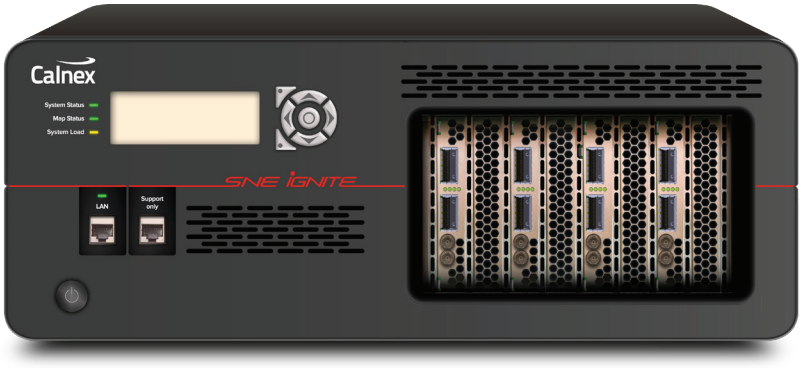
Calnex SNE Ignite

High Precision Network Emulation

Test 5G O-RAN with real-world network conditions in your lab

The SNE Ignite is a multi-port, FPGA-based, precision network emulator designed to meet the stringent requirements associated with applications requiring high accuracy, such as O-RAN fronthaul testing. The Network Emulator can apply line-rate network impairments on Ethernet links at 100GbE, 25GbE, and 10GbE. The SNE Ignite features:

- **Low intrinsic latency:** many fronthaul links, depending on O-RAN device classification, can be intolerant to delays as low as 8 µs.
- **Low Packet Delay Variation (PDV):** ensures that PTP synchronization is not affected.
- **Low Maximum Time Interval Error (MTIE):** guaranteed clock stability and precise synchronization.
- **PTP Transparent Clock (TC):** integrated one-step TC means that data flows can be separated and impaired independently without affecting synchronization, regardless of packet size.
- **Nanosecond accuracy:** means precise, repeatable testing.
- **SyncE and External Clock input:** SyncE passthrough with or without External Clock synchronization.
- **Multi-port:** enabling testing of multiple devices or links simultaneously; supports up to eight 100GbE/25GbE/10GbE ports.



Key Highlights

- **Full line-rate network emulation:** prove 100GbE, 25GbE and 10GbE device and infrastructure performance with full line-rate network simulation.
- **Precision emulation:** delivers high accuracy with nanosecond resolution and repeatability, ensuring faithful reproduction of network conditions.
- **Delay at line-rate:** of up to 320ms at 100GbE and up to 42 seconds at reduced bandwidth with Extended Delay Option.
- **SyncE Pass-Thru mode:** maintains SyncE clock link between devices.
- **PTP Transparent Clock (TC):** integrated one-step TC means that data flows can be separated and impaired independently without affecting synchronization, regardless of packet size.
- **Software upgradeable:** to 100GbE interface speed option — protecting your investment.
- **Configurable:** as two, four, six or eight 100GbE/25GbE/10GbE ports — scale as/when needed.
- **Cost-efficient:** supports multiple concurrent users with isolation through port reservation.
- **Automation:** using Local Timeline Option or RESTful API.

Applications

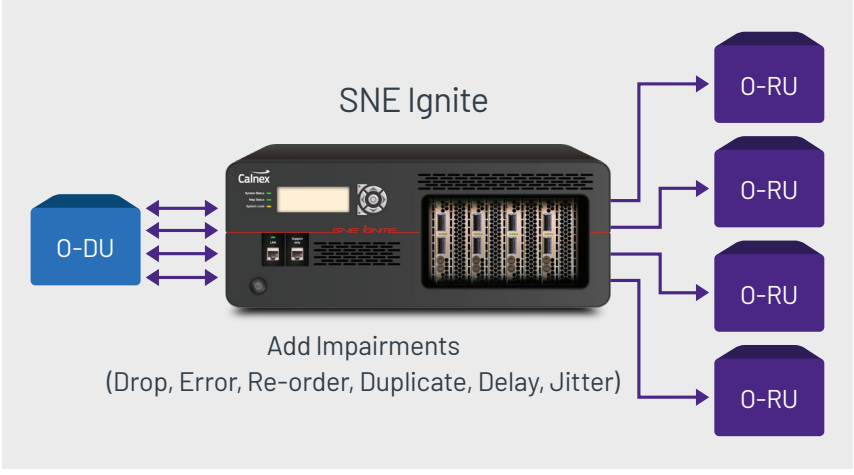
The SNE Ignite is a total solution to the problem of real-world Ethernet testing. It combines comprehensive and highly-accurate network emulation for:

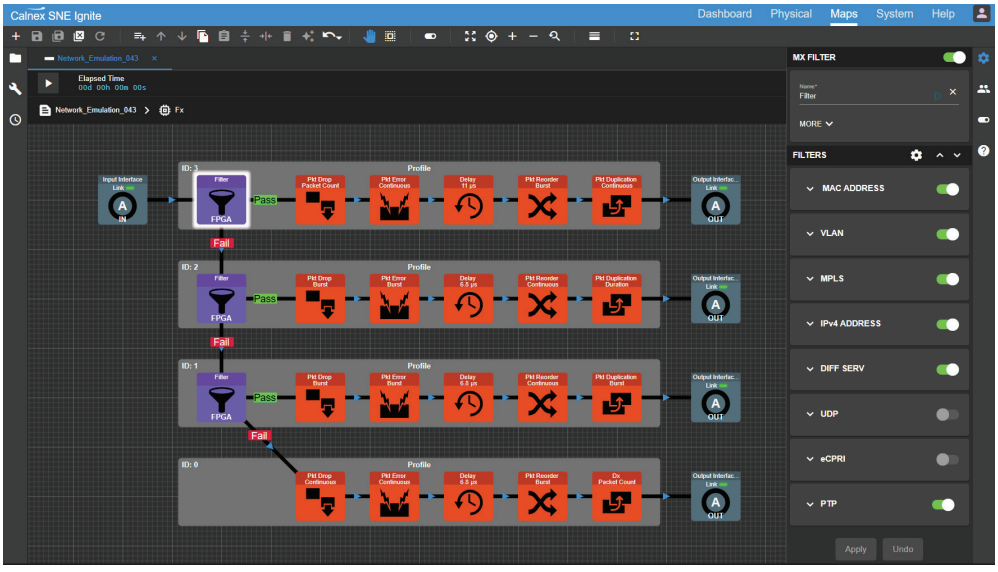
- O-RAN fronthaul (O-DU to O-RU) test
- O-RAN midhaul (O-CU to O-DU) test
- 5G Mobile Edge Computing (MEC)
- 5G Core and backhaul
- Datacenter interconnect / migration
- Cloud migration planning
- Telecom / Federal applications
- Defense applications
- Customer Proof of Concept (PoC)
- SLA verification
- IPTV, video

Features

The SNE Ignite is available with the following:

- Extensive and powerful set of filters to configure packet impairments.
- Drop, error, delay, re-order or duplicate packets.
- Web-based UI and graphical user interface.
- FPGA architecture for high accuracy and throughput.
- Local automation and RESTful API.





SNE Ignite's graphical map-based WebUI interface feels instantly familiar, intuitive, and simple to navigate.

Technical Specifications

Ports	
Optical Interfaces	100GbE: QSFP28 (LR4/SR4) – 2, 4, 6 or 8 ports (optional) 25GbE: SFP28 (SR/LR) – 2, 4, 6 or 8 ports (optional) 10GbE: SFP+ (SR/LR) – 2, 4, 6 or 8 ports (optional) At least one of the 100GbE or 25GbE options must be ordered. Optical Adaptors are provided to convert QSFP28 to SFP28 for 25GbE, and QSFP28 to SFP+ for 10GbE.
Forward Error Correction (FEC)	100GbE NRZ: RS (528,514) KR4 25GbE NRZ: RS (528,514) KR4 FEC can be disabled at 25GbE
Clock Reference	Internal or External (10 MHz)
SyncE Pass Thru	Clock can be recovered on one port and passed transparently to another.
Passthrough Pause Frames	As defined within IEEE 802.3x standard.
Passthrough PFC Frames	As defined by the 802.1Qbb standard.
Flows	
Impairment Profiles	25GbE/10GbE: 16 profiles allowing 8 flows of impaired packets in each direction. Each profile can be configured individually. 100GbE: 8 profiles allowing 4 flows of impaired packets in each direction. Each profile can be configured individually.
Filtering	Powerful user-configurable filters including ranges and wildcards: • MAC Source and Destination Address, Length/Type • VLAN (Priority, VLAN ID & Type), Custom VLAN • Custom VLAN Length, Offset, Mask, Value • MPLS Label, CustomMPLS • Custom MPLS Length, Offset, Mask, Value • IPv4 Source and Destination Address • IPv4 Version No, DiffServ/ToS, Protocol • IPv6 Source and Destination Address • UDP/TCP Source port, Destination port • Custom L3 Length, Offset, Mask, Value • Custom L4 Length, Offset, Mask, Value • Custom L5 Length, Offset, Mask, Value
GTPv2	Targeted GTPv2 control message impairments (e.g. create session request, modify bearer request, etc.) • GTPv2 Version, Type, Tunnel EndPoint ID

Technical Specifications cont

Flows cont	
GTP Filter	Targeted GTP control message impairments (e.g. create session request, modify bearer request, etc.) • GTP Version (v1, v2), Type, Tunnel EndPoint ID
eCPRI Filter	Targeted eCPRI impairments • eCPRI Revision, Concatenation Indicator, Message Type, Encapsulation
RoE Filter	Targeted RoE (Radio over Ethernet) impairments • Message Type, Flow ID, Length, Ordering Info
PTP Filter	Layer 2 Ethernet, Layer 3/4 UDP IPv4
PTP Transparent Clock	1-step Transparent Clock • The residence time is measured and placed in the PTP event message correction field.
General	
Web Browser User Interface	Drag and drop user interface. Intuitive user interface allowing user to draw out their target network on screen, add impairments as required and visualize the network-under-test.
Local Automation	Timeline Option enables local configuration automation to a 1s resolution.
Remote Control	RESTful API enables full remote control.
Smart Start-up	Automatically launch previous map on boot.
Multi-user Support	Multiple users, share maps, assign ports to individual users.
Impairments	
Packet Corruption	The following corruption impairments can be applied to packets: • Dropped packets • Errored packets • Duplicated packets • Re-ordered packets Mode (applies to all corruption impairments): burst (1 – 10,000), rate (0.00001 to 100%). Continuous or On/Off/Repeat (applies to all packet types) based on time or number of packets.

Technical Specifications cont

Impairments cont.	
Latency/Delay and PDV/Jitter	• Constant Delay • Gaussian distribution of jitter • Gamma (internet) distribution of jitter • Uniform distribution of jitter • Step distribution of jitter • Import from an external file • Jitter range from 1 µs to 400 ms; step size is 1 ns • Add independent delay/jitter distribution to each profile simultaneously • Readout of Max, Min Jitter and Max Delay for the applied distribution
Timeline	Easy automation via the Web UI without scripting or the need to learn Remote Control commands. This (auto-change) feature allows the user to easily automate emulation and schedule changes to emulation settings via the user interface with no manual intervention required. Users can loop the timeline for continuous playback.
Minimum Delay Emulation (Intrinsic Delay)	• 6.8 µs at 10GbE • 6.8 µs at 25GbE • 6.8 µs at 100GbE • 14 µs at 10GbE (Jumbo Frame Mode) • 8.85 µs at 25GbE (Jumbo Frame Mode) • 8.85 µs at 100GbE (Jumbo Frame Mode)
Maximum Delay Emulation	Line rate delay: Full line-rate delay of • 80 ms at 100GbE • 320 ms at 25GbE • 750 ms at 10GbE Delay Resolution: 1 ns.
Maximum Extended Delay Emulation	Extends line-rate delay to: • 320 ms at 100GbE • 1280 ms at 25GbE • 3200 ms at 10GbE Extended Delay: up to 22 s (all rates at 1G reduced bandwidth). Extended Delay: up to 42 s (all rates at 500M reduced bandwidth). Delay resolution: 1 ns.
Link Flap	Enables the port administrative state to be cycled up/down, down/up, available via the RESTful API.

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