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Executive Briefing

# HOW TO PROFIT FROM THE 5G NETWORK SLICING OPPORTUNITY

5G network slicing will enable telcos to provide specialized connectivity in a flexible manner. However, to do this in a profitable way, telcos must make changes in their operations' systems, people and processes. We explore this in a case for network slicing to enable an esports event – and much more.

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# Preface

The document has been prepared by independent research firm STL Partners and commissioned by Nokia. It is based on STL Partners' continuous research programme into the future telecoms operator and how to get there.

Mentions or allusions to companies or products in this document are intended as illustrations of market evolution and are not intended as endorsements or product/service recommendations.

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# Service innovation in a 5G world needs to support variety at scale and fast failure

At STL Partners we have written at length about fifth-generation (5G) cellular networks. Consensus is growing that in spite of faster speeds, lower latency, greater capacity, ultra-reliability and greater flexibility promised by 5G technology, the business case for consumer-facing 5G connectivity services is elusive[1]. Saturation and price competition in the mobile broadband marketplace mean that network operators are unlikely to realise substantial revenue growth from existing services in the long-term.

If 5G is to be about more than "faster 4G", it must enable operators to build new kinds of connectivity-based services for enterprises and consumers. Many such use cases have been mooted, some more attractive – and viable – than others, all yet-to-be-proven to work in practice. The challenge for operators is in building a realistic business case with little information to hand.

This has led us to conclude that there won't be one "killer 5G use case" – there'll be many. This comes from:

1. Many hundreds of new use cases
2. Diverse requirements for these use cases related to throughput, latency and reliability
3. Many different enterprise customers with new and specific needs

The combination of 1, 2, and 3 listed above will create an exponential rise in requirements on operators.

5G, as a network designed from the ground up as virtualised, should be able to provide flexible connectivity solutions that cater to specific capabilities that customers require. This means that operators must be able to support services which don't just do one thing at scale, but that they can support variety; potentially many hundreds of different slices, overlapping in time and location.

Network slicing is an example of how operators will need to be more flexible in a 5G world. Until now, public mobile networks have been built on the principle that all connected devices communicate using a single network over the same physical infrastructure (access interfaces, core functions, etc.) as everyone else. The operator rolls out a "one-size-fits-all" network which is designed to cover a set of well-defined use cases (primarily voice calls, SMS and consumer mobile broadband), but not much else.

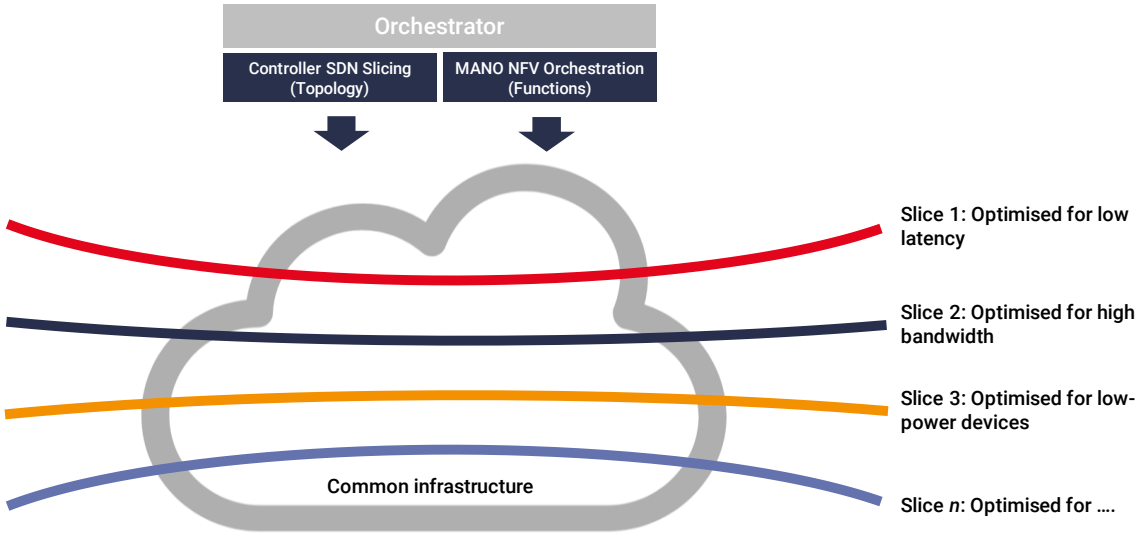
With 5G, this will change. Network functions will run as software on virtualised generic infrastructure, rather than on dedicated physical appliances as in the past. This has many advantages – not least that the operator will be able to spin-up and spin-down network functions at will without the need to install expensive bits of dedicated equipment. However, it is the multi-tenancy aspect of virtualisation

[1] STL Partners: 5G: 'Just another G' – yet a catalyst of change

that allows operators to "run, create and manage multiple logical functionally-discrete end-to-end networks over a common physical infrastructure", or in short, "network slices". Furthermore, underlying resources permitting, such network slices can be spun-up and taken-down as needed; for example, just for a couple of days, in a given geography.

Figure 1 illustrates how this might look in practice:

**Figure 1: Diagram of network slicing**




Source: STL Partners

Each end-to-end network slice has the functionality of a complete network, including specific network layer capabilities, operational parameters and network characteristics. Network slices (may) each have their own set of network functions and required compute, storage and networking resources to meet certain requirements. This means that each network slice can be designed to serve either a particular use case, purpose or even an individual customer (or "tenant"). This can also mean that a given slice does **NOT** need to include functions and related resources that are not required (for example, voice services or mobility management that allows users to maintain service while moving at high speed across cell sites).

The vision of 5G network slicing set out in this study is still some way off; we estimate 3-5 years for most operators. However, operators need to define and start building the supporting technology, processes, skills and organisations today, if they are to meet the vision of tomorrow.

## Variety at scale – fundamentally shifting telco economics… and approach to innovation

Based on their technical capabilities, network slicing offers significant promise to operators looking to "do something different" with 5G. As discussed above, there will not be one, but many use cases that will be needed to drive new service growth. For such a situation to be profitable for operators, they must be able to support ***variety at scale.*** This means being able to pursue opportunities that would previously have been considered too "niche" or "unproven". It is hard to overstate how far-reaching this change could be for operators in how they approach new service innovation. Through slicing, operators' investment in new services becomes a software-driven exercise.

In instances where slices are designed for a specific use case, purpose or customer, there is a possibility that the slice will not end up being re-used that much. Just as we have seen with cloud-based software services, for new services to be viable even at low levels of adoption, service providers need to minimise the cost of first developing, releasing and then providing services "on-demand". This is fundamental to the economics of supporting variety at scale. It is also fundamental to the economics of innovation.

## Fail well, fail fast

Telcos lament that much of the value their networks have helped to create, has been captured by over-the-top players (OTTs). Sometimes, operators have sought to recapture this value with innovation efforts of their own, by which time, it is generally too late. Furthermore, the scope and outcomes of this innovation is often limited because it occurs only in response to proven success by others. Slicing holds out the promise of greater agility and genuine innovation. But only if done right.

Even with slicing, if there is a high cost of developing, introducing and operating new services for which demand is "un-proven", operators cannot justify pursuing these potential opportunities. They would need more proof in the potential market, typically by waiting for others prove it. Here lies the rub. If operators were to wait for evidence that a slice will be successful before they build it, they risk missing out in the opportunity. This is not dissimilar to the circumstances of content production houses. It is very difficult to predict what will be the next big game, block-buster movie or mini-series. In order to deal with this, executives will commission a broad range of new titles (shows, movies or games). Of course, most titles get only funding for a pilot and then perhaps the first few episodes. If it is a commercial hit, more funding will follow. If not, the production company will not have spent too much money on content that will not be popular with the public. Some titles will break even, many (indeed most) will fail, a few will be very successful and profitable.

To be truly innovative (and achieve the growth that comes with this), operators should look to embrace a similar approach – and to create a fast fail environment. Among other things, this means that the designing and provisioning of a new service slice needs to be as low an investment as possible, such that having many break-even or non-commercially successful slices will not break the bank. **Essentially, telcos need to change the way they approach service innovation in a 5G network slicing world.**

# Modelling slicing service innovation through an esports example

This study seeks to investigate what changes telcos need to undergo in order to be able to deliver the service innovation vision set out in the previous section. To do this, we have explored the practicalities of just one example of a use case for 5G network slicing – managed connectivity for an esports tournament.

Esports is an attractive example for this exercise for two key reasons:

1. Esports is a growing and technologically innovative industry. This year, it was estimated that global revenues from esports would exceed US$ 1bn, and likely double by 2022[2]. Not only this, but esports event organisers want to provide the freshest, most exciting and engaging experiences to their highly-demanding, tech-savvy audience. While we do not necessarily know what these value-add applications will be,[3] 5G network slicing (along with other technologies like AR/VR) will likely enable these innovative use cases, and the esports industry is likely to be a fast adopter of these experiences.

2. Although esports organisers are enterprises, esports itself is a consumer-driven industry. As a case study, it is representative of a range of B2B2X (B2B2B, B2B2G and B2B2C) opportunities; selling connectivity to an enterprise that then couples this together with their wares to sell to their end market -- either other businesses, public sector enterprises or consumers. Unlike a pure B2B enterprise use case, which is where telcos have initially focused their slicing efforts, in B2B2X opportunities, the telco will face more market risk. This increased risk means it is particularly important for telcos to keep costs low and embrace an agile, variety-at-scale, fast-failure strategy. However, many of these findings still apply to pure enterprise opportunities too.

## Esports today: best effort connectivity

At esports events today, professional competitors play the game live on a stage. Audience members, at some events more than 150,000 of them, watch the action unfold on large screens. The chief technical focus of the esports event company is on providing the highest quality, largest screens and speakers – and this specialised equipment will travel too as they host events at different venues.

Esports event connectivity requirements focus on ensuring that the players have the fastest and most reliable connectivity possible. With prize money for these kinds of events reaching upwards of $30 million,[4] esports organisers cannot afford for players to experience any kind of latency or jitter that might unfairly affect their performance. To ensure speed and reliability, organisers install their own

[2] Reuters: US videogames outlook
[3] A non-exhaustive list might include instant replays on audience members' devices, Multiview game play where audience members can view the game from various different points of view, 3D AR experiences, 360 degree views, time lapses and "all play" open sessions where audience members are able to join in in playing the games themselves.
[4] Forbes: Fortnite World Cup by the Numbers

gaming server at the venue and use wired Ethernet to connect the players, game servers, sound systems and video screens.

In comparison, connectivity for audience members at esports events today is similar to any large-scale event. Typically, event organisers will make use of the existing connectivity set-up of the event spaces (conference and convention centres, exhibition halls, sports arenas, and so on). In most cases, this will be a free-to-access Wi-Fi "hotspot" which works purely on a best-effort basis. Public cellular connectivity may also be available – although indoor availability is largely out of organisers' control.

## Esports connectivity under 5G: a gamechanger?

The major change under a 5G paradigm would be that Wi-Fi connectivity and potentially broadband fixed access could be replaced by specialized indoor 5G connectivity (delivered as a slice), enabled by installation of 5G small cells in the venue. These small cells are part of the operator's public, nationwide 5G network and could be owned by the operator or could be provided by a neutral host.

Audience members which are already customers of the service provider whose service runs over the small cell will connect automatically through their existing cellular device. For customers of other SPs, access is a little more complicated. Most are likely to be given a temporary SIM – either a physical card or an eSIM code – that enables them, for the duration of the event, to use the given operator's network. Although less likely, a form of local roaming agreement could also make this possible. The intention is that all users (including those who already use the operator's network) would be able to connect for the duration of the event without it impacting their current data plans. Furthermore, the operator would be able to "showcase" its network's capabilities to both its existing customers and potential new ones.

The 5G small cell installed at the event venue will enable the service provider to offer a dedicated network slice for the duration of the esports event. This slice should enable service providers to provide the kind of low latency, high bandwidth connectivity at scale that audience members require to unlock the types of customer experiences discussed earlier.

## What are the key cost hurdles for the esports business model to succeed?

Of course, there are several key variables that will determine whether providing a 5G network slice for esports events will be an attractive, and profitable, endeavour for a telco. These include:

- **What you can charge per user per day.** This is, at this stage, frankly unknown and will depend on a variety of circumstances, like the value-add experiences that are on offer for audience members at that particular event.
- **What it costs to design and develop the service.** The slice must be designed to deliver the ultra-low latency and high bandwidth requirements. The slice will be designed once and then productised so that all events in all locations (esports or otherwise) with similar requirements can be catered to and therefore will not incur a re-design cost for every instance.

- **What it costs to set up and decommission the slice per event.** Once designed, the service will be spun up, run for a few days and spun down, when and where there is demand e.g. for a couple of days when an esports event is happening at the venue.

**As a telco, you should focus on keeping the cost of service design and delivery of new slices to a minimum, so that you can sustain a wide stable of viable services, fail fast on the duds and reap the rewards on those that take off.**

# Slicing service innovation: how to ensure profitability

## Figure 2: Operators must ensure the cost of developing the 5G slice is low – in order for esports to be profitable

| Cost of developing a slice | Price charged per user per day | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 56% | $ 1.50 | $ 1.40 | $ 1.30 | $ 1.20 | $ 1.10 | $ 1.00 | $ 0.90 | $ 0.80 | $ 0.70 | $ 0.60 | $ 0.50 | $ 0.40 | $ 0.30 | $ 0.20 | $ 0.10 | $ 0.08 |
| $ 50,000 | 74% | 68% | 62% | 55% | 49% | 42% | 36% | 29% | 21% | 14% | 6% | -2% | -10% | -20% | -29% | -32% | |
| $ 75,000 | 64% | 59% | 53% | 47% | 41% | 35% | 29% | 23% | 16% | 9% | 2% | -5% | -13% | -22% | -31% | -34% | |
| $ 100,000 | 56% | 51% | 46% | 41% | 35% | 30% | 24% | 18% | 12% | 6% | -1% | -8% | -16% | -24% | -33% | -35% | |
| $ 125,000 | 50% | 45% | 40% | 35% | 30% | 25% | 20% | 14% | 8% | 2% | -4% | -11% | -18% | -26% | -35% | -37% | |
| $ 150,000 | 44% | 40% | 35% | 31% | 26% | 21% | 16% | 11% | 5% | -1% | -7% | -13% | -20% | -28% | -36% | -38% | |
| $ 200,000 | 35% | 31% | 27% | 23% | 19% | 14% | 10% | 5% | -0% | -6% | -11% | -17% | -24% | -31% | -39% | -41% | |
| $ 300,000 | 22% | 19% | 15% | 12% | 8% | 4% | 0% | -4% | -9% | -13% | -18% | -24% | -29% | -36% | -43% | -45% | |
| $ 400,000 | 13% | 10% | 7% | 4% | 1% | -3% | -7% | -10% | -15% | -19% | -23% | -28% | -34% | -39% | -46% | -48% | |
| $ 500,000 | 6% | 4% | 1% | -2% | -5% | -9% | -12% | -16% | -19% | -23% | -27% | -32% | -37% | -43% | -49% | | |
| $ 750,000 | -6% | -8% | -10% | -13% | -16% | -19% | -21% | -25% | -28% | -31% | -35% | -39% | -44% | -49% | | | |

Source: STL Partners

Figure 2 shows the cost of product development for a 5G network slice (here noted down the left-hand side of the table) versus the price per user per day that the telco can charge for a network slice (here noted across the top of the table). This is based on calculating a five-year ROI. We can see that if, for example, design of the slice is kept to under $50,000 that even charging at little as 50c. per user per day will still be a profitable exercise for the telco. However, if development costs exceed $300,000, the charging model to remain still profitable becomes much less flexible, with a need to charge more than $0.90 per user per day. As telcos will likely struggle to control the price users will be prepared to pay, they need to keep cost of product development low, to make sure that as many slices as possible are in the top left hand-side of the table, or in other words, are as profitable as possible.

By highlighting the key variables around new slice business viability, operators can better understand the "innovation architecture" of the business operations they need to build. Another way of looking at this is by two main cost components:

- The cost of ***developing a slice*** (this is already discussed above) which includes the specification, design, assembly and testing of a new slice / service. In practice, this will be a process of adapting an existing slice and/or combining existing network function components with new ones through an iterative process. It excludes network function licensing costs which should be deferred until the services are actually used. Once the slice has been developed it is available to sell and ready to deploy.

- The cost of actually deploying and dismissing the slice that has been ordered. This is the same as the cost of ***spinning-up and spinning-down*** a slice for a service and location that has been

ordered by a customer. In the case of esports, this would be a slice for the esports connectivity service in the venue location and for the duration of the esports event. In theory, this could be achieved through by a provisioning team operating a manual orchestration, service chaining and configuration process, much in the same way that managed services are delivered to enterprise customers by service providers today. However, this could be slow, expensive and error-prone. Greater automation and AI should help to reduce this cost.

In figure 3, we have mapped how these two variables impact overall return for the esports case. Here we are assuming that the operator can charge $1 per user per day, somewhere in the middle of the pricing suggested in figure 2. In summary, this shows that if the cost of developing the slice exceeds $400,000, even if the cost of setting up the service for a specific event was as low as $100, the slice would not be a viable service. Equally, if, through automation, the cost of setting up and decommissioning the slice can be kept below $1,250, the service can be viable with development costs as high as $300,000. Essentially, operators must consider strategies to keep both of these variable costs as low as possible. Strategies for doing this are outlined in brief in the following section: **What can telcos do to keep slicing service innovation and provisioning costs down?**

## Figure 3: Cost of setting up and decommissioning the slice must also be kept to a minimum

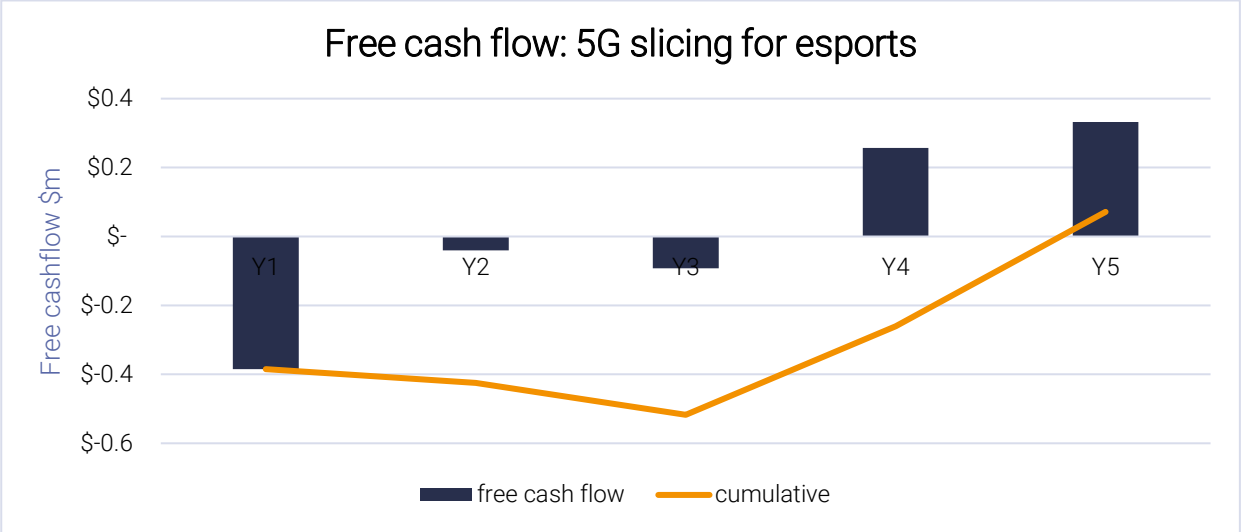
Cost of spinning up and spinning down a slice

| Cost of developing a slice | 4% | $ 100 | $ 200 | $ 300 | $ 400 | $ 500 | $ 600 | $ 700 | $ 800 | $ 900 | $ 1,000 | $ 1,250 | $ 1,500 | $ 1,750 | $ 2,000 | $ 2,250 | $ 2,500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $ 50,000 | 45% | 44% | 43% | 42% | 41% | 41% | 40% | 39% | 38% | 37% | 35% | 33% | 31% | 29% | 27% | 25% | |
| $ 75,000 | 38% | 37% | 36% | 35% | 35% | 34% | 33% | 32% | 32% | 31% | 29% | 27% | 25% | 23% | 21% | 20% | |
| $ 100,000 | 32% | 31% | 31% | 30% | 29% | 28% | 28% | 27% | 26% | 26% | 24% | 22% | 20% | 19% | 17% | 15% | |
| $ 125,000 | 27% | 26% | 26% | 25% | 24% | 24% | 23% | 23% | 22% | 21% | 20% | 18% | 16% | 15% | 13% | 11% | |
| $ 150,000 | 23% | 22% | 22% | 21% | 20% | 20% | 19% | 19% | 18% | 17% | 16% | 14% | 13% | 11% | 10% | 8% | |
| $ 200,000 | 16% | 15% | 15% | 14% | 14% | 13% | 13% | 12% | 12% | 11% | 10% | 8% | 7% | 5% | 4% | 3% | |
| $ 300,000 | 6% | 5% | 5% | 4% | 4% | 3% | 3% | 2% | 2% | 1% | 0% | -1% | -2% | -3% | -4% | -6% | |
| $ 400,000 | -2% | -2% | -3% | -3% | -3% | -4% | -4% | -5% | -5% | -5% | -6% | -8% | -9% | -10% | -11% | -12% | |
| $ 500,000 | -7% | -8% | -8% | -9% | -9% | -9% | -10% | -10% | -10% | -11% | -12% | -13% | -14% | -15% | -16% | -17% | |
| $ 750,000 | -18% | -18% | -18% | -19% | -19% | -19% | -19% | -20% | -20% | -20% | -21% | -22% | -23% | -24% | -25% | -25% | |

Source: STL Partners

If operators can keep these costs down, the business model for 5G network slicing for esports events could look like this:

**Figure 4: Payback for 5G network slicing for esports could happen as early as Y2**



# What can telcos do to keep slicing service innovation and provisioning costs down?

There are several steps that telcos should take to maximise their chance of making network slicing profitable. Below are five key areas we recommend telcos should focus on to achieve this.

1. As has been mentioned throughout this report, the first message is that a **learning culture of fast failure must be adopted**. Practically, for most telcos this will mean significantly shortening their innovation cycles so that, should there be demand for a particular kind of slice, telcos can respond to this demand quickly and move from slice development to a commercialised offering. At the moment, there may be a 12-18 month lag time even for a highly promising and profitable service or product between it being added to a telco's strategic roadmap and it being launched.

   In addition, in order to stimulate a learning culture, telcos must consider reorganising their innovation and R&D teams and changing how they approve funding for new projects. Instead of a lengthy period of proving the long-term viability of a product, telcos must evaluate the business case quickly through identifying key metrics for success and then accelerate the process of funding and governance significantly. DevOps and design thinking form key components of this approach.

2. Secondly, across the whole of the design, build and in-life process, telcos must introduce a high degree of **automation**. For example, once the esports slice is defined within the operator's systems, spinning up a new instance to support an event should be a simple job of visiting a software portal, inputting usage parameters, and pressing a button to go live.[5]

   Operationally, when a slice is in use it will also need to be highly automated including service assurance, management and orchestration of the slice end-to-end. Alongside automation, artificial intelligence should be used, for example, to ensure that operators do not default on SLAs. If the performance of a slice comes close to defaulting on, say, latency requirements, there must be processes automatically triggered to provision additional resources and ensure that performance is maintained.

3. 5G slice-based services will run across virtualized infrastructure and as such, telcos should frame their licensing agreements with their network function suppliers to be as flexible as the network itself. Telcos will only want to pay for network functions when they are live. As we envisage that slices will be spun up and spun down only when there is demand and that payment for the slice will be on a pay-as-you-use basis, it is particularly important that telcos also pay for their licenses in a similar fashion. It is likely that telcos will need to develop a mechanism for

[5] Equally, it should be as straight forward a process from the esports company/venue owner perspective too. They can simply select the required service from a digital marketplace, and a slice is automatically configured to provide the needed latency, throughput and resilience.

knowing when a slice is live and in use e.g. a rights management regime and infrastructure, to ensure this works for the vendor community.

4. Automation of the orchestration and provisioning is essential to drive agile economics and to be successful, the other **supporting systems, processes and people** need to support this. These must be simplified and upgraded to handle the flexible provisioning of slices.

5. Although they have already moved a long way, Telcos must become even more market-driven than technology driven. If they are going to shoulder increased market risk, inherent in growth through service innovation, telcos need to focus on reducing their delivery risk to balance this out. Telcos will need to work more closely with the end-customers of network slices, be they consumers or enterprises, to understand their requirements specifically but equally ensure that slices designed can be productised and re-used in other scenarios. This is part of a wider movement we see where telcos are bridging the gap between marketing and technology driven teams within the telco to ensure open coordination occurs between the two.

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