

# The Potential of Fixed Network Slicing

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## Executive Summary

Fixed Network Slicing – while less discussed than its 5G counterpart – has the potential to alter significant aspects of the fixed broadband market, both retail and wholesale. But how aware are operators of its potential use cases and benefits? Finding it out is the purpose of this study undertaken by Diffraction Analysis with 15 network operators around the world.

Most operators are aware that Fixed Network Slicing exists and will soon be standardized, and about half of them are seriously involved in assessing its potential. Others tend to see it as more of a long term perspective. Incumbents and large network operators, unsurprisingly, are the most mature on the topic.

Network operators can see potential applications of Fixed Network Slicing both to their internal operations (folding fixed, mobile backhaul and B2B into a single access network without losing each business unit's control and specific needs) and their external customers (wholesaling a better active product than bitstream as well as end to end B2B slices).

The most immediate use case that resonates with many operators is the ability to offer wholesale fiber to the home products in a way both more flexible and secure than current bitstream wholesale – and less complex to implement than fiber unbundling. With demand from access seekers and regulators still low, few incumbents envisage Fixed Network Slicing in the near future, but a number of altnets and wholesalers see an opportunity for them to capture market share, especially if the incumbent is reluctant to offer network slicing.

Other use cases are less compelling in the short term, especially as Fixed Network Slicing is enabled by access network virtualisation, which some operators see as part of the mid- to long-term planning.

For those enthusiastic about Fixed Network Slicing, there are still some challenges ahead, first and foremost the complexity of articulating a business model for the technology's implementation. Additional revenues and new services are not easy to conceptualise, and costs of implementation largely unknown. Other potential challenges include organizational or human resource issues as virtualisation and slicing will require more IT and less engineering skills.

In summary, while the potential is clearly recognized by most players, implementation will happen at a different pace between those who feel there is something to be gained in moving first, and those who are in more of a ‘wait and see’ pattern. As demand from internal and external customers builds up and as regulators educate themselves to the potential for wholesale redefinition, the market should gradually shift towards Fixed Network Slicing adoption.

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# I. Introduction

While perhaps not as frequently discussed as its mobile counterpart, Fixed Network Slicing is a technology enabled by virtualisation that conceptually changes the way that different end-user functions (mobile cellsite traffic, consumer traffic, enterprise traffic, wholesale traffic, etc.) share the fixed network’s resources and capacity. It can also be used to lease multiple wholesale customers virtual access to the same infrastructure. Fixed Network Slicing technology is in advanced stages of standardization, with an expected date for the final standards to be published in 2019. And yet visibility for the technology seems to remain limited.

The purpose of this qualitative study is to understand the degree of maturity of various service providers when it comes to fixed network slicing, their awareness of potential use cases and their interest in said use cases. The study consisted in a series of conversations with senior decision makers within the Technology Office of these service providers.

## Methodology

Diffraction Analysis conducted interviews with 15 service providers in North America, Latin American, Europe Middle-East & Africa and Asia-Pacific in order to capture their views on a variety of subjects related to Fixed Network Slicing. The core focus of these interviews was Network Slicing in the fixed access, although the conversations occasionally veered towards a broader outlook on slicing, especially when discussing potential B2B applications.

The interviews were designed to capture the spontaneous (unprompted) views of the service providers’ technology offices on fixed network slicing and its potential benefits. In addition, a number of use cases were presented to the interviewees for comments and discussion. Broader issues, such as adoption timeframes and key challenges were discussed as well.

The targeted service providers were chosen with two key criteria in mind: they needed to serve a significant number of fixed access lines as a primary focus of their business, and they needed to participate in the wholesale market, either as a provider of wholesale access network services or as a purchaser of said services. The sample is very diverse, both in terms of scope of operations, market position, participation in the mobile market and place in the value chain. How the sample is spread between these criteria is presented in Exhibit 1 below.

**Exhibit 1 : Sample Buildup**

| Scope         |          |          |       |
|---------------|----------|----------|-------|
| International | National | Regional | Local |
| 2             | 9        | 3        | 1     |

| Market Position |                    |        |
|-----------------|--------------------|--------|
| Incumbent       | Incumbent + Altnet | Altnet |
| 7               | 1                  | 7      |

| Fixed/Mobile |              |
|--------------|--------------|
| Fixed        | Fixed-Mobile |
| 7            | 9            |

| Place in Value Chain |                    |        |
|----------------------|--------------------|--------|
| Wholesale            | Wholesale + Retail | Retail |
| 6                    | 8                  | 1      |

## II. Fixed Network Slicing in a Nutshell

Fixed Access Network Slicing is a technology evolution enabled by the virtualisation of fixed access network elements. Essentially, it allows a network operator to create isolated virtual network instances which operate independently over a shared network infrastructure.

The arrival of software-defined networking (SDN) and network function virtualisation (NFV) in the access domain thus create a new way of sharing infrastructure. Virtualisation is leveraged to offer parallel “slices” of the access network and provide independent control of each slice. A network slice is a logical network, defined within an operator network, that can be dynamically created to meet certain performance criteria (e.g. latency, reliability, throughput). Compared to physical layer unbundling and active layer network sharing techniques, network slicing promises to deliver far greater control and flexibility for operators.

This has two major implications:

First, it means that network elements that could previously not be shared at a passive level because of physical constraints (limited resources, incompatible architecture, etc.) or technology constraints (vectored copper bundles) can now be shared in a way functionally identical to unbundling without any changes in the physical plant;

Second, it means that network slices can be created to meet exact needs as an alternative to generic wholesale active products such as bitstream or (the inappropriately named) VULA (Virtual Unbundled Local Access).

Network slicing promises to go beyond traditional wholesale models. This technology would enable novel uses of telecom networks and may appeal also to vertically integrated operators. A Network Service Provider could slice its access network in order to provide an “owned-like” experience to internal divisions or third parties. It would allow offering differentiated services to different end-user market segments (e.g., consumer broadband, enterprise services, mobile transport). It would also allow service partitioning for targeted services with customized QoS and functional requirements. This capability could attract 5G or IoT application providers and specific industry verticals such as healthcare, smart metering, OTT video streaming, real-time gaming or smart cities.

The standards for Fixed Network Slicing are still being discussed, but the publication of TR-386 by the Broadband Forum in January 2019, provided the specification of the management interfaces required to achieve Fixed Access Network Slicing. This completes most of the standardization effort, but further work is needed to consider Fixed Access Network Slicing in the context of an overall SDN/NFV network architecture. Discussions are underway in the Broadband Forum SDN&NFV Work Area amongst other committees. From an operational point of view, knowledge build-up is still required to understand the aspects of bandwidth partitioning and fair resource usage among different virtual network operators using network slices offered by an infrastructure provider.

### III. Larger service providers understand fixed network slicing better

#### Maturity

The first angle explored in our interviews was the maturity of the service providers' technology offices when it comes to fixed network slicing. Keeping in mind the diversity of our sample, particularly in terms of scope, it's important to stress the very different nature of the technology offices between a regional fixed operator for example and a national incumbent fixed-mobile operator. Our expectation was that maturity would be largely impacted by service provider scope.

Half of the sample is either seriously looking into fixed network slicing to try and understand its implications, or actually involved in the standardization process. While this does not mean they have yet decided to implement network slicing, it denotes a strong interest in the technology: the prevailing view in this sub-sample tends to be that fixed network slicing can have profound implications on the market and the way services are delivered to both wholesale customers and end-customers.

*“ We heavily invested in the standardisation process. We see a lot of promise in FANS and want to make sure that it is implemented properly by the industry. – An International Operator ”*

The other half of our sample was either not aware of fixed network slicing at all, or peripherally aware of it, but convinced it was a long-term industry development. That latter view was largely correlated to a sense that virtualisation itself was a long-term endeavor, particularly as applied to the access portion of the network. This sub-sample was hard pressed to express benefits of network slicing that might not be achieved with current QoS mechanisms and tended in fact to not see slicing as anything else than another solution to control or deliver QoS.

Exhibit 2 shows how these views are spread across the sample. Generally, the less mature service providers tend to be smaller players – either local or regional in scope – or alternative network operators (altnets). Generally, all incumbents have devoted some resources to assess the implications of fixed network slicing.

**Exhibit 2: Maturity of fixed network operators on FANS**



Source: Diffraction Analysis

One key takeaway across the board however, is the expression of a certain amount of ambiguity when it comes to building a business case for fixed network slicing. In other words, even for those who have studied the technology in depth and are involved in standardization currently, building a cost and benefit analysis in financial

terms is proving not to be easy. Keeping in mind that our interviewees were strategy people within the CTO office, the implication of this finding is that at board level in most of these companies the impact of fixed network slicing on business operations is not yet well understood.

“ *The CTO office is very involved on the topic and quite enthusiastic, but so far we have failed to articulate the benefits to business decision makers. – An Incumbent Operator* ”

## Perceived Benefits

We then explored the benefits that fixed network slicing could deliver. At this stage, specific use cases were not discussed unless the service providers brought them up themselves.

The use cases that are spontaneously discussed by service providers fall into two categories that have very different philosophies and different benefits as well.

The first sets of use cases are **internally focused**. They would allow a business line to run its own virtual network through a slice, thus eliminating the need for duplicated physical network assets. The key benefits here would be in capex and opex savings through the implementation of a “converged network” strategy.

Being able to deliver true B2B characteristics in access products on the same network as the one used for residential customers seems to be the primary use case that comes out spontaneously. Being able to fold mobile backhaul into the fixed network architecture is another use case although it is generally seen as more distant in time. A faster than anticipated deployment of 5G might shift that focus although – as we will see when we discuss that use case in detail later – our sample is divided on this particular issue.

Beyond the cost reduction potential of this internally focused approach to slicing, some multinational players also expressed a longer term vision of using slices as virtual instances across national networks, even though this goes beyond the scope of pure access network implementation.

“ *We operate in dozens of countries, each with its own network architecture, engineering rules, order processing, pricing, etc. We need a unifying layer to streamline it all, and FANS might just deliver it for us. – A Multinational Operator* ”

Service providers heavily involved in fixed access wholesale tended to have in mind a second set of use cases, more **externally focused**. The idea here would be to use fixed network slicing to create wholesale products that would sit somewhere between passive products (unbundling) and current active products (bitstream).

While the benefits of offering (or purchasing) such products are perceived very differently by players in different market positions (incumbents tend towards reluctance while altnets are more enthusiastic), the consensus seems to be that such products could change market dynamics significantly. For some players, there is an element of game theory in potentially embracing fixed network slicing, as a way perhaps to avoid regulation on other wholesale products (avoiding dark fiber unbundling, for example).

“ *The key difference with slicing is that it’s a platform: it avoids the messy physical stuff of unbundling, but the wholesale customer is in charge, not the wholesaler. – A* ”  
**Multinational Operator**

Again, beyond the strict access network aspects, a longer term externally focused use case mentioned would be the ability to offer slicing to B2B customers with critical needs like utilities, cities or transportation authorities. This would allow them such a high degree of control and quality on the network assets they would lease that they would no longer consider deploying their own telecom networks.

“ *We don’t see wholesale as a short term slicing use case for us, but we are keen to explore the ability to deliver end-to-end virtual critical networks to enterprise customers such as transport authorities or utilities. – A* ”  
**National Wholesaler**

## IV. Use Cases

In order to get a more in-depth assessment of the potential interest in fixed network slicing, we presented five use cases to interviewees and asked them about their interest in these use cases:

- **A wholesale FTTH use case:** wholesaling slices of FTTH access as a substitute or additional option to fiber unbundling and bitstream;
- **A wholesale FTTC/G.FAST use case:** wholesaling slices of vectored copper drops, whether horizontally in fiber to the curb deployments or vertically (in-building) in the case of fiber to the distribution point;
- **A Mobile Backhaul use case:** providing a mobile business unit (or external mobile operator) access to mobile backhaul in slices for added control and the possibility to operate on a single physical infrastructure serving all business units;
- **An Enterprise use case:** providing a B2B business unit access to its own dedicated network slice to ensure quality of service and control for B2B end customers;
- **A Merged Networks use case:** using slicing to create an overarching network abstraction on top of heterogeneous fixed networks acquired over the years.

For each of the use cases we discussed interest, the practicalities of implementation, the time frame, and the potential challenges. The feedback is summarized below as well as in the next sections of the document.

### Wholesale FTTH Use Case

This use case is clearly the one that generated the most in-depth discussions. It is probably the earliest clear use case that many players in the market can conceptualize.

Position in the fixed access market as well as existing regulatory regimes are key tactical aspects that seem to inform the degree of interest that interviewees expressed in potentially using fixed network slicing to create wholesale access products. Before examining the various positions by different players, it's important to detail how a wholesale slicing product is perceived, more or less across the board:

- Slicing is seen as an alternative to dark fiber that would in a sense sit in between dark fiber and bitstream: it would offer the control, flexibility and ability to differentiate that dark fiber promises but as an active product and therefore without having to tackle the technical and organizational complexities of dark fiber unbundling;
- Consequently, interviewees nearly unanimously imagined that a slicing wholesale access product would be priced somewhere in between dark fiber and bitstream. Note that an argument for slicing being priced above bitstream could be made (it does deliver a promise of better control and differentiation after all) but few if any interviewees felt that their market could absorb a higher priced wholesale product (at least in the residential space);
- Finally, despite remaining uncertainties about how a slicing offer would work in practice, it is generally understood that a large part of the work currently done by the wholesaler in a bitstream context (layer 2 service design, monitoring, etc.) would be effectively handed over to the wholebuyer;

With this in mind, the various degrees of interest (or lack thereof) are, as mentioned above, largely dependent on market position.

For established incumbents who currently offer regulated bitstream offers and are not threatened by dark fiber regulation, there is little interest in considering fixed network slicing as a wholesale alternative: it would mean revenue degradation. Their lack of interest is generally attributed to lack of demand, but a few more candidly admit that it's very hard to internally sell an investment program that would result in revenue erosion. That being said the increasing pressure from governments and investors to consider co-investment and infrastructure sharing for fiber network expansion could change those positions over time.

There are exceptions amongst incumbents, with a few of them expressing interest wholesale slices, but these seem mostly down to specific regulatory considerations in the countries where they operate. In particular, when a regulatory review is looming that might impose dark fiber unbundling, or bitstream price regulation if currently unregulated, there might be a tactical advantage in adopting slicing in order to avoid an unwanted regulatory outcome.

“ *So far, we have always anticipated our regulator and offered wholesale options for FTTH at both passive and active layers. We have thus avoided regulation. As our network expands, we see slicing as a worthwhile option to continue to avoid regulation. – Incumbent* ”

Altnet wholesalers express more interest in exploring the possibilities of slicing, particularly as it offers them a potential edge competing against an incumbent who might be reluctant to embrace it. This means that slicing may be an opportunity for market share acquisition over the incumbent. It might also allow for opex savings as network operations activities are pushed over the wholebuyer.

“ *If slicing allows us to offer a product that is cheaper and better than VULA we will attract customers who currently find it easier to work with the incumbent only. – Altnet Wholesaler* ”

Some altnets are also interested in leasing wholesale slices in order to enable faster product design cycles and better differentiation as well as a privacy in service design that bitstream does not offer.

“ *Many of our FTTH wholesale providers are also our retail competitors. Currently if we negotiate a specific bistream product with them, their marketing teams know we will launch a new product and can figure out what it will be on the basis of our requests. With slicing we would have absolute privacy and be able to keep everything quiet until we launch commercially. – An Multinational Operator* ”

Finally, new wholesale operators who are still largely in deployment phases look at slicing as a potential day one technology, not considering other alternatives like bitstream or dark fiber but embracing slicing from the start.

Few interviewees have definitive views on slicing, and there is still space for things to evolve as more information emerges about how it will be operated and priced. As the results of early field trials are published, some positions may well change. Considering it's hard to build a business model around fixed network slicing yet, some interviewees see risks in being an early adopter. But some altnets clearly seem to think that there might be a big payback in market share in moving fast.

## FTTC/G.fast Use Case

While it is possible for a telco to offer passive (dark fiber) wholesale products in the access, it is impossible to do so with vectored copper: vectoring requires real-time monitoring of all the copper lines in a given bundle. Slicing therefore offers the possibility of a wholesale product delivering a degree of control that simply cannot be currently obtained.

Amongst operators who have G.fast planned or deployed, slicing is seen as a way to solve a complicated conundrum, namely how to offer a passive-like wholesale product in-building or over vectored drop copper. Regulators in many countries insist on the sharing of the passive infrastructure inside multi-dwelling units, and doing so physically, while possible, tends to be messy. Slicing offers an opportunity to side-step the issue.

**“** *We have a regulatory obligation to share in-building connectivity with our competitors, but sharing FTTP is a currently a headache. Slicing could be a solution.* **”**  
– **An Incumbent**

However G.fast is not yet widely deployed, and therefore the number of operators in our sample expressing interest in this use case was small. There are several reasons that explain this feedback from the market: some are due to the technologies under discussion, others due to the nature of our sample: because of our focus on wholesale and the need to balance incumbents and altnets, many of our interviewees actually have no copper network at all.

Incumbent operators who have significant FTTC deployment also raised the issue of their ageing plant: FTTC deployment, for those operators that embraced it, started over a decade ago, and many of these operators doubt (rightly or wrongly) that their FTTC hardware could be easily virtualized. Additionally, most of these operators are today focused on deploying full FTTH, and are therefore reluctant to consider upgrades to the FTTC plant.

## Mobile Backhaul and Enterprise Use Cases

While presented to the interviewees as distinct, the mobile backhaul and enterprise use cases are viewed in a very similar manner by the strategy people within telco's CTO offices. Essentially, what they boil down to is a promise of better asset utilisation (and associated costs savings) to collapse separate physical networks serving separate retail markets into one. To put it differently, where today the mobile division of a telco might operate on a completely separate physical infrastructure for mobile backhaul to the retail broadband division, slicing

might enable the merging of these infrastructures into a single network serving both. Slicing would allow for each division to have full control over the parts of the infrastructure it needs with no risk of performance being degraded by the use of the same infrastructure by another division.

### Enterprise

A portion of the interviewees for whom the enterprise business is important failed to see the benefits of fixed network slicing in the context of a full fiber service. Many of these companies either do not think that a network level differentiation is necessary between residential and enterprise customers (service differentiation is made on SLAs and customer support), or use existing PON quality of service mechanisms to deliver a better service to enterprise customers.

“ *We have currently implemented QoS differentiation as included in the PON standards. We fail to see what slicing would deliver beyond that that would justify the investment... – An Incumbent* ”

It should be stressed that most Tier 2 or Tier 3 interviewees do not have a separate enterprise network division, and therefore are not receptive to the argument of collapsing separate network assets into one: that is already how they operate.

That being said, some operators had a broader view of potential uses of slicing in a B2B context. In particular operators serving enterprise customers through a multiplicity of wholesale networks see slicing as a way to deliver a consistent quality of service over infrastructure they do not physically control.

“ *For large national enterprise customers, we sometimes need to contract through three or four external network operators to reach all the end-points. This is operationally very complex and makes it impossible to deliver a consistent experience across all these networks. A sliced virtual layer could enable both consistent service quality and ease of management; that would be a game changer. – An Incumbent* ”

In a sense, this goes beyond the pure internal use case, and indeed a number of operators see a lot of promise in slicing as a way to deliver a turnkey network solution to critical businesses like utilities, cities, or similar entities that might otherwise be tempted to deploy their own proprietary networks to get the quality of service and degree of control they need.

“ *We can see the opportunity to go after contracts such as that of our capital's transport department, who wants to be able to offer services to car drivers and commuters and is currently envisaging its own network deployment. However, in order to be able to do this we need to be certain the vendors will implement a consistent view of slicing between the access and other parts of the network. We're not there yet. – A National Wholesaler* ”

## Mobile Backhaul

While the perspectives around enterprise were discussed as being relatively short term, the applicability of slicing to mobile backhaul did not seem so near to many of the interviewees. Most of them have separate network organisations for fixed and mobile and are very reluctant to merge those, mostly for reasons of internal politics. Also, the current density of 4G cellsites does not make point to point fiber backhaul uneconomical. However, many are aware that as cellsites densify with 5G, the issue may need to be revisited.

In fact, interviewees as a whole have heard a lot more about 5G slicing than they have about fixed network slicing. While this may inform some of their answers and possibly lead to some confusion, it is also an important element in understanding their views on end to end solutions going forward: 5G slicing will not live entirely separately from the core and aggregation networks, and therefore from mobile backhaul. Fixed network slicing and 5G slicing will have to work together for end to end slices to be viable.

“ *We're not interested in slicing for mobile backhaul because we have a policy to not use our residential network to connect cell sites. We may reconsider this as fixed and mobile technologies evolve. – A Fixed-Mobile Incumbent* ”

The main exception to this view is a tower company that we interviewed as part of the study. Unsurprisingly perhaps, they see the deployment of wholesale FTTH and wholesale backhaul to connect the towers as entirely symbiotic, resulting in a single network outlook.

“ *« Our entire strategic plan is predicated on delivering both fixed and mobile as Infrastructure as a Service, so clearly slicing is a key technology to create the service and manage/control differentiation for our customers. – An Altnet Tower Co.* ”

Altogether, about two in five of our interviewees believe that efforts to merge fixed, mobile and enterprise infrastructure is a strategic priority to deliver significant opex savings. Some believe that slicing will be a key element of delivering that vision, but others don't know how they will get there yet. Amongst the rest of the sample, many consider that mobile activities are too critical to be merged with the rest.

This suggests that while the goal of a single converged network will be hard to execute without slicing, it may be a tougher sell than anticipated. Paradoxically, these same operators often identify a convergence of fixed and mobile backhaul network assets as a key cost reduction opportunity.

## V. Key Takeaways

Having discussed the anticipated benefits of slicing and the level of interest in the different use cases, we tried to assess a number of other aspects of the decision process to implement slicing: the challenges foreseen, the timing of a deployment, the importance of multi-vendor compatibility and the expectations the telcos may have in terms of the numbers of slices they'd need.

### Expected Challenges

One of the most frequently mentioned challenge is concerns about the availability of relevant skills. This is not an issue directly associated with slicing but rather more generally perceived around software defined network and network virtualisation. Still, the issue is that the current telco organisations are constituted mostly of telecom engineers whereas a virtualized network will require a lot of specialised IT skills and less engineering skills. Recruiting the right profiles is challenging, in part because telecom operators might not be the most exciting prospect for young IT profiles, in part because the IT field is much larger and candidates have other options. Inversely, larger operators are now in a position to offer more exciting and open jobs for the types of candidates that they need for this IT transformation.

“ *The kinds of skills we will need to transition to SDN / NFV are often poached by large internet companies (Facebook, Google) at salaries we can't match. – A Wholesale Altnet.* ”

Another related issue is the expectation of internal resistance. Slicing (in its external applications at least) consists in a much larger degree of control handed over to wholebuy customers. This means that the organisation as it currently exists needs to learn to “let go”, something that is hard at the best of times.

Wholesalers specifically have an additional concern around regulation. Wholesalers, even if they are keen to implement, are concerned that regulators may hamper or slow down such implementations. The general consensus is that regulators have not yet looked into fixed network slicing today, and may move too slow.

“ *Frankly, our regulator understands nothing of this, and may not even really know about it. And yet we are regulated. This might cause a lot of delays and pains. – A Regulated Incumbent.* ”

A few of the more mature operators expressed concerns around assessing two key aspects of the technology:

- Security, which they see as the guarantee that the user of one slice cannot affect the performance of another by mishandling his own slice;
- Privacy, which they see as the guarantee that the user of a slice (or indeed the network operator) cannot see how another slice user is implementing its products and services within that slice.

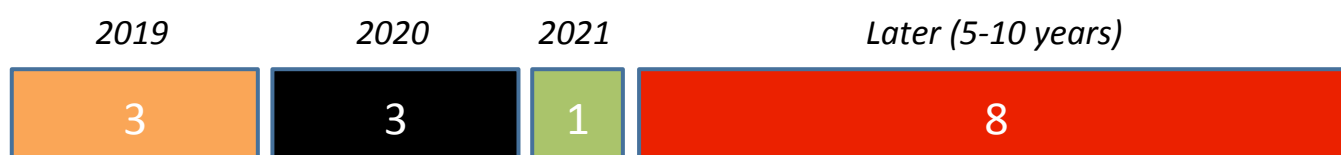
These concerns seem mostly to stem from a lack of understanding of exactly how slicing would work rather than an in-depth analysis of the technology. Interestingly, regarding privacy, the operators who have a more in-depth view on slicing consider it to be a key benefit rather than a challenge.

By far the most important challenge expressed by many of the interviewees however, is the difficulty in articulating a business model around fixed network slicing. Interviewees understand the concept and see (for some of them) its promise, but they also anticipate that the implementation of slicing – both in technology and in organisation – will require significant changes. They have yet to figure out the savings and new revenue opportunities that it presents.

## Timing

Interviewees were not generally sure about the timing around fixed network slicing. Those most involved in the standards definitions expect standards to be finalised in 2019 and the first commercial solutions to be available soon after, but that doesn't necessarily give them clarity on their own implementation. Still, as shown in exhibit 3, a little under half the sample believes they will implement slicing in the relatively near future while the rest sees it as something that may emerge in the longer term. Unsurprisingly, this is mostly correlated to the interest the telcos have in the technology, and relates mostly to the earliest understood use case, i.e. wholesale FTTH.

**Exhibit 3: Timeframe for slicing implementation (# of interviewees)**



Source: Diffraction Analysis

Timing for fixed network slicing is generally associated with the implementation of SDN/NFV in the access and not considered as a separate development. Those who are the most aggressive on timing are also those who feel they have advanced the most on the virtualisation of the access network.

“ *In our ideal scenario, we'd like to do customer trials in 2020 and have customers live in 2021. Not sure the vendors (or us) will be ready by then though.* – **An Altnet Wholesaler** ”

The timing uncertainty is related to standardization and implementation but also to the challenges mentioned above around the articulation of the business case. The CTO office at many telcos' is aware that it needs to convince upper management before anything can happen.

Inevitably, views on slicing are tied to the broader outlook on SDN/NFV. Interviewees skeptical about the need for a short term implementation of SDN/NFV in the access (or who think that it will be very gradual) tend to view slicing as something that happens after that implementation is well underway. This is the prevailing view amongst smaller retail players. Larger players, who have more staff to consider long term evolutions of their networks and associated benefits tend to have a shorter timeframe in mind for virtualisation in the access, and therefore a shorter timeframe in mind for slicing as well.

“ *SDN/NFV in the access will not be a big bang.* – **An Incumbent** ”

## Multi-Vendor Compatibility

If there was one issue discussed where our sample was unanimous, it was that multi-vendor compatibility needed to be integrated in the standards for fixed network slicing. Even operators which have currently chosen a single vendor for all their access needs were in favor of it.

A number of interviewees expressed the notion that fixed network slicing didn't make any sense without vendor interoperability. No one wants a lock-in, and moving ahead without MVC could create an even worse situation.

“ *« Think about it: how can you ensure the full functionality of a slice if it doesn't bridge equipment from different vendors? – An Incumbent* ”

## Number of Slices

Because the understanding of slicing differs from operator to operator and because they do not find the same use cases interesting, it was worthwhile exploring how many slices they felt they might need to deliver the benefits of fixed network slicing. Exhibit 4 shows how many slices the operators expect to have to handle.

Exhibit 4: Number of expected slices (# of interviewees)



Source: Diffraction Analysis

A few of the interviewees – clearly thinking about using slices for end to end critical application enterprise connectivity – mentioned they would need close to 100 slices. All other interviewees, thinking more about wholesale, gave numbers of up to 10 slices, with the most common view situated between 4 and 8. In general, the reasoning around this number is related to the number of mass market wholesale customers considered to be the only likely candidates for slicing in the short term.

Few of the interviewees however asked themselves about slice management and how an increased number of slices might make the management more and more complex.

“ *« Too many slices would introduce excessive complexity in managing the underlying assets. We need to be slicing (internally) according to need, not one slice for each business line or use case. – An Incumbent* ”

## VI. Conclusion

The key use case for fixed network slicing in the short term will be in FTTH wholesale. As a wholesale product, slicing is perceived to deliver the following benefits:

- To the wholebuyer, increased control, real-time monitoring and privacy. More generally, the ability to differentiate as not every service provider will use slices in the same way for product design;
- To the wholesaler, a lower-touch product at a potentially more aggressive price point than bitstream to gain market share and deliver better quality of service to wholebuyers.

While a number of service providers have expressed interest in fixed network slicing, the maturity and understanding of the technology is still relatively low across the sample. This is understandable since standardization is only expected to be finalized in 2019, but means that maturity will have to evolve in a number of areas before widespread adoption can be considered:

- Technology strategists within telcos will have to understand the use cases more in-depth and figure out how they apply to their own businesses;
- Marketing within wholesale telcos will need to analyse the implications of offering slices as wholesale products, how it affects not only pricing levels but pricing models and what the constraints and limitations may be for sharing underlying assets. They also need to anticipate what may be a rocky commercial transition from existing bitstream offers to slicing offers;
- Regulators will have to educate themselves on the promises and implications of fixed network slicing, especially as incumbents by and large seem reluctant to adopt the technology.
- As vendors clarify pricing models, telcos will need to build business cases around fixed network slicing to figure out the economics going forward.

That being said, for those who see potential, the timeframe could be relatively short and certainly not in the 5-10 year scenario that the less adventurous see. As the standards are finalised in 2019 and pilots start gaining speed, attention will become more focused on the actual benefits and use cases being experimented with.

The wholesale use cases will likely emerge first with altnets, and as competitive pressure builds up and regulators analyse the benefits, will gradually spread to other market players.