

Spirent Landslide™ for the Evolution to 5G

5G Mobility Infrastructure Testing Platform

Landslide Features

The Spirent Landslide 5G mobility infrastructure test platform incorporates device emulation and network testing capabilities that expand through various 3GPP releases (Release 13 and onward). The Landslide 5G testing feature set supports validation needs for the entire evolution path to 5G:

Extensions to 4G

Non-Standalone 5G

True Native 5G

In particular, Spirent Landslide's 5G testing offers:

1. Extensions to 4G

- High scale device emulation of all types including IoT devices as defined in the CAT-M and NB-IoT standards supporting PSM and eDRX
- IoT-specific node testing and emulators such as: ClIoT Serving Gateway Node (C-SGN), Service Capability Exposure Function (SCEF) and the enhanced-for-IoT Home Subscriber Server (HSS)
- Network slicing testing and emulation in different forms such as Release 13 Dedicated Core (i.e., DECOR)
- Release 14 Control and User Plane Separation (CUPS), nodes testing with supporting node emulators such as SGW-C, SGW-U, PGW-C, PGW-U
- Virtualized-network testing supporting DevOps methodologies for optimized deployment
- Device and service Busy Hour call modelling

2. Non-Standalone 5G

- 4G/5G Dual-connectivity: High scale 5G device emulation of any kind (eg; smartphone, IoT, vCPE, ...), with 4G and 5G radio access node emulation (eNodeB, gNB), for dual-connectivity testing as defined by Options 3, 3a and 3x in 3GPP standards with multiple mobility scenarios
- Combined 5G and non-5G device load generation capability
- 5G to 4G fallback scenario emulation
- 4G to 5G and 5G to 4G S1-U re-selection based on service requirements
- Device and service Busy Hour call modelling
- Full 4G Core emulation for 5G RAN and dual-connectivity testing
- gNB-DU emulation for gNB-CU ORAN testing in NSA mode

3. True-Native 5G

- High scale 5G device and radio access (gNB) emulation to test both 5G Core (5GC) or 5G Service-based E2E core network architectures with Intra and Inter RAT mobility (including EPS fallback)
- High scale 5G Core nodes testing and emulation (AMF, SMF, UPF) exposing and testing N3, N4, N6, N11 interfaces
- 5G Service nodes testing and emulation (AUSF, CHF, LMF, NEF, NRF, NSSF, PCF, UDM) exposing and testing N7, N8, N10, N12, N13, N15, N22, N28, N29, N40, N51, N1 interfaces
- Full RAN and Control Plane emulation to test and isolate UPF (exposing and testing N3, N4, N6 interfaces)
- Full RAN and User Plane to test and isolate AMFs and SMFs exposing N1, N2, N6, N8 and N11 interfaces
- Full 5G Core and content emulation for 5G RAN and device testing
- gNB-DU emulation for gNB-CU ORAN testing in SA mode
- Support for complex Native CUPS and Native Slicing topologies

The Evolution to 5G

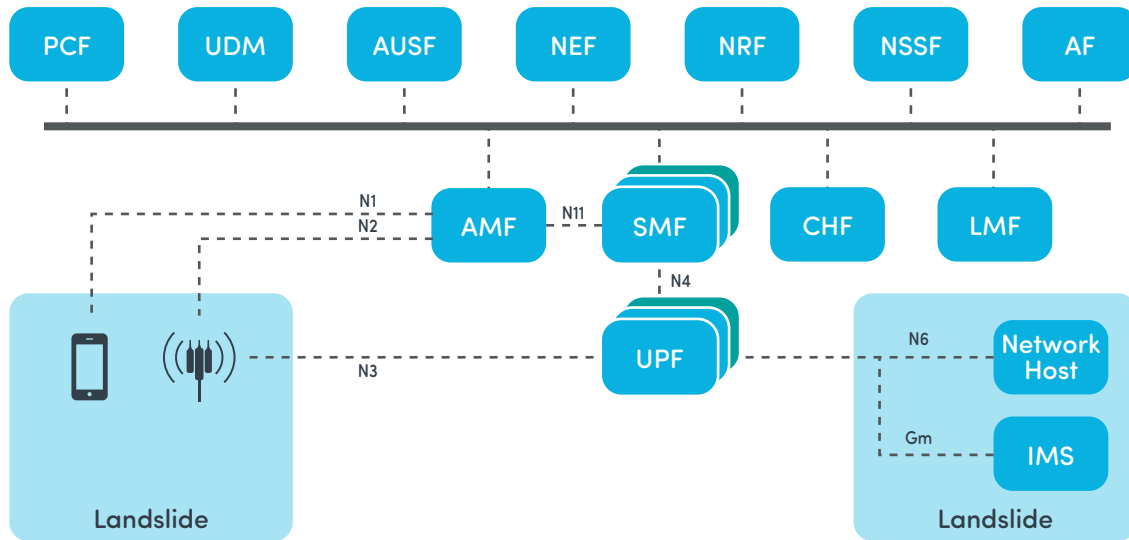
The next generation of mobile networks—commonly known as 5G—promises a revolution in cellular communications enabling services such as massive IoT, Fixed Wireless Access and enhanced Mobile BroadBand (eMBB).

Based on completely new radio access, core and network design (including slicing, separation of control and user plane and distributed network functions), 5G supports massive density of devices of any kind, operating at increased speeds with minimum latency, while making an efficient use of the network's resources.

To ensure a successful adoption of this new technology carriers and equipment manufacturers alike must define an evolution strategy (from 4G extensions and 5G non-standalone to true native-5G), and ensure that the infrastructure can handle the requirements of such evolution.

Spirent's Landslide emulates 5G devices and network functions to validate new 5G mobile and core nodes, ensuring their readiness to deliver high-quality 5G services.

System Overview



Spirent Landslide's 5G emulation feature set, capacities and performance align with the requirements of the evolution towards 5G, being able to emulate millions of devices of all types communicating with the network at rates of tens of thousands of events per second and traffic of Gigabits per second. With its unique dynamic testing capability, Landslide can test all the 4G and 5G infrastructure nodes in isolation and subsequently change the testing topology to progressively incorporate more nodes to the testbed for a full end-to-end network or slice validation.

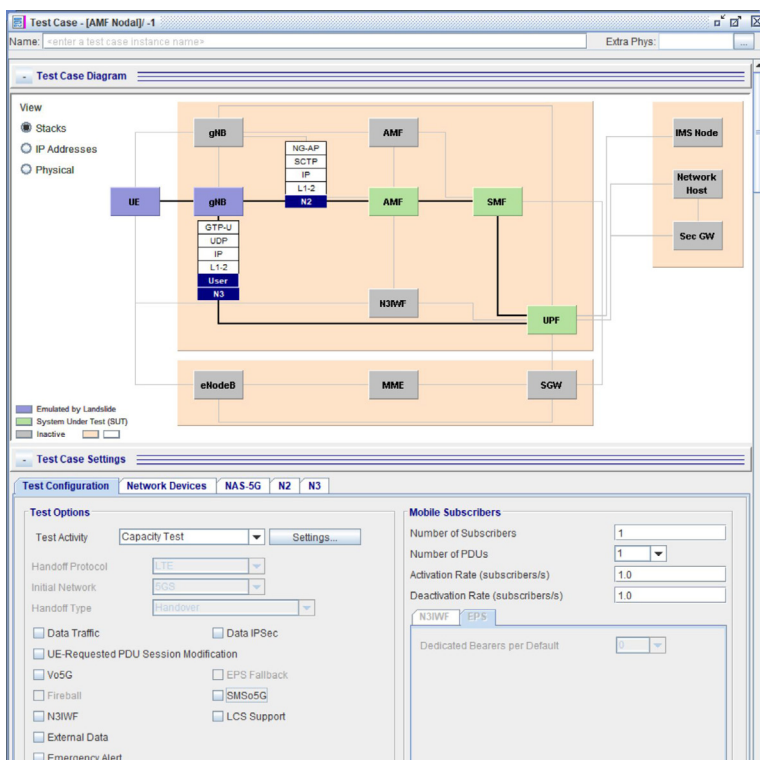
Complex 5G call modeling scenarios can be created that include specific 5G devices in various stages of activation, deactivation, dual-connectivity, handovers and 5G data transfers. Carriers also can capture measurements in the live 5G network and replicate them in the lab with Landslide for increased realism in the testbed.

Spirent Landslide's Message Editor enables custom variations of messages in key interfaces to allow users complete development of the rapidly-changing interfaces from one 3GPP version to another. Supported on N1, N11 and the 5G SBA interfaces.

In addition to the extensive 5G testing capabilities, Spirent Landslide also offers individual 5G-related node emulators (e.g., gNB, gNB-DU, gNB-CU, AMF, SMF, UPF, AUSF, CHF, LMF, NEF, NRF, NSSF, PCF, UDM, SGW-C, SGW-U, PGW-C, PGW-U, etc.). This emulation option is ideal for lab setups where a 3GPP compliant node is required to complete a test objective.

Applications

- **Generate** massive scale of device connections and diverse speed traffic patterns to the network as it is expected in 5G
- **Validate** virtual core 5G deployments throughout the entire DevOps lifecycle
- **Verify** compliance of 3GPP Release 15 5G core nodes, interfaces and service points in isolation prior to network integration
- **Validate** CUPS multi-node deployment per-service scaling and performance
- **Define** network slicing (e.g., Native 5G, EDECOR, DECOR, etc.) based on services requirements and verify correct slice traffic routing
- **Quantify** slices' performance in terms of latency and throughput
- **Validate** support of 5G Location to enhance the offered services (Nlmmf and Lpp)
- **Emulate** 5G UEs over Wi-Fi to verify non-3GPP access to the 5G N3IWF and AMF
- **Validate** Intra-5G and I-RAT mobility and Inter-Technology mobility, Xn, N2 Handovers, 5G to 4G and back to 5G mobility, EPS Fallback with N26 support plus 5G to ePDG Handover
- **Test** Dual-RAN access against different EPCs and network slices
- **Analyze** RAN performance and handoff based on service quality requirements
- **Design** backhaul size and connectivity to support 5G demands
- **Perform progressive network integration** and interoperability of the new 5G nodes
- **Validate** confidentiality (SUPI encryption) and authentication mechanisms (5G AKA/5G EAP-AKA') as defined by 5G's enhanced security requirements
- **Evaluate** optimal number of PDU sessions and their associated serving network slices based on services requirement
- **Verify** mobility behavior under different Session and Service Continuity Modes (SSC Modes 1, 2 and 3)
- **Validate** 5G based private networks based on SNPN (Standalone Non-Public Networks) functionality
- **Test** robustness and resiliency of the AMF to negative scenarios
- **Design** automated procedures of network function distribution and Local Area Data Network (LADN), around Multi-Access Edge Computing (MEC)
- **Analyze** and monitor quality of 5G services under real world conditions
- **Characterize** traffic prioritization and resources management policies for 5G in shared networks
- **Verify compliance**, performance & capacity of ORAN components like gNB-CU
- **Perform load testing with busy hour call modeling**
- **Test** lab completion with related emulators: AMF, SMF, UPF, AUSF, CHF, LMF, NEF, NRF, NSSF, PCF, UDM, SGW-U, SGW-C, PGW-U, EIR, PGW-C, gNB, gNB-DU, gNB-CU



About Spirent

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



Landslide is part of **Spirent's Lifecycle Service Assurance (LSA) solution suite**.

To learn more about **Landslide** and **LSA**, please visit:

www.spirent.com/Products/Landslide

and

www.spirent.com/Solutions/Service-Assurance

3GPP 5G Technical Specifications

TS 23.501 v15.3.0	TS 29.244 v16.5.0	TS 29.510 v15.4.0	TS 32.291 v15.4.0
TS 23.502 v15.3.0	TS 29.502 v15.2.1	TS 29.512 v15.4.0	TS 33.501 v15.5.0
TS 23.503 v15.3.0	TS 29.503 v15.4.0	TS 29.518 v15.2.0	TS 37.340 v15.2.0
TS 24.501 v16.5.0	TS 29.507 v15.4.0	TS 29.531 v15.4.0	TS 38.412 v15.2.0
TS 24.502 v15.2.0	TS 29.508 v15.4.0	TS 29.572 v15.4.0	TS 38.413 v16.2.0
	TS 29.509 v15.4.0		

Ordering Information

Description	Part Number
Landslide 3GPP R14 CUPS Sx Interfaces	L-FT-105
Landslide 5G NSA Dual Connectivity	L-FT-106
Landslide 5G SNPN (Standalone Non-Public Network) Testing	L-FT-174

Testing ORAN Nodes

Landslide RAN gNB-CU 5G NSA Test Application	L-R-APP-080
Landslide RAN gNB-CU 5G SA Test Application	L-R-APP-082
Landslide RAN gNB-CU 5G NSA Emulation Application	L-R-APP-081
Landslide RAN gNB-CU 5G SA Emulation Add-On	L-R-FT-081

Testing 5G Core Nodes

Landslide 5G AMF Core Node Test Application	L-APP-052
Landslide 5G AMF Core Node Emulation Application	L-APP-053
Landslide 5G UPF Core Node Test Application	L-APP-054
Landslide 5G UPF Core Node Emulation Application	L-APP-055
Landslide 5G SMF Core Node Test Application	L-APP-058
Landslide 5G SMF Core Node Emulation Application	L-APP-059
Landslide N3IWF Node Emulation Application	L-APP-701
Landslide N3IWF Node Test Feature	L-FT-700
Landslide EIR Node Test Feature	L-FT-143
Landslide EIR Node Emulation Feature	L-FT-144
Landslide TWIF Node Test Feature	L-FT-171
Landslide 5G Command Mode	L-FT-113
Landslide 5G AMF Negative Testing	L-FT-165

Emulating Service-Based Nodes

Landslide 5G BASE Service Node Emulation Application	L-APP-057
Landslide 5G PCF Service Node Emulation Feature	L-FT-110
Landslide 5G UDM Service Node Emulation Feature	L-FT-112
Landslide 5G AUSF Service Node Emulation Feature	L-FT-115
Landslide 5G NSSF Service Node Emulation Feature	L-FT-116
Landslide 5G CHF Service Node Emulation Feature	L-FT-120
Landslide 5G NEF Service Node Emulation Feature	L-FT-122
Landslide 5G LMF Service Node Emulation Feature	L-FT-128
Landslide 5G Security Edge Protection Proxy (SEPP) emulation	L-FT-146

Testing Service-Based Nodes

Landslide 5G BASE Service Node Test Application	L-APP-056
Landslide 5G PCF Service Node Test Feature	L-FT-109
Landslide 5G UDM Service Node Test Feature	L-FT-111
Landslide 5G AUSF Service Node Test Feature	L-FT-114
Landslide 5G NSSF Service Node Test Feature	L-FT-117
Landslide 5G CHF Service Node Test Feature	L-FT-119
Landslide 5G NEF Service Node Test Feature	L-FT-123
Landslide 5G SMSF Service Node Test Feature	L-FT-125
Landslide 5G Security Edge Protection Proxy (SEPP) testing	L-FT-145

5G Services

Landslide 5G E911 Emergency Services	L-FT-702
Landslide 5G NG911 PSAP Node Emulator	L-FT-703
Landslide 5G Location Services	L-FT-133
Landslide 5G External Data & Apps	L-FT-134
Landslide 5G Core Message Editor	L-FT-153
Landslide 5G SBI Message Editor	L-FT-154
Landslide LTE Positioning Protocol extensions (LPPe)	L-FT-170

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