Assuring 5G Core Network with Digital Twin Solutions

Digital Twin Solutions

for U.S. Defense

Spirent

In recent years, commercial technology innovations have reshaped networks to be faster, more adaptive and more interoperable than ever. 5G core networks place a far greater reliance on software and cloud environments than previous generations, rendering the old ways of managing hardware unfeasible – and making military adoption of this commercial advancement an inevitability.

Accelerating Tactical Advantage

For the U.S. Department of Defense, 5G is a critical, strategic technology that promises to power advanced communications and ubiquitous connectivity for military advantage.

Already, this emerging wireless technology is shaping a faster, more connected, more powerful – and more complex battlespace. 5G can power high-speed connectivity and communications across a massive number of devices. Yet even as the DOD calls for the acceleration of 5G technology prototyping, experimentation and adoption, defense leaders rightly insist that 5G core networks not be deployed until they are proven to meet the military's high performance and security standards.

Assuring Battlespace Advantage

To prepare for the new shape and speed of war, defense leaders are actively researching the potential of 5G networks. They are looking to optimize secure, private networks. They are also exploring the vast possibilities of secure network slicing with distinct performance and security requirements. Because a 5G core network is disaggregated, defense teams are also analyzing options for placing parts of the network at or near the tactical edge, to power the most critical communications with the least disruption.

Yet only when 5G is successfully deployed in the operational environment will defense forces experience battlespace advantage. The DOD is earnestly pushing to move through the research and prototyping phases, to validate and adopt 5G core networks in the real world.

Accelerating Prototyping and Adoption

To confidently deploy and manage the primarily software-based 5G core networks from proof-of-concept to live operational use, defense leaders want to be assured that every piece of the network will perform as needed when it is mission critical. First, they need a way to test and validate use cases at scale, to select and configure technologies. Then, they'll need to manage and continually validate the ongoing software releases and configurations once the networks are operational.

Spirent's 5G Digital Twin solutions provide an end-to-end 5G test network built upon network emulation, traffic generation simulation and test automation. Spirent's solutions ensure that 5G technologies function in the lab and, more importantly, that they perform as needed when live.

Using a digital replica of the network, Spirent's Digital Twin solutions can support an array of 5G core network decisions:

- **Private network architecture:** Since defense operations have complete control over a private network, testing may be focused on whether and how well different commercial technologies meet the rigorous military requirements. Using a digital twin to emulate core network configurations, testing can reveal which options work best for each use case.

- **Network slicing:** 5G enables the configuration and management of numerous network slices, each with its own requirements. A slice devoted to telemedicine may have low latency and high priority over other slices to support real-time, remote lifesaving medical intervention for a warfighter on the front. Or a high-priority, high-security slice is devoted to autonomous vehicles. Or a lower-priority slice with low latency supports augmented reality troop

training. Testing many slices at once – across a range of environmental, congestion and interference conditions – helps to validate the security and performance of each.

- **Deployment models:** A disaggregated, distributed 5G core network has immense deployment flexibility. To minimize disruption, signaling capability may be closer to the edge. To support high volumes of high-definition video, part of the network could be hosted at the edge for faster processing. Digital twins can emulate multiple deployment models, so results can inform decisions about where to place different parts of the network for each use case.

- **Infrastructure technologies:** To take advantage of rapid deployment and scalable infrastructure, the DOD is looking at hosting core networks on commercial hardware and cloud infrastructure. Robust testing will help discover which technologies work best, where there are vulnerabilities, and how and whether security requirements can be met.

- **Validation and revalidation:** Digital twins can be used for network prototype performance and security testing at scale, across a range of best-case and worst-case network conditions in congested and contested environments.

Evaluating, Testing, Automating and Managing Networks

Spirent 5G Digital Twin solutions model the entire 5G network, offering defense organizations a lab environment to test any component – or any combination of network technologies. To ensure that the services tested in the lab will operate similarly in the field, the Spirent 5G Digital Twin solutions framework supports the blending of emulated and commercial elements. It's a vendor-agnostic environment to test network technology performance and security across a broad range of use cases.

For 5G core network use cases, testing and evaluation reveal the performance and security across a broad set of scenarios and conditions. With robust automation, Spirent 5G Digital Twin

solutions not only support repeated and complex testing scenarios when 5G technologies are being developed and prototyped; they can also continuously monitor and revalidate live networks, once deployed.

Spirent's Digital Twin solutions emulate conditions in the field – or replay captured live conditions – to recreate:

- **Traffic,** including mobile signaling and data usage, application traffic and application security threats.

- **Network protocol exchanges** across core networks, as well as virtual and cloud-native network functions.

DIGITAL TWIN FRAMEWORK

AUTOMATION
Lab and Test Automation, Pre-Built / Configurable Test Suites / Continuous Testing

TRAFFIC GENERATION

Mobile Signaling & User Data	Ethernet Traffic (Layer 2/3)	GNSS Signaling
Voice, Video & Data (Over-the-Air)	Application Traffic (Layer 4-7) & Security Threats	Timing & Sync Signaling

NETWORK EMULATION

Core Networks	Ethernet Endpoints & Impairment	GNSS Simulation & Channel Modeling
Access Networks (RAN & APs)	Virtual and Cloud-Native Network Functions	UE Emulation

By artificially impairing the network with massive traffic, cyberattacks, outages and other interference, Spirent's Digital Twin solutions help reveal the performance of core networks under anticipated conditions. Defense leaders can then optimize and, ultimately, deploy and manage 5G core networks in tomorrow's complex battlespace.

Why Spirent 5G Digital Twin Solutions for Defense Core Networks?

Spirent's 5G Digital Twin solutions offer defense leaders instant access to the most advanced 5G network environment, without a capital investment. It also provides a team of experts who have deep experience with legacy and emerging communication platforms – and who understand the unique requirements of the defense community.

Combining a single source of testing across the entire 5G network with military network,

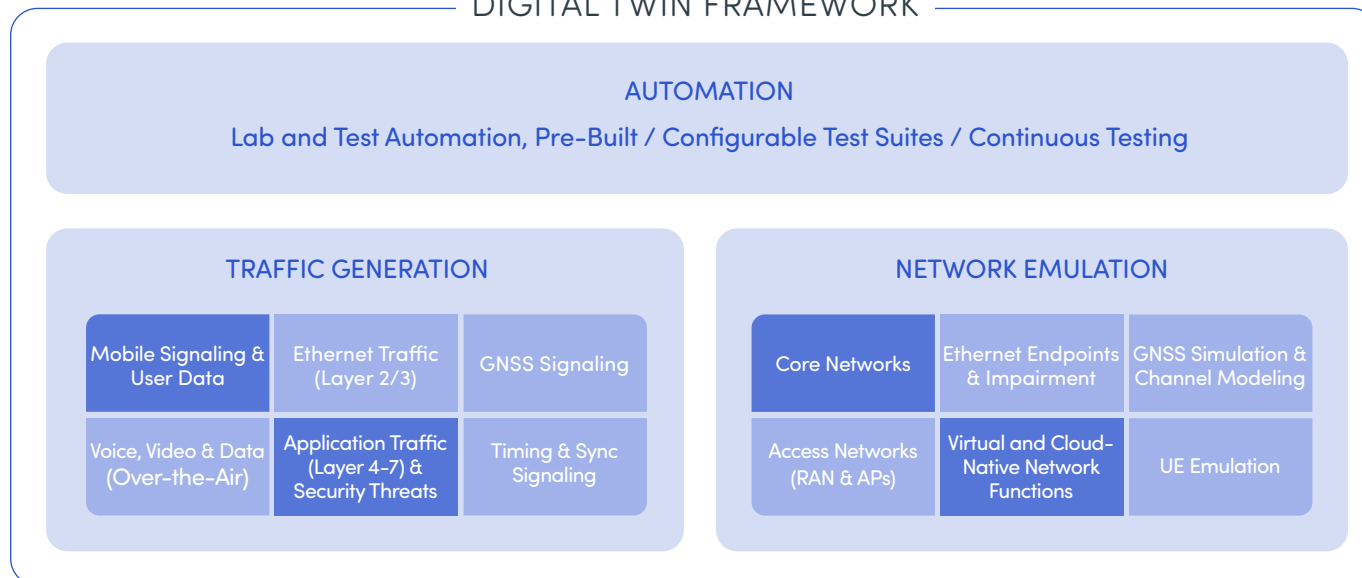cybersecurity and technology experts, Spirent's 5G Digital Twin solutions provide defense leaders:

- **Flexibility** to test and validate multiple core network configurations across a broad range of use cases and network conditions – all without a capital investment.

- **5G Expert Guidance** built from more than 1,800 successful engagements across the 5G ecosystem.

- **Technology Evaluation** of third-party technologies and cloud solutions, from a vendor-neutral partner.

- **Accelerated Adoption** that comes from at-scale evaluation of prototypes, and planning for live deployment.

- **Ongoing Validation** after the network is deployed, for automatic and consistent revalidation of updates and configurations.

- **Assurance** that the networks meet the rigorous performance and security requirements of defense operations in the battlespace.

Contact us to experience the power of 5G and Spirent's Digital Twin Solutions.

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