Securing Battlespace Connections: 5G Resilient Communications

Digital Twin Solutions

for U.S. Defense

spirent™

As adversaries become more sophisticated about intercepting and disrupting mission-critical communications, the DOD has continued to advance the resiliency of their communications. 5G opens the doors to powerful network configuration options that increase the number of communication pathways and accelerate the time to access communications.

Ensuring Mission-Critical Communications

In the battlespace, every communication is critical. If one base station or pathway is compromised, operators and warfighters rely on instant access to alternative lines of communication to convey messages and information. The advent of 5G wireless technology presents a tremendous opportunity for the U.S. Department of Defense to strengthen resilient communications, with numerous network options and redundant communication paths to route messages quickly and covertly.

Yet that very flexibility must be explored to determine the best network options and security policies to support secure and reliable 5G resilient communications in the field.

Envisioning 5G Resilient Communications

When setting up communication networks for the battlespace, defense forces may build and bring their own network structures or they may "operate through," using existing cellular networks and infrastructure. The first option provides more control; the second is faster to set up and may have better coverage. A combined private/ public network, where defense leaders have established relationships and access protocols with friendly wireless carriers – and augmented that network with additional security measures, can be the right mix for fast and secure communication access.

Multiple communication pathways are also essential for resilient communications and 5G promises to support an exponential number of alternate routes compared with previous technology platforms. 5G supports advanced mobile ad hoc networks (MANETs), with mobile nodes connected wirelessly in a standalone fashion or as part of a larger network. A range of network topologies may be used for multi-hop, single-directional or bi-directional links and communications. If one pathway becomes compromised, there are multiple paths available for mission-critical tactical communications.

The vision of 5G resilient communications is compelling. Yet defense leaders must ensure that the technologies, policies, and processes meet their security and performance standards well before deploying to the field.

Defining 5G Resilient Communications

Defense leaders are actively exploring how, and how well, various 5G network models, technologies and protocols work. Which combinations deliver the fastest, most secure, most adaptable communications? What configurations will give their forces an edge on the battlefield, while operating as safely and securely as possible?
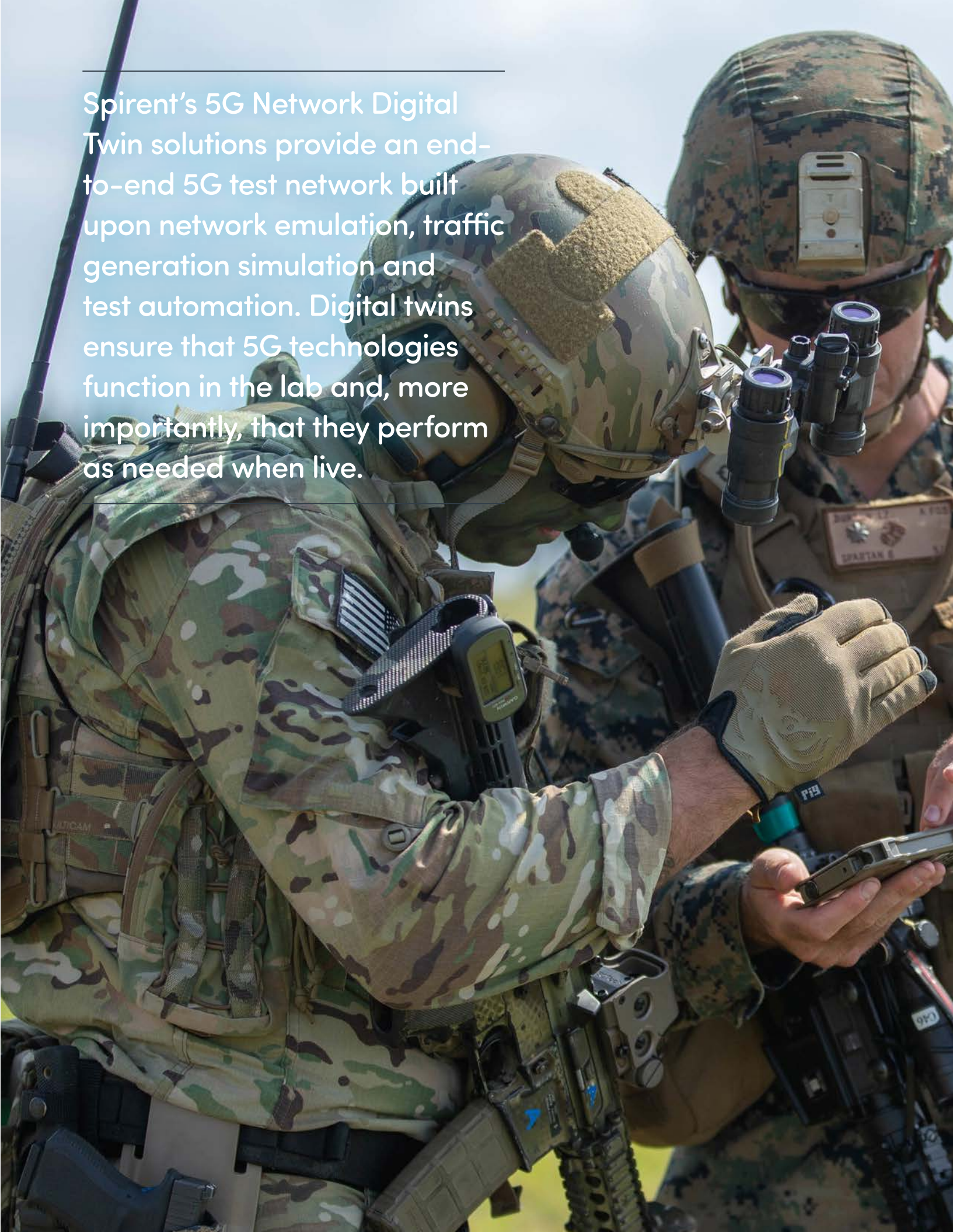
Using a digital replica of the network, digital twins can support an array of 5G resilient communications test and evaluation needs:

- **5G core network performance.** A 5G digital twin is a software emulation of the 5G physical network and can emulate core network configurations for private, public and hybrid models to support testing the performance of each in anticipated scenarios. Use case testing may evaluate how well an existing public infrastructure delivers voice, video and data services for military use. Or explore the minimal set of network capabilities that defense forces need to bring and deploy for required private network coverage in specific locations. Or examine roaming scenarios across hybrid networks to determine the best models for deployment.

- **Security testing.** Every component of a resilient communication network must not only perform as needed, but it also has to be secure. Core and distributed networks. The myriad devices. And every connection point along the way. Because digital twins can emulate any or all parts of the network, they support robust security testing. Use case testing can reveal current security strengths and vulnerabilities of the network and devices, to help determine

what security levels are required. Evaluations can also inform endpoint security requirements for using an existing public infrastructure.

- **Cloud performance.** By emulating a cloud network, a digital twin supports testing of how the cloud infrastructure impacts overall network performance. Is it reliable? Does it support voice, video and data communications without significant degradation? Testing and evaluation will help determine whether the cloud network is a viable element for resilient communications.

- **Device-to-device communications.** 5G has the capacity to connect massive numbers of people, machines and devices using high-speed connections – without going through the cellular network. Digital twins accurately recreate the complex effects of massive traffic, cyberattacks, outages and other interference, supporting the in-lab testing of thousands of interconnected devices on the ground, airborne, at sea – across a range of dynamic MANET topologies.

Such use case testing and evaluations are informing defense requirements for resilient communication infrastructures that support multiple communication paths and adapt quickly when one or more is compromised.

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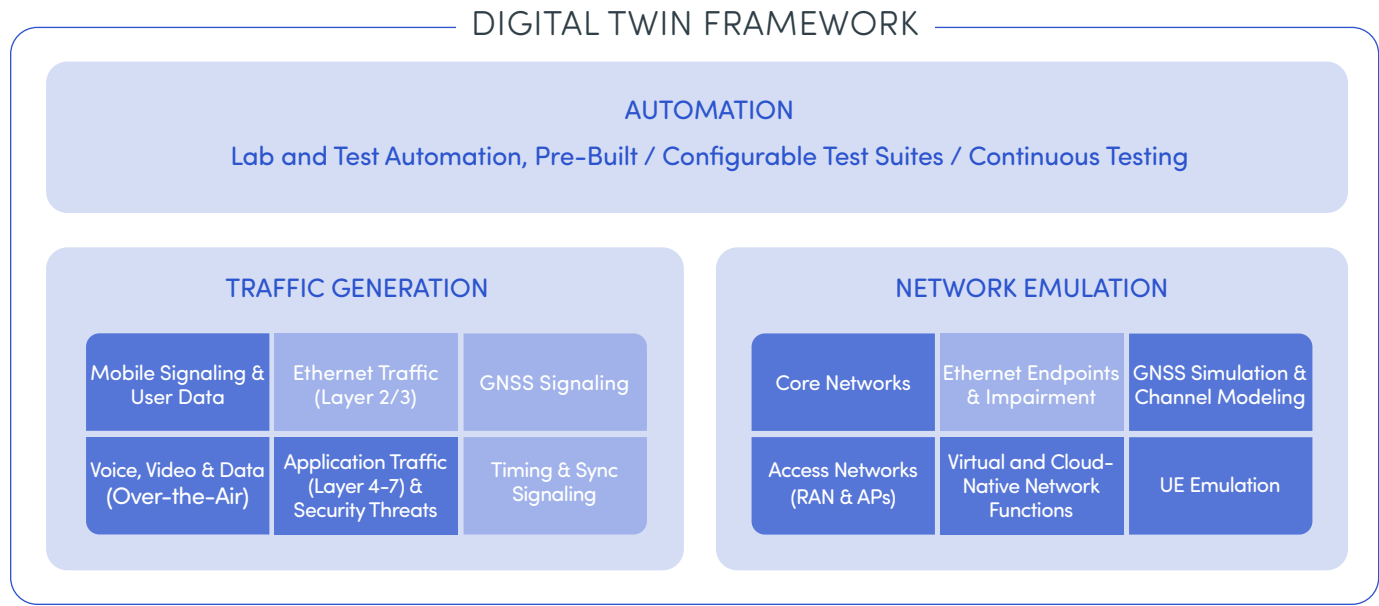
Testing and Defining Battlespace Connections

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 resilient communications use cases, testing can help determine which network options will work best in what environments, current and desired network performance and security, and device-to-device communication performance and security across a broad set of scenarios and conditions. With robust automation, Spirent 5G Digital Twin solutions are used to configure and repeatedly execute complex testing scenarios.

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

- **Traffic,** including mobile signaling and data usage; over-the-air voice, video, and data; and application traffic and security threats.

- **Network protocol exchanges** across a range of core networks, cloud networks, access networks and channel modeling scenarios.

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

Why Spirent 5G Digital Twin Solutions for Resilient Communications?

Spirent's 5G Digital Twin solutions offer defense leaders instant access to the most advanced 5G network environment, without the significant upfront investment of commercial infrastructure. These solutions incorporate teams 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 defense community experts for defense networks, cybersecurity and technologies, Spirent Digital Twin solutions inform requirements and technology advancements to define and harden 5G resilient communications.

For 5G resilient communications initiatives, Spirent Digital Twin solutions provide defense leaders:

- **Assurance** that forces can communicate reliably and securely across a range of approved network options, so they can operate as safely as possible in the battlespace.

- **Rapid Access to Communications,** when able to utilize existing public infrastructures.

- **Accelerated Planning and Development,** empowered by lab and test automation and continuous integration/continuous delivery (CI/CD) best practices, defense leaders can test, prototype, and optimize 5G technologies faster and more reliably than field testing could accomplish.

- **Expert Guidance** based on Spirent's proven experience executing large-scale 5G network tests and deep understanding of defense requirements.

- **Improved Reliability, Resilience and Security** across integrated technologies.

- **Reduced Risk** of inefficient or ineffective testing that could jeopardize mission outcomes.

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

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