Ofcom
making communications work
for everyone

Promoting trust in telephone numbers

First consultation

CONSULTATION:

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Section

Annex

1. Overview

In February, we published our statement on the future of landline services. This set out some of the potential benefits to consumers as phone companies move their landline services to newer 'internet protocol' (IP) technology. We explained how Ofcom's rules mean phone users must be protected equally regardless of how their landline phone service is delivered. We also set out the roles and responsibilities of different organisations, and our expectations of telecoms providers as they make these changes.

This technology change brings new challenges – for example, it has become easier to hide or change callers' identity information presented through phone numbers, and therefore more difficult to trace and prevent nuisance or scam calls. Tackling nuisance and scam calls is an ongoing priority for Ofcom, Government and the Information Commissioner's Office – to protect consumers from harm, and to promote trust in telephone numbers.

This document sets out our proposal for a key change in the way numbers are used by networks, which we believe is necessary to tackle nuisance and scam calls.

What we propose – in brief

We believe a common numbering database needs to be established as a basis for verifying callers' numbers are genuine

We want to reduce the number of nuisance and scam calls as telephone services migrate to IP technology. Our view is that a common numbering database across industry would enable telecoms operators to verify that the caller's number is genuine.

We believe a common database could be in place by 2022, by which point calls made on IP networks may represent the majority of calls. The database could then be progressively used to verify that the identity of a calling number is genuine for calls made on these networks.

A common database could also support more efficient processes for porting numbers and routing calls to these numbers when customers switch between competing providers, as well as support improvements and efficiencies in number management.

We will engage with industry in setting the strategy and delivering these plans

We will continue to work closely with other organisations to develop options for implementing a common numbering database. This includes engaging with industry bodies as part of our proof of concept project with distributed ledger technology (blockchain), which we have already started.

This overview is a simplified high-level summary only. The proposals that we are making and our reasoning are set out in the full document.

Context

1.1 Telephone calls are important to many people and businesses. Around eight in ten UK households (81%) have a home phone service and 94% of adults use a mobile phone.[1] Nearly all (96%) small and medium sized businesses use landlines and most (64%) use mobile phones.[2] More than 200 billion minutes of phone calls a year are made in the UK, which generates call revenues for industry of more than £3bn.[3]

1.2 Although different ways of making calls have emerged - such as 'Over The Top' (OTT) voice and messaging applications - and usage of traditional telephone services is falling, phone calls are likely to remain important. As with other platforms, the more people connected to a telephone network, the more each user benefits from the option to contact others. What makes phone services stand out is that it is an open platform, where anyone using a phone service can call any other user, whatever network they are on.

1.3 UK telephone networks are undergoing substantial change, as telecoms providers gradually move their landline customers from the country's traditional telephone network – the 'public switched telephone network' (PSTN) – to IP technology.

1.4 For most customers, switching to an IP-based service should be straightforward. They will continue to receive what they recognise as a traditional phone service and will keep their existing telephone number. For many, the only change will be that their telephone service will be delivered via a socket on their broadband router rather than a traditional telephone socket. For most mobile customers, the migration will be seamless as networks and mobile handsets move to 4G.

1.5 These changes create opportunities. For example, to help identify and prevent nuisance calls and to improve the quality of phone calls. Therefore, it is important that regulation is kept under review through these changes.

1.6 Today, we have published three consultations on the future use of phone numbers, and the arrangements between networks. Our aims are to:

- **Promote competition between providers** of phone services, recognising the changing market, where OTT, social media and messaging platforms offer alternatives to traditional phone calls.
- **Promote confidence in phone numbers and services** by tackling nuisance and scam calls and addressing pricing practices that lead to unexpected or unreasonable bills.

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[1] Ofcom Technology Tracker H1 2018. See Ofcom, 2018. *Communications Market Report*, p.11. https://www.ofcom.org.uk/__data/assets/pdf_file/0022/117256/CMR-2018-narrative-report.pdf.

[2] A proportion which may have increased since the latest survey we commissioned. Jigsaw, the SME experience of communications services: research report, 2016. https://www.ofcom.org.uk/__data/assets/pdf_file/0030/96348/Ofcom-SME-consumer-experience-research-2016-Report.pdf.

[3] Ofcom data tables. Annual minutes and voice revenues for fixed and mobile to Q3-2018. https://www.ofcom.org.uk/research-and-data/telecoms-research/data-updates/telecommunications-market-data-update-q3-2018.

- **Protect consumers from harm** by making sure they continue to have access to important services.

This document

1.7 A phone number is the 'address' that identifies both the called party (the dialled number) and calling party (the Calling Line Identity or CLI) and conveys information to callers about the price of the call and the nature of any service provided.

1.8 That identity information must be trustworthy. Although new technology provides opportunities to lower the cost and improve quality of calls, it also increases the risk of harm to consumers by making it easier to hide or change that identity information for the purposes of scam or nuisance calls – a process known as spoofing.[4] If measures are not taken to address these issues, people could lose trust and confidence in telephone services.

1.9 We announced last year that we had secured Government funding to explore how distributed ledger (blockchain) technology might be used to create a future numbering database.[5] This is a collaborative project involving industry and other partners, which aims to complete a proof of concept by March 2020.

1.10 In this document, we discuss three key areas where there are issues in the current regime and the transition to IP has the potential to have an impact (either positively or negatively); CLI authentication, number portability and number management.

1.11 Our initial view is that, in principle, the adoption of a common numbering database is necessary to enable the development of technical measures to better protect consumers from nuisance and scam calls as IP-based services become widely adopted.

1.12 In addition to authenticating CLI, we think a common numbering database could address certain number portability issues, by:

- making the routing of calls to ported numbers more reliable and efficient; and
- making it easier for phone companies to action porting requests through new automated processes.

1.13 A numbering database could also support improvements and efficiencies in number management. For example, once the PSTN is fully retired, we could allocate numbers to phone companies in smaller blocks, based on their actual need or demand.

1.14 Therefore, in this document, we propose that a common database should be established.

1.15 If there is broad agreement on the need for a common database, the next steps would be to develop potential technical solutions so there is sufficient detail for reasonable cost

[4] Spoofing is where callers deliberately change the phone number and/or name relayed as the Caller ID information. This is done to either hide their identity or to try to mimic the phone number of a real company or person who has nothing to do with the real caller. For further information see https://www.ofcom.org.uk/phones-telecoms-and-internet/advice-for-consumers/problems/tackling-nuisance-calls-and-messages/phone-spoof-scam.

[5] See https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/blockchain-technology-uk-telephone-numbers.

assessments to be carried out, supporting processes to be developed and implementation timescales to be discussed.

1.16 In the first instance we would expect industry to lead this development. It would be for industry to consider how best to implement a database, including the assessment of possible options and selection based on costs and capabilities etc.

1.17 We believe it should be feasible to develop and implement a database by 2022. Once it is deployed, we would expect telecoms providers to progressively implement measures so they can verify that CLIs are valid and authentic. We would also expect phone companies to provide suitable indicators of 'trustworthiness' to anyone receiving a call.

1.18 In order to facilitate this, we would expect to engage with telecoms providers, vendors and standards bodies, such as the NICC, to establish a credible road map for implementing these measures. This activity would be expected to commence in 2020.

1.19 This would not eliminate all nuisance calls, and further work may be needed in applying it across all types of calls – for example, in authenticating non-UK phone numbers. However, it has the prospect of making a very significant contribution to providing assurance about the identity of the caller. With similar work being progressed in the USA, Canada and elsewhere, we will continue to work with international partners to tackle issues of shared concern.

Next steps

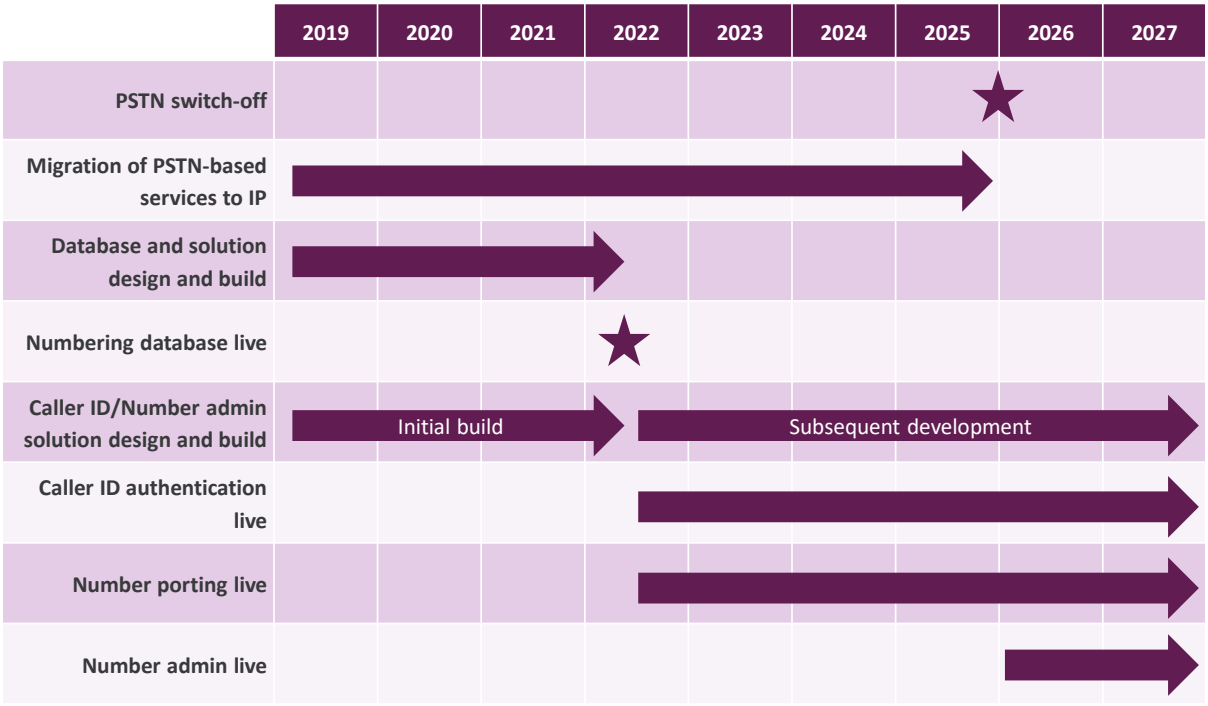
1.20 We invite responses to this first consultation by 6 June 2019.

1.21 The indicative timeline below sets out how developments might be sequenced with industry migration plans and PSTN 'switch-off'. We may not be able to make substantial changes to number allocation arrangements until after PSTN switch-off in 2025. However, we believe CLI authentication could be introduced for some calls originating on the new IP networks from around 2022, based on the current implementation of equivalent measures in the USA.[6]

1.22 We also think that establishing a numbering database earlier (including making improvements to number portability) could support migration of phone services to IP.

[6] Using the STIR/SHAKEN framework developed by the Internet Engineering Task Force (IETF) and the Alliance for Telecommunications Industry Solutions (ATIS) – see https://about.att.com/story/2019/anti_robocall.html [Accessed 9 April 2019].

Indicative timeline of database developments



Source: Ofcom.

1.23 We intend to publish a summary of responses to this consultation in the summer and outline next steps.

1.24 We will continue to develop our strategy and implementation options in collaboration with industry and interested parties through various groups including the All IP Steering Group, the CLI Strategic Working Group, the Number Port Executive Steering Group (NPESG), the Office of the Telecommunications Adjudicator (OTA2) and the NICC.

2. Background

Introduction

2.1 The public switched telephone network ("**PSTN**") connects UK homes and businesses to each other and to the rest of the world.

2.2 By dialling a unique number[7], people can use the telephone to call anyone else connected to the PSTN.[8] UK phone companies assign numbers to their subscribers and, in turn, apply to us for allocations of stocks of numbers. We administer the UK's pool of telephone numbers.

2.3 Technology deployed in the 1980s, called Time Division Multiplexing ("**TDM**") is still used by a number of providers of telephony services.[9] But TDM equipment is now at the end of its working life and will need to be decommissioned in the UK in the next few years.

2.4 The rapid growth of the internet from the mid-1990s onwards means many people and businesses now have internet connections. This increasing demand has also driven demand for connectivity of higher and higher speed and performance. The technology used to carry traffic on the internet is known as Internet Protocol ("**IP**").

Migration of telephony services to IP

2.5 As phone companies decommission their TDM equipment, the telephony service will migrate to IP.

2.6 Indeed, some providers already offer services using IP. A large number of businesses use IP-based voice services and some providers of services for residential customers use IP technology within their networks. However, BT in particular continues to support voice services on its TDM network, which means a large number of calls continue to be made on TDM networks, and IP networks have maintained some TDM equipment to interconnect to BT.

2.7 BT has announced that it will complete a migration from its TDM network to be 'all-IP' from 2025. Other providers with TDM networks have similar migration plans. This follows a global pattern of telecoms companies transitioning from TDM to IP technology. Although BT's intention is to complete the change by 2025, we expect to reach a 'tipping point' (the point where more subscribers have migrated to IP-based services than remain on the PSTN and ISDN[10]) in advance of this.

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[7] From the international public telecommunication numbering plan (ITU Recommendation E.164).
[8] The aggregate of the world's interconnected telephone networks that are run by different operators providing network infrastructure for public telecommunications services.
[9] TDM is a way of putting multiple data streams into a single signal by separating the signal into many short duration segments. Each data stream is then put together at the receiving end using timing.
[10] Integrated Services Digital Network – introduced in the late 1980s and mainly used by businesses and organisations. This provides the simultaneous digital transmission of voice and data services over traditional circuits of the PSTN.

2.8 BT's migration is not confined to BT's retail customers. Other telecoms providers also lease wholesale access to its PSTN and ISDN (through its legally separated Openreach company), to provide voice and other services to their residential and business customers. Openreach has been consulting with its telecoms company customers on the withdrawal of its TDM access services which will require providers to migrate voice services to IP.

Copper retirement

2.9 In addition to switching-off the PSTN, Openreach is considering retiring its copper access network.[11] Currently, residential customers, and some businesses, are connected to Openreach's network using a pair of copper wires (a 'copper pair'). This copper pair connects the customer to the local exchange from where telephony services are provided. The first generation of broadband services shared this copper pair from the exchange. More recently, Openreach has deployed superfast broadband. This places the broadband equipment at a street cabinet closer to the customer. The cabinet is connected to Openreach's network using optical fibre, but continues to use the copper pair to connect to the customer. This is known as Fibre-to-the-Cabinet ("**FTTC**"). In some cases Openreach has also deployed fibre that connects all the way to the customer's premises (Fibre-to-the-Premises or "**FTTP**" or full fibre).

2.10 Openreach has deployed full fibre to 1.2 million of UK homes and businesses[12] and adding this to deployments from other providers, full fibre is now available to around 1.8 million homes and businesses in the UK. Openreach plans to cover 10 million homes by 2025 under its Fibre First programme. Several other providers plan significant full fibre deployments, including:

- CityFibre and Vodafone have plans to cover five million homes by 2025;
- TalkTalk has a new company (FibreNation) to roll out full fibre to three million homes;
- Virgin Media plans to reach four million premises by the end of 2019/20 as part of its Project Lightning network expansion; and
- Hyperoptic plans to extend its full fibre network to 50 towns and cities.

2.11 In areas where it has full fibre, Openreach intends to retire its copper network once customers are migrated to full fibre.

2.12 We have recently set out initial proposals for a phased transition of customers from copper to new fibre networks with the protection of consumers at the heart of this approach. This means supporting Openreach in retiring its copper network by relaxing some existing

[11] On 21 March 2019, Openreach launched an industry consultation on an exchange-based approach to upgrading the UK's digital infrastructure with full fibre. This consultation includes Openreach's proposed approach to withdrawing copper services in areas as full fibre becomes available.
[12] Openreach press release 8 April 2019. https://www.homeandbusiness.openreach.co.uk/news/one-million [Accessed 9 April 2019].

regulatory requirements associated with copper networks; and moving regulation (including associated price protections) from copper to fibre services. [13]

2.13 Openreach proposes to retire its copper network in each area around 3 years after having deployed full fibre to that area, with the first areas being retired after PSTN switch-off in 2025. Given the timeline for Openeach's full fibre deployment, copper retirement is likely to progress at a much slower pace than migration to IP and subsequent PSTN switch-off, and for most areas copper retirement will take place some years after PSTN switch-off.

Impact of the migration of voice to IP on numbering

2.14 The migration of voice services to IP gives rise to a wide range of issues which we described in our recent policy statement on the future of fixed telephone services. [14] One of these areas is telephone numbering.

2.15 Telephone numbers are used to identify both the destination of the call (the dialled number) and the origination of the call (the Calling Line Identity or "**CLI**"). In the UK, we allocate numbers to telecoms providers in accordance with our National Telephone Numbering Plan (the "**Numbering Plan**") [15] and providers assign the numbers allocated to them to their customers. When customers decide to move between voice providers, number portability allows them to keep their numbers.

2.16 As services migrate to IP they will continue to use the same phone numbers. TDM networks and IP networks must be able to originate, terminate and convey phone calls to each other and continue to rely on telephone numbers as the common addressing scheme to do this.

2.17 Telephone numbers will therefore remain a key means by which consumers will identify called and calling parties during the current transitional period. After this transition, the future of telephone numbering in an all-IP world will be subject to new challenges and present new opportunities.

2.18 In this document, we discuss three key areas where there are issues in the current regime and the transition to IP has the potential to have an impact (either positively or negatively).

2.19 The first concerns the authentication of CLI on IP networks, and the implementation of technical solutions to address these issues.

2.20 The second is number portability. Whilst number portability is currently supported in the UK for fixed-line and mobile numbers, several issues arise due to the way it has been

[13] Ofcom, 2019. *Promoting competition and investment in fibre networks. Initial proposals – Approach to remedies.* Section 5. https://www.ofcom.org.uk/__data/assets/pdf_file/0018/142533/consultation-promoting-competition-investment-approach-remedies.pdf.

[14] Ofcom, 2019. *The future of fixed telephone services.* Policy positioning statement. https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/telecoms-competition-regulation/future-fixed-telephone-services.

[15] See https://www.ofcom.org.uk/__data/assets/pdf_file/0013/102613/national-numbering-plan.pdf.

implemented. These are particularly acute for business customers seeking to switch providers and port their fixed-line numbers.

2.21 The move to IP provides an opportunity for number portability arrangements to be re-visited to address the issues with the current solution and processes. IP networks provide the capability to readily access databases containing telephone numbering information that can be used for call routing and CLI checking.

2.22 Finally, our Numbering Plan like those around the world has been shaped by the development of the PSTN.[16] We are consulting separately on the future use and meaning of phone numbers,[17] but there are issues about how we might manage the UK's stock of numbers. The current number management system allocates and manages numbers based on large blocks of numbers. Once networks are all-IP, numbers could be allocated at a more granular level allowing them to be used more efficiently and, subsequently, allow them to be managed more dynamically.

2.23 We think that there may be synergies with solutions for CLI authentication and number porting which could support the better management of the UK numbering scheme in the future.

[16] For example, geographic telephone numbers (which today begin with 01 or 02) where the first few digits relates to a UK area, were originally devised to allow a subscriber to automatically 'trunk dial' without needing a human operator to connect their national call. So, from the 1950s, a subscriber could dial a geographic telephone number to automatically instruct their local telephone exchange (say in Bristol) to switch them to subscriber connected to a different telephone exchange (say in Glasgow).

[17] Ofcom, 2019. *Future of telephone numbers. First consultation.* https://www.ofcom.org.uk/consultations-and-statements/category-1/first-consultation-future-of-telephone-numbers.

3. Calling Line Identification authentication

Current issues

Introduction

3.1 CLI facilities provide information to the recipient of a telephone call about the party making the call. CLI data consists of a phone number that identifies the caller and a privacy marking, indicating whether that number can be shared with the recipient of the call. The presentation of CLI data enables the recipient of a call to make informed decisions about incoming calls, but this also relies on the CLI data being accurate.

3.2 General Condition C6 (GC C6) of our general conditions of entitlement[18] requires telecoms providers to provide CLI facilities by default, unless they can demonstrate that it is not technically feasible or economically viable to do so. Where CLI is provided, it must include a valid, diallable telephone number which uniquely identifies the caller. We have also published guidance on how CLI data should be carried through different networks and the responsibilities of different parties involved in the routing of a call. Its aim is to ensure that telecoms providers improve the consistency of CLI data presented to consumers, whilst also complying with statutory requirements on the privacy rights of individuals making and receiving calls.[19]

Implementation of CLI facilities in the UK

3.3 CLI facilities were first introduced in the UK in November 1994. The introduction of this service meant that for the first time, recipients of a call could identify the number from which a call had been made. At that time, the CLI data provided alongside the call was reasonably reliable as this information could only be inserted into the call by a relatively small number of telecoms operators.

3.4 Since then, the technology supporting voice calls has evolved, and fixed voice services can now be provided in different ways. Some of these involve using lower cost, packet-based technologies, such as IP. The introduction of these technologies has meant that the responsibility for managing the CLI associated with the call has moved away from a comparatively small number of telecoms operators into a wider range of voice service providers and end users themselves.

3.5 This technology change has brought about some benefits. It is now much cheaper for businesses to make calls. Call centres that make calls on behalf of different businesses can

[18] See https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/telecoms-competition-regulation/general-conditions-of-entitlement.
[19] Ofcom, 2018. *Guidance on the provision of Calling Line Identification facilities and other related services.* https://www.ofcom.org.uk/__data/assets/pdf_file/0021/116670/cli-guidance.pdf.

insert an appropriate CLI for a specific call. Businesses that have employees in different physical locations can share CLI regardless of where the employees are based.

Spoofing phone numbers

3.6 However, as IP has also made it cheaper to generate calls, it has resulted in an increase in the volume of unsolicited calls.[20] Using IP, service providers (and some callers) can also more easily manage and manipulate the CLI data provided with a call, and, consequently, the CLI data that is provided may not be as accurate as it used to be, deliberately or otherwise.

3.7 This development can be intentionally misused for a variety of malicious reasons, most obviously by 'spoofing' the identity of a caller to mislead the recipient of that call. The misuse of CLI has already led to significant harm for consumers, for example where scammers mislead the recipient of the call about their identity, in order to encourage the call recipient to provide them with sensitive information or money. Some of the most pernicious instances have been cases where fraudsters are spoofing numbers allocated to banks or Her Majesty's Revenue and Customs, that would not be normally used to make outbound calls, such as customer contact numbers. We are currently working with UK Finance, an industry body representing the UK financial sector, to share information with telecoms providers about the numbers that should not be used in call origination, but there could be technical solutions which could provide more dynamic information about valid telephone numbers.

3.8 As well as direct harm from scams, the misuse or spoofing of CLI data can also reduce consumer trust in the system as the CLI is no longer effective as an identifier about the source of the call. Without this trust, there is a greater risk of harm, as consumers may be reluctant to accept calls undermining the general utility of the phone service.

3.9 Ofcom's review of consumer complaints about callers making silent and abandoned calls (among the types of nuisance calls that can be subject to specific Ofcom enforcement action) suggests that spoofed CLIs are used in some of these calls. This makes it more difficult to identify the caller. Ofcom uses a call tracing mechanism to identify wrongdoers, but spoofing means the process is more resource-intensive and time-consuming than necessary, as it makes it more difficult to trace the call to the original caller and in some cases it is not possible to trace the caller at all.

[20] More information and data on nuisance calls trends can be found in the latest March 2019 update to our 2013 Joint Action Plan with the Information Commissioner's Office (ICO) published at https://www.ofcom.org.uk/__data/assets/pdf_file/0029/139970/nuisance-calls-joint-action-plan-2019.pdf.

New rules to tackle spoofing but technical developments needed

3.10 In September 2017, we extended regulation to improve the accuracy of the provision and display of the calling party's telephone number to end users.[21] Specifically, we included a new obligation on telecoms providers intended to ensure CLIs use genuine dialable telephone numbers. We also included additional new requirements on telecoms providers to inform their customers if CLI facilities are not available, to provide CLI facilities at no additional charge to their customers and to take reasonable steps to identify and block calls on which invalid or non-diallable CLI is provided. All these new requirements have become effective since 1 October 2018.

3.11 Under GC C6.4 telecoms providers are required to ensure, so far as technically feasible, that any CLI data that is provided with and/or associated with a call includes a valid, dialable telephone number which uniquely identifies the caller.

3.12 However, telecoms providers are currently limited in the checks that they can make to ensure that the number is a valid, dialable number. Ofcom publishes information about UK telephone numbers that are available for allocation or are allocated.[22] From this, providers have access to information about number ranges that have not been allocated and therefore should not be used in telephone calls. However, a telecoms provider may not be using all the numbers in a range that has been allocated to them and there is currently no publicly available information setting out the allocated numbers which are in use and numbers which are not in active use. Furthermore, as there are no means to authenticate the use of a number, providers are currently unable to verify whether the caller has permission to use the telephone number that is associated with a telephone call.

3.13 Therefore, given the consumer harm from incorrect CLI data discussed above, we consider that more needs to be done to ensure that the CLI data that is displayed to the end user is correct and can be trusted. However, in the long run, as greater use of IP makes the potential for spoofing even more widespread, the presentation of the CLI data alone will no longer be sufficient to provide assurance to an end user about the identity of the party making that call. In recognition of this, there is ongoing work to improve the authentication of CLI data, such as the work of the Internet Engineering Task Force ("**IETF**") on the Secure Telephone Identity Revisited ("**STIR**") standard.[23]

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[21] See: (i) Ofcom's statement and consultation of 19 September 2017 entitled *"Review of the General Conditions of Entitlement"*; (ii) Ofcom's statement of 26 April 2018 entitled *"Guidance on CLI Facilities. A statement on revising the guidance on the provision of Calling Line Identification facilities"*; and (iii) Ofcom's statement of 30 July 2018 entitled *"Statement on changes to the General Conditions of Entitlement. Changes to General Condition C6, other minor drafting changes and changes to the guidance on the Calling Line Identification facilities"*. See https://www.ofcom.org.uk/consultations-and-statements/category-1/review-general-conditions;

[22] See https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/numbering/numbering-data.

[23] Further information about STIR is available at https://datatracker.ietf.org/wg/stir/about/ [Accessed 9 April 2019].

Secure Telephone Identity Revisited (STIR)

3.14 STIR is intended to facilitate the verification of the calling party's authorisation to use a particular telephone number for an incoming IP call, through authentication of the CLI data. In summary, phone numbers are 'attested' and 'signed' at call origination and 'verified' at call termination. It has been developed by the IETF.

3.15 We discussed CLI authentication and STIR in our last consultation on changes to our guidance on CLI facilities. In a statement of 26 April 2018, we said, given developments and consultation responses, that we did not expect CLI authentication to be ready in the UK for at least another three years.[24]

3.16 At that time, NICC - a technical forum for the UK communications sector that develops interoperability standards for public communications networks and services – had published a report on how STIR could be implemented in the UK.[25] In this report, NICC stated that its recommended solution for UK implementation would require a database of which numbers are assigned for usage on which networks (i.e. a common numbering database). It also said that launching STIR without a numbering database would be of limited value since "this would only provide a pointer back to the network that originated a call, rather than whether they had any rights to use the associated CLI".

3.17 NICC identified that a database would need to be populated with all UK telephone numbers (of all types including geographic, non-geographic and mobile phone numbers) allocated to telecoms providers from the Numbering Plan, or at least those which are in use by telecoms providers (e.g. assigned to subscribers).[26] The database would need to definitively map which telecoms provider is authorised to use which telephone numbers. Because of number portability, this would require a database of which individual number is assigned or ported to each telecoms provider. According to NICC, populating this database would be a significant undertaking in terms of scale and ensuring the integrity of the data.

3.18 We recognise that implementing STIR will not eliminate all nuisance and scam calls, and further work may be needed in applying it across all types of calls - for example, in authenticating non-UK phone numbers such as international calls. However, we think it has the prospect of making a very significant contribution to providing assurance about the identity of the caller. With its introduction being progressed in the USA, Canada and elsewhere, we will continue to work with international partners to tackle issues of shared concern.[27]

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[24] Ofcom, 2018. *Guidance on CLI Facilities. A statement on revising the guidance on the provision of Calling Line Identification facilities.* Paragraphs 3.11 to 3.15. https://www.ofcom.org.uk/__data/assets/pdf_file/0012/113214/statement-guidelines-cli-facilities.pdf.

[25] NICC's document of April 2018 entitled *"Report into implementation of Secure Telephone Identity Revisited (STIR) in the UK"*; https://niccstandards.org.uk/wp-content/uploads/2019/03/ND1522V1.1.1.pdf [Accessed 9 April 2019]. See, in particular, page 31.

[26] i.e. excluding stocks of unassigned phone numbers held by telecoms providers.

[27] For example, through our involvement with the Unsolicited Communications Enforcement Network (UCENET). See https://www.ucenet.org/ [Accessed 9 April 2019].

3.19 Given the risks posed by the migration to IP networks, we believe that implementing STIR should be a priority.[28] But there is still a significant amount of work to do before the standard can be implemented and it may take some time before a solution will be ready. In particular, whereas many other countries have established telephone numbering databases commonly to support number portability solutions, the UK has not done so. To fully implement STIR, therefore, the UK would need to develop a numbering database. Were such a database deployed, we would expect telecoms providers to progressively implement STIR in their IP-based voice networks, so that they can verify the CLIs used are valid and authentic on a call-by-call basis, and consequently, provide suitable indicators of 'trustworthiness' to the called party.

3.20 We are at a proof of concept stage in assessing whether distributed ledger (blockchain) technology could provide the basis for establishing a common numbering database.[29] This technology provides a system for recording the transaction of assets (phone numbers) in which the transactions (such as current provider assignment) and their details are recorded in multiple places at the same time. Unlike traditional databases, distributed ledgers have no central data store or administration functionality.

3.21 We would welcome stakeholders views on blockchain and other candidate solutions in response to this consultation.

Timeframes

3.22 As noted earlier, we think that implementation and population of a suitable common numbering database solution should be feasible by some time in 2022.[30] STIR can only be implemented in standards compliant IP networks and, hence, can only have an impact when a significant proportion of traffic is originated and carried on such networks. Based on our current understanding of telecom providers' PSTN switch-off plans, this situation could be starting to be the case at around the same point in time.

3.23 Consequently, we think it is feasible that some level of CLI authentication can start around 2022 which would grow over time until PSTN switch-off is complete around 2025. As part of the industry and stakeholder consultation process, a road map of what could be deployed and when will need to be developed, potentially including the equivalent of

[28] Tackling nuisance and scam calls is an ongoing priority for Ofcom, Government and the Information Commissioner's Office. See, for example, *Ofcom's Annual Plan* setting out *Our programme of work for 2019/20* published in March 2019 and available at https://www.ofcom.org.uk/__data/assets/pdf_file/0020/141914/statement-ofcom-annual-plan-2019-20.pdf.

[29] We announced in October 2018 (https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/blockchain-technology-uk-telephone-numbers) that we had received some public funding to investigate whether blockchain technology could help improve how telephone numbers are managed. This pilot is being conducted in collaboration with industry and others.

[30] We note NICC's observation regarding the task of populating a database which we agree could be significant.

limited 'on net' options that form part of the USA SHAKEN[31] plans and the issue of how best to signal the resulting trustworthiness status of individual calls to end users.

Consultation questions

Question 3.1: Do you have further views about the implementation of STIR?

Question 3.2: Are there any other approaches we should consider for addressing CLI authentication?

Question 3.3: Do you agree a common database would be required to support the implementation of STIR?

Question 3.4: What are your views on using blockchain technology as the basis for a common numbering database to support CLI authentication? What other solutions do you think should be considered and why?

Question 3.5: What are your views on timeframes?

[31] **S**ignature-based **H**andling of **A**sserted information using to**KEN**s (SHAKEN) is a US industry framework for managing the deployment of STIR technologies with the purpose of providing end-to-end cryptographic authentication and verification of the telephone identity and other information in an IP-based service provider voice network. Further information is available at https://www.atis.org/ [Accessed 9 April 2019].

4. Number portability

Background

Purpose of number portability

4.1 Subscribers can choose to keep their telephone number(s) when switching between telecoms providers. The facility that enables this is known as 'number portability'. When a subscriber keeps their telephone number when changing provider, the number is described as 'ported' from one service provider to another.

4.2 Authorities in many countries around the world have introduced number portability to promote competition in liberalised communications markets. Consumers are more likely to benefit from competition when they can switch easily between service providers vying with each other for their custom. Having to take a new telephone number can be a barrier to switching. Introducing number portability, so consumers can opt to keep their phone numbers regardless of service provider, can be an important facilitator of consumer choice and helps foster effective competition in markets for communications.

4.3 Number portability has made switching possible for those consumers who would not switch if it meant having a new telephone number, and for those consumers discouraged from switching due to the costs and hassle of having to take a new number. For example, some enterprise consumers may place a high value on retaining their telephone number in the running of their businesses.

4.4 It also reduces the cost of switching for those consumers who would have switched even without number portability. Number portability also benefits callers by, for example, reducing the number of calls to wrong numbers where the person they want to call would have changed their number in the absence of number portability.

Implementation of number portability in the UK

4.5 The UK was one of the first countries to introduce number portability. Subscribers were able to keep their geographic telephone numbers (numbers which today begin with 01 and 02 and where the first few digits form a code associated with an area in the UK[32]) when switching between fixed-line providers from 1996. Subsequently, number portability was extended to include non-geographic numbers (numbers which nowadays typically begin with 03, 05, 08 and 09) which people use to call businesses and Government agencies, to get information, make payments for services and vote on TV shows. From 1999 mobile subscribers were also able to keep their numbers (beginning with 07) when switching between mobile service providers.

[32] For example, 01284 is the geographic area code for Bury St Edmunds.

4.6 Since the introduction of number portability, millions of telephone numbers have been ported by UK consumers and businesses when switching between competing providers of fixed-line and mobile telephony services.

Current regulatory requirements

4.7 Telecoms providers are required to provide porting in the circumstances set out in General Condition B3 (GC B3) of the general conditions of entitlement[33], which implements Article 30 ("Facilitating change of provider") of the Universal Service Directive.[34]

4.8 In particular, telecoms providers are subject to the following requirements:

a) they must provide number portability within the shortest possible time, including subsequent activation, on reasonable terms and conditions, including charges, to any of their subscribers who so request (GC B3.3); and

b) where another telecoms provider requests portability, they must provide it as soon as is reasonably practicable in relation to that request on reasonable terms (GC B3.7).

Current porting arrangements

4.9 Porting arrangements have three main components:

- Order handling and port activation;
- Call routing; and
- Service establishment.

4.10 We discuss these below, and the issues associated with them.

Order handling and port activation

4.11 Arrangements for handling customer orders to port between service providers and to coordinate the activatation of ports are maintained and documented by industry by agreement. In principle, industry-agreed processes and service levels provide a consistent customer experience and enable telecoms providers to run efficient porting operations.[35]

4.12 Porting processes have common features such as:

- raising the port order requested by the customer;
- validating the order to make sure it is legitimate and only rejecting them for defined reasons;

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[33] See https://www.ofcom.org.uk/__data/assets/pdf_file/0023/106394/Annex-14-Revised-clean-conditions.pdf.
[34] Directive 2002/22/EC. The Universal Service Directive is part of the European Common Regulatory Framework for electronic communications networks and services, which comprises: (i) the Framework Directive (Directive 2002/21/EC), (ii) the Authorisation Directive (Directive 2002/20/EC), (iii) the Access Directive (Directive 2002/19/EC), (iv) the Universal Service Directive (Directive 2002/22/EC) and (iv) the Directive on privacy and electronic communications (Directive 2002/58/EC). We note that the European Electronic Communications Code (Directive 2018/1972/EU) will repeal and replace these directives with effect from 21 December 2020.
[35] As opposed to running operations to cater for lots of different bilaterally agreed order handling arrangements and service levels.

- dealing with any order cancellation by the customer e.g. a change of mind about switching;
- setting up and coordinating port activation at a particular time and in a manner which minimises any loss of service; and
- recovery arrangements if something goes wrong with the order.

Fixed number portability

4.13 There are two fixed porting processes: one for geographic numbers used for most fixed-line phone services (geographic number portability or GNP) and another for specially tariffed numbers like 0800 freephone (non-geographic number portability or NGNP). These processes are documented and hosted on the OTA2 website. OTA2 chair the industry groups which maintain these processes.[36]

4.14 In summary, the fixed porting process is managed by the gaining provider. The gaining provider raises a port order (sometimes backed up with a written letter of authority from the customer) with the losing provider to cease the current service and port the number. The losing provider checks that the order details are correct and match their customer records and then accepts or rejects the order. Once accepted, the gaining provider triggers the activatation of the port on the port date. The documented minimum lead times to complete these activities vary between 4 and 25 working days depending on the degree of complexity involved.[37]

4.15 For the big phone companies providing services to the residential market, we believe that porting performance under existing processes is generally satisfactory. Residential port orders are the least complex and the highest in volume. These companies therefore operate automated systems to complete port orders.

4.16 In the business sector we believe there are significant issues with porting, especially between the large number of smaller companies selling services over long supply chains and using hosting and interconnect platforms like BT's IP Exchange. These issues include:

- **Lack of transparency:** gaining providers can find it difficult to identify who the relevant parties are it needs to coordinate with to progress port orders;
- **Lack of automation:** order handling is generally carried out manually making it costly to do and prone to mistakes;
- **High level of order rejections:** often caused by data errors and mismatches particularly when using postcodes to validate orders; and

[36] The process documentation can be found at http://www.offta.org.uk/best.htm [Accessed 9 April 2019]. The OTA2 is an independent organisation tasked by Ofcom to oversee co-operation between communications providers and enable a competitive environment in the telecommunications sector.

[37] These complexities include the number of telecoms providers involved in the processes and the number of phone numbers, lines or channels involved in the port order.

- **Propensity for non-compliance:** non-compliance by some losing service providers with industry agreed processes and/or our regulations intended to delay, disincentivise, deprive or otherwise frustrate customers from switching providers.[38]

4.17 In practice, we think there are far too many instances of customers, especially SMEs[39], having a poor porting experience and in some cases being prevented from switching and keeping their phone numbers as a result of these issues.[40]

4.18 We recognise that the OTA2 and industry have sought to tackle these problems by making process improvements such as pre-order validation – a scheme to encourage better cooperation to reduce validation rejections.[41] We have also engaged with the OTA2 and the Number Port Executive Steering Group ("**NPESG**")[42] asking them to prioritise establishing and implementing a new port override process to allow ports to be completed successfully when a subscriber's legitimate request to port is being incorrectly blocked or frustrated.[43]

Mobile number portability

4.19 The mobile industry have a different process than fixed for porting mobile phone numbers. It is documented and hosted on a website run for the mobile phone companies called the MNP OSG.[44] The OSG is a forum for members to meet and agree the detailed arrangements to provide regulated mobile porting and it operates under the "OSG constitution".[45]

4.20 In summary, the process of porting mobile numbers starts with the subscriber obtaining a Port Authorisation Code ("**PAC**") which is valid for 30 days. They currently get a PAC by calling their current provider but, from 1 July, subscribers will be able to get this automatically by text or online instead.[46] The gaining provider uses the PAC supplied by the customer to set up the activation through a central MNP web system. The port is activated

[38] In 2018 we fined a telecoms provider called Cloud M £50,000 and one called Gateway Telecom £20,000 for flouting our porting rules as well as requiring the payment of compensation.
[39] Small and medium-sized enterprises.
[40] See https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/we-fight-for-your-right-to-port-a-number. There is significant evidence about this including statistics maintained by the OTA2 on order rejections, customer complaint data, Ofcom enforcement cases and business customer research such as https://www.ofcom.org.uk/__data/assets/pdf_file/0010/113113/sme-communications-needs.pdf.
[41] See http://www.offta.org.uk/files/AppJ.pdf [Accessed 9 April 2019].
[42] The NPESG comprises representatives from individual phone companies and industry associations involved in fixed number portability.
[43] See https://www.ofcom.org.uk/__data/assets/pdf_file/0022/123961/number-portability-letter.pdf.
[44] The Mobile Number Portability Operator Steering Group. The website is at http://www.mnposg.org.uk/ [Accessed 9 April 2019].
[45] See http://www.mnposg.org.uk/Main_Documents/OSGConstitution_Ver2.1.pdf [Accessed 9 April 2019].
[46] The PAC is still supplied the customer's current provider (so they can validate and authorise the porting of the number in accordance with the agreed process rules) but the customer does not have to speak with their current provider if they choose not to. This is explained further in our decision on reforming the switching of mobile communication services at https://www.ofcom.org.uk/consultations-and-statements/category-2/consumer-switching-proposals-to-reform-switching-of-mobile-communications-services.

the next working day (unless the customer chooses a later date). Porting takes longer for bulk orders i.e. porting more than 25 mobile numbers.

4.21 We concluded a review of mobile switching in December 2017.[47] Although we recognised that most consumers found the process easy, there was a significant minority of consumers who were either finding the process difficult or were deterred from switching. We therefore imposed reforms to address these harms including the changes to getting PACs (as mentioned above) and commitments from the OSG to reduce instances of loss of service when porting.

Call routing

4.22 The routing of calls to ported fixed and mobile numbers in the UK is generally achieved by means of 'onward routing'.[48] This means that the call is initially routed by the originating network to the network which first hosted the dialled number before it was ever ported (the donor network).[49] The donor network then onward routes the call to the network currently serving the called subscriber on the ported number (the recipient network). It does this by inserting a prefix to the dialled number which identifies the recipient network. There are several issues with this approach including:

- **Additional transmission costs:** extra call set-up processing and additional switching activities compared to a non-ported call;
- **Call quality:** where traffic is onward routed over a TDM network certain call features may be lost in what would otherwise have been an IP-to-IP call;
- **Reliability:** service issues may arise across either the donor and/or recipient networks making them potentially more difficult to identify and longer to resolve; and
- **Dependency:** the ported customer is irrevocably reliant on their original provider (despite choosing to switch elsewhere) and dependent on its technical and financial viability in perpetuity.[50]

4.23 The UK is almost, if not entirely, alone in the world in maintaining arrangements for onward routing calls to ported numbers. Modern porting solutions use centralised systems for automated order handling.[51] Ports are activated by updating a routing database used by telecoms operators to query the appropriate serving network for any dialled number

[47] Ofcom, 2017. *Consumer switching. Decision on reforming the switching of mobile communication services.* https://www.ofcom.org.uk/__data/assets/pdf_file/0023/108941/Consumer-switching-statement.pdf.
[48] Further detail on how onward routing is achieved can be found in NICC technical service descriptions for each of geographic (ND 1203), non-geographic (ND 1207) and mobile number portability (ND 1208) at https://niccstandards.org.uk/publications/nd1201-1299/ [Accessed 9 April 2019].
[49] The originating network (who is not the donor or recipient) does so because it does not know that the dialled number has been ported out from the donor or who the recipient network is. Where a recipient network originates calls to numbers it has ported-in, it may employ 'call trap' to terminate the call 'on-net' i.e. without it routing out to the donor network and back again (a call routing inefficiency sometimes called 'tromboning').
[50] These issues with onward routing were set out in paragraph 56 of the Competition Appeal Tribunal's judgment of 4 November 2016 of (Case Number: 1245/3/3/16), which is available at https://www.catribunal.org.uk/sites/default/files/1245_BT_Judgment_CAT_22_041116.pdf [Accessed 9 April 2019].
[51] Such as third party run clearinghouse solutions to submit and resolve port order transactions.

and to route calls directly. This kind of 'all call query' direct routing solution means that there is no difference in the routing of calls to ported or non-ported numbers.[52]

Service establishment

4.24 These onward routing arrangements to enable portability are established on a bilateral basis between telecoms operators. Depending on the circumstances, it may take several months or longer to plan, build and test the technical arrangements[53] as well as negotiate and agree commercial terms to establish a porting service with just a single donor operator. Whilst all telecoms providers are obliged by regulation to put these arrangements in place on request as soon as reasonable practicable, they can be prone to delay and disagreements, especially where there are customers waiting on the conclusion of service establishment to be able to port.[54] Wholesale charges for conveying onward routed traffic to ported fixed and mobile numbers has also been an ongoing source of periodic complaints, disputes and regulatory interventions.[55]

Opportunities to improve UK porting arrangements

Summary

4.25 As outlined above, there are several issues with the UK's existing porting arrangements, which can increase costs, reduce quality/consumer experience, and undermine competition. In Section 3, we explained why we consider that a common numbering database should be adopted for the purposes of authenticating CLIs as phone services migrate from being delivered over the PSTN to IP networks. In order to maintain this database for that purpose, the record of which telecoms provider is serving a subscriber in respect of any phone number will need to be changed each time a number is ported.

4.26 The adoption of a common numbering database could therefore provide the opportunity and impetus to deliver significant improvements to the UK's dated porting arrangements.

[52] As opposed to other direct routing solutions which may still be reliant on a donor network – such as 'query on release' where a routing database is only queried by the originating network after the donor network has returned a signal that the dialled number has been ported-out.
[53] Industry end to end process manuals for fixed porting (GNP and NGNP) state 85 working days as the target time for service establishment.
[54] We know this from speaking directly with fixed-line phone companies about porting issues and from our own experience in trying to resolve potential complaints or disputes about service establishment informally.
[55] More information and background on porting charges can be found in our Statement on Guidance and Consultation of September 2014 on *Porting charges under General Condition 18, Guidance on the setting of porting charges in compliance with GC18 and consultation on a new mobile donor conveyance charges Direction* at https://www.ofcom.org.uk/__data/assets/pdf_file/0026/79424/statement_on_porting_charges_under_gc18.pdf. See, in particular, Section 2.

Fixed number portability

4.27 For fixed number portability, the move to IP and the availability of a common numbering database could offer opportunities to address the issues set out above both in terms of order processing and routing.

Order processing

4.28 As noted above, for a common database to be effective in authenticating CLI, it must be up to date. Where a fixed number is ported, the database will need to be updated at the time the port is completed.[56] While two sets of processes could be managed – existing porting processes and new processes to update the database - our initial view is that integrating these processes could better address current concerns with fixed number portability. For example, and depending on the specific technical implementation of the common database, the interaction between gaining and losing providers could be established via the system to provide automation of a robust end-to-end process for all ports.

Routing

4.29 In addition, a common numbering database, holding details of which number is hosted on which network, would allow calls to be directly routed, rather than using the current onward routing scheme used for ported numbers in the UK. Whilst onward routing could continue to be used if a common database is in place, the move to IP technology makes it more cost effective for networks to access the common database to determine routing on a call-by-call basis.

4.30 Direct routing would remove a number of the disadvantages of onward routing by removing the original (donor) network provider from the call routing.[57] This would therefore remove the need to carry out service establishment between donor and recipient networks and to set up and maintain bilateral relationships to port numbers.

Mobile number portability

Order processing

4.31 We considered the order processing arrangements for mobile portability as part of our review of mobile switching and our reforms will come into effect on 1 July 2019. However, as it is necessary for the purposes of CLI authentication to include all live numbers in a common database, it might be appropriate to consider harmonising mobile porting

[56] This kind of activity is not new. For example, under current porting process arrangements, telecoms providers need to record any change of 'ownership' of a number (i.e. the communications provider identification code associated with a telephone number) when a port completes in emergency services databases.
[57] In an all-IP world, some of the disadvantages currently seen could be reduced. For example, the loss of functionality due to TDM networks would no longer occur. However, as there are a range of IP standards and implementation of standards, more IP networks within the routing of the call could still impact quality.

processes with the process for updating the database. It would also provide the opportunity to harmonise porting processes for all telephone numbers.

Routing

4.32 As for fixed number portability, the common numbering database would provide the opportunity to directly route calls to ported mobile numbers.

Developing new processes

4.33 As discussed above, the move to IP and the implementation of a common database could lead to industry processes needing to change.[58] Our view is that, in principle, a common database is likely to support more efficient and reliable processes for porting numbers when customers switch between competing providers and for routing calls to these numbers. If a common database is adopted, we may need to support the development of processes to enable its use.

4.34 This database would provide necessary information for direct routing and order handling processes could also be intergrated into the database system. As a first step, we are engaging with industry, through the NPESG, to facilitate the development of new fixed porting processes for a common database environment. The NPESG is considering what a future strategic porting solution and process will need to look like, from networking constraints to conventions for porting numbers and the reconsideration of appropriate validation criteria. We recognise that engagement will need to be extended to include the OSG in order to capture mobile porting processes.

4.35 Any new processes developed will need to be implemented by a diverse set of stakeholders including number range-holding providers, non-range-holding providers, resellers and range-holders without network capability. Industry will need to consider the community of interest for developing, implementing and utilising new porting processes and systems, and to agree the requirements for participation in developing the functional specification of how stakeholders will interact with the common database solution.[59] At this stage, discussions are centred on developing a set of porting processes that will be used in the proof of concept to develop a common database using blockchain technology.

4.36 Once there is a clearer view on the approach for providing a common database, based on the progress of the blockchain pilot, we expect industry will engage in developing a comprehensive set of porting processes to make use of any new common numbering

[58] In addition, they might need to change as a result of new regulation in order to comply with the new porting requirements set out in Article 106 of the European Electronic Communications Code, which must be transposed into national law by 21 December 2020.

[59] For example, the current MNP web system used for processing PACs is available throughout the mobile value chain i.e. networks, virtual networks, aggregators and resellers. Some mobile service providers may have their own interface to the MNP web system and so obtain PACs directly whilst others may rely on their upstream wholesaler for this.

database. We expect that this stage would likely require closer cooperation between the fixed and mobile sectors.

Openreach migration plans and number portability

4.37 Given BT's plans to retire its PSTN and ISDN, Openreach announced last year that it will withdraw its wholesale line rental ("**WLR**") products that rely on the BT PSTN/ISDN by 2025.[60]

4.38 We understand that, as a result, over 16 million telephone lines that use Openreach's wholesale products will be transferred to IP networks.

4.39 Openreach consulted its customers about the withdrawal of WLR products and the introduction of alternative services in May 2018. In it Openreach recognised that end customers being moved by their telecoms provider from WLR products to alternative products, or moving from one provider to another, will want to retain their existing telephone numbers.

4.40 Openreach sought the views of its customers on whether the current fixed porting process would be robust enough to manage the anticipated volumes of number porting during the migration of WLR product lines to alternative products.

4.41 In October 2018, Openreach set out its response to its consultation. In relation to number portability it indicated that it was exploring initiatives to increase automation of port orders and bulk 'shift' end customer's numbers to new platforms in certain circumstances. Openreach said it would develop its initiatives in consultation with industry and the NPESG in particular.

4.42 If the migration leads to an increase in number portability, it would be a concern if processes were not sufficiently robust to handle the increased volumes. A common numbering database could be beneficial in addressing any such concern (for the reasons discussed above). However, we note the migration is planned to commence before a database is likely to have implemented. As such we welcome Openreach's focus on this.

4.43 In terms of numbers being transferred between platforms, while this does not constitute number portability, we do accept that moving a large number of numbers and the call routing of traffic during the migration will need to be carefully managed. A similar call routing approach to that used for number portability could be used to manage traffic during the migration. In this case, direct routing using a common numbering database would offer an efficient alternative to an approach based on onward routing.

4.44 We would welcome the views of stakeholders on whether the availability of a common numbering database could help facilitate a smooth migration to IP perhaps in relation to more robust order handling processes and systems and/or direct routing.

[60] See https://www.openreach.co.uk/orpg/home/products/wlrwithdrawal/wlrwithdrawal.do [Accessed 9 April 2019].

Timeframes

4.45 The current blockchain proof of concept is expected to complete in March 2020. After understanding the learnings from this pilot, the next steps toward selecting a viable solution should be clearer.[61] Our current view is that this could lead to a common numbering database being available by 2022.

4.46 We expect number portability processes could also be developed by this time and that telecoms providers could have in place systems developments to use information in the database for call routing. As such, we would expect that the benefits discussed above could start to be realised from the point at which a common database becomes available.

Consultation questions

Question 4.1: What are your views on the current implementation of number portability in the fixed and mobile sectors?

Question 4.2: What are your views on sharing the functionality of a common numbering database for CLI authentication to also support improvements in UK porting processes?

Question 4.3: We are currently supporting a blockchain pilot. Do you have any views on using this technology for port transactions and a routing database? Are there other alternatives that should be considered?

Question 4.4: What are your views on implementation timeframes and the importance of a common database solution being available to support the migration of telephony services to IP?

[61] Including consideration of any alternative solutions.

5. Number management

Current approach

5.1 Ofcom is responsible for the administration of the UK's telephone numbers. This is carried out as part of our regulation of the communications sector under the Communications Act 2003 (the "**Act**"). In particular, Ofcom is required by section 56 of the Act to publish a Numbering Plan, setting out the telephone numbers available for allocation and any restrictions on how they may be adopted or used.[62] In carrying out our telephone numbering functions, we have a general duty to ensure that the best use is made of phone numbers and to encourage efficiency and innovation for that purpose.[63]

5.2 Among other things, we are therefore responsible for ensuring that sufficient numbers are available to meet demand and for setting the policy on how numbers may be used and procedures for their allocation.

5.3 We currently run a Number Management System ("**NMS**")[64] which allows telecoms providers to apply online for the allocation of numbers and to manage their existing resources. We use the NMS to perform certain of our functions and duties in managing the UK's telephone numbers such as determining any allocation taking into account the provisions of the Numbering Plan.

5.4 We allocate numbers to telecoms providers in large blocks. The size of number blocks vary from 100,000 numbers down to 1,000 depending on the type of numbers (e.g. mobile, geographic or special service numbers). Where there is material shortage of numbers, we allocate numbers down to 100 numbers in some instances.

5.5 However, the extent to which we have been able to allocate numbers in smaller blocks is subject to some technical constraints deriving from the use of older types of telecoms equipment. TDM exchange equipment in switched telephone networks analyses the digits of dialled telephone numbers to extract (or 'decode') the necessary information for routing and tariffing of calls. The limited capacity of decode built into some of these TDM exchanges restricts the number of digits of each dialled telephone phone number that those networks can decode into routing information.

5.6 This means that the minimum size of number block that we can allocate to any network, including modern IP networks, must be sufficiently large for all networks to route and must therefore accommodate the technical restrictions imposed by TDM exchanges.

[62] The Numbering Plan is available on our website; see https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/numbering.
[63] Section 63 of the Act.
[64] See https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/numbering.

Numbering in an all-IP environment

5.7 As explained in Section 2 above, TDM voice equipment is now reaching the end of its working life and the PSTN is set to be switched-off in 2025. Phone services will be migrated onto IP networks and, from this point, we would expect the technical limitations that lead to us needing to allocate numbers in large blocks will cease.

5.8 Subject to consultation on the future use of telephone numbers more generally, we would anticipate being able to manage the national numbering scheme in a more efficient and dynamic way, once these limitations fall away.

5.9 For example, rather than allocating numbers in set sized blocks regardless of how many numbers an applicant actually needs, we might be able to allocate an amount of numbers more aligned to the actual requirement, thereby matching allocation to demand more efficiently. We could also take back unused numbers previously allocated in blocks larger than the telecoms provider needed. This could potentially lead to allocations of much smaller blocks in some circumstances, enabling us to make more efficient use of the UK's telephone numbers and reduce the likelihood of number exhaustion.[65]

5.10 We may also need to consider what future arrangements are appropriate to provide for an allocation of numbers to be transferred from one telecoms provider to another. Under current porting arrangements, the telecoms provider to whom we have allocated a block of numbers retains that allocation even with regard to numbers within its block which have been ported out to another provider. Currently, the allocatee becomes the donor of ported out numbers and remains responsible for onward routing call traffic to these numbers until the number is either ported back or returned to them if the service is terminated.[66]

5.11 If calls to ported numbers are directly routed in the future (i.e. treated the same as calls to non-ported numbers for interconnect call routing purposes), the allocatee would have no control of, or interest in, 'its' numbers which have been ported out. The role of a donor provider is likely to become irrelevant under these new routing arrangements.[67] In such circumstances, it might be appropriate that where a number is ported from one provider to another so the number allocation is also transferred.

5.12 In this environment, a common numbering database (providing information of which telecoms provider is using which individual numbers) might help us keep up-to-date records of how number allocations are transferred from one telecoms provider to another provider over time. We might also consider whether it would be appropriate to integrate some (or all) of the elements of our NMS into the same common database after PSTN retirement in 2025 to avoid duplication.

5.13 Under current arrangements, once numbers are allocated, it is often difficult to keep track of which providers are actually using the numbers. The numbers that we allocated to any

[65] In addition to the consequences of dealing with number scarcity, such as costly and disruptive number reorganistions.
[66] We describe onward routing in paragraph 4.22 above.
[67] Depending on interconnection arrangements, call traffic may be routed via a third party transit provider. But there would be no difference in the treatment of calls to ported or non-ported numbers in this regard.

specific telecoms provider may have been 'sub-allocated' to other providers or resellers in lengthy supply chains or to a third party provider offering hosting services. Circumstances such as these can lead to complications and delays where issues arise that may require investigation or enforcement. We think more transparency over who is actually using the numbers allocated to any specific telecoms provider may have benefits for industry and other agencies in a range of situations, such as the deterrence and detection of improper activities.

5.14 For the reasons set out above, we consider that a common numbering database could also support improvements to our approach to number management.

Timeframes

5.15 As soon as a common database is populated with sufficient data and in use, some of the benefits set out above might emerge. For example, we would have access to up-to-date data on which telecoms providers are using which numbers and so may be better able to manage numbers being used to provide IP services.

5.16 However, it is unlikely we would be able to allocate numbers in smaller blocks (or on an individual basis) until the PSTN is switched-off in 2025, due to the limitation of number decode in TDM exchanges.

Consultation questions

Question 5.1: What are your views on the potential for a common database solution to also provide shared functionality to support number management?

Question 5.2: What do you see as the benefits or disbenefits of changes to number management post PSTN retirement?

6. Initial views on establishing a common numbering database and next steps

A numbering database is needed to support future voice services

6.1 Our initial view is that, in principle, the adoption of a common numbering database is necessary to enable the development of technical measures to better protect consumers from nuisance and scam calls as IP-based services become widely used. In addition, a numbering database could also support more efficient processes for porting numbers and routing calls to these numbers when customers switch between competing providers, as well as improvements and efficiencies in future number management.

6.2 This document sets out the key reasons why we think we need a common numbering database as migration to IP is realised. With this first consultation we are seeking to establish whether stakeholders broadly agree, in principle, with the need for a common database. We are also inviting comments, more generally, on our initial view.

6.3 We recognise that we reached a similar view before in respect of number porting. In 2007, we decided to require telecoms operators to establish a common database to allow direct routing of calls to fixed and mobile ported numbers.[68] That decision was set aside on appeal by Vodafone Limited supported by other operators to the Competition Appeal Tribunal and remitted back to us.[69]

6.4 As we noted in our 2016 strategic review of digital communications in response to some stakeholders' calls for improvements to fixed portability, we have not been able to reach industry consensus on how to take porting forward when we have looked at this in the past. We said then that we wanted to see industry reach consensus on how improvements to porting could be made.[70]

6.5 We think that views are now changing. In particular, the OTA2 and industry established the NPESG around two years ago to pursue a consensus view on improvements to fixed porting. They set out agreed proposals for short-term fixes and strategic transformation last year.[71] We welcomed this and are engaging closely with them.

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[68] Ofcom, 2007. *Telephone number portability for consumers switching suppliers.* Concluding Statement. https://www.ofcom.org.uk/__data/assets/pdf_file/0018/46080/statement.pdf. We also conducted two other reviews on moving to a direct routing solution for porting; one in in 2005 (see https://www.ofcom.org.uk/__data/assets/pdf_file/0024/40947/261832.pdf) and another in 2010 (see https://www.ofcom.org.uk/__data/assets/pdf_file/0023/45653/statement.pdf).

[69] See Competition Appeal Tribunal Judgment, Case Number 1094/3/3/08 dated 18 September 2008 at http://www.catribunal.org.uk/files/Judgment_1094_180908.pdf [Accessed 9 April 2019].

[70] Ofcom's statement of 25 February 2016, entitled *"Initial conclusions from the Strategic Review of Digital Communications"*, Annex 1, paragraphs A1.408-A1.409. See https://www.ofcom.org.uk/phones-telecoms-and-internet/information-for-industry/policy/digital-comms-review/conclusions-strategic-review-digital-Communications.

[71] NPESG Industry Response to Ofcom of February 2018 and attachments.

Next Steps

6.6 If there is broad agreement on the need for a common database, the next steps would be to develop potential technical solutions to provide sufficient detail to enable reasonable cost assessments to be carried out, supporting processes to be developed and implementation timescales to be discussed.

6.7 In the first instance we would expect industry to lead this development. It would be for industry to consider how best to implement a database, including the assessment of possible options and selection based on costs and capabilities etc.

6.8 To facilitate this process, we are keen to continue to work closely with stakeholders and with industry bodies to convene and coordinate activities. This includes continuing our leading role in the current work on piloting the use of distributed ledger technology (blockchain) as a potential alternative to existing centralised database and clearinghouse solutions.[72] We also recognise that we may have a role to play in reviewing our regulation to support any agreed implementation approach.

6.9 In the event that a broad consensus is not reached, we would need to consider what options to pursue in order to address our concerns regarding nuisance and scam calls in an IP environment.

Consultation questions

Question 6.1: Do you agree, in principle, with the need to develop and adopt a common numbering database? If not, why not?

Question 6.2: If you do not agree with the need to develop and adopt a common numbering database, do you have any suggestions on how the issues we have set out in this consultation could be addressed?

Question 6.3: Do you agree that in the first instance industry should lead the implementation of a common numbering database, with Ofcom providing support to convene and coordinate key activities? If not, what are your views on how implementation should be taken forward?

[72] Such as those deployed in many other countries around the world to implement number portability and for which there are a number of vendors in the market for the supply of numbering/porting solutions.

A1. Responding to this consultation

How to respond

A1.1 Ofcom would like to receive views and comments on the issues raised in this document, by 5pm on 6 June 2019.

A1.2 You can download a response form from https://www.ofcom.org.uk/consultations-and-statements/category-2/promoting-trust-in-telephone-numbers. You can return this by email or post to the address provided in the response form.

A1.3 If your response is a large file, or has supporting charts, tables or other data, please email it to consult.numbermanagement@ofcom.org.uk, as an attachment in Microsoft Word format, together with the cover sheet (https://www.ofcom.org.uk/consultations-and-statements/consultation-response-coversheet).

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

Adrian Ball
Ofcom
Riverside House
2A Southwark Bridge Road
London SE1 9HA

A1.5 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:

- Send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files. Or
- Upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.

A1.6 We will publish a transcript of any audio or video responses we receive (unless your response is confidential).

A1.7 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt if your response is submitted via the online web form, but not otherwise.

A1.8 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.

A1.9 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at Annex 4. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.

A1.10 If you want to discuss the issues and questions raised in this consultation, please contact Adrian Ball on 020 7981 3862, or by email to adrian.ball@ofcom.org.uk.

Confidentiality

A1.11 Consultations are more effective if we publish the responses before the consultation period closes. In particular, this can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that everyone who is interested in an issue can see other respondents' views, we usually publish all responses on our website, www.ofcom.org.uk, as soon as we receive them.

A1.12 If you think your response should be kept confidential, please specify which part(s) this applies to, and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we do not have to edit your response.

A1.13 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.14 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further at https://www.ofcom.org.uk/about-ofcom/website/terms-of-use.

Next steps

A1.15 Following this consultation period, Ofcom plans to publish a summary of responses and outline next steps in the summer.

A1.16 If you wish, you can register to receive mail updates alerting you to new Ofcom publications; for more details please see https://www.ofcom.org.uk/about-ofcom/latest/email-updates.

Ofcom's consultation processes

A1.17 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex 2.

A1.18 If you have any comments or suggestions on how we manage our consultations, please email us at consult@ofcom.org.uk. We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.

A1.19 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:

Corporation Secretary
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA
Email: corporationsecretary@ofcom.org.uk

A2. Ofcom's consultation principles

Ofcom has seven principles that it follows for every public written consultation:

Before the consultation

A2.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. 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

A2.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.3 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 for people to give us a written response. If the consultation is complicated, we may provide a short Plain English / Cymraeg Clir guide, to help smaller organisations or individuals who would not otherwise be able to spare the time to share their views.

A2.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A2.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.

A2.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A2.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish all the responses on our website as soon as we receive them. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

A3. Consultation coversheet

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

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

Nothing ☐

Name/contact details/job title ☐

Whole response ☐

Organisation ☐

Part of the response ☐

If there is no separate annex, which parts? _____

_____

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

DECLARATION

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

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

Name Signed (if hard copy)

A4. Consultation questions

A4.1 We set out below a consolidated list of the questions on which we are inviting specific responses from stakeholders in relation to the matters discussed in this consultation.

Question 3.1: Do you have futher views about the implementation of STIR?

Question 3.2: Are there any other approaches we should consider for addressing CLI authentication?

Question 3.3: Do you agree a common database would be required to support the implementation of STIR?

Question 3.4: What are your views on using blockchain technology as the basis for a common numbering database to support CLI authentication? What other solutions do you think should be considered and why?

Question 3.5: What are your views on timeframes?

Question 4.1: What are your views on the current implementation of number portability in the fixed and mobile sectors?

Question 4.2: What are your views on sharing the functionality of a common numbering database for CLI authentication to also support improvements in UK porting processes?

Question 4.3: We are currently supporting a blockchain pilot. Do you have any views on using this technology for port transactions and a routing database? Are there other alternatives that should be considered?

Question 4.4: What are your views on implementation timeframes and the importance of a common database solution being available to support the migration of telephony services to IP?

Question 5.1: What are your views on the potential for a common database solution to also provide shared functionality to support number management?

Question 5.2: What do you see as the benefits or disbenefits of changes to number management post PSTN retirement?

Question 6.1: Do you agree, in principle, with the need to develop and adopt a common numbering database? If not, why not?

Question 6.2: If you do not agree with the need to develop and adopt a common numbering database, do you have any suggestions on how the issues we have set out in this consultation could be addressed?

Question 6.3: Do you agree that in the first instance industry should lead the implementation of a common numbering database, with Ofcom providing support to convene and coordinate key activities? If not, what are your views on how implementation should be taken forward?