State of the Art Packet and
Optical Networking

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Crossing the 5G Chasm

White Paper

The commoditization of the telecoms market has ensured that the launch of 5G is pretty much 'a given'. Driven by the need for market leadership, the search for new revenue streams and the fear of missing out, more and more carriers are launching 5G. As in previous generations, up till now most 5G launches are primarily enhanced mobile broadband (eMBB) in nature. The myriad of new use cases and business models so talked about in conjunction with 5G, have not yet come to pass.

While early adopters may be willing to pay a bit more for 5G, the majority of the industry agrees that in the long run, consumers will not pay much more for bigger, faster broadband. As such, unlike previous mobile generations, the business case for 5G has remained elusive.

What happened to all those 5G business cases?

At the beginning, 5G was hyped as the new service enabler. Promising to change society 'as we know it', 5G was expected to enable everything from IoT to industry 4.0 to smart cities to gaming. Over time, industry experts began to ask the all-important question: Where's the money? And a growing number of people began to question the 5G business model.

So what has become of the 5G business models? **Let's take a look:**

Industrial IoT (Industry 4.0)

Much work remains to be done before Industry 4.0 can be incorporated into manufacturing equipment. Even after sensors, monitoring systems and BI have been implemented, many agree that this use case will best be served by local area/private 5G network

eMBB

The industry agrees, consumers will not pay more than an additional 5% over their current plan. That said,these types of services are allowing some SPs to enter new markets (rural, cable etc.) which will ensure some ROI.

Smart Cities and Smart Transportation

Smart cities don't necessarily need real-time communication. The variety of sensors, monitors and systems connected have multiple benefactors. The question remains: who will pay a premium for these 5G services.

IoT

Looks to be more of a narrowband solution which can be served as well by current LTE infrastructure and WiFi. Experts agree consumers will not pay more for 'bigger' unlimited bundles.

Autonomous Vehicles

The industry's darling, while captivating requires massive R&D before going mainstream. It will take a good many years before anyone sees money out of these applications.

There Is One Business Case Left Which Has Not Been Displaced (Yet) – Real Time Video

Real-time (a.k.a. ultra-reliable low latency) video can be used in a variety of applications, but my favorite examples include cloud gaming and remote surgery. Currently these applications are served by expensive dedicated connections or local implementations only, which means that there are pain points currently not being addressed. And this pain point is primarily a carrier play.

Let's look at some real life examples:

Gaming

According to Mark Newman, Chief Analyst, TM Forum, gaming is the fastest growing sector of the entertainment industry, worth $150 billion a year. Cloud gaming requires real-time, interaction – hence low latency, speed and reliability are the name of the game.

Even Google, has set its sights on the gaming market with the upcoming launch of Stadia and Project Stream. Stadia early adopters will be asked to pay $130 for a hardware starter kit (with three months of premium service), and $10 a month afterwards. The cost covers access to the cloudified game console and the ongoing use of the game controller. Games will likely cost extra as currently Google doesn't seem to be interested in shaking up the business model. However, Google cannot virtualize the console nor make use of today's devices (phones, tablets, computers) for gaming and this means that Google cannot guarantee the real-time gaming experience. These rely on network quality and latency between players and Google data centers which is currently based on public internet. As opposed to multiplayer gaming, cloud gaming requires the game output (video) to be rendered in real time in the cloud and delivered with very low latency to the user.

Remote Surgery – Ever since the Lindberg Operation, patients around the world have held on to the hope of access to specialized surgeons, without the need of traveling long distances (beyond their local hospital). For those with unique conditions, or with problematic health, remote surgery promises to improve the accessibility of quality medical care.

The Lindberg Operation utilized expensive fiber optic ATM technology to optimize connectivity, reliability and minimize latency. But these are often prohibitively exorbitant. Later surgeries were actually carried out over Bell Canada's public internet – but in those days bandwidth demand was very much lower than today. In general, telemedicine has been held back by more than just 'connectivity and latency' issues, but studies have determined that super low latency is required for successful auditory, visual, and even tactile feedback between the locations.

Currently the telemedicine market is estimated at ~$25 billion and expected to triple by 2022.

Remote Surgery

For both use case examples, ultra-reliable low latency communications (uRLLC) is required.

The 'Wait And See' Approach

Given the heavy costs of the new spectrum and radio alongside the shaky business case, it is no surprise that the majority of carriers have decided to launch 5G in non-stand-alone (NSA) mode, supporting the higher speeds with their current 4G/LTE infrastructures. The fact is that eMBB can be served well, or at least served well enough, with the current infrastructure.

It is the 'other 5G services', such as uRLLC, that will require a step-up of network capabilities. However, many of the carriers I've spoken to don't know if, or when, these services will become available. As a result, they are taking a pragmatic, 'wait and see approach' to upgrading their transport network.

This wait and see approach doesn't take into consideration two aspects:

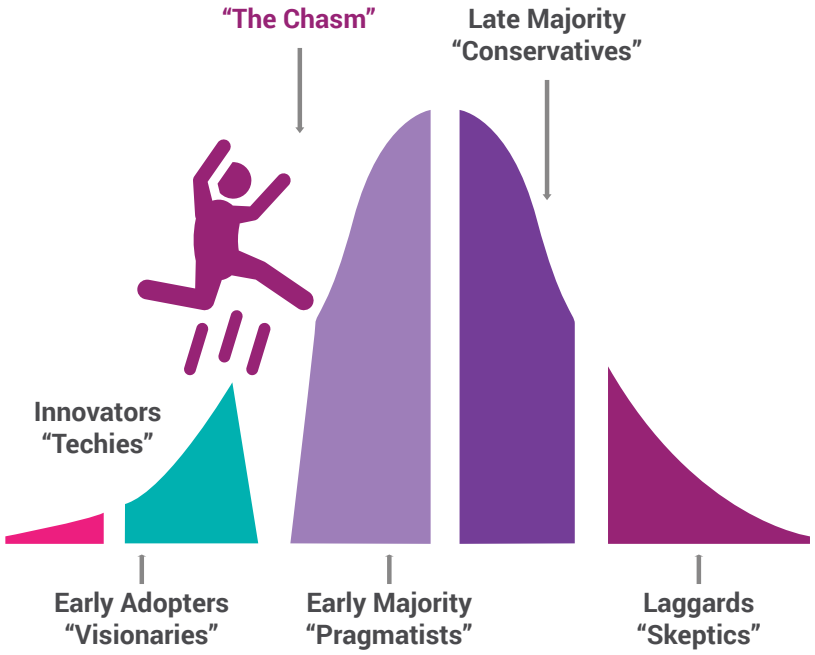
01 The product life cycle, and how quickly or easily that will evolve

02 How long it will take to evolve the network for those requirements of advanced 5G services (such as uRLLC)

5G Product Life Cycle and Crossing the Chasm

There is little doubt that 5G is still in its infancy. As is often the case during the innovation/early adoption phase of the product/service life cycle, interest is being driven more by carriers, governments, journalists and regulators than consumers. During this phase, sales slowly grow as early adopter awareness increases. Yet, most carriers are eagerly awaiting the 'early majority'.

In 1991, Geoffrey A. Moore, in his book 'Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers' suggested that the transition from selling to 'early adopters' to selling to the 'early majority' is not as intuitive, or fluid, as some economic/marketing theorists might have us think. In fact, there is a 'chasm' between early adopters and early majority, where the latter are more pragmatic and less likely to accept a non-mature product without definitive benefits.



Understanding the 'chasm', overcoming it and even taking advantage of it is often a make or break point for many companies. Let's look at a couple good and bad examples:

GOOD

iPod by Apple: A classic tale of utilizing the time during the 'chasm' to develop a product which revolutionized the industry. Apple was not the first MP3 manufacturer. However, unlike others, Apple understood that it wasn't the format that was important to music enthusiasts, but rather the ability to listen to their personal music 'on the go'. The ability to load nearly 1000 songs onto a small, portable player was the 'tornado in the music industry's perfect storm'.

Facebook: Facebook was not the first social media platform. By the time Facebook was launched in 2004, social media sites such as LiveJournal, SixDegrees, Friendster and MySpace existed and had each accumulated millions of users. Yet none of them reached the success of Facebook, whether because of technical deficits, loss of focus, or because of poor timing.

BAD

Digital media: Blu-Ray won the initial battle with the Toshiba HD format due to backing from most major studios. However, it was eventually displaced by CD/DVD's due to improved accessibility and the fact that given a DVD burner, anyone could make one. These were all eventually displaced by flash, which was more attainable, easier to use and cheaper.

Smartphones: While Apple is cited for taking the smartphone across the chasm, the industry is littered with various losers who were not able to make the adjustments. Blackberry, who dominated the corporate email sector and Nokia who dominated the consumer mobile phone sector are but two examples.

So what can we learn about crossing the chasm?

01 You don't have to be first – however your product needs to be 'complete' enough to answer a pain point for the 'pragmatic majority'.

02 Study the market – learn from the mistakes of similar products and offer a better alternative. Use these learnings when devising and finalizing your offering.

03 Utilize greater trends – such as the ubiquity of broadband and the internet, adoption of the smartphone and more.

04 Winners are companies that have used the time of the "chasm" to study the market, tailor their product, and find a solution that resonates well. Losers, hold tradition close and find transition difficult.

While marketing theory is nice, what does this have to do with 5G? In my humble opinion, carriers should leverage chasm 'downtime' to prepare themselves for the next stage in the product life cycle!

In other words, this is the perfect time to implement and deploy network slicing, which is required for assured uRLLC services.

Again Network Slicing?

In a world where network resources are limited, network slicing is the technology of choice for network architects and industry bodies (IETF, ITP, and others). Network slicing is an architectural concept which, in effect, views the network as a pool of assets: physical network resources (PNFs), virtual network resources (VNFs), connectivity, bandwidth and compute. A network 'slice' combines these assets, in different combinations, to form a virtual network. Each slice is customized to meet the specific needs of the applications, services and resources that need to run over it.

But not all slicing is made equal. In fact industry bodies differentiate between different types of slicing – hard and soft. According to the IETF, hard slicing refers to the provision of resources in such a way that they are dedicated to a specific network slicing instance. Whereas, soft slicing refers to the provision of resources in such a way that whilst the slices are separated such that they do not interfere, on average, with each other, they can interact dynamically, which means they may compete for some particular resource at some specific time. In other words, 'soft slicing' promises delivering on SLAs on average, while 'hard slicing' dedicates fixed resources to specific services or customers.

To make things even more complicated, there are a variety of technologies which can be used for achieving hard and soft slicing. Let's take a look at some of the more popular ones:

	 Soft Slicing 1	 Soft Slicing 2	 Hard Slicing
Technologies	Segment Routing-TE, MPLS, Enhanced VPNs, PCE etc	H-QoS, Dedicated Queues	FlexE, TSN, WDM, OTN, G.mtn
How it works	The path of the service is computed by a path computation element (PCE) based on service and network parameters	Manages rules relating to delay, jitter, and queuing	Dedicates resources for specific traffic
Benefits	Optimizes the flow of traffic across the network	Queuing mechanisms are used to prioritize traffic	Service Level agreements (SLAs)
Best used when	The network is not fully utilized and bandwidth and jitter need to be strictly controlled	Soft assurance is required for bandwidth and delay	Hard assurance is required for bandwidth, delay, security, reliability and delay variation. And in network sharing scenarios.
Downsides	No guarantees	Un-prioritized traffic has increased chances of being lost or delayed. Expensive to fully implement even more so than HW upgrades	No over provisioning possible, resources allocated even if not in use
Hardware or software driven?	Primarily software in existing solutions	Both hardware and software capabilities	Primarily hardware capability

Again Network Slicing?

For the packet side of the house, soft slicing is a mere extension of statistical multiplexing paradigms. And to be honest, packet and statistical multiplexing are very efficient when there are no QoS guarantees or when they are soft.
The inability to 'over provision', inherent to hard slicing technologies, puts a crimp in the potential revenue stream of carriers. It is for this reason that slicing capabilities need to be dynamic and intermittent in nature. To enable the sale and resale of the same resources, on the fly (dynamically) and for limited periods of time. Even the IETF, expects the frequency of reprovisioning with network slicing will be relatively high. The limited nature of uRLLC services (i.e. for the length of a game/match or a surgery) makes this reasonable.

But That Will Take a Lot of Work….

I admit, that I have heard from customers that the benefits of network slicing do not outweigh the complexities (and costs) of re-architecting the network. And while that may be true, ultra-reliable low-latency (uRLLC) services need resources to be allocated in a way that provides a highly reliable, resilient service with stricter SLAs. Otherwise gamers will experience a delay or the surgeon just might cut too deep.

In the end, even release 15 suggests that 5G networks must have the ability to accommodate different service classes (SST= eMBB, uRLLC, mMTC etc). Network slicing is currently the only way to efficiently, and cost effectively deal with multiple services types. The upside? Network slicing will improve the chances of ROI and price the services differentially. I believe that over time, all types of slicing will be used, both soft and hard. Slicing will also need to be available across carriers, so that services are not limited in terms of geography.

Network Slicing, Next Steps

The good news is, that there is time before you will be required to offer full-blown slicing. However, preparing your network for slicing will take time. You have implemented new technologies in your network before, you know the process is a long one. Here are some thoughts:

01 Ask your vendors tough questions – how are they planning on providing slicing? What is their suggested evolution path to 5G? If they don't have answers for you, or their answers are vague, perhaps this is the time to look for alternative solutions.

02 Ask for independent third party verification of claims. The EANTC has been testing some aspects of slicing and can provide insights.

03 PoC away – test, retest, and test again. The only way to know if the slicing works with your current components or new components is to test.

04 Define the geographical scope – upgrading a network with thousands of nodes may seem a bit overwhelming. See where you are supplying real-time video today and focus there.

05 Use network upgrades and EOLs to your benefit – when you add/replace a network element make sure to choose a network slicing enabled element. Not just soft slicing, but hard slicing too.

06 Keep in mind that even if you don't use all the capabilities on day one, buying solutions which are capable of providing flexible solutions might save you money in the long run.

Whether you want it or not, going 5G is most likely a given. True, the 5G business cases have not yet materialized, and there are still more questions than answers. And yet, the 'wait and see' approach may not be the best network strategy for recouping your costs.

History is littered with examples of companies who have not used the 'chasm' wisely, waking up only after those who arrived with more holistic solutions to customer pain points. Since rolling out network slicing, is no different than incorporating new technologies in your network, you know how time consuming and complex the process is.

Slicing has many flavors and many technologies, but currently only hard slicing, which dedicates fixed resources to specific services or customers can assure uRLLC services, such as real-time video. And enabling dynamic, hard slicing, can secure future revenue streams which will help you recoup your investment.

It is said that 'fortune favors the bold' – prove it right!

Contact us to learn more about deploying network slicing in your network at rbbn.com

About Ribbon

Ribbon Communications (Nasdaq: RBBN), which recently merged with ECI Telecom Group, delivers global communications software and network solutions to service providers, enterprises and critical infrastructure sectors. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge IP solutions, UCaaS/ CPaaS cloud offers, leading-edge software security and analytics tools, as well as packet and optical networking leveraging ECI's Elastic Network technology.