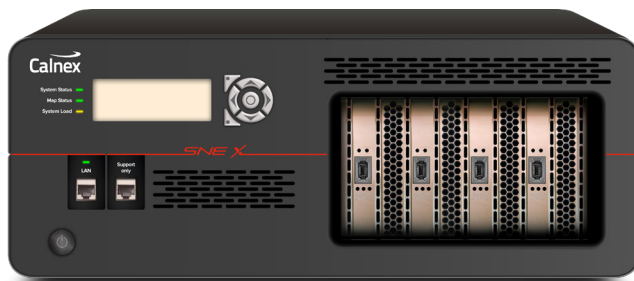


# The World's First 400G Network Emulator

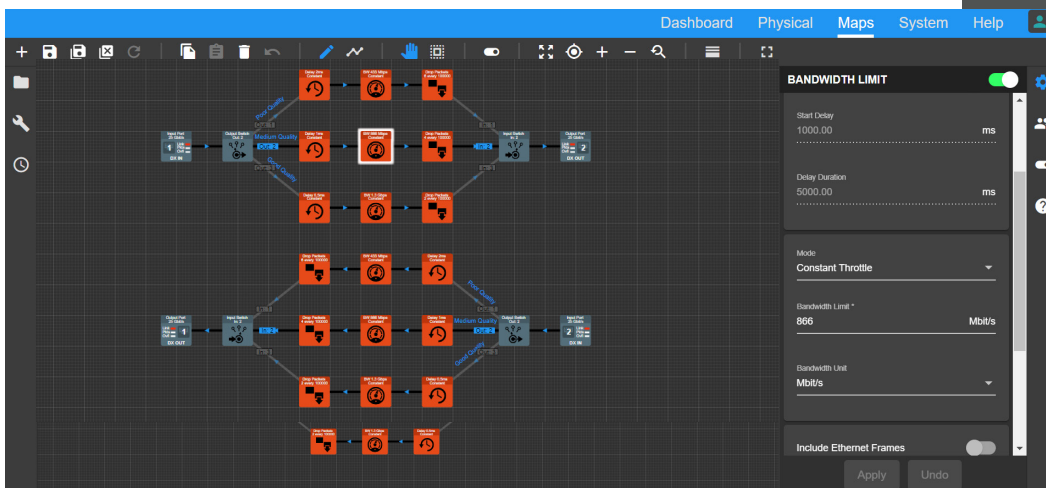
## Accurately replicate real-world network conditions to optimize AI performance in your lab

Networks and applications require robust, real world testing to give confidence before deployment. The Calnex SNE-X is a multi-port, high-performance network emulator designed to drive product quality and reduce the cost of test with rigorous, scalable test capability. The SNE-X has the ability to inject failure conditions onto a link, such as delay, jitter and packet loss, or accurately model the performance of various network topologies. The Calnex SNE-X offers:

- **Up to 4 ports** – allows network impairment.
- **Low intrinsic latency** – maximum intrinsic latency of 20µs is ideal for simulating throughput-sensitive applications.
- **High performance backplane** – allows simultaneous testing with Any Port to Any Port™.
- **Advanced network modelling** – recreate a timeline of network performance to replay a real failure scenario, or emulate ever changing conditions.
- **RDMA/RoCEv2 support & filtering** – impair RoCEv2 traffic independently, enabling precise testing of latency-sensitive, high-throughput workloads.



The SNE-X provides industry-leading flexibility in building and modelling complex, real-life systems enabling you to simulate networks and emulate the real-world conditions under which applications and platforms need to perform.



## Applications

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

### 5G

- Mobile Edge Computing
- Backhaul
- Midhaul

### Data Center

- Interconnect
- Management
- Migration
- Ultra Ethernet Testing

### Cloud

- Infrastructure
- Application testing
- Device testing
- AI Workloads

The flexible Web UI enables you to drag and drop from the extensive list of impairments into your network “map” to create a range of impairment scenarios that can run simultaneously for fast, high-volume test.

Technical Specifications	PRODUCT RANGE 400G
<b>Physical</b>	
Network Interfaces	up to 4
Standard Network Interfaces	OSFP
Max. Packet Rate Per Port (bi-directional)	SNE's 400G platform is being continually upgraded to meet the latest performance demands of 400G testing environments. Please contact your Calnex Solutions sales representative for further information
Dimensions	4u Rack
Intrinsic Latency	<20µs
Max. Frame Size — Jumbo Mode 9219 bytes; Non-jumbo Mode 1542 bytes	✓
RDMA / RoCEv2 Support	✓
<b>General</b>	
Timing Precision	10µs
Any Port to Any Port™ Packets can be sent between any port for complete flexibility	✓
Live Changes — Real-time modification of any impairment setting	✓
Traffic Capture and Replay with Looping Option Volatile Storage (20G RAM) Non-volatile Storage (1TB SSD)* *Max Traffic Capture Rate 1Gb/s	✓ optional
Bi-directional, Independent Emulations	✓
Timeline — Schedule changes to emulation settings with no manual intervention required. Option: loop timeline for continuous playback	✓
Link Flap	✓
<b>Delay Emulation — up to 4s at 25GbE; up to 4s at 10GbE; up to 10s at 1GbE; up to 30s (all rates at reduced bandwidth)</b>	
Delay Emulation (at reduced bandwidth) - up to 650ms	✓
400GbE Extended Delay Emulation — up to 2.714secs	optional
Fixed Latency	✓
Variable Latency	✓
Ramp	✓
Normal / Gaussian	✓
Sinusoidal Wave	✓
Jitter — 0.1ms to 100ms or 0.1 to 100% of constant delay	✓
Timing Constraints (specify start and duration of impairments activity) Start / Duration 0.01ms to 360,000ms (in 0.01ms increments)	✓

Technical Specifications (cont'd)	PRODUCT RANGE 400G
<b>Bandwidth Emulation (with user configurable buffer size up to 20Mbytes for video)</b>	
Constant Throttle	128bits/sec to 25G
Random Range (min to max with time constraints)	128bits/sec to 25G
Random Range Duration — 1000ms to 60 minutes (in 0.1ms increments)	✓
<b>Background Traffic Generation</b>	
Fixed Data Rate Generate broadcast packets Range (min to max with time constraints)	500byte/sec to 400G
Range Duration 1000ms to 360,000ms (in 1ms increments)	✓
<b>Reordering</b>	
Time Based Re-order Displace packet from 0.1ms to 500 ms	✓
Position Base Re-order Displace packet up to 10,000 places	✓
<b>Corruption</b>	
Bitflips Start and end position (first byte to last byte), 1 to 100%	✓
Byte Overwrites Start and end position (first byte to last byte), 1 to 100%	✓
Ethernet Fragmentation MTU: 68 to 9000	✓
Bit Error Rate (Per) Simulation x bits in y received (1 bit to IE+15)	✓
Enable/Disable FCS	x
<b>Duplication</b>	
Simple (single duplication) Packets received on link will be immediately duplicated once	✓
Timed (duplicated every x seconds) Single duplication after specified delay (1ms to 10,000ms)	✓
Complex (multiple, timed duplication) Specified multiple duplications after specified time delay (1ms to 1,000ms)	✓
<b>Loss</b>	
Standard — Drop x packets in y received	✓
Percentage — Drop 1% to 100% (in increments of 1%)	✓
Markov — 2-state random packet drop (as per ITU-T G.1050 Appendix II - Gilbert-Elliott model)	✓
Outage — Drop all packets received on specified link	✓
Drop Evenly — Packets will be dropped regularly throughout emulation	✓
Drops in Bursts — Packets will be dropped in continuous groups	✓
Timing Constraints — Start/Duration 0.01ms to 360,000ms (in 0.01ms increments)	✓

Technical Specifications (cont'd)	PRODUCT RANGE 400G
<b>Modification</b>	
Generic Packet Modifier — Modify up to 6 bit/byte sections per packet	✓
<b>Analysis (Extract analysis information from any part of the emulation)</b>	
Bandwidth Graph — Show bandwidth utilization — export, clipboard, peak, averaging, etc.	✓
Packet Rates — Show packet utilization, Inter Packet Gap	✓
RTP Analyzer — Output detailed information on RTP streams	optional
<b>Stateless load generation with multiple load distribution models</b>	
TCP Client — Simulate clients with data streams	optional
TCP Server — Simulate servers with data streams	optional
DDOS Simulation — Simulate extremely stressful DDOS environments	optional
<b>Audio Visual (AV) Pack</b>	
RTP Filter	optional
MPEG H.264 and H.265 Corruptor	optional
<b>Management</b>	
Drag and Drop User Interface — Simple User Interface, allowing user to draw out their target network on screen, drop impairments as required and visualise the network-under-test	✓
RESTful API for Test Automation	✓
Smart Start-up — Automatically launch previous map on boot	✓
<b>Filtering (UDP, TCP, Packet count)</b>	
Maximum Filter — Connect multiple filters in any way to create complex filter rules	unlimited
IP Source / destination address filtering (impair specific traffic flows)	✓
TCP — Advanced: Source and destination port filtering (including range) TCP Packet length filtering	✓
UDP — Advanced: Source and destination port filtering (including range) UDP Packet length filtering	✓
MAC Address — Src / Dst single or range	✓
Ethernet Payload	✓
Packet Counting — Fail or Pass packets based on packet count or percentage	✓
<b>Advanced Filtering</b>	
Generic Filter — Filter on multiple bit / byte values with logic operations	✓
IP Protocol — Payload Type and Value	✓
MPLS — MPLS Label, QoS Value, TTL Value	✓
RDMA / RoCEv2	✓
VLAN — VLAN ID, User Priority	✓
MPEG Video	optional
RTP A/V	optional
<b>Reporting</b>	
Live Monitoring — Bandwidth monitoring, packets per second, interpacket gap, export to CSV max/average values, etc.	✓

Calnex Solutions plc is a global leader in Test and Measurement solutions for next-generation telecom networks. Our products help to prove new technologies for applications such as SD-WAN, DataCenters, Cloud/OTT, Broadcast Video, and AV/Video conferencing. For more information contact Calnex today:

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CX2031 v1.4