all fixed to mobile and mobile to fixed traffic, we obtain an NPV of £297.3m.

Process-related Aspects

Most operators thought that current porting lead times were satisfactory, although one mobile operator wanted a significant reduction. There was widespread belief that there was a major process related issue with setting up the current bi-lateral porting arrangements. New entrants, especially, found this to be resource intensive and time consuming, and of far greater importance than the CDB issues.

Several operators brought our attention to issues related to NP, although not directly to routing. These include the definition of Publicly Available Telephony Services (PATS), which services are PATS, and the applicability of the NP General Condition (which applies only to PATS). We believe these issues have been solved in the March Statement, although several operators still referred to them as causing concern.

Several operators also thought that removal of the reference to the NP Functional Specification has created problems with setting up porting agreements.

2 Introduction

2.1 Background

In August 2004 Ofcom issued a consultation paper on An Assessment of Alternative Solutions for UK Number Portability which considered whether portability solutions making use of a Common Database of numbers could protect subscribers using ported numbers from failure of their original provider. As part of this work Ofcom commissioned a report from Mason Communications[1] which assessed the costs of a CDB/ACQ (Common Database/All Call Query) approach to NP (Number Portability).

The conclusion from this study was that although there were benefits in moving to this system from the Onward Routing (OR) method then in place for NP, it was difficult to justify in terms of the overall costs. It was decided that this should be re-examined when the UK network moved away from the TDM architecture to the new architectures required by Next Generation Networks. This decision has led to the commissioning of this current study. The Mason study only considered mobile networks briefly, with most of the emphasis on fixed networks.

A second consultation, which commenced in November, 2005 considered number portability and technology neutrality.

2.2 Study Objectives

Ofcom intends to consult later in 2006 on both porting lead times and the routing of calls to ported numbers. In preparation for this consultation, the current study has been undertaken to help understand what developments have taken place since the Mason report, and how this may affect the previous conclusion on the costs and benefits of the CDB/ACQ approach.

The present study updates the previous work:

- By looking at mobile networks in more detail
- In the light of NGNs, architecture changes and revised approaches by the operators
- By determining whether there had been any changes in the costs and benefits of different approaches to implementing number portability.

The study will provide background information for the consultation process.

We were asked by Ofcom to focus primarily on the issues associated with the routing of calls rather than the business processes required for number portability. However we have considered some aspects of process issues where they affect routing, or where particular issues with the porting process have been brought to our attention.

[1] Costs and Implementation Issues of a Central Database Solution for Number portability in the UK, Mason Communications Limited, April 2004

2.3 Approach

The approach adopted in this study was to interview:

- A number of relevant and representative UK network operators and service providers
- A small number of regulators from countries which have experience of running a CDB/ACQ system
- A small number of suppliers of equipment into the NP and NGN market places.

In addition to the interviews, we have also conducted desk research and carried out literature searches to understand where developments are currently taking place.

An objective of the study was to update the previous work on costs. We have made an updated version of the cost model produced by Mason Communications, using the data supplied to us from interviewees, to look at NGN costs and to include mobile numbers and traffic.

2.4 Interviews

A structured questionnaire was produced and agreed with Ofcom as the basis for gathering data. The questionnaire contained:

- General background on the study and its relation to previous work and the planned consultation
- Strawman timescales for moving to a CDB/ACQ type system for NP (and hence away from the current OR solution which depends on the original donor network)
- Strawman architectures so that we could explore technical opinions and identify issues
- Detailed questions on NP implementation plans and the effect NP changes might have on costs, services, numbering and other issues.

During the study, the following organisations were interviewed:

- Cable and Wireless
- NTL/Telewest
- Vodafone
- Thus
- Hutchison 3G
- Viatel
- Easynet
- T Mobile
- BT
- Talk Talk (Carphone Warehouse)
- The Irish Regulator, Comreg
- The German Regulator, Bundesnetzagentur
- Ward Solutions, suppliers of CDB/ACQ equipment
- Nortel.

We requested interviews with Orange and O2, but these organisations were unable to respond within the study timescales.

2.5 Content Layout

Section 3 provides some general technical background on networks and NP.

Section 4 briefly outlines overseas experiences.

Section 5 summarises the feedback from the interviews with operators and other key stakeholders.

Section 6 describes our cost modelling process and its results.

Section 7 summarises our observations.

Appendix A provides the results for each of the scenarios modelled.

Appendix B is a brief glossary of key terms used in the document.

Further technical background information is contained in Appendices C and D.

3 Technical Background

3.1 Introduction

This section provides some technical background on how NP is implemented in current networks and what the technical plans are for future networks. It also highlights some technical issues which have been brought to our attention and which affect number portability.

The central issue in Number Portability is how operators route calls (and messages) to numbers which have been ported. In order to route correctly, operators need information to tell them the location of the destination number. Historically, all call routing in telephone networks has been based on number range analysis. Network switching equipment analyses the number digit by digit, and only examines as many digits as necessary to carry out the next stage of routing. For example, with the UK national number of 01763 875200:

01 indicates a UK national fixed network number

763 indicates an area code

87 indicates an operator number range

5200 indicates one specific number within a block of 10000 numbers allocated to that number range (0000-9999).

If there is no number portability in a network, then 0176387 is sufficient to uniquely identify the network operator responsible for terminating the call. In the presence of number portability, it is not sufficient as 875200 may have been moved to another number range holder.[2] However, the number 0176387 still refers to a number block (or number range) that is allocated to one operator.

In a porting scenario:

- The network from which the user is making a call is termed the originating network
- The network on which the call ends up is the terminating network
- The network which has been allocated the number block within which the called number originally lies is called the donor network
- The network to which the called number has been ported is called the recipient network.

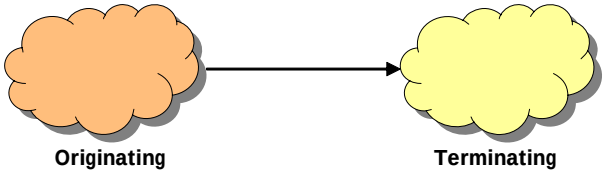
Note that in all cases where a number has been ported the recipient network is the terminating network.

The following sections illustrate the various methods which are available to route calls where number portability is provided in a national network. The scenarios are representative of both fixed and mobile networks, although they have been simplified as far as possible to illustrate the main features. Not all of the scenarios are actually implemented in current networks, but they are presented to show the two essential features which must be considered:

- How information is obtained to do the routing
- How the routing is carried out.

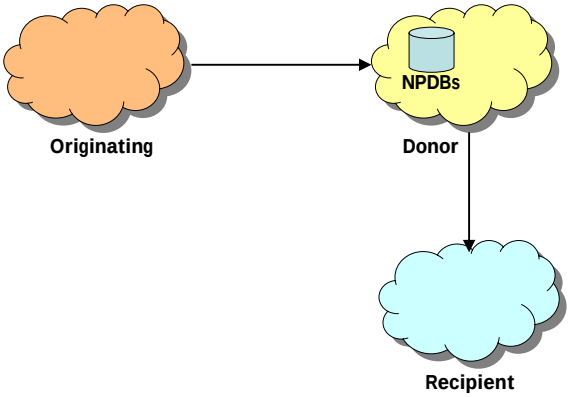
[2] And in the UK network it is now permissible for the number to be moved to a different area code as well.

3.2 Case 1: No Portability



In the base case, the originating network determines the recipient network by number block analysis, as explained in Section 3.1 above.

3.3 Case 2: Onward Routing



In this case, the destination number has been ported. It shows the Onward Routing (OR) method which applies to the UK fixed network today.

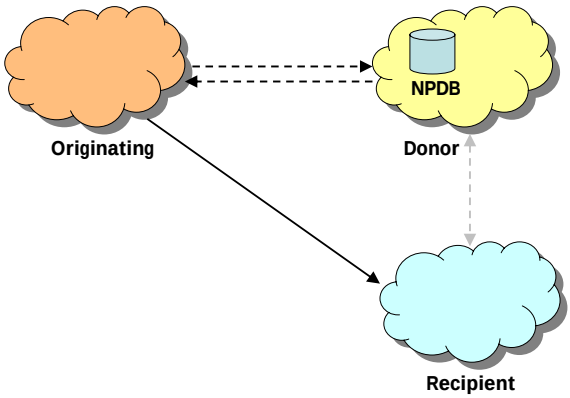
- The originating network identifies the donor network by analysing the number block, exactly as it does to route any call
- The donor network looks up internal Number Portability Databases (NPDBs).

In the case of a ported number, the NPDBs will indicate a network other than the donor to receive the call. There is one NPDB per TDM switch within each network. The donor network needs 2 interconnect ports to route the call.

The following are typical characteristics of the OR deployment model for NP:

- The solution relies on the donor network for call routing
- Additional call transmission and switching capacity is required as the call is “tromboned” via the donor network, driving investment in legacy equipment in order to avoid network congestion
- In a worst case scenario if a ported non geographic number is dialled, and is terminated on a ported geographic number; this can result in a call tromboning across several networks
- Additional call set up delay can be experienced
- The potential for call degradation is greater due to the additional call transmission and switching requirements
- The donor network operator incurs costs for calls which they no longer terminate (resulting in the application of APCC/DCC settlements).

3.4 Case 3: Direct Routing

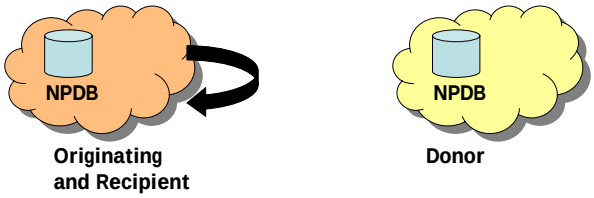


This shows a Direct Routing (DR) method without the use of a common database.

- The originating network identifies the donor network by number block analysis
- The originating network consults the donor network's NPDB and identifies the recipient network
- The originating network routes the call to the recipient network
- The donor network may signal to the recipient network as part of the process

This represents the direction in which the UK mobile networks are heading.

3.5 Case 3a: Call Trap

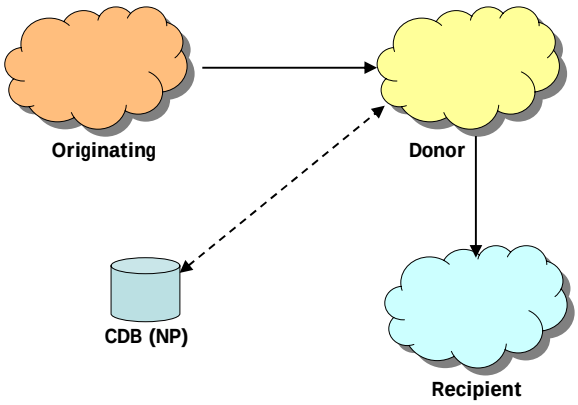


This is a variant of Direct Routing in which the originating and recipient network is the same.

- The originating network consults its own NPDB to identify that it is the recipient network
- It then routes the call internally.

Note that the originating network's NPDB duplicates information in the donor network's NPDB. The donor network is not involved in delivering the call. There is a routing efficiency gain as the call is retained on the originating network.

3.6 Case 4: Onward Routing with a CDB



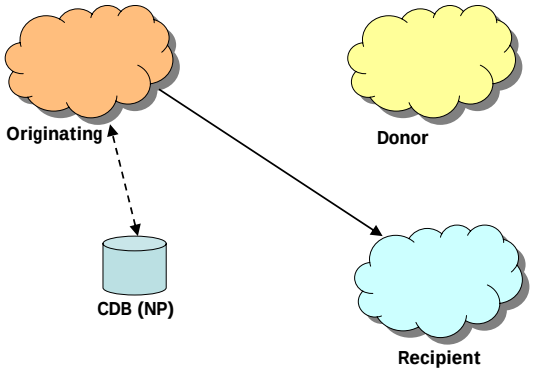
This illustrates a system where a Common Database (CDB) is used to provide the destination information. It also illustrates a case where an originating network cannot consult the CDB directly. An example of where this could occur is in a fixed to mobile call, where the mobile networks have implemented the CDB ahead of the fixed networks.

- The originating network identifies the donor network by analysing the number block
- The donor network identifies the recipient network by consulting the number portability CDB.

There is one CDB which contains reference NP information for use by all networks. The donor network needs 2 interconnect ports to route the call.

This is the situation that might occur in the UK if the mobile networks start using a CDB ahead of the fixed networks. This situation already exists in Germany.

3.7 Case 5: Direct Routing with a CDB - TDM network



The Direct Routing case means that the donor network is not involved in routing a call to a ported number.

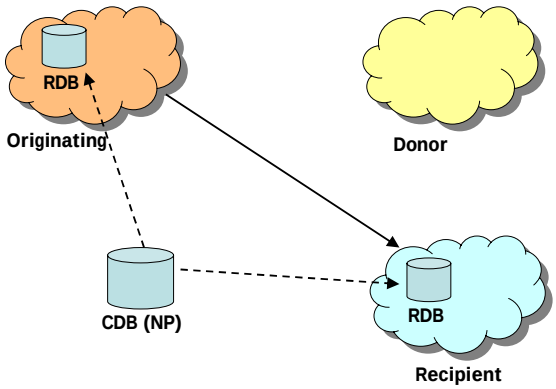
- The originating network identifies the recipient network for every call by consulting the number portability CDB (i.e. ACQ)
- There is one CDB which contains reference NP information for use by all networks.

This requires all originating networks to be able to consult the CDB which is not within the normal capability of a TDM switch

A variation on ACQ is Query on Release (QOR). In this case a call is routed initially to the number block holder. If it is to a ported number, the donor network signals back to the originating network

with a failure code. The originating network then queries the CDB and the call is routed according to the CDB entry. This has the advantage that the CDB is queried only for ported numbers. It has the disadvantage that there is extra post dial delay for ported numbers.

3.8 Case 6: Direct Routing with a CDB - NGN network



The key feature of an NGN is that it can contain routing databases that are queried to route every call. This contrasts with TDM networks which primarily rely on number block analysis.

- The originating network identifies the recipient network for every call by consulting its routing database (RDB), i.e. ACQ
- There is one CDB which contains reference NP information which is used in the generation of the RDB by each network
- This requires all originating networks to be able to consult the CDB.
- As in Case 5, DR gives independence from the donor network.
- Further detail on NGN architecture is given in Appendix C.

3.9 NP in mobile networks

The mobile network operators have indicated that the industry has a 3 stage NP plan which introduces Onward Routing initially (Case 2), then adds Call Trap (Case 3a) and finally Direct Routing[3] (Case 3). Some, but not all, networks have now introduced Call Trap.

In the case of mobile messaging the number block analysis is performed by the SMSC, which then signals the mobile network to deliver the message. Portability is currently supported by the Signalling Relay Function in the donor network forwarding the signalling to the recipient network. This is driven by a local database but could be driven by a central or common database (as happens in Germany and Ireland). This approach uses a CDB but is not independent of the donor network.

There is no existing standard that would support donor network independence for messaging (SMS, MMS). ENUM[4] is a developing NGN standard that is intended to do this within mobile networks.

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[3] It should be noted that this NP plan is not reflected in the NICC ND1208:2005/08 document, and is different to the phased introduction described in its (fixed) geographic equivalent ND1203:2000/05). We believe that this is a mobile operator agreed process rather then an NICC one.

[4] See Appendix D for a description of ENUM (and further information on interconnect and numbering).

3.10 NP and International Calls

Fixed and mobile calls targeted at a ported number, which originate from an international operator, are routed to the number block holder, who then onward routes the calls to the recipient (Case 2).

For mobile and fixed voice calls the most logical step to achieve direct routing is for the transit operator, which brings the call into the UK, to do a DB lookup and direct route the call (Cases 3, 5 and 6). To achieve donor network independence only Cases 5 and 6 would be appropriate.

In the case of mobile international messaging (i.e. SMS and MMS) the originating SMSC uses number block analysis to identify the number block holding network and the signalling relay operates to ensure correct delivery as for national messaging.

To implement either Direct Routing or donor network independence all world-wide service centres (SMSC, MMSC) would need access to the CDB. This would be a major change to systems worldwide and is not dealt with by present standards.

3.11 Interconnects

Many smaller network operators have interconnects with only one other network operator. Typically they will route all calls to number blocks other than their own (even ported in numbers) to the operator they have interconnect with. The call is then routed through the interconnect operator's transit network to the operator that hosts the number block. In this case a CDB lookup may be performed by the transit operator rather than the originating operator, as they are incapable of directly routing the call themselves.

The move to NGN architectures leads to the change from traditional TDM based interconnects to those based on IP. The standards for this interconnect are currently under discussion in the NICC. The approach to be used for NP is not clear.

There is a potential issue with OR during the transition phase to NGNs. Where voice calls pass between the TDM and IP (NGN) networks there is potential degradation in voice quality. OR may increase the number of passages between TDM and NGN[5] thus increasing the voice quality degradation.

[5] For example where a call originates form a TDM network, is passed to the NGN donor network and is forwarded to a TDM terminating network.

4 Overseas experience

4.1 Overview

As part of our study we have carried out a brief review of international experience in number porting. Many countries are reported as running a CDB/ACQ system, where we have spoken to individuals or companies directly involved with these systems we have found that even where countries have adopted these systems, the use of them is sometimes optional, thus tending to negate the claimed benefits of a CDB solution.

4.2 Ireland

Ireland has implemented an ACQ system for fixed and mobile NP. However the use is optional and most operators use OR.

Fixed NP was introduced in 2000. The CDB is operated by CAP Gemini. Ireland has about 1.3M PSTN lines and around 90% of these are supplied by Eircom. Number porting is at a low level, with around 3500 ports per year. Irish regulator, Comreg, expect the level of porting to increase significantly in the near future with the introduction of LLU and a product to enable porting with LLU (previously porting was not permitted with LLU). The CDB is funded by Comreg. It is not clear why the ACQ is not used - presumably because there is a very low level of porting and there is no mandate to do so. An update to NGN is planned, but no detailed information was available.

Mobile Number Portability was introduced in 2003. There are 4.3M mobile subscribers (103% penetration) and the porting level is much higher than in the fixed network (around 15%). The CDB for mobile is separate from the fixed CDB and is supplied by Ward Solutions and is in use by all mobile operators. The CDB is operated in a non-real time mode, with data regularly updated to local real time databases within each operator's system. The CDB also provides process tracking and number porting status. Mobile NP in Ireland is believed to be achieving port times of 2 hours (when port levels are within a stated maximum porting rate).

4.3 Germany

NP became mandatory in Germany in January 1998, although the mobile operators were allowed to avoid implementation until November 2002 due to "technical difficulties".

Geographic numbers

These are assigned in 1k blocks by the regulator, and the block assignments are distributed by the regulator to the operators.

Each operator maintains a database of ported out numbers (from their number block allocations and from ported in numbers) and where they have been ported to. This data is exchanged between operators every night. There is no requirement on the technical implementation of the routing of calls to ported numbers. Operators are free to agree bilaterally on routing with ACQ, QOR and OR all being present in the networks.

There have been problems with this approach, with operators using old versions of the database information. In practice many small operators just route everything to Deutsche Telekom.

It is generally accepted that this process would not be used for a new implementation but it works. Everyone would prefer a CDB approach, but nobody is prepared to implement it because of the cost of change. In summary this is a distributed non real time database.

Non geographic numbers

These are assigned individually to the end user. The regulator has to run a database to manage the individual customers for the numbers, so this database had an operator field in it as well. This is populated when an operator declares that they are servicing that number. An extract of this database containing only number and operator (plus some "time to live" information) is downloaded by the telcos each night and used for routing. The database is paid for by the charges for the numbers.

Overall the system works well and no changes are planned. Routing prefixes are used in the network to ensure correct delivery.

In summary this is a central non real time database

Mobile Numbers

This is operated as a real time CDB by the mobile operators but it is a closed system. The CDB for holding mobile numbers was developed by T-Systems for the mobile operators. The specifications are closed and access is only available to operators (fixed and mobile).

Fixed operators have complained about the charges to access the database (€10k p.a.) but this is subject to commercial agreement between the operators. The information is needed for billing as well as routing as there are different charge rates for calls to the different mobile networks.

Only 1% of mobile numbers are ported. This is believed to be because the €25 administration charge for number porting is passed on to the consumer, who generally is not prepared to pay and so takes a new number.

Calls to mobiles are frequently routed non-optimally, with the mobile operators forwarding the calls to the correct operator and charging the originator extra for the service. The main problem is that the cost of implementing the IN to do the lookup in fixed networks is too high (particularly since there are so few ported numbers).

In summary this appears to be a central real time database

General

The regulator is unaware of the proportion of geographic numbers ported.

Non Geographic number porting is meaningless in Germany as there is no donor operator (all numbers are issued to the customer directly from the regulator).

The AKNN (www.aknn.de) is the German equivalent of the NICC and maintains standards for operator interconnect. The geographic and non geographic number portability standards are available online. They do not deal with mobile number portability.

The regulator sees no problems with the introduction of NGNs, and Geographic numbers are migrated to IP services already. There has been an issue with numbers being simultaneously used with TDM and IP networks and this is now banned by the regulator.

5 Results of interviews

5.1 Interview Brief

A questionnaire was agreed with Ofcom as the basis on which the interviews would be conducted. The questionnaire covered the following areas:

- Current methods by which operators implemented NP
- The perceived benefits of changing to an improved system for NP
- Operators plans for introducing NGNs
- How an improved system for NP could be implemented
- Implementation issues arising, including transition
- Impact on Services and Service Innovation
- Process related issues
- Numbering
- Strawman timescales
- Costs.

An interview report was compiled for each session and fed back to the participants for confirmation that we had represented their views correctly.

5.2 Current Implementation of NP

All UK fixed operators currently use Onward Routing (OR) for number portability.

All UK mobile operators use OR, although some have implemented Call Trap. Direct Routing, which operators recognise would give some routing efficiencies, is not implemented at all at the moment as there are some issues to do with bill resolution that need to be resolved first.

5.3 Benefits of Introducing CDB

Operators were asked to comment on the list of possible benefits of a CDB solution proposed by Ofcom:

- Resilience to failure of the donor network
- Reduced capital costs due to more efficient routing
- Reduced risks and costs of developments as a result of simplification and greater clarity of direction
- Removal of distortion from current termination payment arrangements
- Improved efficiency in number allocation.

The top level objective, that of making the initiating operator responsible for call routing (and hence avoiding reliance on a donor network), was accepted as a desirable benefit by most operators, but not without reservations. They felt it should not be pursued at any cost because:

- The incidence of donor network failure has been very small
- The existing system of Onward Routing works well in almost all cases
- Operators have invested in the current system and could not necessarily see much benefit resulting from re-investing significant amounts in a new system.

Some said that alternative protection processes against donor failure were available by means other than resorting to a CDB solution. One pointed out that this was more a service continuity issue than a NP issue. However, others expressed the view that although donor network failure

had not been a recent issue, there was an increasing number of small new entrants (including some offering mobile services), and so the likelihood of an operator failure had increased.

Opinions on the other benefits were varied and not consistent across operators or operator types.

Operators were asked to propose other benefits of a CDB solution. There were a few suggestions, for example a better end user experience, but no consistent themes.

One operator, and one vendor, said that network quality issues could arise with high volumes of porting and high ported traffic. This is because the donor network needs to have sufficient capacity to handle the ported calls. Also, latency and call distortion were more critical in NGNs using IP and so direct routing would become more attractive to maintain call quality.

5.4 NGN implementation plans

All of the larger fixed network operators we interviewed said that:

- They have clear plans for moving to NGNs in a reasonably short timeframe
- They acknowledged that TDM legacy equipment will still be used in their network for some time; they do not know today all the details of how this equipment will be phased out
- They have a significant on-net traffic profile, which means that they want to optimise routing for ported numbers.
- Smaller, or newer entrant fixed operators said that they would implement NGN directly, without going through a TDM network phase.
- Mobile operators are implementing partial NGN architectures, e.g. through use of IP transmission and switching in the core. Some operators currently have no plans to move to full NGN (IMS).

5.5 Future Implementation of NP

Future implementations of NP will have to be consistent with the underlying architectures. In the fixed network, operators reported a clear intention to move to NGNs, and so NP will be based on NGNs. In the mobile network there is less clear intention from the operators to make such a significant change.

A large majority of respondents thought that, from a purely technical point of view, CDB/ACQ was the best solution for NP. All respondents felt that a CDB which combined fixed and mobile porting information was highly desirable in an environment where fixed/mobile convergence was expected to increase. However, even though CDB/ACQ was viewed as good technically, there were major concerns about its costs, benefits, and the associated process issues. The lack of standards is seen by operators as a major block to moving forward with a new NP routing method, for both fixed and mobile networks.

In general, fixed operators had slightly different views to mobile operators about the direction in which NP implementation should go. Fixed operators were supportive of CDB/ACQ being introduced with NGNs, but said there was no choice but to proceed with OR for first implementations. One supportive operator said that CDB/ACQ for NGNs was ‘just a discussion concept with no clear way forward’. Mobile operators in the main were much less supportive as they felt that their systems were working well and when Call Trap was fully implemented they would have many of the benefits of CDB/ACQ. However one mobile operator was strongly in favour of CDB/ACQ as they felt it would improve quality and the associated process changes would promote competition.

All operators want to retain their own routing databases within their own networks, for performance, security and integrity reasons. Thus a CDB was expected to provide non real time number porting information rather than real time call routing.

Some fixed line operators are newer entrants who tend to provide VoIP services (although it was pointed out that there are also many smaller operators with perhaps just one TDM switch). Many are small in terms of customers connected and most have one interconnect only, to BT. However

there is at least one operator which is implementing an NGN as their first voice architecture and they plan to have millions of customers in a relatively short space of time. Currently they have little experience of handling ported out numbers. Operators like this are deploying NGNs which are CDB/ACQ capable but will use OR until standards are defined for Direct Routing. Some small operators suggested that the cost of identifying their own ported in numbers is prohibitive as it requires a database lookup for every dialled number (just as a NP CDB would).

In the mobile network, some operators mentioned that Direct Routing of calls was the next stage of improvement, as described above, and in Service Description 8. This relies on signalling relay, which is a special mobile network function. Operators noted some problems with the settlement process where the donor and recipient operator settle for Onward Routing. If the donor operator is not involved in call delivery, as would be the case in Direct Routing, the current settlement process fails.

Mobile operators were in the main critical of going to a new scheme as they were convinced that they had implemented a good system with visibility of each others' databases (i.e. HLRs). One view was that this actually implemented a 'common or central' database already, in the sense that everyone had access to the information they needed, although the implementation was by a distributed database hosted by the operators jointly. Although not strictly resilient to a donor failure, they felt this was extremely unlikely in the UK market.

5.6 Implementation and Transition Issues

Transition arrangements to NGNs were a big concern especially for the larger fixed incumbents. All said that they would not invest in upgrades to their legacy TDM switching in order to introduce an ACQ system because:

- It would be costly
- It would soon be superseded by NGNs
- It would not now be possible to get upgrade support from the switch suppliers, even if they wanted to do it.

Most operators will use OR when they transition to NGNs, at least initially, because that is all they can plan for today. A gradual move to CDB on NGN is seen as possible by some, on the basis that NP standards for IP interconnect are agreed and IP interconnect commercials are attractive; but this is too far into the future and uncertain for any form of definite plan.

Mobile operators said that their more capable TDM networks were able to support a CDB/ACQ. However, two said that there was no commercial case for the cost required and that the existing OR mechanism worked well. A third said it wanted to move to a CDB as soon as possible and that the cost of doing so, while still large, was justifiable.

All operators agreed that with the increasing importance of fixed-mobile convergence the only sensible long term solution was for a single NP CDB consisting of both fixed and mobile number porting information. One mobile operator supported this but also pointed out that the CDB should not constrain a faster mobile solution in the shorter term.

In a NGN implementation, all numbers are looked up for routing purposes (quite apart from NP), so all respondents agreed that the only appropriate CDB implementation is one in which all calls are queried. Most operators believed the best solution was for this database to be updated automatically with NP information using DNS/cache techniques.

There was a general agreement that ENUM was the most likely way of storing and distributing number and service information using DNS principles. However, no standards currently exist for how this will work for NP. If ENUM/DNS is to be used in a NP database, it is essential that an organisation with strong DNS experience is used to operate it.

Two operators reported that SMS has to be considered separately from voice for NP purposes. They indicated that there is no defined standard for how an international originated SMS should be routed. Currently such a SMS has to be routed to the number block holder and a UK CDB solution would not change this unless the CDB was accessible to all international operators. This raises the

question of the domain of operation for an ACQ CDB system (i.e. is the domain UK or international?).

5.7 Impact on Service Innovation

Most operators said that current NP by OR did not impact or constrain service innovation because typically a new service would not be introduced until all networks were able to support it, or NP was not offered in conjunction with that service.

However, mobile operators recalled the example of Video Messaging initially not working across some donor networks until they had a 3G capability. A few operators quoted other examples and were conscious that being completely independent of donor networks would allow them to innovate at their own speed.

Only one operator stated a problem with implementing NP on NGN services.

There were few concerns expressed about the new services enabled by NGNs impacting on NP.

5.8 Process Related Issues

Many operators felt that, although a shorter porting time is of course better, the existing porting time (of about 5 days) is satisfactory. One mobile operator said that 5 days was one of the barriers associated with NP and that a more appropriate target porting time should be 2 hours (as is reported to be achieved in Ireland). Several operators believed that the introduction of a CDB solution should allow the porting time to be reduced from 5 days down to perhaps 24 hours.

Several operators felt very strongly that a major process-related problem with NP is the time-consuming and resource-intensive process of setting up a bi-lateral arrangement with another operator. In the case of most new entrants, this problem dwarfs the benefits associated with a CDB and is a priority issue to be resolved. Many operators believed that industry-wide efforts are needed to come up with an efficient multi-operator process.

There was strong feedback from many operators that the loss of the Functional Specification for NP was a negative move that made setting up NP agreements harder.

Other process issues were:

- Where a porting arrangement has been set up, time to port should be reasonably short, as win back schemes can divert customers back to the current serving operator
- Where a porting arrangement does not exist, it can take many months and much work to set one up with a new operator. There was an indication that a porting arrangement could not be set up in advance, since you needed a potential customer in order to create the agreement.

The primary concern of the smaller operators is not so much portability but the time and effort required to get basic connectivity.

5.9 Numbering and ENUM

Several statements made by operators about current numbering arrangements implied that the distinction between a geographic location of a fixed number and also between fixed and mobile numbers is being eroded.

Some operators expressed concern over numbering, for example what services are offered behind which numbers. There are now new entrants who have been allocated 07x number blocks and their perspective is very different to the larger more established operators with 07x numbers. One of the larger operators said that they did not agree with new entrants being allocated numbers in this range for services they did not consider as mobile. This is not strictly an NP issue, but operators were of the view that it should have higher priority than NP, and NP should not be the driver to make changes.

The following assertions were made:

- Many numbers have been moved from geographic areas, breaking the linkage between the current National Destination Code (NDC) scheme and the user's physical location
- The numbering scheme in the UK has moved from being location and call charge based, to being only call charge based
- The deployment of NGN architectures will further erode the association of area number codes with a physical location
- The ability to enable call forwarding to route calls between fixed and mobile networks has started to associate the numbers ranges together
- The development of Fixed-Mobile Convergence (FMC) will drive the merger of Fixed and Mobile numbering
- The use of 07x (mobile) numbers for nomadic and other services was of concern.

A universal opinion was that it was likely that FMC will continue and probably accelerate; therefore a combined NP database for both fixed and mobile numbers was the only sensible solution.

The use of the term ENUM was widespread, and it was pointed out that it can be a cause of confusion since ENUM can refer to:

- User ENUM
- Infrastructure or Operator ENUM.

All operators thought that infrastructure ENUM[6] would be highly relevant to NGN architectures. ENUM is a part of the IMS mobile NGN standards.

5.10 Strawman Timescales

On the hypothesis that a CDB solution for NP was to be introduced, we agreed with Ofcom that the following set of key milestones would be tabled for comment by the operators:

- NGN standards for number portability agreed by the Network Interfaces Consultative Committee (NICC): January 2007.
- Common database established, available for voluntary live use by network operators: April 2008.
- Records for all ported telephone number hosted on NGN nodes must be populated in the common database: April 2009.
- All Calls to ported numbers to be resilient against failure of the donor network: 2012.

There was widespread feeling that the timescales for steps 1-3 were very optimistic, given peoples' general knowledge of the NICC process and the likely speed of the necessary standards which needed to emerge to define a new process. No operator felt that the NP standards would be produced by the NICC by January 2007. Some believed that IP interconnect standards would become available in mid to late 2007, but may not at that point include the required NP component.

Most operators felt that once standards had been defined a 5 year implementation timeframe was a reasonable objective for reaching the point where there is close to 100% independence of donor networks (several stated that absolute 100% would never be reached). Some operators felt that the 2012 target (i.e. all calls to ported numbers to be resilient against failure of the donor network) could still be achieved, even if the standards are delayed by up to one year.

One mobile operator believed a CDB solution was possible and desirable by the end of 2007 and should not be constrained by fixed network timescales.

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[6] User ENUM is largely irrelevant to the current discussion, as it is an uncontrolled, public database. Infrastructure ENUM refers to the standards (which are still evolving) to be used for converting E.164 numbers to URIs.

Several operators, mostly the larger incumbents, felt that in the absence of agreed standards and without a common Industry direction NGNs would have no option but to continue with the existing OR solution for NP.

5.11 Other Factors

Operators mentioned factors which they felt were important in the context of this discussion but not always directly related to NP.

Some new entrants reported the difficulties they have had in getting some of the larger incumbents to provide access to their new number ranges (e.g. 07x and 056x) in the absence of an obligation to do so. These operators believe that an Industry-wide connectivity directive is needed, even before NP issues are considered.

A number of operators recognised the pressure on fixed geographic numbers and supported the allocation of smaller blocks. Some suggested this be included in a NP CDB unifying NP with the number block analysis function. Several pointed out that, with an NGN, it is not necessary to have contiguous number allocations.

Several operators with existing VoIP networks reported concerns with the definition of Publicly Available Telephony Services (PATS). The NP General Condition applies only to PATS and VoIP services have been questioned as to whether they are PATS or not (and hence are eligible for NP).

Several operators recalled that most of the Industry did not want Ofcom to remove the reference to the NP Functional Specification in the recent relaxation of the NP General Condition. Although this had given some parties more freedom in setting up NP arrangements, it had primarily resulted in encouraging more bi-lateralism and individually negotiated arrangements where previously there had at least been a common framework for all arrangements. These operators felt that this could only exacerbate the existing problems with setting up the NP arrangements.

5.12 Costs

5.12.1 Changes from 2004 report

Those operators who were involved in the Mason report all reported that the costs/benefits equation had not changed at all since 2004 in terms of the option of modifying TDM networks for a CDB solution. This is primarily because upgrading processor capacity remains as costly as it was in 2004. In fact some operators said that the solution had become impossible because manufacturers no longer support the necessary upgrades.

These operators state that they will not upgrade any TDM switches to use ACQ. The costs of introducing an ACQ system were not felt to be substantially different to the estimates produced for the Mason study.

5.12.2 Costs of NGN

Cost information for implementing a CDB solution in NGNs has been difficult to obtain, although all future NGN operators believed that these costs are significantly lower than for TDM networks and that the cost/benefit equation should favour taking advantage of the NGN architecture and current rollout plans to move to a CDB solution.

For future NGN implementations, cost information is not really known due to lack of specific implementation experience and uncertainty over aspects of implementation. However, the general feeling was that the setup cost and operational cost of an NGN CDB would be relatively small and acceptable if part of existing deployment plans. Some thought that these costs would still be too high if they meant changing their current implementation plans based on OR.

Several operators, typically those who do not support changing from the current OR implementation, felt that while overall number porting and ported traffic stayed at current levels there was no case for incurring any cost of change. There were some views, based on a number of

assumptions, that levels of at least 30% would be needed before routing efficiency gains could justify the cost of change. A few responses emphasised the distinction between ported numbers and ported traffic when considering the economics of NP. Even with quite small levels of porting it is possible that large numbers of call attempts to ported numbers could result, for example from business numbers (which have a higher propensity for porting and which carry a higher than average level of traffic).

There were mixed responses to the impact on future NP volumes of factors such as LLU, fixed mobile convergence and Voice Line Access. Some said there would be no change to NP volumes. Others believed there would be an increase but no material change to the economics of NP.

6 Cost Modelling

6.1 Cost Modelling Overview

The costs of introducing number portability relative to the benefits were modelled by Mason in their 2004 report to Ofcom. The conclusion in 2004 was that to change fixed networks to ACQ would have a Net Present Value (NPV) of around -£200 million, showing that the benefits would be outweighed by the costs.

In this study we have investigated whether the 2004 conclusions still stand. To do this we updated the Mason model in the light of current prices for Average Port Conveyance Cost (APCC), and then modelled a range of possible implementations of ACQ. In particular we have also modelled mobile networks (not included in the original Mason model) and explored the effects of NGN technology on costs.

The Mason report modelled the costs of upgrade for fixed TDM networks to perform ACQ and Query on Release (QOR) on a CDB. In our work we have only adapted the model for the ACQ case. We have not updated the QOR case as this was not favoured by respondents.

The current model evaluates an NPV based on capex and opex estimates for CDB and network changes, and also estimates the costs for Onward Routing (OR) based on the APCC and Donor Conveyance Charge (DCC).

The following table lists the scenarios we have evaluated and their associated NPVs:

Scenario		Costs Modelled	Traffic				Comment	Capex	Port costs p/min		NPV
			F-F	M-F	M-M	F-M			fixed	mobile	£m
F1	TDM	Fixed	•				Base	£267m	0.0267		-200.6
F2	TDM	Fixed	•				Base with 2006 APCC	£267m	0.0163		-214.9
F3	TDM	Fixed	•			•	Adds fixed - mobile Traffic	£267m	0.0163	0.8	-126.1
M1	TDM	Mobile			•		Adapt Base model to mobile	£12m		0.8	189
M2	TDM	Mobile			•		Above with Lower DCC	£12m		0.1	8
M3	TDM	Mobile		•	•		Adds mobile - fixed traffic	£12m	0.0163	0.8	193.1
C1	TDM	Fixed and Mobile	•	•	•	•	Combined	£287m	0.0163	0.8	73.7
N1	NGN	Fixed	•				NGN variation on base	£61.5m	0.0163		15.3
N2	NGN	Fixed and Mobile	•	•	•	•	NGN variation on Combined	£73.5m	0.0163	0.8	297.3

Our starting point is an ACQ model which is exactly the result from the original ACQ model produced in 2004 by Mason. This is represented by Scenario F1.

Updating for Fixed networks

We have brought the 2004 model (i.e. Scenario F1) up to date, i.e. with a start date of 2006 and using the latest value for APCC in the fixed network. Other costs remain unchanged. This is represented by Scenario F2.

We have also added in the fixed to mobile traffic (which was not considered by Mason), which was not considered by Mason. This gives an increased benefit of reduced OR costs for mobile terminated traffic, with negligible additional cost in the CDB. This is represented by Scenario F3.

Modelling Mobile networks

We then considered a set of scenarios examining a mobile only implementation. Firstly, we take a purely mobile-centric view. Scenario M1 considers the costs of implementing an ACQ solution on the mobile networks, and only considers mobile to mobile traffic. This uses the current industry

DCC which has not been changed for some years. An alternative view of this is presented in Scenario M2, which applies a lower DCC that we believe reflects costs more accurately. We then add in the mobile to fixed traffic (represented in Scenario M3) which, as in the fixed network, increases benefit at marginal cost.

The UK network as a whole

Scenario C1 combines the fixed and mobile models to give a current view of the UK network as a whole with CDB/ ACQ implemented.

Updating for Next Generation Networks

We then consider the future for fixed networks, post introduction of NGN. We start with an NGN only version of the Mason model, i.e. fixed network centric with only fixed network traffic included (represented in Scenario N1). We then introduce the mobile network as well as all the fixed to mobile and mobile to fixed traffic, to produce Scenario N2. This represents the long term future of the UK network as a whole, with CDB/ ACQ implemented.

Scenario N1 is a variation on Scenario F2, to model the likely costs of an NGN rather than a TDM implementation.

Detailed results for all of these Scenarios are shown in the Appendix A.

6.2 Results Summary

Scenario F1 - 2004 Base Fixed Only	Scenario F1 (the baseline scenario) reflects the 2004 model (i.e. there are no changes to the 2004 model).
Scenario F2 - 2006 Fixed Only	Scenario F2, in which the 2004 results are brought up to date, shows that the business case for the fixed network upgrade to ACQ has deteriorated in the last two years. The primary reasons are: • Reduced costs of onward routing as represented by the Lower APCC charged by BT • Obsolescence of the equipment which can no longer be upgraded, which means that capex costs cannot be revised.
Scenario F3 - Fixed Originated, Fixed and Mobile Terminated	This scenario extends the Mason model by adding in the mobile terminated traffic. The traffic levels are derived from the Ofcom 2005 review. We have only split this into fixed and mobile termination reflecting the source Ofcom figures which do not break out the geographic and non geographic parts. Adding the mobile terminated traffic provides a small improvement to the NPV compared to Scenario F2, as the mobile APCC (or DCC as it is known in mobile) is much larger than the fixed APCC. This results in an increase in the savings resulting from not paying the higher cost of OR for mobiles. It does however have a large negative NPV
Scenario M1 - Mobile Only	The scenario, for mobile networks alone, shows a different picture. The cost of the ACQ upgrade to the mobile networks is much lower because the networks are inherently more intelligent. In addition the APCC (DCC) is much higher because the switching capacity used is more expensive. This results in a significant positive benefit for the mobile operators as a whole from a change to ACQ for mobile numbers only. Note that the costs and benefits do not in general apply to the same operators and that the current settlement process would need to be changed to “correct” for this.

Scenario M2 - Mobile Only	This scenario is similar to Scenario M1, but uses a DCC cost of 0.1p/min. This results in a small NPV, i.e. the cost benefit of the change is neutral.
Scenario M3 - Mobile Originated, Fixed and Mobile Terminated	As with Scenario F3 adding the mobile to fixed traffic to the ACQ in the mobile networks brings a small additional benefit to the mobile only case.
Scenario C1 - Mobile and Fixed Combined	This scenario, in which all the UK is running ACQ, is effectively a linear combination of Scenarios F3 and M3. Significant savings arise for the mobile terminated calls. Significant costs fall on the fixed network operators in this scenario.
Scenario N1 - Fixed NGN	Scenario N1 shows that for an all-NGN scenario, the change to a CDB approach has a higher NPV than Scenario F2; the NPV is now positive. In reality, if the switch to a CDB was made now for NGNs, we anticipate many of the costs of the switch would be absorbed in the rollout costs of NGNs, since the costs of implementing Onward Routing in the NGNs would not apply.
Scenario N2 - Mobile and NGN Fixed Combined	This is the final picture scenario, i.e. all the UK running ACQ, with NGN fixed networks. In this scenario savings accrue to all network operators.

6.3 Other Observations

Under the current agreements the costs of OR are incurred by the donor operator, and recovered from the recipient operator.

In a CDB solution approach, it is likely that the additional costs of the CDB lookup will fall on the originating operator but will be incurred for all calls not just those to ported numbers. In this case, the costs are incurred by a party with an interest in the call succeeding; therefore we would expect the costs to be borne by the originating operator. In a scenario where a CDB is available but lookup is optional, with the current settlement arrangement[7], there is no incentive to incur the cost of a lookup.

Most of the cost of a switch to ACQ in a TDM network is incurred by upgrading switch processors and in the IN to do the database lookups. As the traffic on TDM networks falls with the migration of the network to NGN the unused IN and processor capacity will increase. We estimate that if the TDM traffic dropped by somewhere between 75% and 90%, the existing infrastructure would have sufficient capacity to perform the CDB lookups. In this case, the upgrade costs would be similar to those for NGN implementation. This may be a useful reference point in an ACQ implementation timeline.

6.4 Basis of Costs used for Modelling

The costs that have been used in the presented cost models are:

Fixed Network TDM Upgrades	For Scenarios F1, F2, and F3 we have made no changes to the capex and opex figures used in the baseline model produced in 2004 (the operators we spoke to suggested that the original figures should not be changed). It should be noted that these scenarios are largely theoretical, as

[7] Settlement is between recipient and donor only, the originating operator is not compensated.

	upgrading fixed TDM networks is no longer considered an option, since support for the introduction of new features on these switches is no longer available, with maintenance updates only being supported. Although these scenarios are unlikely to be adopted, they are included as informative "stepping stones" in showing how costs and benefits build up under different circumstances.
Fixed Network NGN	The Mason report modelled the costs of upgrade for TDM networks to perform ACQ and QOR on a CDB. In the intervening 2 years the installed base of networks has started moving to Next Generation architectures. The costs of implementing a CDB approach in these new NGN networks has not been studied in detail by the operators because there are no standards yet defined for doing so. Whilst no respondents could provide any cost indications for adding CDB to the NGN, the overwhelming majority of responses suggest it would be lower than the upgrade costs for implementing ACQ on a TDM network. The Mason study identifies three significant capex items: • IN platform • Signal Switching Point (SSP) right-to use, • Switch processors The IN platform function is a part of the routing database in the NGN architecture. The SSP function is provided within the call server in the NGN architecture. The NGN call server processors are much more powerful than the switch processors in the TDM architecture. This is because in an NGN they are required to do much more processing than in the TDM architecture. The additional processor load of performing an ACQ in the NGN architecture is negligible and an upgrade would not be required to specifically support this functionality. Therefore, whilst we have received little feedback on NGN costs from operators in our interviews, we conclude that these three capex items, identified as significant in the Mason report, would be negligible in the most common fully evolved NGN architecture. Mason identified several other capex items in their report. These included: • SSP-SCP Connectivity • Rebuild Data Routing Tables • Integration of IN with New Switch Types • Switch Build Fees – Redesigning Switch Architecture • Internal Systems Development • Interface to CDB • Implementation • Process Development • CDB Of these items, the first four are related to the TDM network architecture and will not be present in an NGN. There will, however, be similar capital items related purely to the NGN architecture, which we believe will be lower for an NGN, though not significantly so. The remaining five elements will be present in the NGN architecture with similar costs to those of the TDM case. The Mason report costed these items at £61.5m at the time. Based on our above reasoning we conclude this figure should be used for the NGN in our model. Our capex figures for Scenario F3 are summarised as follows:

	<table><tr><td></td><td colspan="2">Capex £m</td></tr><tr><td></td><td>TDM</td><td>NGN</td></tr><tr><td>IN Capacity Upgrade</td><td>86.7</td><td>0</td></tr><tr><td>SSP right to use fee</td><td>23.7</td><td>0</td></tr><tr><td>Processor upgrades</td><td>94.8</td><td>0</td></tr><tr><td>Other capex</td><td>61.5</td><td>61.5</td></tr><tr><td>TOTAL</td><td>266.7</td><td>61.5</td></tr></table> We have made a reduction in the opex for NGN compared with that used by Mason for the TDM network. We have identified three elements of opex for the NGN. • The cost of operating the CDB itself estimated at £625k per annum based on our discussions with a CDB supplier • The additional costs of operating a real time resilient CDB proxy inside the operator's network, which we have estimated at a total of £620k, based on our own experience of the hardware and software cost of similar systems • Operational staff costs for which we have used the same £200k figure used by Mason.
Mobile Network Upgrade	This applies to Scenarios M1, M2 and M3. A mobile network is inherently more "intelligent" than a fixed network so is capable of doing the ACQ with minor capacity upgrade. At least two mobile networks have already implemented the Call Trap function. To do this they perform an ACQ on an internal database of ported-in numbers to identify calls to ported-in numbers and directly route to them. Moving to an ACQ system for all routing (not just for ported-in numbers) is a simple extension of this process. The database would have to be much larger (a copy of the main CDB) and the routing prefix would have to be added to all ported numbers as they leave the network. Our analysis of traffic data shows that an operator implementing the Call Trap function can save between £0.11M and £1.1M per annum in donor conveyance charges. If the operators who implemented Call Trap look for a 7-year payback, this suggests that the capital costs of the implementation are in the range of £0.8M to £8.0M per operator. Since at least two operators have already implemented Call Trap we put the range of costs for the 5 UK operators to implement ACQ at £0.8m-£24m. For modelling purposes, M1, M2 and M3 have used UK network upgrade costs of £12m (i.e. the middle point of the stated costs range above).
Fixed Network OR Costs	The fixed network uses APCC as the indicator of OR costs. As the APCC is a published cost, we have used this as an indicator of the actual network costs to perform OR. The value for BT's APCC has changed from 0.0267p/min in 2004, to a current cost of 0.0163p/min. We have used the current APCC cost in all

	scenarios except Scenario F1, the base line scenario.
Mobile Network OR Costs	The Donor Conveyance Charge (DCC) is the mobile equivalent of the APCC, the payment made to the donor operator for forwarding a call. As with the APCC this indicates the additional cost of OR. The current rate used by the industry for settlement is 0.8p/min; however this figure has not changed in 6 years. We believe that the industry has insufficient incentive to bring this figure up to date, as the major operators' income and payments derived from this figure broadly balance out. We believe this figure is inappropriate to use when considering the industry as a whole, as it does not reflect the current costs of OR. Based on the capital equipment and operating costs figures we have received from operators, we have estimated a cost figure for the DCC of 0.1p per minute. This is higher than the fixed equivalent, but the mobile network switches are more expensive. We have presented two alternative mobile only scenarios one based on the published DCC and another of our estimate of cost. We have used an annual porting rate of 2% for mobile number porting. This reflects current porting rates for mobile numbers which are higher than for fixed.

7 Observations

Over the course of the project several discrete issues have emerged other than those directly relating to costs. Ofcom has asked us to identify these issues in this report, and to provide comments that might usefully inform the consultation process. The table below records the observations, explaining for each one what the issue is, and where appropriate giving our technical opinion.

1	***Cost benefits results***	NGNs represent an opportunity to introduce CDB/ACQ at lower cost than previous TDM networks. Industry needs directives to agree a common approach so that the costs can be estimated. Without a common approach, the UK NGN introduction will miss the opportunity to introduce a better NP system at reduced cost. We believe that a simple cost benefit model does not show all of the benefits that may accrue, e.g. the benefits of increased competition, or the avoidance of issues that may arise such as reduced call quality in the event of additional traffic through donor networks if porting rates increase.
2	***A move to a CDB implementation by "natural evolution"***	It is unlikely that UK fixed network operators will move to a CDB implementation of NP by natural evolution. Mobile operators are slowly moving towards a direct routing solution, but it will not be donor network independent, will not use a CDB, and there are no specific timescales for implementation.
3	***Interim NGN architectures and a CDB solution***	Whilst fully evolved NGNs are able to perform CDB lookup at low cost, a potential issue for interim NGNs (being used as a "stepping stone" implementation by large operators and by new entrants) is that they do not have the flexibility to implement the CDB at the same low cost. Fixed operators forced to adopt a CDB lookup approach too quickly may incur capex that will have to be written off, or they may have to move to fully evolved NGN in one step, possibly delaying the change.
4	***Separate NP solutions for fixed and mobile networks should be***	There are likely to be some barriers to free competition if separate mobile and fixed databases

	avoided	are allowed to evolve. The signalling required for interrogation of the mobile "DB" is the SS7 based MAP signalling as used by mobile networks. This is not easily usable by non GSM/3GPP mobile networks such as those of: fixed TDM operators, fixed NGN operators and new entrant VoIP fixed and mobile operators. Such an approach does not apply to the fixed operators. Whilst they could also set up their own internal portability databases the costs of using the "HLR based" approach designed for the mobile networks will in our view be excessive. Setting standards for a common fixed-mobile solution, but allowing mobile and fixed to move at different rates, would allow the routing benefits that apply to the mobile case to be achieved earlier.
5	***Timescales***	In the absence of Industry consensus we believe that NGN implementation will continue to use Onward Routing.
6	***The current porting process lead time is not constrained by the lack of a CDB solution***	Feedback received during the study indicates that there is some confusion between the "CDB based ACQ" approach to number portability and the business process of porting a number. In the current OR based technical solution for NP in TDM networks there is a timetable that drives the port time. We did not identify any technical reason why the current Onward Routing method need constrain the porting process to substantially more than 24 hours. We conclude therefore that changes to the porting business process could significantly reduce current port times (but stated problems regarding the setting up of bilateral porting arrangements need to be taken into account).
7	***The current porting process is controlled by the donor operator who has no incentive to reduce lead times***	A move to a CDB solution would have a beneficial effect on port lead times. At present the port process is controlled by the donor operator who must set up the OR (and in the case of mobile operators issue the PAC). There is no clear incentive for the donor operator to carry out this process quickly; indeed if they delay for long enough they may win back the customer. A CDB solution would remove control from the donor operator, i.e. the donor would no longer need to initiate porting by "handing over" the number. In practice checks would be required to prevent fraudulent porting (for example, validation by calling or messaging the user of the ported number).

8	***The need for a consistent, common approach to NP***	We believe a consistent, common approach is needed for NP. Almost half of all traffic passes between fixed and mobile operators. Any approach that does not bridge the boundary between fixed and mobile will require Onward Routing to remain in place for this traffic. In addition, where numbers are being ported between these domains (e.g. a mobile number might be ported to a converged fixed/mobile operator using VoIP and WLAN for mobility), greater barriers result from CDB implementation differences.
9	***The use of OR is a potential barrier to new service introduction***	Interviewed operators generally felt that new service introduction would not impact current number portability. We note however that historically number portability has been a problem for SMS, MMS and video calling (i.e. the most recent new services introduced). We believe that, whilst OR remains, a new service will have to be supported by the originating, donor and recipient networks for that service to operate. Operators have generally reported that competition forces all operators to collaboratively support new services. However, moving to a CDB is perhaps necessary to support service innovation, particularly by smaller and new entrant operators.
10	***Direct Routing is not dependent on a CDB***	Mobile operators are moving towards a Direct Routing solution that uses the signalling relay and Home Location Register (HLR) interrogation rather than a CDB. Some view these HLRs as a distributed CDB and we agree this is the case. However, this approach does not provide all the benefits that would be provided by a CDB as identified by Ofcom (documented in 5.3). In particular in the “HLR solution” the DB holding a ported number is operated by the number block holder. In the case of network failure (whether technical or commercial in nature) this will be lost, therefore there is no resilience against failure. This approach also needs number block analysis to identify where the DB for a number can be found.
11	***There are separate benefits offered by Direct Routing compared to those of a CDB solution***	Direct routing eliminates the costs of Onward Routing, although there is an incremental cost in determining the direct route for each call. The CDB allows call routing to be independent of the donor operator. It also allows the porting process to be driven by the recipient operator rather than the donor operator.

12	***The current settlement process "barrier" to direct routing***	We note that the settlement process is at present delaying the introduction of Direct Routing in mobile networks. We believe that a change in the settlement process would better support the use of a CDB solution for NP. At present the cost of OR falls on the donor and recipient operators, who settle the OR cost between them. With a CDB lookup the additional cost of portability falls on the operator who consults the CDB. This should be the originating operator, but might be a transit operator in many cases. To support the use of the CDB, we believe any OR cost should be borne by the originating operator (with the terminating operator receiving the full termination payment). The donor operator should charge the originating operator for OR when it takes place. The originating operator can then decide on a purely commercial basis whether to carry out a CDB lookup or not. We believe that a system like this in place will encourage a move to CDB lookup as a network is upgraded.
13	***A CDB solution for Number Portability is technically good, but has no short term commercial justification***	Ofcom asked if Industry has sufficient incentives to provide an improved solution for number portability. Operators generally recognised the merits of an improved solution, including the benefit of not being dependent on the donor network. Some operators, mostly new entrants, but also one mobile operator, favoured moving to an improved solution as soon as possible. However, most operators, especially the larger incumbents (both fixed and mobile) are convinced there is no commercial case to move to an improved solution. In terms of the improved solution, all operators accepted that the only sensible option (from a technical perspective) is a CDB in which all calls are queried to determine routing. Some operators indicated that the term ACQ is related to a TDM implementation and that in a NGN environment all calls are queried as part of the normal routing operation. We believe that this is true in principle, but some operators may decide to implement NGN using TDM emulation, and hence will continue to rely on number block analysis.
14	***Cost Benefits of a new solution and incentives to move from current system***	The operators gave us no information on costs. One reason stated for this was that they did not know what they should be costing, as there was no direction to introduce a new system. The operators' existing cost-benefits information indicates to them that there are few benefits to justify the costs. Where an individual operator disagrees with this statement it is difficult to move forward on the basis of cooperation. Small

		operators will also find it difficult to move forward if the larger operators do not want to cooperate.

Appendix A Scenario results

Scenario F1 – 2004 Fixed only

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
9		Incremental savings		£m	-	-	-	15.5	17.2	18.8	20.5	22.1	23.8	25.4
10		Incremental opex		£m	-	1.8	5.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0
11		*Incremental EBITDA*		*£m*	-	*(1.8)*	*(5.4)*	*6.6*	*8.2*	*9.8*	*11.5*	*13.1*	*14.8*	*16.4*
12		Incremental capex		£m	53.3	106.7	106.7	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(53.3)*	*(108.5)*	*(112.1)*	*6.6*	*8.2*	*9.8*	*11.5*	*13.1*	*14.8*	*16.4*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(53.3)	(101.4)	(97.9)	5.4	6.3	7.0	7.6	8.2	8.6	8.9
17		Net Present Value (NPV)		£m	(53.3)	(154.7)	(252.6)	(247.2)	(241.0)	(234.0)	(226.3)	(218.2)	(209.6)	(200.6)

Scenario F2 – 2006 Fixed only

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	13.3	14.7	16.0	17.4	18.7	20.1	21.4
10		Incremental opex		£m	-	1.8	5.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0
11		*Incremental EBITDA*		*£m*	-	*(1.8)*	*(5.4)*	*4.3*	*5.7*	*7.0*	*8.4*	*9.7*	*11.1*	*12.4*
12		Incremental capex		£m	53.3	106.7	106.7	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(53.3)*	*(108.5)*	*(112.1)*	*4.3*	*5.7*	*7.0*	*8.4*	*9.7*	*11.1*	*12.4*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(53.3)	(101.4)	(97.9)	3.5	4.3	5.0	5.6	6.1	6.4	6.8
17		Net Present Value (NPV)		£m	(53.3)	(154.7)	(252.6)	(249.1)	(244.8)	(239.8)	(234.2)	(228.1)	(221.7)	(214.9)

Scenario F3 - Fixed originated, Fixed and Mobile terminated

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	25.6	29.4	33.1	36.9	40.6	44.4	48.1
10		Incremental opex		£m	-	1.8	5.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0
11		*Incremental EBITDA*		*£m*	-	*(1.8)*	*(5.4)*	*16.6*	*20.4*	*24.1*	*27.9*	*31.6*	*35.4*	*39.1*
12		Incremental capex		£m	53.3	106.7	106.7	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(53.3)*	*(108.5)*	*(112.1)*	*16.6*	*20.4*	*24.1*	*27.9*	*31.6*	*35.4*	*39.1*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(53.3)	(101.4)	(97.9)	13.6	15.5	17.2	18.6	19.7	20.6	21.3
17		Net Present Value (NPV)		£m	(53.3)	(154.7)	(252.6)	(239.0)	(223.5)	(206.3)	(187.7)	(168.0)	(147.4)	(126.1)

Scenario M1 - Mobile only

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	28.7	34.3	39.9	45.4	51.0	56.6	62.2
10		Incremental opex		£m	-	0.2	0.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2
11		*Incremental EBITDA*		*£m*	-	*(0.2)*	*(0.7)*	*27.5*	*33.1*	*38.6*	*44.2*	*49.8*	*55.4*	*60.9*
12		Incremental capex		£m	2.4	4.8	4.8	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(2.4)*	*(5.0)*	*(5.5)*	*27.5*	*33.1*	*38.6*	*44.2*	*49.8*	*55.4*	*60.9*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(2.4)	(4.7)	(4.8)	22.4	25.2	27.5	29.5	31.0	32.2	33.1
17		Net Present Value (NPV)		£m	(2.4)	(7.1)	(12.0)	10.5	35.7	63.2	92.7	123.7	155.9	189.0

Scenario M2 - Mobile only Lower DCC

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	3.6	4.3	5.0	5.7	6.4	7.1	7.8
10		Incremental opex		£m	-	0.2	0.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2
11		*Incremental EBITDA*		*£m*	-	*(0.2)*	*(0.7)*	*2.3*	*3.0*	*3.7*	*4.4*	*5.1*	*5.8*	*6.5*
12		Incremental capex		£m	2.4	4.8	4.8	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(2.4)*	*(5.0)*	*(5.5)*	*2.3*	*3.0*	*3.7*	*4.4*	*5.1*	*5.8*	*6.5*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(2.4)	(4.7)	(4.8)	1.9	2.3	2.7	3.0	3.2	3.4	3.6
17		Net Present Value (NPV)		£m	(2.4)	(7.1)	(12.0)	(10.0)	(7.7)	(5.1)	(2.1)	1.1	4.5	8.0

Scenario M3 - Mobile originated, Fixed and Mobile terminated

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	29.4	35.0	40.7	46.3	52.0	57.6	63.3
10		Incremental opex		£m	-	0.2	0.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2
11		*Incremental EBITDA*		*£m*	-	*(0.2)*	*(0.7)*	*28.1*	*33.8*	*39.4*	*45.1*	*50.7*	*56.4*	*62.1*
12		Incremental capex		£m	2.4	4.8	4.8	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(2.4)*	*(5.0)*	*(5.5)*	*28.1*	*33.8*	*39.4*	*45.1*	*50.7*	*56.4*	*62.1*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(2.4)	(4.7)	(4.8)	23.0	25.8	28.1	30.0	31.6	32.8	33.8
17		Net Present Value (NPV)		£m	(2.4)	(7.1)	(12.0)	11.0	36.8	64.9	94.9	126.5	159.3	193.1

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Scenario C1 - Mobile and Fixed combined

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	55.0	64.4	73.8	83.2	92.6	102.0	111.4
10		Incremental opex		£m	-	1.8	5.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0
11		*Incremental EBITDA*		*£m*	-	*(1.8)*	*(5.4)*	*46.0*	*55.4*	*64.8*	*74.2*	*83.6*	*93.0*	*102.4*
12		Incremental capex		£m	55.7	111.5	111.5	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(55.7)*	*(113.3)*	*(116.9)*	*46.0*	*55.4*	*64.8*	*74.2*	*83.6*	*93.0*	*102.4*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(55.7)	(105.9)	(102.1)	37.5	42.3	46.2	49.5	52.1	54.1	55.7
17		Net Present Value (NPV)		£m	(55.7)	(161.6)	(263.7)	(226.1)	(183.9)	(137.7)	(88.2)	(36.1)	18.0	73.7

Scenario N1 - NGN Fixed only

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	13.3	14.7	16.0	17.4	18.7	20.1	21.4
10		Incremental opex		£m	-	0.3	0.9	1.4	1.4	1.4	1.4	1.4	1.4	1.4
11		*Incremental EBITDA*		*£m*	-	*(0.3)*	*(0.9)*	*11.8*	*13.2*	*14.6*	*15.9*	*17.3*	*18.6*	*20.0*
12		Incremental capex		£m	12.3	24.6	24.6	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(12.3)*	*(24.9)*	*(25.5)*	*11.8*	*13.2*	*14.6*	*15.9*	*17.3*	*18.6*	*20.0*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(12.3)	(23.3)	(22.3)	9.7	10.1	10.4	10.6	10.8	10.8	10.9
17		Net Present Value (NPV)		£m	(12.3)	(35.6)	(57.8)	(48.2)	(38.1)	(27.7)	(17.1)	(6.4)	4.5	15.3

Scenario N2 - Mobile and Fixed NGN combined

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
6	**ACQ - Cash Flow (Year End)**													
7														
8					2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
9		Incremental savings		£m	-	-	-	55.0	64.4	73.8	83.2	92.6	102.0	111.4
10		Incremental opex		£m	-	0.5	1.6	2.7	2.7	2.7	2.7	2.7	2.7	2.7
11		*Incremental EBITDA*		*£m*	-	*(0.5)*	*(1.6)*	*52.3*	*61.7*	*71.1*	*80.5*	*89.9*	*99.3*	*108.7*
12		Incremental capex		£m	14.7	29.4	29.4	-	-	-	-	-	-	-
13		*Cash Flow*		*£m*	*(14.7)*	*(30.0)*	*(31.0)*	*52.3*	*61.7*	*71.1*	*80.5*	*89.9*	*99.3*	*108.7*
14														
15		Discount Factor	7%		1.00	0.93	0.87	0.82	0.76	0.71	0.67	0.62	0.58	0.54
16		Cash Flow (Present Values)		£m	(14.7)	(28.0)	(27.1)	42.7	47.1	50.7	53.6	56.0	57.8	59.1
17		Net Present Value (NPV)		£m	(14.7)	(42.7)	(69.8)	(27.1)	20.0	70.7	124.3	180.3	238.1	297.3

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Appendix B Glossary

ACQ	All Call Query
APCC	Average Port Conveyance Cost
CDB	Common Database
DCC	Donor Conveyance Cost
DNS	Domain Name System
DR	Direct Routing
FMC	Fixed Mobile Convergence
HLR	Home Location Register
IMS	Internet Multimedia System, The Mobile NGN standard
IN	Intelligent Network
MMS	Multimedia Messaging Service
NGN	Next Generation Network
NP	Number Portability
NPV	Net Present Value
OR	Onward Routing
PSTN	Public Switched Telephone Network
QOR	Query On Release
SCCP	Signalling Connection Control Part
SMS	Short Messaging Service
SS	Softswitch
TDM	Time Division Multiplex
VoIP	Voice over IP

Appendix C NP realisation in NGNs

The details of NP implementation are dependent on future standards and availability of equipment. Figure C1 shows a possible network segment for an NGN to show the relationship between the operators' routing databases and a central NP database.

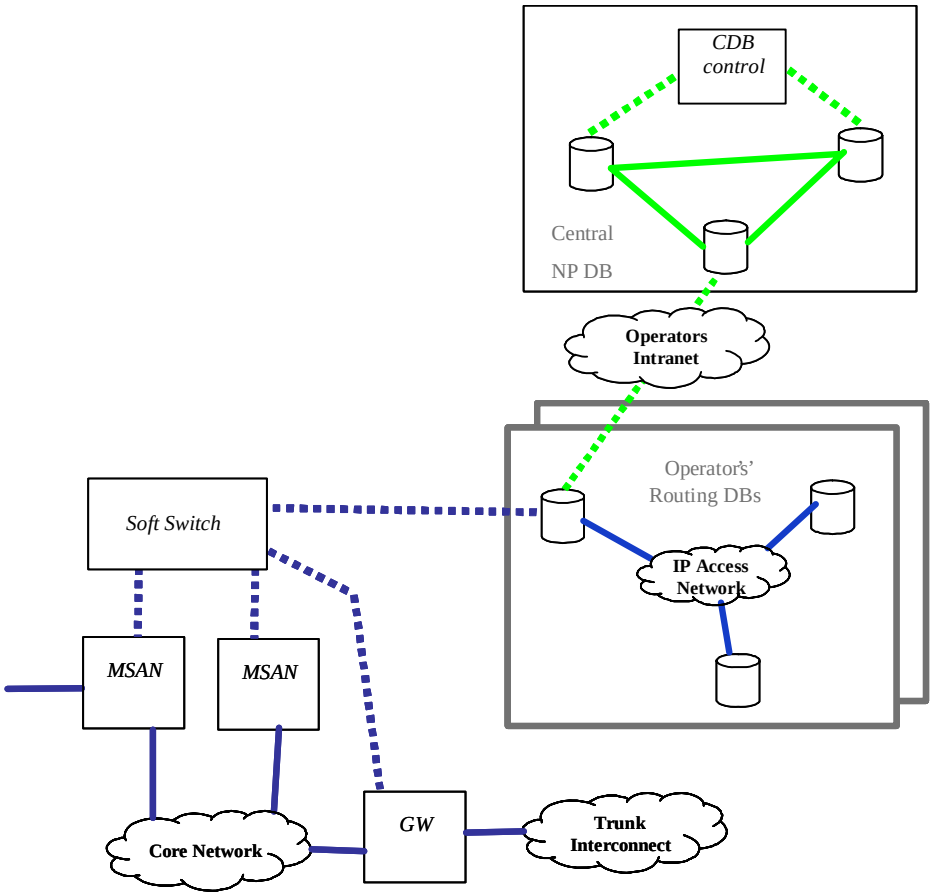

Figure C1: NGN Network Segment

In a fully featured NGN the Soft Switch[8] (SS) queries a database in real time, for every call, to determine how to route calls. The database can be either local to the SS or remotely located providing it has the necessary bandwidth. The database, which is owned by the operator, is completely contained within its own network, with the implementation being based on its own security and integrity requirements. Similar databases will be implemented by each operator.

A single number portability database (logically a CDB) is shown connecting to each operator's database via an access network. The CDB will automatically push new information about ported numbers into the operators' databases. There will be controls on caching and update rates to ensure that new data is propagated through the networks in the timescales required by the porting process. The CDB could also contain business logic to control the port process, although this would require agreement of a standard process.

There are many possible database implementations but the operator ENUM architecture, for both the internal routing information and the NP CDB, is the subject of widespread debate.

In principle NP lookups can be merged into the routing database. The ENUM approach would use extensive caching of data to reduce lookup related traffic and support fast operation and so access to the NP CDB would not need to be real time to support call set up times.

[8] Also referred to as a Call Server

Transition NGN Architecture

The above description is effectively that of a “fully featured” NGN. This is characterised by complete separation of the transport network based on IP, and the control network using separate servers and SIP/TISPAN signalling. There is however another architecture that is also often referred to as NGN. This uses the same IP transport but has the control integrated within the transport structure. This approach is used by some small new entrants. It is also used as a “stepping stone” by major operators in the transition to NGN. It is important to understand that the low cost of introducing a CDB lookup comes with the separate control servers, which inherently use lookups to identify how to route calls to numbers. Introducing CDB lookups to the interim architecture means defaulting to many of the costly processes associated with the update of TDM networks.

Digit Analysis in NGN Architectures

TDM call routing is based on routing tables that are part of the originating TDM switch. The routing of a call is determined by using partial digit analysis of the dialled number and so relies on E.164 numbers being allocated in blocks.

In NGN architectures it is possible to carry out full digit analysis at the originating Soft Switch; this is sometimes also referred to as All Call Query (ACQ). This allows an operator to identify the recipient network by analysing information held within an associated database. The call can then be routed to the most appropriate interconnect. This removes the need for a transit layer switch (deployed in a large network operator’s infrastructure) as it is no longer required to carry out routing based on the number block allocation. It also allows direct routing of ported numbers.

Initial, i.e. interim, NGN deployments may use TDM emulation for both routing and portability, in which case they will use partial digit analysis based on existing number block principles.

Appendix D Interconnect and numbering

Calls are carried between both fixed and mobile network operators on interconnect circuits; these connect the networks together to form the UK PSTN. A call to a ported number typically follows the same interconnect route to the target destination as a non ported number, the difference being the addition of the routing number prefix after OR has been applied.

Due to the tromboning effect of OR, the capacity of the network interconnects add an additional complexity to the associated capacity management. To ensure that the integrity of the PSTN is not compromised, each network operator currently forecasts the amount of porting capacity required and notifies their associated interconnect operators using the agreed porting and interconnect processes.

An associated issue is the potential to impact porting timescales. If a network operator fails to notify another operator of a significant increase in ported call traffic; or the request requires additional capacity to be added, the porting timescales can increase. This requires each operator to continually provide accurate forecasts of traffic profiles for each of the operators it has a porting and interconnect agreement with.

NGN IP-based Interconnects

The move to NGN architectures leads to the change from traditional TDM based interconnects to those based on IP. In the NGN architecture there are two main types of interconnect gateway: IP to IP, and IP to TDM. Which type is used is based on the architecture of the recipient's network; i.e. in:

- ***IP to IP***, the call will be carried as VoIP across the interconnect, with the gateway handling IP address resolution and call accounting aspects
- ***IP to TDM***, the call will be converted from IP to TDM voice. This type of interconnect gateway will typically be used for migration from TDM to NGN architectures, and also where an operator is not deploying an NGN-based network.

The Impact of NP and NGN IP Interconnects

IP to TDM interconnect gateways introduce two potential areas of concern:

- Any expenditure on IP to TDM interconnects will at some point become redundant. An operator with a significant number of OR calls traversing its NGN architecture originating from or terminating on TDM networks; will need to deploy IP to TDM interconnect gateways. A CBD solution, in which the call is sent directly from the originating network to the recipient network, may minimise the need to deploy IP to TDM interconnect gateways, and therefore remove significant potential costs.
- Potential degradation of voice quality. When a call is carried across an NGN as VoIP the data stream is packetised (typically into much larger packets than in a TDM network). This packetisation introduces a small amount of delay. There is also some timing jitter introduced by the IP network which adds to this delay. If a call passes through several IP to TDM interconnects these delays add up and the voice quality becomes degraded. The tromboning currently seen when NP is supported by OR leads to the potential for several IP to TDM conversions (as the call passes across more interconnect), hence the potential for more delay being added, and more degradation of call quality.

Numbering and ENUM

- ENUM is a protocol based on work done by the Internet Engineering Task Force's (IETF) Telephone Number Mapping Working Group. The aim of this working group is to define a Domain Name System (DNS) based architecture and protocols for mapping a telephone number to a Uniform Resource Identifier (URI); this can subsequently be used to contact a resource associated with that number. The protocol itself is defined in RFC 3761.
- The ENUM method is being discussed extensively for use in both mobile (IP Multimedia Subsystem or IMS) and fixed (NGN) networks. A primary advantage is that an E.164 number can be associated with a set of resources such as first and second choice destinations, endpoints for various services, and service capability. The ENUM records can also explicitly specify the current serving network so this does not have to be decoded from the number range.

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Annex 7

International benchmarking

International benchmarking study carried out by Intercai on behalf of Ofcom, September 2006

Operational Aspects

The parameters set by regulators for number portability vary from country to country. In this section we focus on the time it takes to carry out the port (once all parties are agreed), the overall time that it takes for a user to move their number from one operator to another and how the process is led.

The time taken to port a fixed line is fairly consistent across European countries at around ten days in total to complete a transfer. Taking a number to a new mobile operator is more variable and the table below indicates the range of lead times for MNP in different countries.

Country	Time to switch to new operator	Target maximum porting period	Porting Process
France	2 hours max	30 days (10 days from 1/1/07)	Led by recipient (but new process will be one-stop-shop)
Germany		31 days (standard contract termination period)	Led by recipient
Italy	1 hour	5 days (reduced from the 15 days target at MNP launch)	Led by recipient
Spain		48 hours	Led by recipient
USA	2.5 hours[22]	14 days	Led by recipient
Australia	3 hours	2 working days	Led by recipient
Austria		3 working days	Led by recipient
Belgium		2 days	
Croatia		5 days	
Cyprus		14 days	

[22] This applies only for mobile to mobile ports. The time for completion of a port between fixed and mobile is typically 2 to 3 days.

Country	Time to switch to new operator	Target maximum porting period	Porting Process
Estonia		7 working days	
Finland		5 working days	Led by recipient
Hong Kong		36 hours (was 48 hours until 2004)	
Hungary		14 working days	
Iceland		10 days	
Ireland	2 hours for a single line / 8 hours for multi line ports	24 hours from request	Led by recipient
Lithuania		28 days	
Netherlands		4 working days (was up to 3 weeks until 2004)	Led by recipient
Norway		7 days	Led by recipient
Portugal		5-20 working days	
Singapore		7 days	
Slovenia		5 working days	
Sweden		5 working days	
Switzerland		5 working days	
UK		5 working days	

Table 1 – Times taken for MNP Source: IML research, Ovum 2005

Levels of porting and the amount of churn between operators

As of the end of 2004, fixed number portability had shown great success; in some cases greater success than mobile number portability. In particular, the U.K. had experienced around four million fixed numbers ports since late 1997 (which equated to just over 10% of all telephone lines).

Fixed portability has also been relatively significant in the US, Denmark and Belgium, all of which have seen 10% or more of subscribers porting their number. This is not always the case and elsewhere, notably in several of the Nordic countries, the number of fixed number ports is very low.

There are very few reliable figures on the level of fixed number porting but the table below presents some comparative information on the cumulative volume of fixed numbers that have been ported.

Country	Quantity of ported numbers		Change (%)	Time since NP introduced (years)
	2003	2004		
France	250,000	400,000	60	8
Spain	835,000	1,279,000	53	6
Denmark	49,000	91,000	86	7
Finland	15,000	15,000	0	9
Ireland	21,500	27,700	29	6
Netherlands	628,700	919,700	46	7
Norway	105,000	198,000	89	7
Sweden	33,500	58,200	74	7

Table 2 – Level of Fixed Porting Source: IML research

In order to put the data presented in the table into proper context, it should be stated that it is by no means always the case that demand for fixed number portability grows year on year. In Denmark, for example, the volume of fixed line ports fell significantly for the three years following the implementation of FNP –163,450, 132,576 and 67,832 lines in 2000, 2001 and 2003 respectively. Over the same period, the volume of mobile ports rose sharply with 82,539 in 2001 and 131,649 in 2002.

The extent to which different countries have taken advantage of mobile number portability also varies widely. In some countries, most notably Finland, Italy and Spain, there has been extensive porting of numbers between operators. In others such as France and Germany, the level of porting has been relatively low.

Comparative market information on MNP is also very limited so the table below illustrates the levels of number porting for the only period possible, between 2003 and 2004.

Country	Quantity of ported numbers		Change (%)	Time since MNP introduced (years)
	2003	2004		
France	120,000	250,000	108	3
Germany	212,000	489,000	131	4
Italy	1,600,000	3,750,000	134	4
Spain	1,200,000	2,283,000	90	6
US		8,900,000	See note[23]	2
Denmark	219,000	259,000	18	5
Finland	312,000	1,525,000	389	3
Ireland	80,000	236,000	195	3
Netherlands	476,000	925,000	94	7
Norway	438,000	452,000	3	5
Portugal	23,500	44,500	88	4
Sweden	242,000	399,500	65	5
Switzerland	81,000	66,400	-19	6
UK	830,000	1,238,000	49	7

Table 3 – Level of Mobile Porting Source: IML research

It is clear from the table that there is little correlation between the time since MNP implementation and its uptake. In Finland, the introduction of MNP has affected the market quite dramatically with two of the six operators in that country, TeliaSonera and Elisa, experiencing a sharp increase in the transfer users during the three quarters following its launch. Similarly, in the South Korean mobile market the first two weeks of MNP, saw the leading operator SKT' lose 80,856 customers to rival KTF and another 47,669 to LGT. In sharp contrast, the introduction of MNP had hardly any impact on the level of swapping between the (very large number of) operators in USA market [24] for reasons discussed elsewhere in this report.

[23] The FCC study of competition in the US market reports that the rate of intramodal porting activity (i.e. between mobile operators) has remained fairly steady – there were 713,000 ports in January 2004 and 735,000 in April 2005. In contrast, the monthly levels of intermodal porting from wireline carriers to wireless carriers significantly increased over the same period, from an average rate of 76,000 ports per month in the first six months of 2004 to an average rate of approximately 99,000 in the second half of the year.

[24] There are over 100 mobile operators in the US, many regional or serving a specific user base but around 40 of them of significant size.

The figure below shows the total number of ports that have taken place in the five main countries and several European comparators. In addition to the actual number of ports, the percentage of users in the relevant market who port their numbers is illustrated.

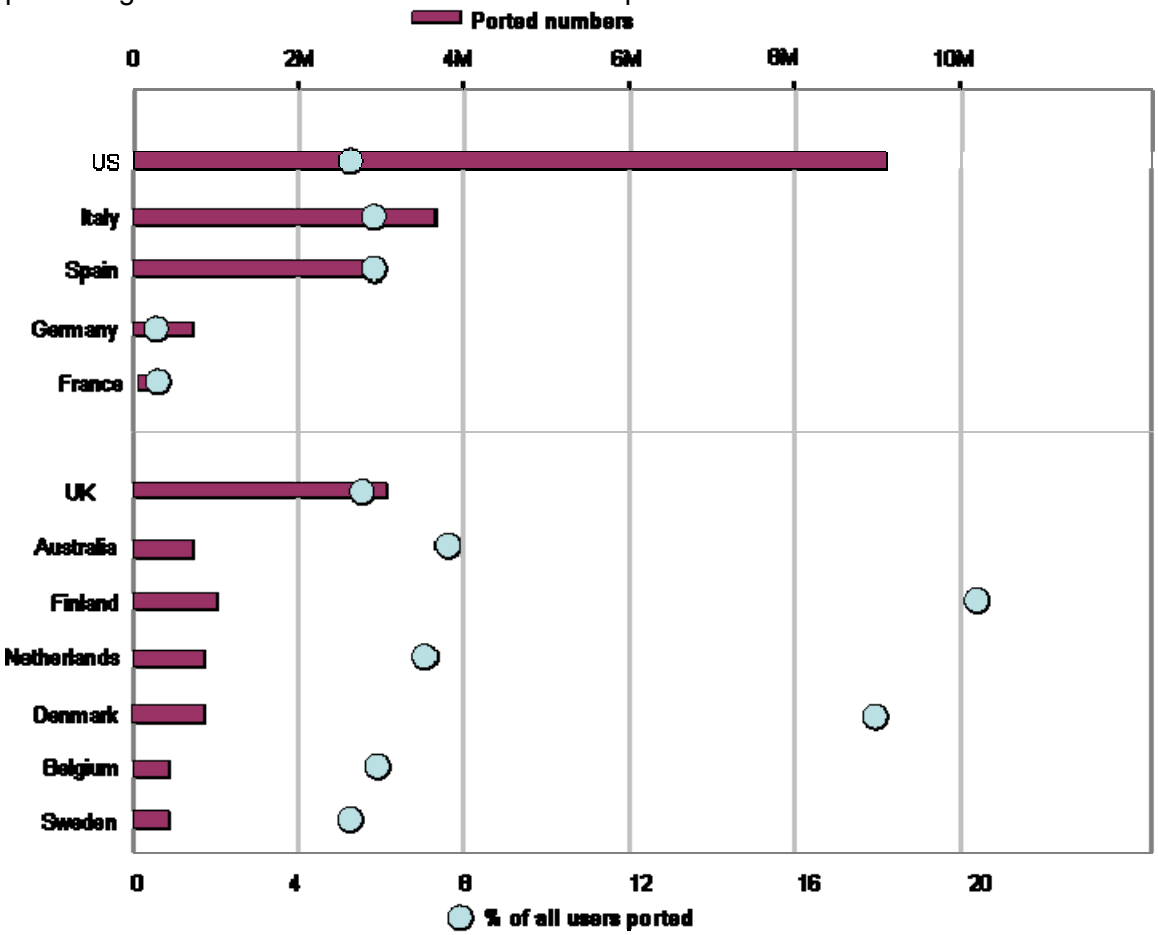


Figure 1 – Overall number and % of mobile number ports

It is clear from the figure that the majority of countries have an annual porting rate between 5 and 8%. France and Germany are noticeably lower than the norm, Finland and Denmark considerably above it.

By the end of 2005, over 25 Million phone numbers had been retained by customers changing from one supplier to another in the EU alone. This represents almost double the number of ports from the preceding year. The main contributions to this total have come from Spain, Italy and the UK with around 60% per cent of the total volume of mobile numbers ported.

Annex 8

Consumer research

Background & Objectives

A8.1 Ofcom considers that a key element of its consideration of number portability issues is an understanding of consumer expectations and experiences of number portability.

A8.2 The principal areas covered by Ofcom's consumer research include:

- Expectations and experiences of number porting
- General switching behaviour
- Impact of number porting on switching

A8.3 Quantitative questions were placed on the BMRB Omnibus in September 2006, with interviews conducted with 2,016 adults aged 15+. Data has been weighted to ensure the sample is nationally representative.

Executive summary

A8.4 More than six in ten consumers know it is their right to keep their number when switching provider.

A8.5 Switchers tend to recall, and non-switchers predict, that the number porting process will be quicker than the maximum time the process should take. Expectations are that the process typically takes a day or two.

A8.6 Eight in ten of those who have ported their number were satisfied with the time the process took – but they often think it was completed in a day or two. One in ten was dissatisfied with the time taken.

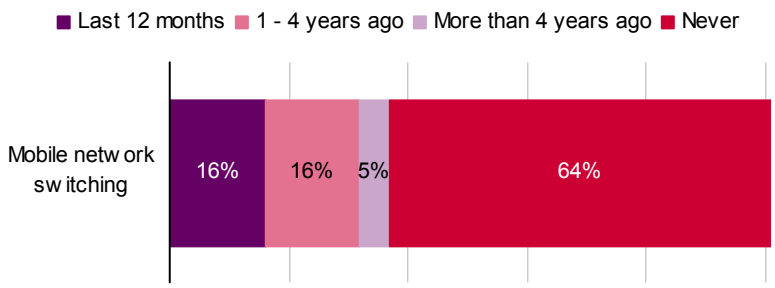
A8.7 Of the two-thirds of mobile phone customers who have not switched provider in recent years, most have stayed as they see no reason to change and are satisfied with their current service. Only 3% of those who answered this question spontaneously raised 'the time taken to transfer their number to a new network' as a reason for not switching provider.

A8.8 Three-quarters of those who have switched in the last four years changed their mobile number. Reasons for changing number are varied. Almost three in ten were 'automatically given a new number', more than one in ten did not know they could keep their number, and a further one in ten say they were not given the option.

Switching behaviour

A8.9 Around a third of mobile users have switched provider in the past four years, half of whom have changed in the past 12 months.

Figure A8.1: Mobile network switching behaviour



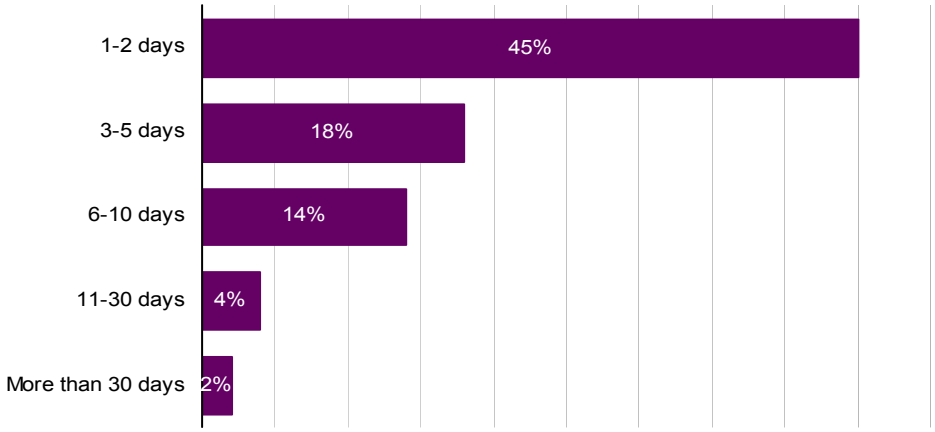
The number porting process

Awareness and expectations of number porting

A8.10 Awareness of number porting is mixed – 62% of mobile users know it is their right to keep the same number when switching mobile network provider.

A8.11 Compared to the time the process actually takes, expectations of number porting are high. The majority of consumers predict it to be quicker than the maximum time the process currently takes. Almost half expect switching to take one or two days, another one in five that it will be complete in five days or less.

Figure A8.2: Expectations of time taken to port number



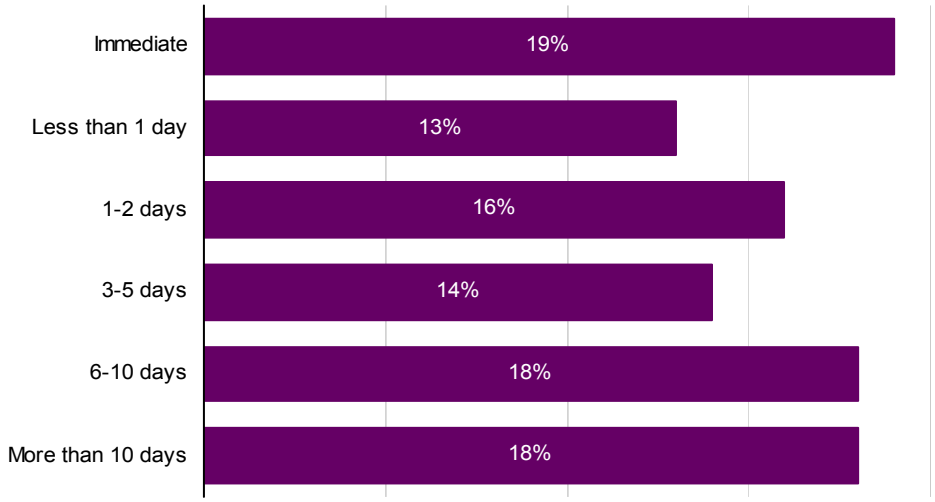
Base: All adults with a mobile phone (1,649)

Switchers' experiences

A8.12 Eight in ten of those who have ported their number were satisfied with the time the process took – but they often think it was completed in a day or two.

A8.13 Switchers' recall of the number porting process may be somewhat unreliable. Almost half say the switch took two days or less, whereas in reality it would have taken up to five days.

Figure A8.3: Recall of time taken to port number

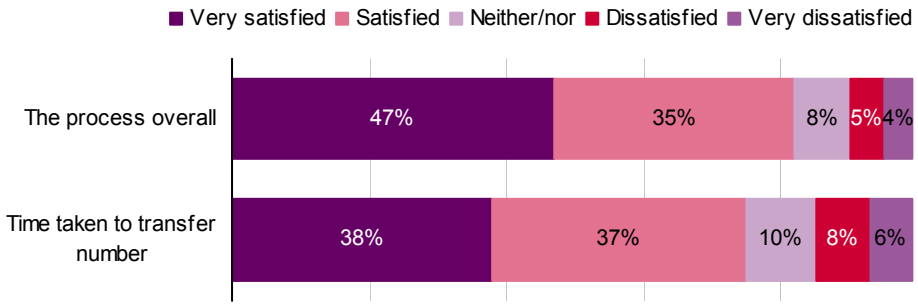


Base: All adults who have switched provider in the last four years and kept their original mobile number (142)

A8.14 Overall satisfaction with the number switching process is high. Almost half are very satisfied, with just one in ten dissatisfied.

A8.15 Three quarters are also satisfied with the time taken to transfer their number, five times as many as were dissatisfied.

Figure A8.4: Satisfaction with number porting



Base: All adults who have switched provider in the last four years and kept their original mobile number (142)

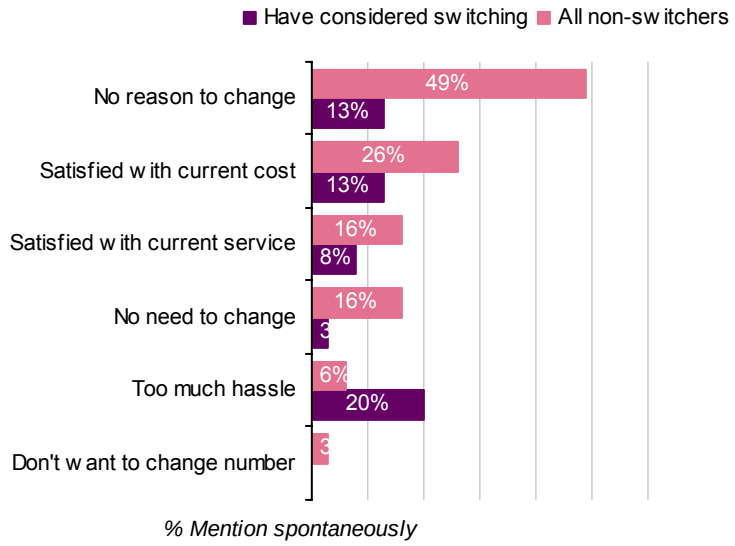
Barriers to switching

A8.16 Amongst the two-thirds who have not switched provider in the past four years, most have stayed with their existing provider because they see no reason to change. They are often satisfied with the cost and/or service from their provider.

A8.17 Only 3% say they have not moved because they 'do not want to change their number' (implying they do not understand number porting) and just 3 of the 1,167 users who answered this question spontaneously raised 'the time taken to transfer their number to a new network' as a reason for not switching provider.

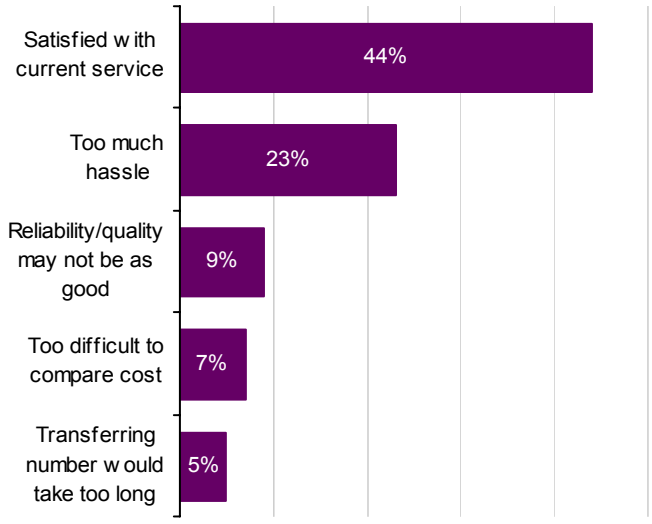
A8.18 Even when prompted with porting times as a reason for not switching, only one in twenty non-switchers cite this as a factor.

Figure A8.5: Reasons for not switching – spontaneous mentions



Base: All adults who have not switched provider in the last four years (1,167)

Figure A8.6: Reasons for not switching – prompted mentions



Base: All adults who have not switched provider in the last four years (1,167)

Switching and porting

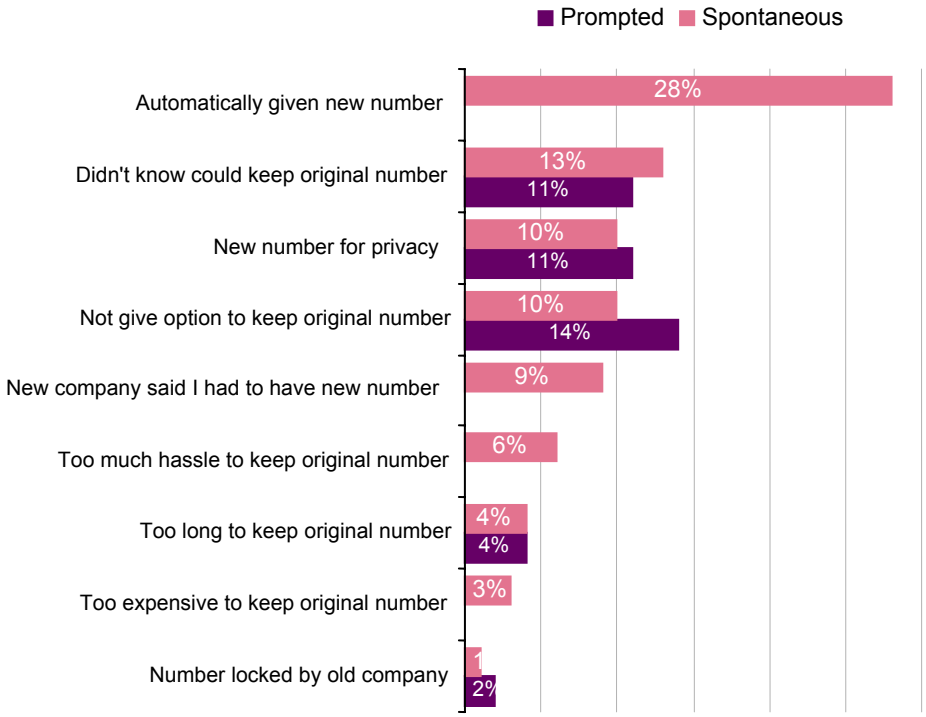
A8.19 Three-quarters of those who have switched in the last four years changed their mobile number.

A8.20 Reasons for changing number are mixed. Almost three in ten were 'automatically given a new number', more than one in ten did not know they could keep their number, and a further one in ten say they weren't given the option.

A8.21 This suggests that it is a lack of information from the new operator's vendors that often explains non-porting.

A8.22 Even when prompted, only 4% said it would have taken too long to port their original number.

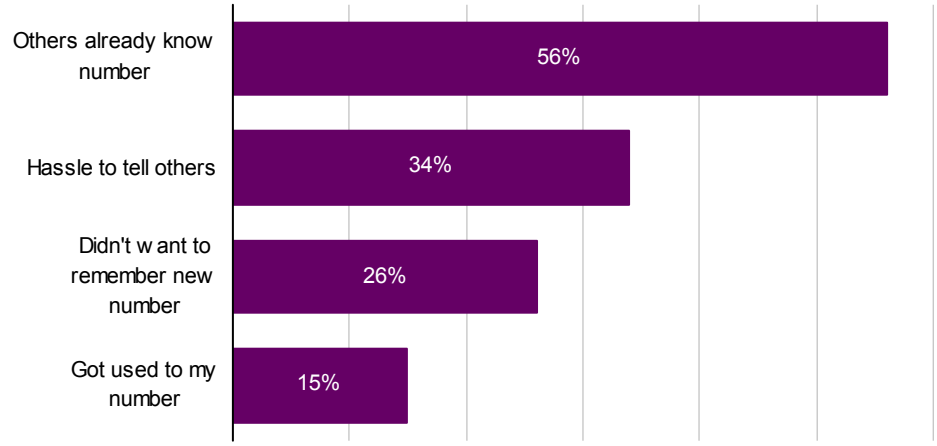
Figure A8.7 Reasons for not porting number



Base: All adults who have switched provider in the last four years (501)

A8.23 Convenience is the main reason for porting amongst the minority of switchers who kept their original number. Their contacts already know the existing number, thus changing would be a hassle both for remembering it themselves, and for passing it on to others.

Figure A8.8: Reasons for porting number – spontaneous



Base: All adults who have switched provider in the last four years and kept their original mobile number (142)

Annex 9

Notification of proposed modification to General Condition 18

Notification of a proposed modification under section 48(2) of the Communications Act 2003

Proposal for modification of Part 1 and General Condition 18 of Part 2 of the General Conditions regarding number portability, which is set out in the Schedule to the Notification under Section 48(1) of the Communications Act 2003 published by the Director General on 22 July 2003 as amended by the notification made by Ofcom on 30 March 2006.

1. OFCOM in accordance with section 48(2) of the Act hereby make the following proposal for the modification of General Condition 18 of Part 2 of the General Conditions regarding number portability.

2. The draft modification is set out in the Schedule to this Notification.

3. The effect of, and OFCOM's reasons for making, the proposal referred to in paragraph 1 above is set out at sections 3 and 4 of the accompanying explanatory statement.

4. OFCOM consider that the proposed modification referred to in paragraph 1 above complies with the requirements of sections 45 to 50 of the Act, as appropriate and relevant to each of the proposals.

5. In making the proposal set out in this Notification, OFCOM has considered and acted in accordance with their general duties in section 3 of the Act and the six Community requirements in section 4 of the Act.

6. Representations may be made to OFCOM about the proposal set out in this Notification and the accompanying statement by 26 January 2007.

7. Copies of this Notification and the accompanying statement have been sent to the Secretary of State in accordance with section 50(1)(a) of the Act and to the European Commission in accordance with section 50(6) of the Act.

8. In this Notification:

(i) "the Act" means the Communications Act 2003;

(ii) "General Conditions" means as set out in the Schedule to the Notification under Section 48(1) of the Communications Act 2003 published by the Director General on 22 July 2003 as amended from time to time; and

(ii) "OFCOM" means the Office of Communications.

9. Except insofar as the context otherwise requires, words or expressions shall have the meaning assigned to them in this Notification and otherwise any word or expression shall have the same meaning as it has in the Act.

10. For the purpose of interpreting this Notification:

(i) headings and titles shall be disregarded; and

(ii) the Interpretation Act 1978 shall apply as if this Notification were an Act of Parliament.

11. The Schedule to this Notification shall form part of this Notification

Signed by Sean Williams

Partner, Competition

A person authorised by Ofcom under paragraph 18 of the Schedule to the Office of Communications Act 2003

16 November 2006

Schedule

Proposal for modification to General Condition 18 of Part 2 of the General Conditions regarding number portability, which is set out in the Schedule to the Notification under Section 48(1) of the Communications Act 2003 published by the Director General on 22 July 2003 as amended by the notification made by Ofcom on 30 March 2006

General Condition 18 of Part 2 of the General Conditions shall be modified as set out below (the deleted text has been struck through and added text underlined, both highlighted in yellow for ease of reference):

18. NUMBER PORTABILITY

18.1 The Communications Provider shall provide Number Portability as soon as it is reasonably practicable on reasonable terms, including charges, to any of its Subscribers who so requests.

18.2 The Communications Provider shall, pursuant to a request from another Communications Provider, provide Portability (other than Paging Portability) as soon as is reasonably practicable (in the case of Mobile Portability, the total period for providing Portability shall not exceed [1 or 3] business day[s][25]) in relation to that request on reasonable terms. Any charges for the provision of such Portability shall be made in accordance with the following principles:

(a) subject always to the requirement of reasonableness, charges shall be cost oriented and based on the incremental costs of providing Portability unless:

(i) the Donor Provider and the Recipient Provider have agreed another basis for the charges, or

(ii) the Director has directed that another basis for charges should be used;

(b) the Donor Provider shall make no charge in relation to System Set-Up Costs or Additional Conveyance Costs;

(c) in respect of Mobile Portability, the Donor Provider shall make no charge or annual fee for ongoing costs relating to registration of a ported Telephone Number or a Subscriber;

(d) charges levied by the Donor Provider shall be based on the reasonable costs incurred by it in providing Portability with respect to each Telephone Number.

18.3 Where the Communications Provider provides Portability in accordance with paragraph 18.2:

(a) the Recipient Provider; and

(b) the Transit Provider,

[25] The period of 1 business day or 3 business days will depend upon which Option set out at Section 4 is considered appropriate by Ofcom in relation to the maximum port lead time for Mobile Portability.

shall, respectively, provide Portability (other than Paging Portability) on reasonable terms (and, in the case of Mobile Portability, the total period for providing Portability shall not exceed [1 or 3] business day[s][26]).

18.4 The Communications Provider shall use all reasonable endeavours to establish a Common Database by 1 September 2008 and to maintain it thereafter.

18.5 As from the Relevant Date, all Originating Communications Providers shall ensure that all Electronic Communications originated by them are routed to the Terminating Communications Provider in a manner independent of the Donor Provider.

[18.6 As from the date on which this notification is made until the Relevant Date, Communications Providers shall ensure that Electronic Communications originated by a Mobile Communications Service and terminated by a Mobile Communications Service are routed in a manner which does not require conveyance by the Donor Network][27]

18.7~~18.4~~The Communications Provider shall, on the written request of the Director, provide the Director with a record of each Telephone Number in relation to which it is providing Portability, specifying the relevant Recipient Provider in each case.

18.8~~18.5~~For the purposes of this Condition:

(a) "Additional Conveyance Costs" mean any costs incurred by the Donor Provider associated with resources used in:

(i) effecting the switch-processing required to set up each ported call; and

(ii) providing the switch and transmission capacity for any part of the duration of each ported call,

additional to the costs of conveyance of non-ported calls from the Donor Provider's network to the Recipient Provider's network;

(b) "Common Database" means information storage system(s) that can be interrogated electronically by each Communications Provider and containing, in relation to each Telephone Number in active use in the UK, up to date and complete information required to route any Electronic Communication originating from a Communications Provider in the United Kingdom to such Telephone Number in a manner not dependent on the intervention in real-time of the Donor Provider.

~~(b) "Communications Provider" means a person who provides an Electronic Communications Network or an Electronic Communications Service;~~

(c) "Donor Provider" means a Communications Provider whose Subscriber Numbers are in the process of being, or have been passed or ported to a Recipient Provider;

[26] The period of 1 business day or 3 business days will depend upon which Option set out at Section 4 is considered appropriate by Ofcom in relation to the maximum port lead time for Mobile Portability.
[27] In the event that Option 4b is adopted, this provision shall apply. In the event that Option 4b is not adopted, this provision shall be deleted.

(d) "Mobile Communications Service" means any Publicly Available Telephone Service consisting in the conveyance of Signals by means of a Public Telephone Network where every Signal that has been conveyed thereby has been, or is to be, conveyed through the agency of Wireless Telegraphy to or from a Public Telephone Network which is designed or adapted to be capable of being used in motion;

(e) "Mobile Portability" means Portability relating to Telephone Numbers Allocated for use with Mobile Communications Services;

(f) "Number Portability" means a facility whereby Subscribers who so request can retain their Telephone Number on a Public Telephone Network, independently of the person providing the service at the Network Termination Point of a Subscriber provided that such retention of a Telephone Number is in accordance with the National Telephone Numbering Plan;

(g) "Originating Communications Provider" means a Communications Provider on whose network an Electronic Communication originates;

~~(g)~~(h) "Paging Portability" means Portability relating to Telephone Numbers Allocated for use with Radiopaging Services;

~~(h)~~(i) "Point of Connection" means a point at which one Public Telephone Network is connected to another;

~~(i)~~(j) "Portability" means any facility which may be provided by a Communications Provider to another enabling any Subscriber who requests Number Portability to continue to be provided with any Publicly Available Telephone Service by reference to the same Telephone Number irrespective of the identity of the person providing such a service;

~~(j)~~(k) "Publicly Available Telephone Service" means a service made available to the public for originating and receiving, or only receiving, national and international telephone calls through a number or numbers in a national or international telephone numbering plan;

~~(k)~~(l) "Radiopaging Service" means Electronic Communications Services consisting in the conveyance of Signals by means of Wireless Telegraphy where every Signal, apart from simple acknowledgement, is ultimately transmitted from a station for Wireless Telegraphy comprised in the Communications Provider's Electronic Communications Network to a station for Wireless Telegraphy or Wireless Telegraphy Apparatus that is not comprised in that network;

~~(l)~~(m) "Recipient Provider" means a Communications Provider to whom Subscriber Number(s) are in the process of being, or have been passed or ported from a Donor Provider;

(n) "Relevant Date" means:

(i) in the case of Electronic Communications originated by a Mobile Communications Service and terminated by a Mobile Communications Service, 1 September 2009; and

(ii) in the case of all other Electronic Communications, 31 December 2012.

~~(m)~~(o) "Subscriber" means any person who is party to a contract with the provider of Publicly Available Telephone Services for the supply of such services in the United Kingdom;

~~(n)~~(p) "Subscriber Number" means the Telephone Number (or Telephone Numbers) which any Communications Provider's Public Telephone Network recognises as relating to a particular Subscriber of that Communications Provider;

~~(o)~~(q) "System Set-Up Costs" mean costs of the Donor Provider incurred—

(i) in the course of making network and system modifications, configuration and reconfiguration, including adapting or replacing software;

(ii) in the course of testing functionality within that provider's network and in conjunction with any Recipient Provider's network,

(iii) thereby establishing the technical and administrative capability to provide Portability;

(q) "Terminating Communications Provider" means a Communications Provider on whose network an Electronic Communication terminates

~~(p)~~(r) "Transit Provider" means a Communications Provider providing, by agreement, Interconnection between a Donor Provider and Recipient Provider via Points of Connection with both Communications Providers.

Annex 10

Glossary

ACQ - All Call Query - a system of interrogating a common database for every call, in order that calls to ported numbers can be routed directly to their Recipient Networks.

CDB - Common Database - an information storage system(s) that can be interrogated electronically for each called number, in order that calls to ported numbers can be routed directly to their Recipient Networks.

Donor Network – the network to which a consumer originally subscribed.

HLR - Home Location Register - a component of a mobile network used to store information about mobile subscribers including the location of those subscribers.

IP - Internet Protocol - a common protocol used for transmission and switching of different services in modern digital networks.

NGN - Next Generation Network - An IP-based electronic communications network which is able to provide electronic communications services and to make use of multiple broadband and quality of service-enabled transport technologies, and in which service-related functions are independent of underlying transport-related technologies.

NICC - Network Interoperability Consultative Committee - is a UK telecommunications industry committee which acts as an industry consensus group in which specifications and technical issues associated with network competition can be discussed.

Onward Routing – is method of routing calls to ported numbers where calls are first routed to the Donor Network who routes the call onward to the network to which the consumer now subscribes.

Recipient Network – the network to which the consumer currently subscribes.

TDM – Time Division Multiplex - a method of sharing transmission and switching resources in a network, now being superseded by packet based technology.