



## Assure 5G

### Operationally Assure 5G Opportunities with Advanced Testing

We're about to enter the era of 5G, with blazingly fast speeds, vast coverage density, large area traffic capacity, and super low latency. As we've pointed out in companion articles in our series on testing and assurance for 5G, 5G is more than a step up from 4G; it's a radical leap that will dramatically improve mobile broadband services and empower the Internet of Things (IoT) by enabling connectivity to billions of global devices.

The opportunities generated by 5G touch nearly every aspect of operations: We'll see new revenue streams, new services and user experiences, new cost savings that reduce both Capex and Opex, introduce new goals, or KPIs. The potential of 5G is immense, with the

5G value chain estimated to be worth \$3.5 trillion by 2035 (IHS & Qualcomm). A recent study by Ericsson and the consultancy firm Arthur D. Little found that CSPs could draw an additional 34% revenue from 5G-enabled market opportunities by 2026.

Because Spirent has been early out of the gate with test and assurance solutions for 5G technologies, we understand the challenges of operationally assuring that 5G delivers on its potential. This paper will examine the changes that are coming in each of these business aspects and suggest testing solutions that service providers and enterprises can access right now to align their operations for success in the 5G operational environment.

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## 5G New Revenue Opportunities

5G will lead to a step change in the capability of mobile networks, opening up possibilities for innovative new services and revenues that will play out through three wide-ranging scenarios:

### Enhanced Mobile Broadband (eMBB)

Enhanced Mobile Broadband will usher in a new world of experiences and business opportunities as it facilitates hugely increased data volumes, overall capacity, and user density.

## eMBB Use Cases

Use Case	Use to...	Applications	Benefits
Indoor wireless broadband	Address the challenge of poor and inconsistent 5G coverage in many homes, businesses and other buildings	Deliver 5G to homes and businesses	Simplify the complexity of networking multiple connectivity types
Outdoor wireless broadband	Enabling outdoor applications	<ul style="list-style-type: none"><li>• HD streaming to in-car infotainment systems.</li><li>• Boosting capacity at events, in populated urban centers and on public transport</li></ul>	Increase usage and revenues
Fixed Wireless Access (FWA)	<ul style="list-style-type: none"><li>• Extend network reach (to rural communities)</li><li>• Increase speed of deployment (fewer physical assets)</li><li>• Expand capacity (in areas of urban density)</li></ul>	<ul style="list-style-type: none"><li>• Capable of providing speeds and capacity 100x greater than 4G and comparable to, if not better than, wired connections</li><li>• An attractive alternative for providing broadband to the home or other premises using 5G radio communications rather than deploying wired connections (i.e., fiber or copper)</li></ul>	<ul style="list-style-type: none"><li>• A cost-efficient new revenue generator with clear differentiation</li><li>• SNS research estimates that FWA subscriptions could reach \$40 billion by 2025.</li></ul>
Augmented and Virtual Reality	<ul style="list-style-type: none"><li>• Media, gaming, and entertainment</li><li>• Industry and health care, especially workers and emergency services</li></ul>	Smart glasses provide visual displays, information overlays, live sight/video feeds, and simulations	Enabling speed, performance, and quality of service supports high SLAs and enables a price premium

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#### Massive Machine-type Communications (mMTC)

For IoT networks, which require low power consumption and low data rates for very large numbers of connected devices, Massive Machine-type Communications (mMTC) provides the economies of scale to drive adoption across multiple business sectors including Smart Cities, Smart Logistics, and Smart Metering.

#### mMTC 5G Use Cases

Use Case	Use to...	Applications	Benefits
Smart Cities	Transportation, security, urban management, tourism, and street lighting	<ul style="list-style-type: none"><li>• Supports high density sensor instrumentation for buildings and roads</li><li>• HD video for cameras monitoring transport and security</li></ul>	Simplify the complexity of networking multiple connectivity types
Smart Agriculture	<ul style="list-style-type: none"><li>• Monitoring and automating crop and herd management</li><li>• Surveying via cameras and drones for land and boundary management</li></ul>	<ul style="list-style-type: none"><li>• Supports increased use of sensors, actuators, autonomy, and visualization technologies</li></ul>	Farming is a cost sensitive industry heavily dependent on managing environmental conditions. The accuracy, performance, and reliability of 5G satisfies these requirements.

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#### Ultra-Reliable & Low Latency Communications (URLLC)

To cater for safety-critical and mission-critical applications such as Autonomous Vehicles, Smart Grids, Industrial Automation, and Smart Healthcare.

#### URLLC Use Cases

Use Case	Use to...	Applications	Benefits
Connected Autonomous Vehicle	<ul style="list-style-type: none"><li>• Providing enhanced capabilities for V2X communications and autonomy</li><li>• Providing more sophistication to advanced driver assistance systems (ADAS)</li><li>• Supporting higher automation levels (3-5) where the need for ultra-reliable low latency and time synchronization of the various traffic participants becomes increasingly necessary</li></ul>	<ul style="list-style-type: none"><li>• Cooperative manoeuvring (lane merge)</li><li>• Cooperative perception (see through)</li><li>• Cooperative safety (network assisted vulnerable pedestrian protection)</li><li>• Automated overtake</li><li>• Cooperative Collision Avoidance</li><li>• Platooning (the creation of closely spaced multiple-vehicle chains on a highway)</li></ul>	Enables new use cases for connected autonomous vehicles
Industry 4.0	Creating smarter factories	<ul style="list-style-type: none"><li>• Enables the use of mobile and autonomous robots on the factory floor</li><li>• Enables new precision engineering capabilities</li><li>• Augments workers with real-time AR and providing remote control of factory and supply chain processes</li></ul>	<ul style="list-style-type: none"><li>• Reduce operating costs</li><li>• Improve efficiency</li><li>• Increase outputs</li></ul>

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#### Network Slicing

Network slicing is a key part of the 5G standards that will enable operators to dedicate a part of their network to a particular service, customer, or group of customers. "Network slicing really is an opportunity for carriers to manage their networks more efficiently," says Chris Pearson, president of 5G Americas.

As *ComputerWorld* reports<sup>1</sup>, network slicing in 5G is expected to open lucrative new business opportunities for mobile operators and other newer entrants, allow new business models to evolve in the mobile market, and enable the network owner to customize the compute, storage, and networking functions of the infrastructure for a given Virtual Network Operator's traffic characteristics.

#### Reducing Costs in New Ways

To realize the promise of 5G, we need to do more than replace waning legacy revenue streams; we need to augment new revenue with new operational savings. Virtualization can help reduce CAPEX costs but automation will be critical to improve profit margins and reduce OPEX.

5G has the potential of delivering new savings and efficiencies for CSPs.

These can be realized across the new 5G network and via the introduction of Virtualization and Automation.

#### C-RAN (Centralized) and Cloud-RAN (Virtualized)

C-RAN (Centralized) and Cloud-RAN (Virtualized) introduces the separation of the radio elements of the base station—called remote radio heads (RRHs)—from the elements processing the baseband signal—called baseband units (BBUs)—which are centralized in a single location and which can be virtualized and hosted in the cloud. Benefits of this approach include:

- Simpler radio equipment at the network edge
- Easier operation
- Cheaper maintenance, since the main RAN

intelligence (BBUs) are centralized and virtualized as a shared resource

- Limits the electronics and processing needed at the antenna site
- Lowers the site costs as processing and air conditioning is not needed.

Centralized and Cloud-RAN deployments present some challenges. The functional split requires these two elements to be connected through a high-speed, low-latency, and accurately synchronized Fronthaul network. Delivering the highly available and time sensitive Radio processing in the Cloud hosting environment for the baseband processing, calls for unique design and performance characteristics. Consequently, in order to guarantee the benefits of Cloud-RAN, the operator must have a cost-effective mechanism for continuous test and assurance.

#### NG Fronthaul

Centralized and Cloud-RAN architectures introduce a functional split between the radio elements and allows them to be distributed and connected through a Fronthaul network. Historically, the split and connection had been on the antenna site from the Remote radio heads (RRH) at the top of the antenna and the Baseband processing unit (BBU) at the bottom. The connection used a proprietary point-to-point interface call CPRI (Common Public Radio Interface).

Now, however, the industry is adopting Ethernet, with new industry standards such as Flex Ethernet (FlexE) and Ethernet-based CPRI (eCPRI), as a more flexible and cost-effective alternative. Benefits of Ethernet-based interfaces include:

- A ten-fold reduction of the required bandwidth
- Allows for efficiency through the use of a common shared switched network rather than a proprietary point-to-point connection from the RRH to the BBU
- Can simultaneously carry eCPRI traffic from several system vendors

<sup>1</sup>Alan Carlton, "What is the difference between network slicing and Quality of Service?" Computerworld.com (Oct. 6, 2017)

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To help realize the financial benefits of the new Ethernet-based Fronthaul networks, proactive service assurance will be critical not only to help assure that the network delivers the relevant high-speed, low-latency, and accurate synchronization, but to simplify and accelerate the turn-up of new cell sites.

#### Core Network Virtualization and Slicing

The Virtualization of the Core Network is not a new concept; many operators have already started to deploy small entry systems today. The step change for the Core Network is the introduction of new capabilities which exploit its virtualization, such as Network Slicing and CUPS.

Virtualization of the Core offers the potential of a more scalable, flexible, and cost-effective solution with lower Capex and Opex. Now couple this with Network Slicing and Control User Plane Separation (CUPS). The virtual network would be able to be sliced and distributed into multiple virtual networks and functions, so we could:

- Deploy and execute exactly the functions needed to support a use case
- Reduce the resources and functions required and optimal utilization of said resources
- No longer have to over-provision the network in order to support multiple industry use cases.

The success of Virtualization and new Core Network capabilities will be critical for CSPs to realizing 5Gs new revenues and reduce costs.

#### Management and Network Orchestration

With the 5G network being built on Virtualization, it is imperative that the management of the network can deliver the agility, efficiencies, and continuous assurance required to exploit the network.

Industry initiatives such as ESTIs MANO and the Linux Networking Foundations' ONAP place Automation at the heart of their designs. Automation will play a key

role in enabling faster services on demand, eliminating manual steps/errors/time, and bestowing the agility needed to dynamically adapt the network to its environment service contexts.

### New Experiences are the New Differentiator

Extracting new revenues and realizing new economies and efficiencies won't happen unless customers perceive added value in their service offerings from faster speeds to ubiquitous connectivity. The customer experience—QoE—will be the true differentiator for service providers in the 5G world.

Consider this recent 5G Consumer Survey from Qualcomm that found that:

- 50% of consumers surveyed are likely to be early 5G adopters with over 60% of them willing to pay on average \$50 extra for 5G
- 85% want faster and consistent connectivity from 5G on their smartphones

The survey also showed that within the top five consumer-desired use cases for 5G enhanced mobile broadband:

- 48% of respondents want lightning fast browsing
- 37% of respondents want to download content 10x faster
- 27% of respondents want better quality video calls
- 21% of respondents want to stream UHD videos

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Let's take video as an example. Video is the unrelenting force driving carrier economics today and for years to come. Mobile video will account for almost 80% of all worldwide mobile data traffic by 2021.

With throughput up to 1Gbps and latencies as low as single-digit milliseconds, 5G appears more than capable of handling the burgeoning amount of video traffic flowing over mobile networks. But more speed alone won't be enough for mobile operators when it comes to ensuring video quality of experience (QoE).

With emerging, bandwidth-intensive types such as 4K ultra-high definition (UHD) and virtual reality (VR) and a shift from downstream to upstream video of social media, IoT, and devices such as drones and autonomous vehicles, 5G could end up being just as congested as 4G, if the industry isn't careful.

To translate these goals into new experiences and realize new revenues rather than just replace revenue, customers must perceive the added value compared to what they get with 4G today.

It's vitally important that Device Manufacturers and CSPs understand and measure the user's perceived experience of data services before launching.

### Assuring the Opportunities

It's evident that 5G is putting tremendous opportunities within our grasp, but the brass ring could just as easily slip out of our grasp if we don't have a robust and reliable testing and assurance strategy in place to underpin it all.

Spirent's experience has led us to the conclusion that we need a new approach to testing and assurance to deliver the significant efficiencies and cost-savings needed for a profitable 5G. Development and operations teams require a unified set of metrics, methodologies, and systems that allows them to adopt streamlined DevOps continuous-testing practices across the service lifecycle.

Lifecycle Service Assurance (LSA) takes just this kind of unified approach.

LSA is a set of best practices for evolving service assurance to meet providers' needs as they adopt automation and roll out virtual, 5G, and IoT networks. These best practices are based on Spirent's unique expertise with automated testing in lab and production environments and the integration of proactive service quality assurance in physical, virtual, and hybrid networks.

To address the challenges of 5G, service assurance must become an integral part of the service across its lifecycle, from initial design and development to operations.

Lifecycle Service Assurance is driven by three fundamental principles:

1. Providers need automation from the lab to the production network—across the complete service lifecycle—so they can adopt DevOps and improve agility.
2. The ability to proactively test services is becoming more critical. Active test provides a key capability for monitoring performance and isolating issues in dynamic, distributed networks.
3. Providers need analytics that support both active test and passive data sources—providing the best of both worlds and all the data necessary to fully automate workflows and move to closed-loop, zero-touch automation.

These principles are based on Spirent's unique expertise with automated testing in lab and production environments and the integration of proactive service quality assurance in physical, virtual, and hybrid networks. Spirent is pioneering the LSA approach working with leading providers on the cutting edge of 5G deployments.

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#### Automating Processes Across the Service Lifecycle

The application of intelligence to automate processes is a core principle of LSA. As we mentioned, active LSA monitoring provides proactive detection of fault conditions, potentially before the customer has even noticed the problem. By applying machine learning alongside both predictive and prescriptive analytics, LSA transforms network and test data into actionable insights, not only to predict issues before they manifest, but also to prescribe potential resolutions to close the loop and resolve the issue.

Lifecycle Service Assurance automates network validation, on-boarding, service activation, and SLA monitoring. By providing a unified set of Service Assurance building blocks, LSA enables rapid, cost-effective automation across the service lifecycle.

#### Being proactive with Active Test and Monitoring

To stay on top of the continuous service lifecycle, you need proactive service assurance. Active testing uses test agents and small amounts of synthetic traffic to monitor the health and performance of the network, the quality of services, and compliance with service level agreements (SLAs). Whereas passive monitoring uses probes to ingest and process massive amounts of data, active testing uses synthetic data by emulating real network traffic on-demand.

Active testing takes on a high level of importance in 5G networks. By emulating certain parts of the network and measuring the performance of services, active testing provides unique capabilities for assessing performance and quality:

- It's the only way to validate new services at turn-up and to continuously monitor SLAs to find issues before customers are impacted.

- Contrary to the belief of many, active testing no longer requires expensive physical probe hardware. Virtualized active test agents (VTAs) can now be deployed on-demand wherever open compute resources are available, unleashing a powerful new capability for assuring networks
- New software-based virtual test agents provide better visibility into the network because they can be dynamically moved to any service end point or any network segment with performance issues
- Active testing can be used to test higher-layer services such as video, OTT, voice, and VoLTE

#### User Experience Evaluation: Measure what matters most

As we emphasize above, it all comes down to the user's experience. Consumers will judge the success of 5G and base their willingness to pay on how they experience 5G. Service providers and device manufacturers simply must do everything they can to understand the user's perceived experience before launch and then continuously monitor, using Active Testing.

As never before, User Experience Evaluation has become a best practice that leading service providers and manufacturers launching next gen devices and services ignore at their peril. In today's competitive environment, the evaluation process must deliver go/no-go and comparative rankings reports on time.

Incorporating test and measurement of data service speeds, latency, transfer times, and RF metrics, Spirent's User Experience Evaluation automates the entire user experience evaluation process to objectively evaluate the user experience involving major devices.

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User Experience Evaluation assures a successful, on-time launch by answering fundamental questions such as:

#### Device Launch: Is my device and network ready?

Compare and rank 5G devices based on live network user experience metrics including user experienced throughput, peak data rates received, latency, and file transfer times.

#### Service Launch: Is my service ready?

Determine if services are ready to launch and how they stack up vs. competitors.

#### Service Benchmarking: How do I stack up?

Compare the user experience of new 5G services to legacy or competitive services to validate differentiation and value for money.

#### Active Test QoE: How am I performing now?

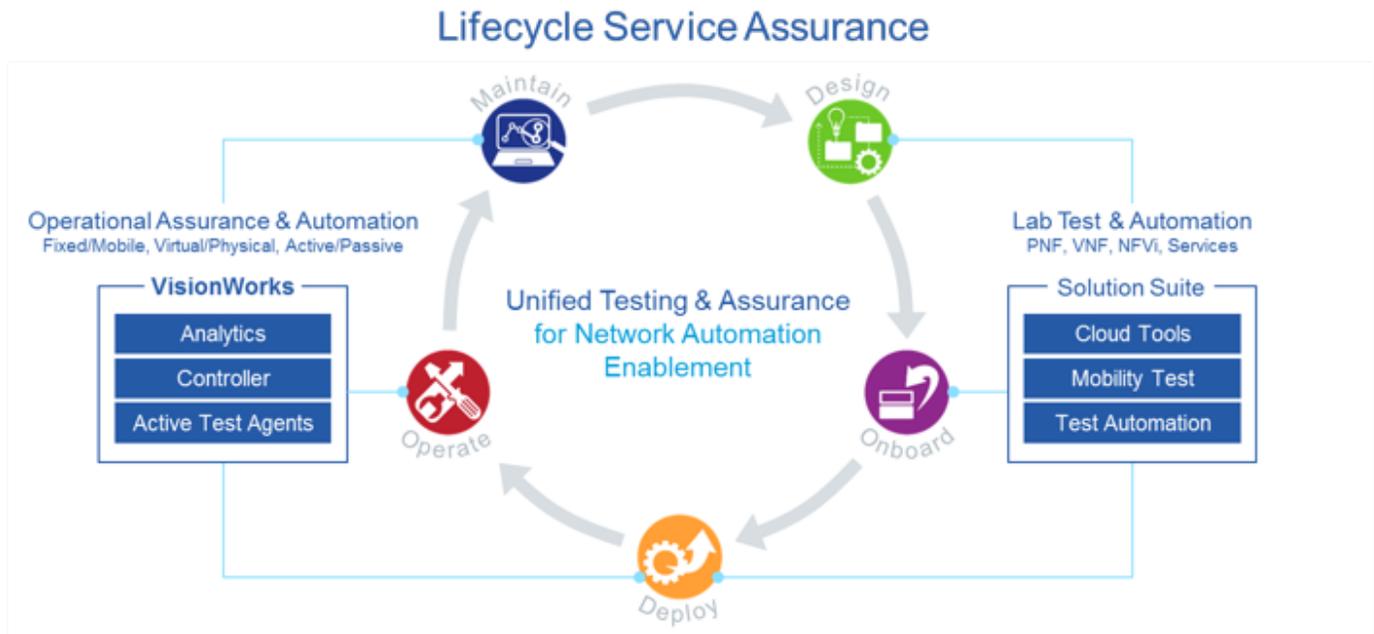
Active monitoring to ensure QoE performance meets or exceeds expectations at any moment.

### Customer Savings from Spirent Operational Assurance

- Lifecycle Service Assurance: \$20m+ annual savings due to reduced SLA violations
- Active Test with Intelligent Automation: \$2 per-subscriber-per-year Opex savings
- User Experience Evaluation: 50% reduction in testing while assuring the successful evaluation and on-time launch of new devices

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### Accelerate the Service Lifecycle, Reduce Costs, and Differentiate Quality with Spirent Lifecycle Service Assurance

As we have seen, 5G is more than just a technology transformation—it's a business transformation and a paradigm shift that calls for a new approach to assurance. Spirent believes that just as the 5G transformation ties together previously distinct technologies and businesses, so must the response to 5G's challenges be a unified, synergistic suite of solutions.

Spirent VisionWorks completely automates testing processes such as verification of end-user service quality and isolation of problems to a specific network segment. VisionWorks provides intelligent and automated active test and assurance across the lifecycle of the evolving 4G/5G hybrid network to enable service agility, cost reductions, network efficiencies, and increased revenues.

Umetrix automates the entire user experience evaluation process, accelerating user experience evaluation for new devices and services and assuring a successful, on-time launch.

Together, Spirent's suite of integrated solutions can operationally assure that 5G delivers on your and your customers' expectations and that you capture those new revenue streams, bolster new services, extract new savings, and deliver new experiences.

Spirent is leading the way in virtualized testing and in integrating assurance into our customers' complete lifecycle. As you explore 5G, we'll work with you to formulate your 5G test strategy and determine the testing you'll require to achieve your specific business outcomes. We'll help you simplify the testing process, reduce overall development costs, and shorten time-to-market. We're committed to an ongoing engagement with our customers to support your success as the 5G journey unfolds.

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#### About Spirent Communications

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks.

We help bring clarity to increasingly complex technological and business challenges.

Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled.

For more information visit: [www.spirent.com](http://www.spirent.com)

#### Don't Let Complexity and Cost Delay Your Opportunity with 5G

Benefit from 5G Lifecycle Service Assurance, Active Test with Intelligent Automation and User Experience Evaluation to assure 5G delivers new revenues, savings and experiences.

Work with a leader in 5G Test and Assurance who has end-to-end expertise and solutions to automate and harmonize test and assurance across the lifecycle.

The business opportunity for 5G is immense. Spirent is here to assure you capitalize on it.

Spirent.  
Promise. Assured.

#### Savings Achieved by Our Customers

Lifecycle Service Assurance:

- \$20m+ annual savings due to reduced SLA violations

Active Test with Intelligent Automation:

- \$2 per subscriber per year OPEX savings

User Experience Evaluation

- 50% reduction in testing while assuring the successful, evaluation and on-time launch of new devices.



#### Contact Us

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