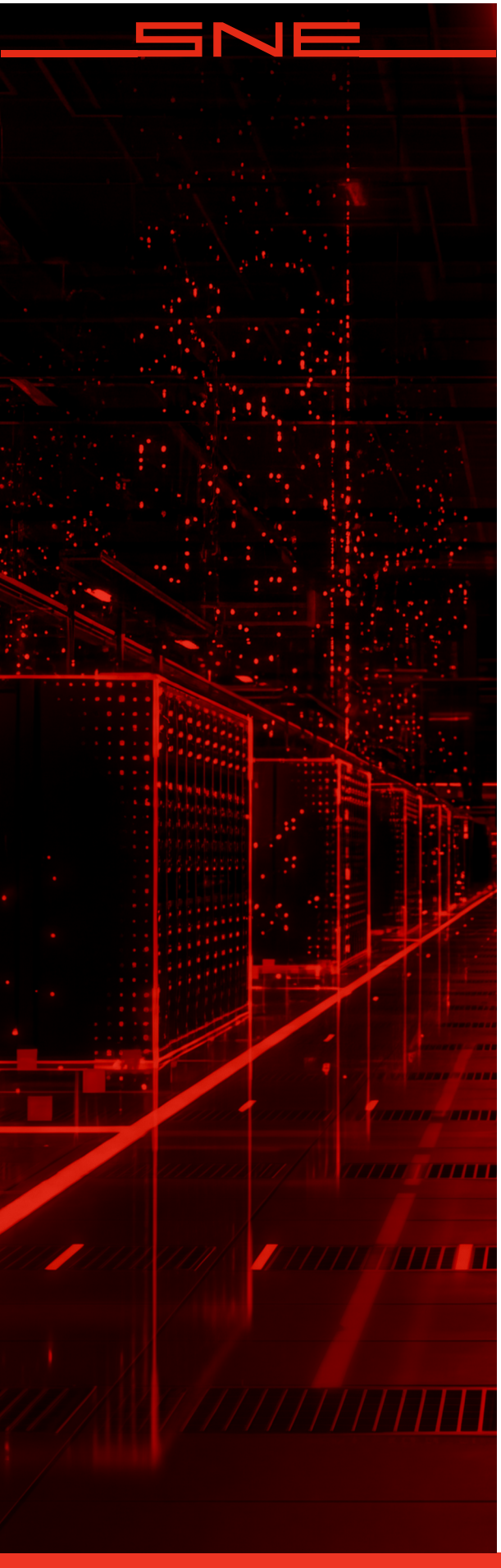
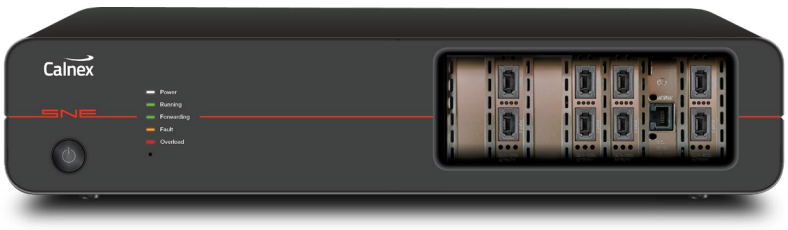


Get predictable infrastructure performance

Multi-port, multi-user network emulation and simulation

Calnex SNE offers industry's highest port density with interfaces from 1GbE to 25GbE



Calnex SNE

Key Highlights

- 25GbE, 10GbE and 1GbE interfaces supported
- Web-based user interface (Web UI)
- RESTful API for easy remote control in your automation environment
- Multi-user
- Multi-port – best-in-class port density with up to 8 ports 25GbE/ 10GbE, up to 16 1GbE
- Timeline feature for easy automation via the WebUI
- Connect any-port to any-port without limitations
- Delay emulation up to 30 seconds
- Over 55+ impairments and tools
- Audio and video MPEG (H.264 & H.265) modification and corruption
- Packet fragmentation and reordering
- Includes generic full packet inspection and filtering
- Packet modification; change any bits or bytes of any packet
- Load generators
- Non-volatile capture and replay
- Link flapping
- Markov random packet drop
- 20Mbyte bandwidth throttle buffer for video applications
- Automated 5G network model
- Personalised User Annotations

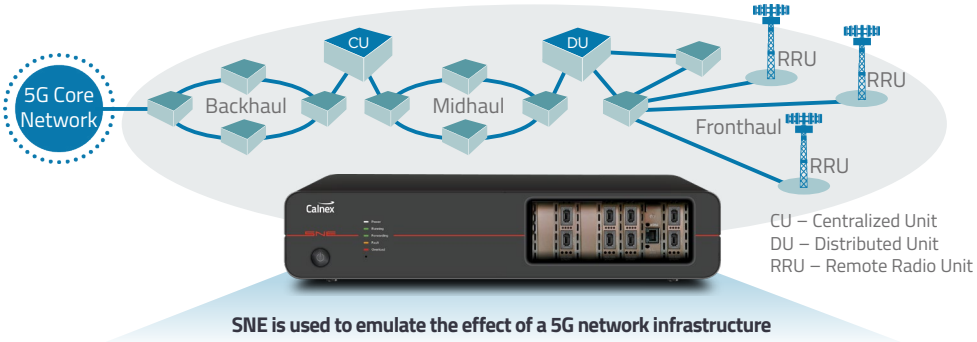
Test with real-world network conditions in your lab with the Calnex SNE network emulator

Real-life networks are a complex system of changing conditions, flexible routes and competing applications. And the only way to get predictable infrastructure performance is to test before deployment.

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

Automated tests with a real 5G transport nework model

5G networks will be used to support numerous new applications and these need to be tested under realistic test conditions. The SNE has a 5G dataset modelled from real data collected by major carriers to enable fast and accurate application testing using common real-world 5G conditions



SNE is used to emulate the effect of a 5G network infrastructure



Easy-to-use visual graphics via web user interface

The Calnex SNE now has a Web User Interface (Web UI). You can simply control your Network Emulator from your web browser on your PC or tablet. No longer do you need a separate client GUI to be downloaded onto your PC and of course you no longer need to worry if the client GUI on your PC is compatible with the instrument software on your Network Emulator.

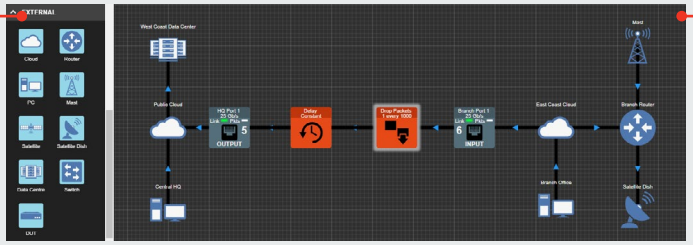


The flexible Web UI enables you to drag and drop from the extensive list of impairments into your network "map" to create specific impairment scenarios to meet your testing needs.

The SNE 's Web UI utilises the same unique graphical design that's used to build network emulation "maps" in the previous GUI. So, if you know how to use the previous Calnex SNE user interface then you will know how to use the new Web UI. If you've never used Calnex SNE before then you will still find the Web UI very easy to use. The SNE Web UI provides a unique visual graphical means of building network emulations. You can take full control by linking together impairments in the order required and directly controlling the flow of packets around the simulated network.

Same Intuitive Drag and Drop functionality

All tools are housed in sidebar menus. Simply drag what you need onto the map area to build your test scenario. Copy and Paste enables whole sections of maps to be replicated easily.

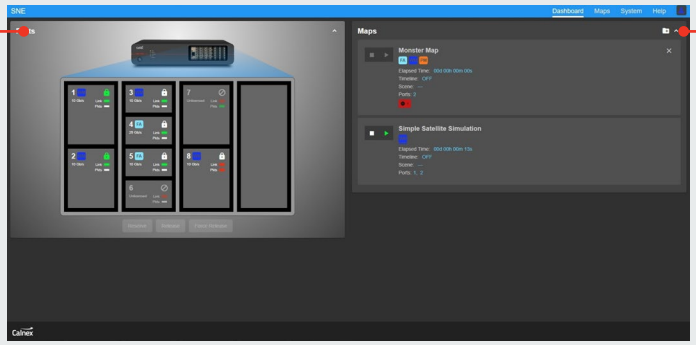


New User Annotations

Users can now personalise their Maps by adding Annotations to the Map end points. Multiple Annotations can be added and named to represent the users' own devies or locations.

Dashboard view - with Ports & Map Summary

Lets you view and reserve ports and run/stop selected maps.



Ports view provides information on port configuration, active ports, data rates and link status as well as information on which ports are assigned to which user.

Map Summary lists user selected maps and enables user to run/stop selected maps for the dashboard view.

Use Calnex SNE to test:

- SD-WAN
- Cloud computing/data center migration
- Broadcast quality video networks – SMPTE
- AV/Video conferencing
- Video/voice applications (IPTV, VoIP, etc.)
- Mobile subscriber networks (VoLTE, eMBMS, etc.)
- Content delivery networks
- CoS/QoS levels
- WAN acceleration/network optimisation
- LAN/WAN enterprise networks
- ADSL/FTTH
- SLA verification
- ITU-T Y.1731/IEEE 802.1ag operations and maintenance
- Satellite links
- Storage networks
- Telecom/Federal network applications
- Carrier Wi-Fi
- Cable/broadband networks
- Microwave
- Wifi and Wimax
- RoIP
- GPRS, 3G, 4G and 5G
- DSL, ADSL and XDSL

Extreme flexibility – multi-port and multi-user

The Calnex SNE is a highly flexible solution for both network emulation and network simulation. Whether you want to emulate point to point links, simulate complex data-centers with multiple gateways or extract out analytical information on video systems, with the SNE you can build your network in seconds.

And because every network and project requirement is different – depending on factors such as location, connectivity, quality of service, number of services and the applications being used across it – reaching beyond simple delay, jitter and bandwidth emulation is essential for any business.

Further, the SNE offers a multi-user, multi-port environment. Each user can be allocated a pair of ports, or a number of ports for their own exclusive use. This ensures a very cost effective and flexible means of providing test resources to a team or department.

Applications

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

Troubleshoot
Investigate reported problems and test resolutions without disrupting production traffic. Moreover, test specific scenarios and gain insight and data about where and when problems arise to identify effective resolutions before they become live issues.

Design networks
Create 'what if?' scenarios to evaluate network changes; evaluate different topologies and technologies before expensive implementation. For example, evaluate WAN Acceleration Technology by determining how different WAN optimisation products will perform under the best/average/worst conditions of your network.

Test application performance
Determine how your software will perform for the end user on their network before deployment; troubleshoot and resolve issues before the need for re-work, release delay or failure.

Optimise performance
Adjust application and software settings under replicated network characteristics to optimise performance for different user groups.

Emulate Real Network Conditions

- Busy peak times
- Long distance
- Jittery connections
- Duplication of data
- Fragmentation of data
- Traffic re-routing
- Limited bandwidth
- Packet corruption
- De-sequencing of data
- Network traffic bursts
- Partial or total outage
- Back-up switchovers
- Network congestion

Key features

Calnex SNE is available with the following:

- Multi-port — market leading port density with up to 8 ports 25GbE, up to 16 ports 10GbE/1GbE.
- Flexible configuration — mix and match interface cards to meet your needs
- Flexible interfaces; SFP28, SFP+ or RJ-45 (or a mixture)
- Timeline feature for easy automation via the Web UI without scripting or the need to learn Remote Control commands
- Wireshark integration
- Easy automation via remote control using RESTful API
- Flow packets between any port, no limitations
- Up to 12 minutes of storage for wire-rate recording at 10Gbps
- Delay emulation up to 30 seconds
- Fast visual emulation design creates networks in seconds

Wire rate

The SNE supports wire rate performance. All 10GbE ports are dual rate, supporting 10GbE and 1GbE operation. All 25GbE ports are multi-rate, supporting 25GbE, 10GbE and 1GbE operation. This makes the SNE very flexible and can be tailored to your individual throughput needs.

"Any port to any port"™ capabilities

The SNE comes with true "Any Port to Any Port"™ capabilities. Whether you are using 4, 8 or 16 ports they will all communicate with each other without limitation.

Many emulate products may state you are buying a '4 port emulator' but often what you actually get is two 'emulators' each with two ports inside a single box. There may be four ports on the outside, but the reality is that you have two independent emulators and you won't be able to send packets between each. So effectively you have got two emulators with two ports, not the four ports you need.

Fragmentation and reordering

When packets cross network boundaries they can become fragmented. The SNE can fragment packets to simulate MTU changes down to 68 bytes. Packets can also be reordered either by displacing the packets "X" number of frames or time into the future.

Load generation

Very few networks are silent as there is always a certain amount of background traffic. Whether it is file servers, printers or other devices generating traffic, it is important to model this correctly.

The SNE provides a number of ways of generating this traffic including background traffic generation (contention), TCP load generators, PCAP file replay, etc.

Video and audio

Dedicated impairments allow smart degradation of video (H.264 and H.265), audio streaming, RTP, RTCP and much more. Understand how robust your AV equipment is to corruption of video or audio framing and view analytics information on video format internals.

Impairments

The SNE provides all the common impairments including delay, jitter, throttle, and so on. Furthermore, it also provides advanced impairments including fragmentation, video corruption, BER corruption, reordering and many more.

Switchover and back-up circuits

Built on top of our powerful filtering system, you can easily simulate multiple paths in any network and switch between them in real-time (or using an external trigger). This allows you to model a "good" and "poor" network and switch between them in real time, plus you can create an unlimited number of paths.

contd. overleaf

Key Features contd.

Comprehensive settings

Not only are there 55+ impairments, but each one of those impairments has extensive options and settings to uniquely control their operation. This gives you an unparalleled level of fine tuning such as buffer and burst management on bandwidth throttles, or affecting only B-Frames in H.264 video streams.

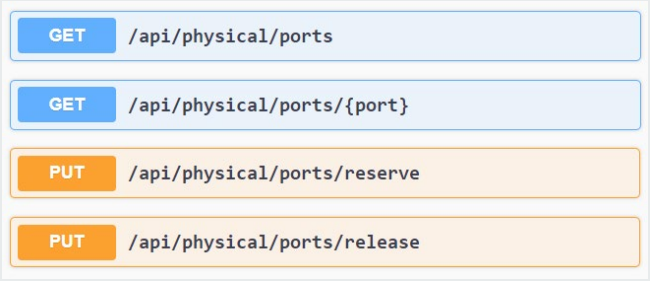
Filtering

It's very important to be able to identify and target certain streams of data on an emulated network. The SNE provides a host of built-in filters to identify packets for impairment or analysis. Moreover, you can join filters together to create more complex filters (for example, you could find HTTP traffic going to Port 8080 on VLAN ID 90 with only two filters).

Easy automation

We understand that everyone's automation environments are different. The SNE can be controlled externally through a variety of methods. A RESTful API is provided offering powerful and efficient web-based automation. The RESTful API provides an easy automation and scripting environment via remote control.

The RESTful API provides the ability to start / stop maps, change impairment settings on-the-fly, link flapping and much more.



RESTful API - for easy automation and scripting



The SNE also comes with a very useful and easy to use timeline (auto-change) feature which allows the user to easily automate emulation via the Web UI without having to learn or develop scripts.

Technical Specifications

	PRODUCT RANGE		
	1G	10G	25G
Physical			
Number of ports per card	4	2	2
Maximum number of ports per SNE (4 full slots)	16	8	8
Supported Rates	10 Mbit/s, 100 Mbit/s, 1 Gbit/s	1 Gbit/s, 10 Gbit/s	1 Gbit/s, 10 Gbit/s, 25 Gbit/s
Interface	RJ45 (GbE Copper)	SFP+	SFP28
Dimensions	2u Rack	2u Rack	2u Rack
Max packet rate per port (Bi-Directional)	2.96 million packets	29.6 million packets	74.4 million packets
Max. Frame Size — Jumbo Mode 9219 bytes; Non-jumbo Mode 1542 bytes	✓	✓	✓
General			
Dimensions (WxDxH)	445x365x89 mm (to fit 2u Rack)		
Intrinsic Latency (Single Direction)	<10µs		
Timing Precision	10µs		
Maximum Frame Size – Non-Jumbo Frame Mode	1542 bytes		
Maximum Frame Size – Jumbo Frame Mode	9219 bytes		
Any Port to Any Port™ packets can be sent between any port for complete flexibility	✓	✓	✓
Multi-user support — Unlimited users, share maps, assign ports to individual users	✓	✓	✓
Live Changes — Real-time modification of any impairment setting	✓	✓	✓
Bi-directional, Independent Emulations	✓	✓	✓
Link Flap — Ports can be cycled on/off to simulate Link Flapping	✓	✓	✓
Disable FCS recalculation — Generate CRC errors by disabling recalculation of Frame Check Sequence on egress	✓	✓	x
Hardware NTP Time Stamping — Lock hardware and packet timings to accurate internal / external clocks	✓	✓	✓
Delay			
Delay Modes — Constant, Gaussian, Ramp, Range, Sinusoidal	✓	✓	✓
Maximum Delay Emulation (Non-Jumbo Frame Mode)	1250ms at 1G	500ms at 10G	500ms at 25G
Maximum Delay Emulation (Jumbo Frame Mode)	1250ms at 1GbE	500ms at 10GbE	1250ms at 25GbE
Maximum Extended Delay Emulation (Non-Jumbo Frame Mode)	30000ms at 1GbE	4071ms at 10GbE	4071ms at 25GbE
Maximum Extended Delay Emulation (Jumbo Frame Mode)	7250ms at 1GbE	725ms at 10GbE	725ms at 25GbE
Bandwidth Limit			
Bandwidth Limit Threshold	8 bit/s to 25 Gbit/s		
Bandwidth Limit Modes — Constant Throttle, Random Range	✓	✓	✓

Technical Specifications contd.

	PRODUCT RANGE		
	1G	10G	25G
Packet Drop			
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)	✓	✓	✓
Packet Reorder			
Packet Distance — Min/max distance of 0 to 10000 packets	✓	✓	✓
Time — Min/max displacement of 0 to 500ms	✓	✓	✓
Jitter			
Jitter — Range 0.01 to 100 ms	✓	✓	✓
Packet Modifier			
Generic Packet Modifier — Modify any 1 to 4 bytes in packets and set to a specific value	✓	✓	✓
Bit Error Rate			
Error Range — Corrupt x bits in every y bits/kbits/Mbits	✓	✓	✓
Packet Corruption			
Overwrite Modes — Bitflips, Byte overwrite	✓	✓	✓
Corruption Level — 0.1 to 100% of packet	✓	✓	✓
Corruption Range — All contents of each packet, Start and end point within each packet	✓	✓	✓
Packet Duplication			
Duplicator Modes — Complex – multiple, timed duplication	✓	✓	✓
Duplicator Modes — Simple – 1:1 duplication of all packets	✓	✓	✓
Duplicator Modes — Duplication every x seconds	✓	✓	✓
Burst Packet			
Burst Modes — N Packets – Accumulates N packets before sending them in a burst	✓	✓	✓
Burst Modes — Timeout – Accumulates packets until the specified time has elapsed, then sends them in a burst	✓	✓	✓
Burst Modes — N Packets OR Timeout – Sends the accu- mulated packets when either condition is met	✓	✓	✓
Burst Modes — Packets AND Timeout – Sends the ac- cumulated packets when both conditions are met	✓	✓	✓
Packet Fragmentor			
Maximum MTU Range		68 to 9000 bytes	

Technical Specifications contd.

	PRODUCT RANGE All interfaces: 1G, 10G, 25G
MPEG Video Corrupter	
Video Format Codecs	0.01 to 100 ms
IDR Frame Corruption	For every x frames, corrupt y frames, affecting z% of the frame. Optionally drop n frames
Non-IDR Frame Corruption	Corrupt I, B and/or P frame
Checksum Correction	Fix IP Header Checksum Fix IP UDP Header Checksum
Decoder Notifications	Non RTP/MPEG packet received Frame with forbidden flag received Unsupported NAL frame received
Filters	
Maximum Number of Filters Per Map	Unlimited – Connect multiple filters in any way to create complex filter rules
Filter Types	
Pv4/IPv6 Address (Source and/or destina- tion, specific address and range)	✓
MAC Address (Source and/or destination, specific address and range)	✓
IP Protocol (Industry or user defined)	✓
VLAN (Single, range or multiple)	✓
UDP (With or without port)	✓
TCP (With or without port)	✓
RTP (Industry or user defined)	✓
RoCEv2 (IPv4/IPv6, OpCode, Queue Pair)	✓
MPLS (Label, QOS value, TTL value)	✓
Counting (Percent or x in y packets)	✓
Diff Serv (DSCP AF Type or TOS value)	✓
Payload (Industry or user defined)	✓
Generic (Any single or multiple bytes within packets)	✓
Packet Generation	
UDP Background Traffic	Constant or range Up to 10 Gbit/s Optionally send packets to broadcast address
TCP Server Generator	Specify TCP source/destination MAC and IP address Up to 10 Gbit/s Generate multiple streams
Traffic Replay	Replay from PCAP file Single replay or loop

* Max traffic capture

Technical Specifications contd.

	PRODUCT RANGE All interfaces: 1G, 10G, 25G
Analysis	
Bandwidth Graph	Show data rate over time Up to 1 hour sliding window Export as CSV file
Inter-Packet Gap Graph	Show average and/or min/max interpacket gap over time Up to 1 hour sliding window Export as CSV file
Packet Count Graph	Show number of packets per second over time Up to 1 hour sliding window Export as CSV file
Traffic Capture	Capture traffic as PCAP Total storage: 20GB volatile (RAM) or 1TB non-volatile (SSD) Capture file maximum size: RAM – 20GB, SSD – 524GB*
Wireshark	Capture traffic directly to Wireshark Max traffic capture rate 1 Gbit/s
Remote Control	
RESTful API	Easy remote control of impairments in an automation environment
Timeline	Schedule changes to impairments with no manual intervention required
Timing Constraints	Specify start and duration of individual impairments activity

Calnex Solutions 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 on Calnex's network emulation products, and to take advantage of our extensive experience in network emulation test, contact Calnex Solutions today:

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