

5G

2021 Update: Market Drivers, Insights and Considerations

A Spirent 5G Report Addendum

5G Trends Accelerating

5G Standalone

- New services and differentiation are primary drivers
- Large service providers are going multi-vendor while smaller telcos look for one key partner
- Supporting high release volumes and managing multi-vendor performance are emerging as key challenges

5G Telco Edge Cloud

- Partnerships, early trials and deployments between hyperscalers and service providers are expanding
- Service providers are still working to benchmark edge performance and integrate assurance for consistent, deterministic latency

5G 4G Open RAN

- Leading 5G service providers are targeting large-scale rollouts, starting 2022
- Interoperability, performance, robustness and systems integrator overheads require that service providers continue to test and validate every deployment phase
- Many leading service providers indicate plans to initially kick off Open RAN engagements with single-vendor rollouts

5G Defense Sector

- Experimentation with the acceleration to cover a wide range of new applications spans AR-based training, telemedicine, and secure and robust connectivity for forward operating bases
- The General Services Administration's (GSA) Federal Mobility Group (FMG) has released the "Framework to Conduct 5G Testing" which is being used to align testing capabilities considerations

5G DSS

- Dynamic Spectrum Sharing (DSS) deployments are increasing in many markets to provide 5G coverage
- Testing still reveals mixed experiences due to inefficiencies and performance degradations, though 5G NR scheduling advancements are starting to address these limitations

6G Vision

- The 6G vision-forming stage is progressing with the industry initially coalescing around a number of key themes, including THz frequencies, use of intelligent reconfigurable surfaces or metamaterials, open networking and networks of networks (cellular, NTN & Wi-Fi convergence)
- The grand ambition for 6G is to combine physical, digital and biological connections for holographic, tactile and physiological-based communications

A Dispatch from the Journey to 5G

Just past the halfway mark for 2021, the dominant trends present at the start of the year persist. Pandemic-induced limitations have forced the entire industry to be more agile and more rapidly responsive than was thought possible. When physical limitations were imposed overnight, there simply wasn't time for long, drawn-out planning, process evolutions and digital transformations. Driven by unprecedented autonomy and latitude to "think outside the lab", teams simply did what needed to be done to keep business moving forward. Spirent expects many of the trends that emerged over the past year to endure for the foreseeable future.

In particular, 2021 demonstrated considerable demand for managed solutions and XaaS (Anything as a Service) offerings. Service providers are intensifying focus on what they do best and increasingly leaving the rest for experts. That willingness to rely more than ever on trusted teams outside of the organization represents a new path to new possibilities.



Service providers are not looking for hired hands, they are seeking partners. Cost efficiencies, accelerated rollout timetables and services that can be turned up globally, on demand, have become hallmarks of these engagements.

Key Segment Snapshots

Service Providers

Service providers remain the largest 5G segment Spirent serves, as adoption of solutions for 5G Standalone (SA) Core evolution, testing and launch continue to grow significantly. Service assurance work also continues to see considerable uptake while edge-enabled lower latency and video quality emerge as key focus areas for operators.

Particularly, operators are benchmarking video performance against spectrum sharing and competitor networks to determine if 5G network coverage gaps can be addressed while still meeting customer expectations. Video is a key battleground and as the 5G share wars continue, first on the consumer front, all eyes are on how to make the best showing with the services that matter most.

Network Vendors

Network vendors established an intensifying focus on high-speed Ethernet and transport capacity and performance testing as data rates in early 5G networks grew 2 to 2.5 times more than 4G. Spend that was delayed or reduced on this front due to Covid is showing a return, especially for 400G testing, which has proven a priority for our customers. Drilling down deeper, X-haul support resulting in new disaggregations is putting heightened importance on timing and synchronization across multi-split networks.

Device Vendors

More 5G devices and more 5G networks means more 5G device testing around operator acceptance and location accuracy. North America is a strong market for Spirent and we observed a marked increase in managed solution demand for field testing that could accurately determine network-wide data, video and voice service experiences.

It's about delivering recurring, real-time answers about whether devices and the networks that support them are delivering. A delicate balance exists between devices, networks and actual experiences. Consumers rarely blame devices when things go wrong, so operators remain intent on finding and resolving the issues related to devices in a timely manner, especially in hyper-competitive markets.

Government & Military

Government and military 5G and ORAN interest is currently heavily U.S.-focused, but poised to expand globally in parallel with service provider exploration. Traditionally content to let telecom groups hash out technical standards, government bodies such as the Department of Defense and the Federal Communications Commission are increasingly influencing design and specifications.

A wide range of experimentation is underway as complex contracts are shopped with an aim toward robustness, resilience, security and performance for emerging next-gen network technologies. For the first time, we're likely to see the government as an early adopter of new mobile tech with learnings and outcomes shared to mutual benefit between public and private industry.

Geographic Trends

At the beginning of the year, we reported an acceleration of 5G Standalone (SA) Core testing and deployments. We now see pursuit of this critical upgrade path materializing across all major regions (North America, Europe and Asia). In particular, automation technology demand is on the rise, initially driven by Covid, and now as a proven, practical approach to cumbersome testing in these complex, multi-vendor environments. The requirement for state-of-the-art test automation, driven by continuous integration and delivery (CI/CD), is also growing across regions.

On the customer experience side, North America is driving the demand for customer experience and service assurance solutions. This speaks to the region's role as one of the most competitive mobile battlegrounds for consumer loyalty. In Asia Pacific, we've seen trends noted in our 2021 5G report hold steady as it relates to a continued focus and investment in transport infrastructure toward an end goal of supporting industrial use cases. In Europe, the overall 5G market, which experienced a Covid-driven slowdown, has finally started to accelerate. All of the leading service providers in the region are now aggressively moving to 5G SA as soon as possible. The global 5G race is back on, and picking up steam.

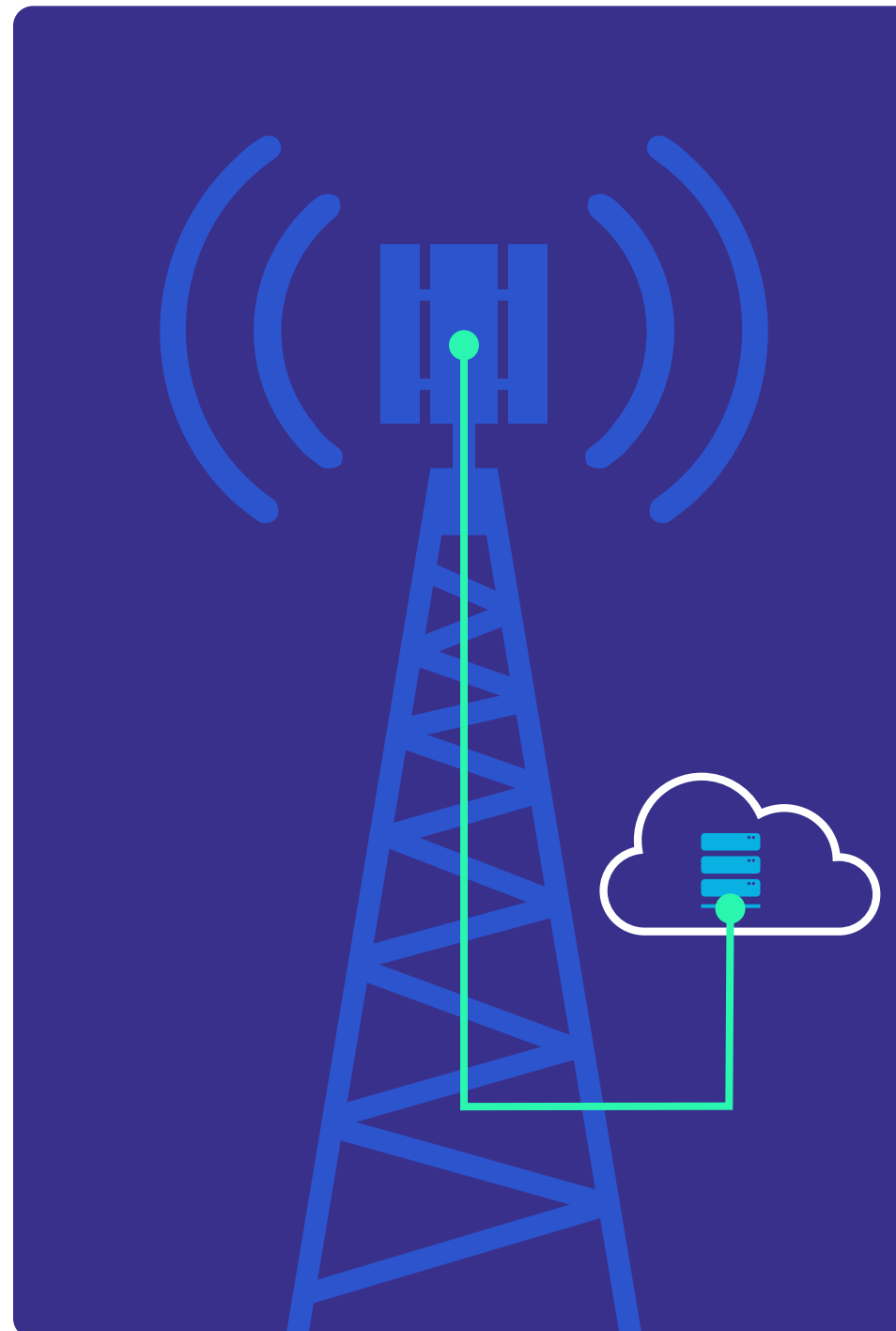
Takeaways on Key Segments

Adoption of 5G is accelerating across both commercial and government segments, and in all global regions. State-of-the-art test automation has been a key enabler of this acceleration, along with adoption of CI/CD methodologies.

Key Milestones on the Journey to Global 5G

Markets

- 5G Launches**
 - Nearly 170 operators have launched mobile or Fixed Wireless Access (FWA) 5G services (source: GSA)
 - More than 270 operators are actively investing in 5G trials and evaluations (source: GSA)
- 5G Standalone Upgrades**
 - Over 75 operators are investing in 5G SA, spanning evaluation, testing and launch (source: GSA)
- 5G Devices**
 - More than 500 5G device form factors are commercially available
 - More than 300 additional 5G devices are in development (source: GSA)
- 5G End User Adoption**
 - More than 450 million 5G subscriptions (source: Spirent)
 - 1.8 billion anticipated by 2025 (source: GSMA)
- 5G Open RAN**
 - 45 ongoing Open RAN trials and early deployments across 27 countries (source: TeckNexus)



Spirent

- 5G Engagements**
 - Spirent now supports more than 1,400 5G engagements (>400 new in H1 2021) and is the number one vendor for 5G Core network testing
- 5G Core Validation**
 - Spirent helped numerous leading communication service providers (CSPs) like Telefónica and Jio validate their 5G Cores and collaborated with Amazon Web Services (AWS) to offer automated 5G Core testing for mobile carriers looking to accelerate delivery of 5G services on AWS
 - Spirent released the industry's first subscription-based automated 5G Core test solution
- 5G Ecosystem Collaboration**
 - Spirent is participating in critical ecosystems spanning work with the 5G Open Innovation Lab, a national research institute for intelligent and connected vehicles, Open RAN testing with GSIs, and 5G security testing for the defense community
- 5G Innovation**
 - Spirent Open RAN (ORAN) initial solution portfolio released
 - Spirent's 5G Network Digital Twin took top honors in global 5G innovation recognition program
- 5G + Wi-Fi Convergence**
 - octoScope acquisition establishes Spirent as the Wi-Fi testing market leader and lays the foundation for future 5G and Wi-Fi convergence testing

Key Updates from the Field

Telefónica

Validating Telefónica's 5G Core on Public Cloud

Telcos are eagerly pushing the boundaries of cloud in pursuit of unprecedented business and technical efficiencies. Spirent test solutions and in-region support recently helped Telefónica validate Amazon Web Services (AWS) Outposts as a viable option to support multi-vendor 5G Standalone Core deployments. Running in both the AWS South America (São Paulo) Region and on AWS Outposts, Spirent's Landslide Core Network Testing solution verified both control plane functionality and high-load testing for user plane performance validation for vendors like Nokia, Mavenir and Oracle.

The end-to-end system was validated for Vivo Brazil based on key components of Telefónica's CI/CD/CT (delivering continuous test) architecture. This development represents a significant step forward for offering standalone 5G services running on top of hyperscaler cloud infrastructure. Telefónica expects the move to help improve automation, drive new revenue streams and introduce new operational processes.

AWS

Teaming with AWS to Automate 5G Network Testing

As mobile operators build 5G networks on the public cloud, they find themselves traversing an entirely new terrain. Every function and service must be tested and validated, over and over. The stakes are high with compliance, capacity and performance all on the line. Help is on the way in the form of 5G Network Validation on AWS, combined with Spirent's groundbreaking Landslide 5GC Automation Package, which are now proven to power rapid testing and validation of deployments and continuous network updates (CI/CD).

With manual testing requirements in the rearview mirror, operators can let automation do the heavy lifting to trigger the right tests and complete validation. Tier-one leaders are blazing a new trail for networks and Spirent is helping them advance swiftly and safely while cutting operational costs, time, and the resources required to succeed.



Latency Testing at the Tier-One Edge

A top North American mobile operator knows that private and public edge cloud deployments represent a path to new revenues driven by low latency consumer and enterprise services. Testing and validating performance on edge clouds in the field isn't just about measuring de facto latency SLAs. It's about consistency and determinism, even during periods of congestion. Transport networks, regional clouds, edge clouds and private edge locations all work in tandem to create next-gen experiences.

Understanding which domains are having issues and determining the root causes is critical to standing up services that meet stringent end user requirements. Spirent's managed solution for edge testing is helping to give the green light to mobile networks seeking to take services to the next level for a range of new industries.



A Testing Ground for 5G National Defense Use Cases

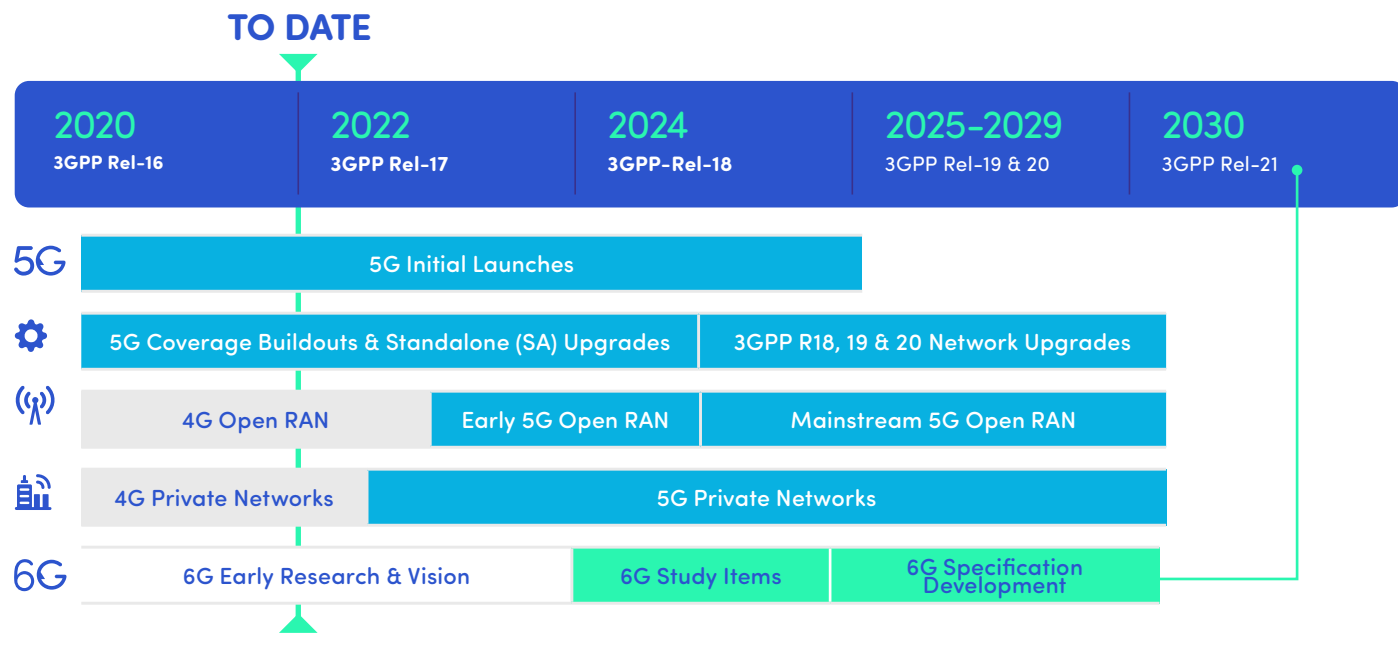
A global defense contractor for the national intelligence community tapped Spirent to help build a testbed for 5G risk mitigation exploration. The military's early interest in 5G networks is redefining what it means to be mission critical. Particularly, new 5G radio core devices and initiatives like ORAN must be subjected to comprehensive, end-to-end testing to uncover potential security exploits and ensure performance will stand up to harsh and vital field demands.

Spirent's 5G Network Digital Twin emulators, including Landslide and CyberFlood, are powering real-world playgrounds for robust testing and validation. This work is ensuring new services and the networks that support them are battle-tested before being deployed to support the government's future lines of defense.

5G: Where Are We?

5G is advancing so quickly on so many fronts that it can be challenging to discern how far we've already come and how far there is to go. In our 2021 report, we shared a timeline that plotted key initiatives and milestones defining 5G's journey, ending with the eventual evolution to 6G.

At 2021's halfway point, 5G remains in its infancy with approximately one-fifth of global operators having actually launched 5G. In many cases, 5G Core network upgrades are just now beginning.



We anticipate four additional major 5G standards releases for the decade ahead. These ongoing feature-rich releases only deepen the need for test and assurance solutions. In particular, demand for managed solutions and services will rise in tandem with new complexities and the constant change that these standards releases introduce.

5G's Path to Progress

No mobile next-gen network upgrade has been easy. In hindsight, they only look simplistic in comparison to the ever-expanding scope of 5G and the seemingly endless interconnected initiatives that must all advance in parallel.

The biggest takeaway for 2021 is that clear pathways ahead continue to be forged. Considerable progress is being made worldwide, even in the face of adversity, complexity and the discovery of new unknowns. Spirent is proud to be a driving force of these ambitious efforts.

To learn more about our latest work in 5G, download our full **5G 2021: Market Drivers, Insights And Considerations** report at www.spirent.com/assets/the-spirent-2021-5g-report.





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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.

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