Vodafone Response to Ofcom Consultation:

Promoting trust in telephone numbers

Executive Summary

Vodafone supports the principle of a common numbering database. We are persuaded that an outcome based upon UK networks using this to secure Calling Line Identities (CLIs) and directly routeing calls to ported numbers is desirable. However, detailed analysis is required to ensure the correct technology choice and to confirm that the costs of migrating to this end-game are justified by the benefits.

We consider that implementing STIR will be beneficial to improve the integrity of CLIs and hence reduce volumes of nuisance marketing calls, but it is by no means a silver bullet.

Improving the efficiency of fixed porting via having a proper record of the communication provider serving each individual number will improve the service provided to businesses and consumers, and as we set out in the companion response addressing IP interconnect issues, has the potential to lessen BT's dominance in the transit market.

The assignment of numbers in 1k and 10k ranges is a legacy of 20th century technologies, and widespread adoption of IP technology affords to opportunity to carry out a thorough review of number management processes in the UK.

Introduction

Vodafone welcomes the opportunity to contribute to Ofcom's policy formulation to improve trust in telephone numbers. We are a significant supplier of services that consume telephone numbers; Vodafone is well known as a provider of mobile services, but also our residential broadband service (which offers landline voice telephony as part of the package) is the fastest growing in the UK market, and we are one of the top providers of communications services to the country's businesses.

It is clear that voice telephony that's fit for the 21st century would have measures to ensure the integrity of Calling Line Identities (CLI). It would also allow calls to be routed directly to the consumer's chosen provider without having to pass through the communications provider they first used potentially decades ago. We should also not be tied to arbitrary sizes of number blocks based on last century's technology. To achieve these goals requires a shared view of which numbers are hosted on which network — a common database of numbers. However, what is currently less than clear — and requires a robust business case — is whether the costs of migration to that optimal world are justified by the benefits compared to the counterfactual of today's outdated operation. This is especially the case in a world of falling fixed voice volumes. It is therefore incumbent on Ofcom to make that case. We are cautiously optimistic that a positive case can be proven, and that the timelines proposed by Ofcom are stretch but achievable.

Answers to Questions

> Question 3.1: Do you have further views about the implementation of STIR?
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> Question 3.2: Are there any other approaches we should consider for addressing CLI authentication?
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> Question 3.3: Do you agree a common database would be required to support the implementation of STIR?

Ofcom will be aware that Vodafone is fully engaged in STIR developments. We are active in the IETF STIR group, have monitored SHAKEN developments in the US, and chaired the NICC Standards Task Group that compiled a report for Ofcom on the implications of implementing the technology in the UK.

We do have some concerns that STIR is a rather large sledgehammer to crack the wrong nut. The wrong nut, because as we set out below, there are shortcomings to what STIR can deliver, meaning that it might not achieve what is expected of it. A large sledgehammer, because STIR is heavily engineered to prevent man-in-the-middle attacks of intermediate networks either manipulating CLI information, or disguising the origin of calls — neither of these are issues currently faced in the UK, but of course could become prevalent in the future.

A simpler alternative to STIR might have been for the terminating network to check a common numbering database to determine which network is supposed to have originated the call, and then for that terminating

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network to initiate a signaling ping to the originating network to confirm that they'd sent said call – thus avoiding the overhead of carrying large quantities of encrypted data in call signalling. However, recognising that STIR is developing a head of steam, in particular via the SHAKEN deployments in the USA, it is likely that support will be inherent in future SIP equipment, so we believe it sensible for the UK to follow international standards.

STIR cannot be considered a panacea for addressing the issues with CLI integrity, however. The concept of STIR is that the originator digitally signs the CLI to assert that they have the rights to use it. However, the matter is complicated by there being two types of CLI, namely the Presentation Number (PN – carried in the From: header in SIP, used for display) and Network Number (NN – carried as PAID in SIP, used to identify where the call entered the public network). Whilst the NN is tied to a specific originating network, business customers can provide their own PN, so the same PN can potentially be used across multiple originating networks that they might choose to use.

NICC's report into STIR[1] recommended that the NN be signed for UK implementation. The alternative of checking and signing the PN would either need the common numbering database associated with the solution to list all originating networks that might use the PN, or otherwise mean that signing (and the information in the common numbering database) to be at the originating *customer* rather than originating *network* level in the case of such businesses – adding a significant level of complexity to the database in either solution. But whilst it's the NN that's digitally signed, it's the PN that gets displayed to end-users. Therefore, we have a fundamental disconnect that STIR is not actually validating the display number that customers see – the wrong nut has been cracked.

It is Vodafone's understanding that this level of complexity does not occur to the same degree in the USA where SHAKEN is being implemented. Participants in the IETF STIR working group appeared surprised by descriptions of the commonly-adopted UK implementation of call-centres acting on behalf of multiple clients so using multiple CLIs used on a per-call basis, and having diverse connections into the public network so the same PN CLIs would be used across multiple originating networks. As such, STIR isn't particularly well geared-up to dealing with this model.

This said, as set out in the NICC report, signing the NN may be sufficient. It will allow terminating networks to unequivocally tie a call to an originating network. That originating network will then be responsible for ensuring that their customers are using valid PNs. If their callers consistently cause problems with nuisance calls, terminating networks would be in a position to mark their calls as a whole as unreliable. In and of itself, this may be sufficient to improve the reliability of CLIs – if not, then it would then be open to Ofcom to take more draconian measures such as requiring that PNs provided by originating business customers are validated by originating networks against an acceptable whitelist for that customer.

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[1] ND1522 – "Report into implementation of STIR in the UK", https://niccstandards.org.uk/wp-content/uploads/2019/03/ND1522V1.1.1.pdf

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It is not essential that STIR is accompanied by a common database of numbers, but it is highly desirable. Otherwise, the mechanism would simply serve to identify the originating network, but not whether they have any rights whatsoever to use the [network] number in question – STIR would be an expensive white elephant.

In the introduction to this response, we set out that Ofcom must carry out a rigorous impact assessment of whether the developments proposed have a positive business case. Vodafone considers that it is unlikely that the introduction of a common numbering database could be justified solely based on STIR implementation. However, when combined with the other potential drivers identified in the consultation, the case may be positive.

> 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?

We are not in the situation of the jury being out on the technology choice for a common numbering database – instead the evidence is still being amassed and has not yet been presented to the jury. It is therefore premature to draw conclusions.

The usage of blockchain does present a potentially viable option. However, there are many questions that need to be addressed before a technology choice is made. Is blockchain scalable to the potentially 1Bn number entries that will be required? How easy will it be to get a bulk download of the data for routeing purposes? Does the "chain" nature of the data comply with ICO requirements to purge redundant personal data? How quickly can changes be made and propagated out to all operators? What about change control and rolling back to previous versions in case of database corruption? In a blockchain approach, there might not be a single central database to be funded, but how do the cumulative costs of the players in the blockchain compare? Absent answers to these questions, it is impossible to draw conclusions of whether distributed ledger is the best approach – blockchain being the latest sexy technology is not sufficient a reason to prefer its usage.

The usage of a third party common numbering database has been frowned upon by many industry stakeholders, we believe principally because operators baulk at the thought of a third party profiting at their expense, and because of the significant costs that arose from the tender exercise when this matter was last addressed a decade ago. However, profit is not a bad thing if it drives efficiency, and it is inescapable that much of the cost of the database envisaged when Ofcom last proposed such an approach were driven by gold-plated requirements[2]. We do not advocate the usage of a conventional third party database, but neither should we rule it out – pretty much the rest of the world can't have all got it wrong.

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[2] For example, a requirement for rapid porting meant that with no fall back to default routeing, the database had just 20 minutes to make requested changes and propagate them out to every UK network node. This led to a need for triple replication in hardened datacentres – in the case of some proposals using nuclear bunkers.

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> Question 3.5: What are your views on timeframes?

The timescales set out – implementation by 2022 with full deployment by 2025 – are stretching, but potentially achievable. However, Ofcom should not repeat past mistakes by hard-coding them into regulation. In determining potential dates, Ofcom must be extremely mindful of operator financial planning timescales: resource availability is already baked-in for FY19/20, and any resources (human and financial) required in FY20/21 will need to be budgeted for during the autumn of this year. It is therefore incumbent on Ofcom and industry to develop a more detailed plan of what is envisaged when, within the next 4-5 months.

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

When number portability was introduced in the 1990s, it was always envisaged that the UK would eventually evolve to a database approach, with direct routeing of calls. That this didn't happen is largely down to the nature of legacy TDM switches dictating that the cost of querying a database for all numbers at origination outstripped the routeing benefit of omitting the rangeholder in calls to ported numbers. With IP technology now superseding TDM, the overhead of carrying out the query has diminished, but conversely the benefit (in network cost terms) of omitting the original rangeholder from routeing also diminishes.

There is thus a legitimate argument of "*if it's not broken, why fix it?*". But the fixed portability system is broken. The breakage that must be addressed is not in the complexity, for example, of dealing with reseller chains (although a bottom-up approach of review of processes would address issues in this area) – it is that the current onward routeing solution inherently involves the rangeholder in the routeing of calls. We can think of no other competitive market where such a phenomenon exists – that you shopped in in one supermarket twenty years ago doesn't mean that you're now forced to take a loop through their car park to visit an alternative one, for example. There are profound implications of this situation:

1. The performance of the rangeholder network remains a contributor to the service quality experienced by customers with ported numbers.

2. When porting between two providers, an unrelated third party rangeholder is involved in the process.

3. The rangeholder is left having to dimension their network to cope with the traffic demands of customers who have long since left them.

4. There are vulnerabilities – mercifully that we've not had to face in sometime – of rangeholders going bankrupt and disrupting the service not just of their customers, but of anyone who used to be a customer of theirs.

5. But most critically, it perpetuates the unique power of BT. As we set out in Vodafone's parallel response on the future of interconnection, BT has cumulative market power via a series of regulated services – for example provision of 999 services, 18000 services and in this context geographic number portability. Fundamentally the majority of geographic number ranges are BT's, as a consequence of their former monopoly status, so this means that although BT's retail market share has diminished, its share of interconnect traffic is disproportionately high. Regardless that retail customers may have chosen Sky or TalkTalk as their provider, if they ported their number, originating networks must route their calls via BT. This means that terminating networks effectively pay to receive calls (once the APCC is subtracted from the termination rate), but more importantly it reinforces BT's power in the wholesale market.

The retail market is bifurcating into a small number of large providers, and a large tail of small (usually IP-based) providers. Cumulatively the small providers serve only a limited portion of the market, but as with MVNOs in the mobile space, they play an important role in driving the competitive market and serving niches. However, as these players are typically small, they cannot justify connection to more than a single network for connectivity. If BT is unique in being able to serve 999, and the small provider needs to route the bulk of their outbound traffic to BT because in a portability context BT is the rangeholder, then it is natural that they will select BT as that sole transit network. The onward routeing regime is reinforcing BT's dominance in the interconnect market – if interconnect traffic volumes were proportionate to retail market shares, then BT would be standing shoulder to shoulder with other networks and its dominance diminish.

Therefore, the situation is one of "*it is broken so we'd better fix it*". The migration to IP will only serve to reinforce this because the demise of WLR will mean that a whole raft of numbers that currently terminate on BT's network – for example all of the numbers associated with Vodafone's residential services – will be ported to terminate on the service provider's network. How much better would it be if Sky could route traffic to Vodafone's fixed customers directly to Vodafone, instead of having to send that traffic to BT at Vodafone's expense?

In mobile, the situation is slightly different. A majority of calls to mobile numbers originate on mobile networks, and home network routeing means for example that any calls from Vodafone customers destined to Vodafone customers – regardless of whether the number is from a Vodafone range or imported – are routed directly. The phenomenon of calls routeing via the rangeholder is less than in fixed, and it does not cause any one of the mobile networks to have dominance.

However, we have a potential domino effect:

a. A unified approach to routeing is desirable, so Vodafone is open to mobile porting adopting a database approach to direct routeing alongside fixed, so long as the economics make sense.

b. The mobile porting processes would need reviewing in order to interact with the database.

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c. If the mobile porting processes are reviewed – and in parallel the fixed porting processes are already under review – there is a rational to consider unifying them.

This domino effect is not a given. Each of the stages needs to be economically justified. But if they can be, such an exercise does appear sensible.

> 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?

As set out in the response to Qs 3.1-3.3, Vodafone anticipates that the cost-benefit analysis would not be positive narrowly for STIR or number portability. However, by combining the two together, it is possible that the case could be made.

> 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?

Please see response to Q3.4.

> 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?

Please see response to Q.3.5 for observations on the timing of the database being available. We consider that population of the database could commence in 2022, although we anticipate significant challenges with data integrity. Further, it is inevitable that the solution would need to work in parallel with existing bilateral arrangements for a protracted period (onward routeing would need to be supported for as long as there are TDM networks).

Ofcom needs to give consideration for the mechanism to incentivise population of the database and usage for direct routeing. Although mandatory population is one approach, a more market driven strategy is an option. For example, when the database is made available, population of the database could be by the terminating network (i.e. the recipient network in a portability context). If the operation of the APCC regime was changed so that once populated, the fees would be billed to the originating rather than terminating network, that would incentivise direct routeing. Finally, at a point at which it is reasonable to expect that all operators could route based on the database, regulation on the level of APCCs could be removed (because at this time calls being sent via the rangeholder would be little different to any other transit call).

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Whilst the ability to direct route and usage of a numbering database is desirable, it is by no means a requirement to migrate services to IP. It is evident that many operators, such as Gamma, Sky, TalkTalk and to a large degree Vodafone have migrated their services to IP technology without demanding wholesale re-engineering of the portability solution. That BT is now migrating its customer base is no reason, in and of itself, to declare the current portability solution not fit for purpose. However, as we set out in the response to Q4.1, there are other compelling reasons to modernise portability in the UK.

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?

The solutions set out for number portability in Section Four would essentially mean that calls are routed on an individual number basis, so the requirement to issue numbers in large blocks would start to fall away (at least for fixed services – other international issues come into play in the case of mobile). Vodafone continues to support a model where numbers are initially assigned to operators, who then issue them to end customers (rather than the alternative approach of customers getting numbers directly from Ofcom and then seeking a network to host them). Therefore, modernising call routeing via the usage of a numbering database will allow the size of the block of numbers assigned to operators to be set according to the demand they have, rather than arbitrary technology restrictions. This will have the advantage of not requiring inefficient number block sizes, and (especially if operators return unused numbers), should mark an end to numbering scarcity.

Taking a step back, numbers that are not yet assigned to operators effectively remain assigned to Ofcom. As such, there is logic in putting all numbers into the common numbering database and treating Ofcom as an operator (albeit one with special privileges), so that the effect of Ofcom assigning a block of numbers to an operator is [technically] the same as Ofcom porting the numbers to that operator. As Ofcom describes in the consultation, this then turns the database into the number management system, rather than requiring a parallel system.

Subject to the costs being proportionate, Vodafone would support such an approach.

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

As we have set out in this response, Vodafone agrees that a common numbering database would deliver significant benefits (but with significant costs), subject to the correct design and implementation in a manner sympathetic to operator network and IT system developments. The case is far from categorically proven, however.

We agree that industry has a large role to play via working groups to progress the activity. Equally, though, this is not a subject where Ofcom can be an observer. It needs to facilitate progress, potentially owning the programme as a whole.

Vodafone UK
June 2019

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