GET TO 5G AND BEYOND

Build Security, Flexibility, and Performance into "All-G" Networks

#GetToBeyond

NetNumber

5G Market Opportunities

When it comes to operator business opportunities for 5G services, analyst revenue estimates are all over the map (see sidebar). It's no wonder. 5G is not an isolated upgrade. As a technology that carries so much promise across so many markets, 5G success depends heavily on the combined influences of consumers, industrial demand, and the successful convergence of wireless and business IP networks—to name just a few.

From Cars to Corporate Networks

As broadly debated over recent years, 5G is the one technology that promises the realization of autonomous automobiles, delivery of the highest quality mobile media, and ubiquitous consumer broadband exceeding current performance. However, while consumer applications of 5G technology get the bulk of attention in the press and from carriers, the greater revenue opportunities may, in fact, be more staid but lucrative business, governmental, and industrial applications.

Business Computing and Services Growth

Network consolidation through 5G and IP convergence will bring a sea change to business computing. Therefore, most analysts and operators agree that enterprise 5G solutions, devices, and services will make up a large percentage of long-term growth and revenue opportunities—if properly productized and deployed. Top areas for these next generation products include IoT, corporate cloud solutions,

and high-bandwidth telecom services such as HD business video, voice, security, and technical support using augmented reality. Gartner analysts, in fact, project that up to 90 percent of 5G IoT service revenue will come from enterprise businesses.[i] Meanwhile, partner supply chains and high-speed global connectivity services will benefit from converged 5G network solutions, in many cases eventually supplanting current landline WAN connectivity over fiber and cable. Other top business and industrial markets ripe for huge 5G service revenue include:

- Robotics (industrial/manufacturing)
- Virtual reality/augmented reality (field support, maintenance, and troubleshooting)
- Private networks (government, military, energy, healthcare)
- Remote monitoring and control (manufacturing, energy, healthcare)
- Smart buildings/infrastructure (commercial real estate, industrial, municipal government)

Many of these innovations, however, depend on the tiered rollout of 5G capabilities, especially network slicing.

It Depends on How You Slice It

Many of these business and industrial innovations rely on 5G's unique network slicing capabilities. A recent report by the GSMA outlines the ability of network operators to create customizable 5G network slices for their customers. Use cases the GSMA cited included connectivity and data usage according to specific needs, including QoS for video and voice, or SLAs for application, storage, and data reliability. Operators could deploy one network slice that serves the individual needs of multiple customers.[ii] These are the 5G services that operators need for addressing the unmet needs of many industrial, healthcare, and energy verticals.

But these 5G vertical industry innovations are not only dependent on the evolution of 5G slicing. There must also be tight coordination between 5G providers and third-party device and application developers, with varying levels of technology maturity. Operators will play a significant role in segmentation pricing, SLAs, and QoS. As a result, significant business and industrial revenue may be much farther out than the low-hanging fruit of consumer upgrades to 5G. Therefore, operators are already gearing up for consumer 5G.

The 5G Opportunity—Highs and Lows

Analysts have widely divergent views of the future of 5G revenues. Two cases:

According to an ITU address in 2018, network operator 5G new addressable revenue is projected to reach $619 billion US by 2026.[1]
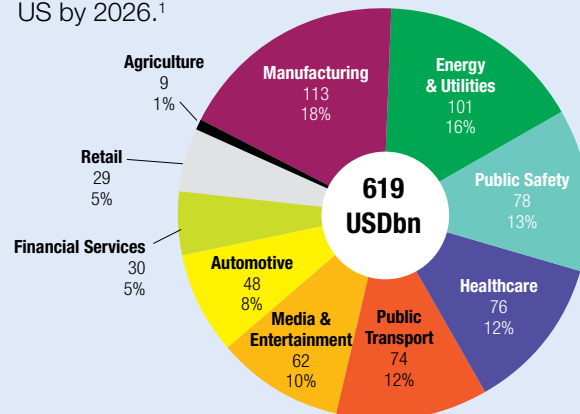
Meanwhile, a recent report by Strategy Analytics projects that 5G will capture just 26 percent of all network traffic by 2026—with a negligible one percent increase in revenue.[2]
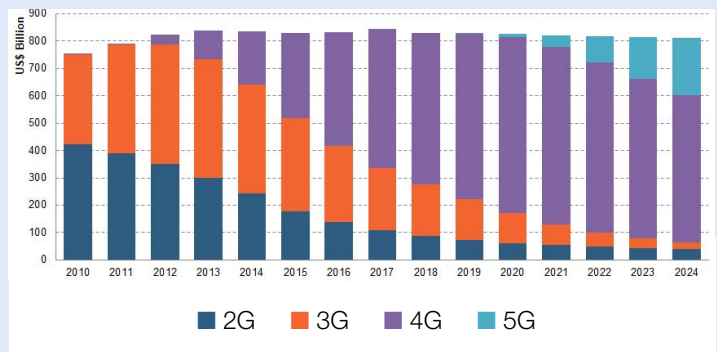
Regardless, 5G is on the way—it remains to be seen how the markets respond.

1 *ITU 2018 Seminar*
2 *Strategy Analytics press release June 2019*

Tip of the 5G Spear: Consumer Services

While 5G enables the development of many new digital services, operators must first ramp up their deployments and transition current customers—mostly consumers and business customers—to the new world of 5G. With the lower cost of 5G bit rates for data as a potential enticement (depending on operator monetization), they can move many customers onto the new network. It's no surprise then that according to an April 2019 survey of network operators, 96 percent will focus their 5G support in 2019-2020 on supporting existing data services.[iii] This gives early adopter, migrating customers a step up in performance (through 4G LTE uplink) and helps finance continued 5G investment. Most advanced 5G features and services cannot become widely available until network density is significantly reached, however, including other consumer-driven services such as ultra-wideband wireless and mmWave, which some carriers have rolled out in only very limited urban areas.[iv]

MEC and the Cloud

Of course, it's the density that counts, so MEC is gaining traction. Because mmWave and slicing directly benefit from Mobile Edge Computing (MEC), especially in reducing latency and expanding cloud computing access, the push is on for higher density operations, which includes proliferation of network-edge clouds. Operators, however, can hedge their bets a little, as even existing LTE networks can leverage edge technology.

And just as networks (IP and wireless) are merging, so is the competition: especially in MEC and edge virtualized environments, traditional telecom carriers potentially run head-to-head with traditional IP network and cloud vendors. Even if RAN takes the lead on MEC for edge networks, the convergence, competition, and unseen risks of the merged networks will cause unpredictable market disruptions.

Further converged network challenges include:

- Programmable core operations for delivering "Network-as-a-Service", allowing operators to customize slices for corporate customers and specific industrial applications.[v]
- Overhaul of operator business/operation and support systems (B/OSS) with intelligent network functionality and automation for real-time pricing.
- Seamless security, performance, and reliability across 3G/4G/5G networks, especially as 5G network density is increased.

> *"As these new computing locations supporting 5G come online, the ability to remotely monitor and manage increasingly dense networks becomes more critical to maintaining profitability. In the area of remote management, data center infrastructure management (DCIM) was identified as the most important [5G] enabler…"* —Vertiv and 451 Research, April 2019.[iii]

Nevertheless, "the edge" (and convergence in the cloud), is where all the innovation is heading.

Operator "5G Readiness" Snapshot

In the IHS Markit 2019 Operator Survey Report, "Evolution from 4G to 5G", 83 percent of operators polled have already launched commercial 5G NSA-NR, with 61 percent testing SA-NR. The long term 5G goals

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LTE is Here to Stay

LTE is not going away any time soon. In fact, LTE Advanced adds many of the conveniences of 5G, including greater performance. It has already proven itself as a reliable platform for video, gaming, HD media, all of which are mainstay services, and it stands to gain and/or maintain market share in the years to come.

Operators agree: According to the IHS Markit 2019 Operator Survey, 69 percent have already made investments in LTE Advanced, and a majority anticipate investments in LTE Pro.[iv]

of cloud-native core, network slicing and ubiquitous coverage are a long way off, according to operators: (68 percent) do not expect to achieve total 5G coverage until 2028 or later. Twenty-eight percent expect to have total coverage by 2027 while only 4 percent expect to have total coverage by 2025. Perhaps as a direct result, all are adding new LTE-Advanced and Advanced Pro features in coordination with their 5G rollouts.[vi] This indicates two trends—operators are ready to move on 5G rollouts for customers, especially consumers, but they realize that LTE Advanced and Advanced Pro will be a significant part of their service offerings for the foreseeable future.

Overcoming 5G Adoption Challenges

While the path to full 5G capabilities is clear enough, how individual operators—and their customers—arrive is not fully mapped out. Operators must decide the best course for their businesses and simultaneous evolve their systems to accommodate the new realities in a post-5G landscape. Here are three main challenges we see for operators in the near and long term:

Security. Always a concern, security in a 5G environment is even broader and far more complex than previous generations as IP and 5G converge.

Performance. Performance is not just a matter of bits-per-second or latency, although those are service priorities, especially when SLA agreements can make or break customer revenue. Performance in a dense 5G network also includes responsive, real-time network management and reliability over many nodes.

Adaptability. Given the complexity of the 5G "journey," systems must be in place that can easily and cost-effectively adapt to changes in technology—without costly or complex changes. Similarly, operators should have the ability to make changes to their business model and introduce innovative services and customizations that could drive significant revenue.

Security

"The fate of 5G hinges on how well—including how securely—the opportunities of the more open, distributed, 5G architecture can be captured." —Patrick Donegan, Founder and Principal Analyst at HardenStance Ltd. Research firm.

Eighty-three percent of operators surveyed agree.[iv] 5G security has been under debate for years. Pieter Veenstra, Senior Manager - Product Development, Security and Routing at NetNumber points out the main security concerns with 5G: "Network complexity will increase with the software defined networks (SDN) and network function virtualization (NFV) used in 5G whereas data protection legislation is tightening. As a result, we should expect a higher level of security, privacy, and integrity protection in 5G considering the growing interest of the cybercriminal community in mobile communications in recent years.

"I call it security through obscurity," said Patrick Donegan. "SS7 and Diameter were never the targets that HTTP and IP have always been, and so they were relatively 'secure'—but with 5G that all changes—especially with IoT." The main culprits giving 5G security professionals "heartburn" are:

- Multiple public attack vectors across HTTP and IP networks through Web apps, email, communications, and retail channels
- On the 5G telecom IT side, potential security vulnerabilities in IoT devices, NFVs, physical network function (PNF), routing, transport, and base stations
- 5G integration and internetworking with existing 3G/4G networks

According to Veenstra, the use of parallel protocol suites and technologies offers more ways for hackers to find attack vectors and gain access via different signaling connections (see Figure 1). However, firewalls between SS7, Diameter, and HTTP/2 internetworks (3G-4G-5G) will provide some of the necessary protection.

Donegan notes that TDM was never designed to be secure. He sees an opportunity for vendors and service providers that understand both telecom and network security to deliver comprehensive network and signaling security solutions.

GSMA and 5G Security Standards

5G security has become a greater issue as adoption of 5G gets underway, and the GSMA has been at work on its "Investigation 5G Security – Tracking Security Open Issues." The latest version, due in Fall 2019, has collected open security issues from developers, vendors, operators, and researchers. Its purpose is to:

- Collect all open security issues relevant to GSMA members
- Deliver descriptions and contexts of these issues
- Track each security issue and report if it is covered in 5G evolving standards or must be addressed in GSMA guidelines

Veenstra, editor and leading this GSMA 5G security investigation, sees great progress being made. The 5G standards are developed following the basic principle of 'Security by Design' including:

1. **Use of mutual authentication:** To ensure that sender and receiver have an established trust and secured end-to-end relationship

2. **Assume an "open" network:** Don't assume any vendor product or process is safe

3. **Assume all links are tapped:** If leaked, encrypted information is worthless to the recipient

Figure 1. Internetworking firewalls for security between platforms.
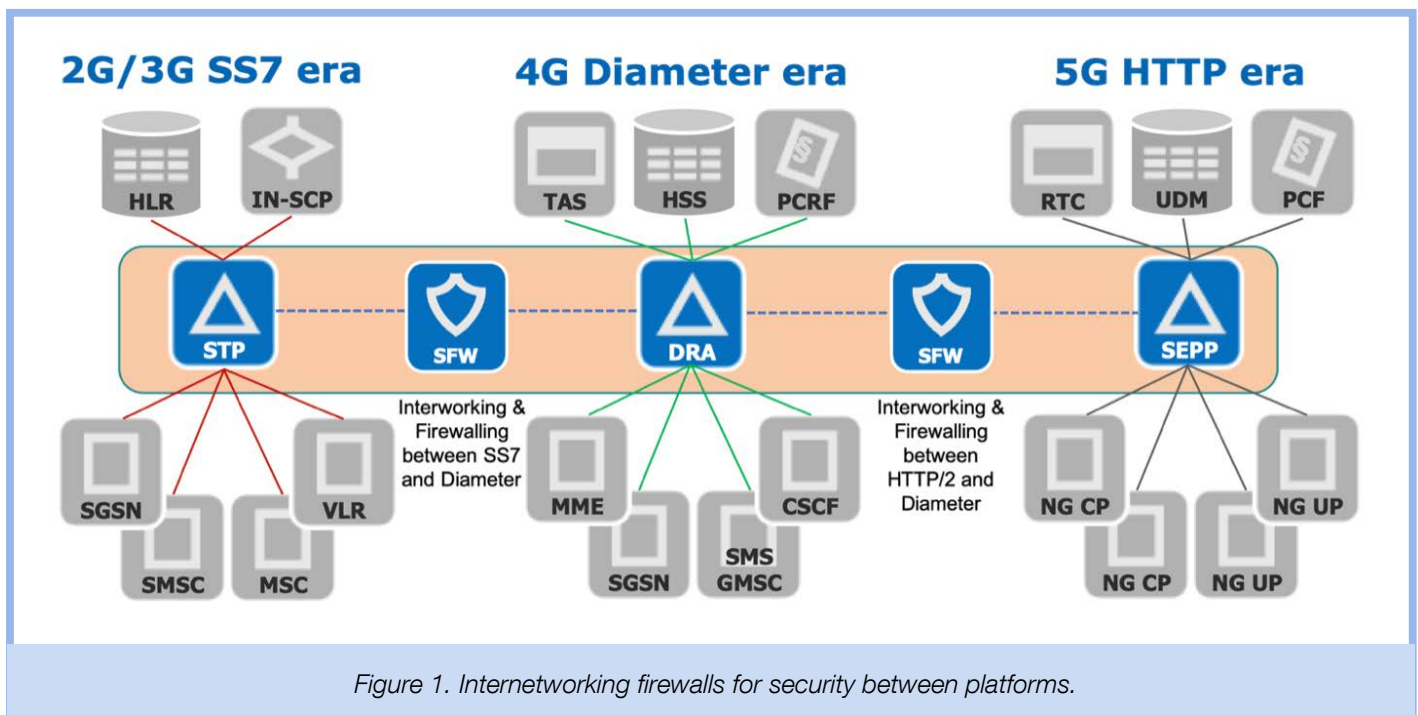
One of the key elements he believes shows the most promise is encryption—from end-to-end. This is a paradigm shift to existing Telco practices as it requires mandatory encryption of all inter/intra-network and privacy sensitive information under all circumstances. "Banking and finance have adopted end-to-end encryption for security, privacy, and compliance," he said. "There is no reason the [telecom] industry cannot do the same."

The current SA-NR implementation of 5G includes embedded security features developed by 3GPP, the ETSI, and the ITU, which addresses many security concerns—and the standards will no doubt be continually updated and refreshed as the technology—and threats—evolve.

Performance

The one millisecond performance requirement for full 5G support could delay full adoption and advanced applications. However, according to IHS Markit's 2019 Operator Survey, 37 percent indicated they are already deploying MEC infrastructure ahead of 5G deployments; an additional 47 percent intend to deploy MEC.[vi] Even with MEC, systems will require a far higher density of radio access antennas, improved operation support systems, and consequently, all new (or upgraded) data center infrastructure management systems (DCIMs) for remote management. The "last mile"—or even last few feet—is not the bottleneck; the entire growing infrastructure and its management must be responsive, robust, and reliable. Therefore, operators should look for innovative DCIM and MEC solutions that can easily integrate into their existing or planned systems and B/OSS management.

Adaptability

The telecom market will become the most fluid in its history throughout the 5G introduction, maturity and beyond. As mentioned, forces within and outside the telecom space are vying for market share, service revenue, and new ways in which to leverage the converged networks. With SDN and NFV, changes can occur over night with software-only modifications. Meanwhile, 5G standards (and programable core), security, and management will also be largely software-driven and subject to modifications and enhancements at any time. These are all positive developments—if systems are in place to leverage them. The ease of introducing new services, the ability to add enhancements to existing systems (including LTE Advanced) and maintaining reliability and security at the highest levels are all hallmarks of an adaptable, business-forward strategy that should serve operators throughout the 5G journey and beyond.

NetNumber and the 5G Edge

The NetNumber All-G TITAN platform delivers software signaling, security, and internetworking to hundreds of operators and millions of customers around the world. TITAN solutions are engineered to concurrently run 2G, 3G, LTE, 5G services on one platform. TITAN is transforming how operators deliver new services to their customers while significantly simplifying the network core, reducing operating costs, and transforming their networks to 5G.

Choice and Flexibility in Deployment

NetNumber multi-protocol, multi-function TITAN servers can be placed wherever and whenever needed—as central location hubs or as edge-based solutions supporting MEC. You can deploy edge servers where required, each with their own customizations if necessary, and NetNumber software connects them into one synchronized and seamlessly managed multi-protocol environment. As far as hardware infrastructure, operators can deploy TITAN on stand-alone servers, on a combination of edge servers, in virtual machines, or deployed in cloud-native containers. The TITAN infrastructure uses industry components—delivering cost savings and flexibility, as well as the latest performance and security advances in the server industry.

The unique, distributed architecture of TITAN allows service providers and enterprises to address regional,

local, and private networks individually, yet retain central control, management, and security. And as technology continues to evolve, or as service models change to address new opportunities and markets, All-G TITAN adapts easily to fit our customers' needs.

Edge-Based Performance, Data Center Reliability

As an edge-enabled device, TITAN reduces latency and management bottlenecks. The platform delivers centralized provisioning and management combined with a powerful, distributed execution architecture that enables all service processing at the optimal location in an operator's network. As a software platform, new DCIMs and B/OSS are applications that can be added, changed, upgraded, and customized wherever needed.

TITAN's built-in geolocation replication adds a customizable layer of backup and failover, delivering a high degree of redundancy and fault-tolerance. Best practice high availability and data recovery processes ensure that traffic, data, and customer data are all protected.

NetNumber 5G Security

NetNumber has been instrumental in delivering the best security for next-generation systems—while maintaining support and innovations for legacy technology. Our award-winning, next-generation security solutions and firewall provide comprehensive All-G security and fraud protection with real-time threat detection (see sidebar). NetNumber delivers inter-networking encryption, eliminating attack vectors within the network, while our signaling firewall protects against malicious attacks on inbound traffic and data.

NetNumber Use Cases

NetNumber processes millions of operator connections a day, worldwide. Our customers have found the technology a flexible, reliable way to build out extensible and highly customizable offerings. Here are a few examples:

- Support for multiple-generation protocols on one system, thereby preserving revenue of legacy systems while providing support and integration of new technologies. (See our white paper *Preserve and Grow SS7 Revenue with Next Gen Networks*.)

- Concurrent support of SS7/Diameter/HTTP2/SIP on the TITAN platform, with options to deploy multiple edge servers with different customizations for local markets with specific needs.

- Global, centralized management of distributed LTE, 5G signaling from separate edge servers.

- Ability to add, move, and change features with software upgrades rather than complex hardware integrations.

NetNumber Named Best Network Security Technology at 5G World Summit

5G World
AWARDS

NetNumber TITAN recently out-ranked many industry heavyweights for the title of "Best 5G Security" at the 2019 5G World Summit in London in June. "This recognition acknowledges the leadership role we've played in the industry via the GSMA" said Steve Legge, Chief Operating Officer for NetNumber. "It validates that smaller companies are innovating on a large scale, and worthy of serious consideration by all operators who are evaluating solutions to address 5G security concerns."

Summing Up

5G unifies and blends traditional communications networks with the global IP world. With all the promise it has for unrivalled innovation, new products and services, and potential revenue, its success depends on security, performance, and flexibility. Due to the interdependence of multi-generation protocols for a smooth 5G transition, and the ongoing value of 3G and LTE, only a software-based solution can provide a true price-performance advantage—hardware-based solutions are too costly and complex to adapt to changing conditions.

NetNumber is a leader in multi-protocol software development, research, integration, and security with 20 years of expertise in delivering high-performance, high-volume solutions to network operators around the world. Visit us at *www.netnumber.com*

References

i   Telecoms-dot-com. "Success of 5G depends upon operators' monetization and pricing strategies." February 2019. *http://telecoms.com/opinion/success-of-5g-depends-upon-operators-monetization-and-pricing-strategies/*

ii   GMSA. "Future Networks." 2018. *https://www.gsma.com/newsroom/blog/5g-network-slicing-brings-business-opportunities/*

iii   Businesswire. "Vertiv and 451 Research Release New Report on 5G Preparedness and Technical Enablers." *https://www.businesswire.com/news/home/20190429005072/en/Vertiv-451-Research-Release-New-Report-5G*

iv   FierceWireless. "T-Mobile revs up 5G in 6 Cities with mmWave." *https://www.fiercewireless.com/wireless/t-mobile-revs-up-5g-6-cities-using-mmwave-spectrum*

v   Flinck, et al. "Network Slicing Management and Orchestration." IETF. *https://tools.ietf.org/id/draft-flinck-slicing-management-00.html*

vi   IHSMarkit "Evolution From 4G to 5G." Service Provider Survey. 24 July 2019.

About NetNumber

NetNumber, Inc. brings almost two decades of experience delivering platforms that power global telecom and enterprise networks. Our software-based signaling-control solutions accelerate delivery of new services like Private LTE and IoT/M2M solutions across multi-generation networks, dramatically simplifying the core and reducing opex.

These solutions span a range of network types from 2G-3G-4G-5G to future G delivered on the industry's first All-G signaling platform - TITAN. NetNumber Data Services are essential for global inter-carrier routing, roaming, voice and messaging. The data powers fraud detection and prevention solutions and enables enterprise B2B and B2C communications platforms. NetNumber's award-winning multi-protocol signaling firewall, fraud-detection, and robocalling solutions secure networks against current/emerging threats.

Please visit *www.netnumber.com* for product or solution information. For configuration and pricing details, please contact your local account representative via *sales@netnumber.com*.

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