Calnex **SNE**

Calnex
Insight and Innovation

Get predictable infrastructure performance

with industry's highest port density

Multi-port, multi-user network emulation and simulation

Test with real-world network conditions in your lab

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.

Extreme flexibility – multi-port and multi-user

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

Key highlights

- Multi-user
- Multi-port - best in class port density with up to 16 ports 1GbE and up to 12 ports 10GbE
- 1GbE, 10GbE and 25GbE*/40GbE* interfaces supported
- Network simulation – create complex multi-hop networks using Virtual Routers for cloud, data-center, customer and WAN simulation
- Connect any-port to any-port without limitations
- Delay emulation up to 10 seconds
- Over 55+ impairments and tools
- Audio and video 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.

Calnex SNE is available with multiple hardware options, including:

- Multi-port - market leading port density with up to 16 ports 1GbE and up to 12 ports 10GbE
- Flexible configuration - mix and match interface cards to meet your needs
- Flexible interfaces; RJ-45 or SFP+ (or a mixture)
- Wireshark integration
- Easy Automation via Remote Control API
- Flow packets between any port, no limitations
- Up to 12 minutes of storage for wire-rate recording at 10Gbps
- Delay emulation up to 4 seconds at 10GbE/1GbE
- Fast visual emulation design creates networks in seconds.

(*) Future release

Visual design

Using Calnex SNE's unique visual design to build emulations, you take control by linking together impairments in the order you require while directly controlling the flow of packets around your simulated network.

The user interface (UI) runs on Windows, Linux or Mac and provide a fast and responsive environment for you to build emulations. The flexible UI enables you to drag and drop from the extensive list of impairments into your network to create specific scenarios to meet your testing needs.

Applications

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:

Design networks:
'What if' scenario building to evaluate network changes - evaluate different topologies and technologies before expensive implementation. For example, evaluate WAN Acceleration Technology by determining how different WAN optimization 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.

Optimize performance:
Adjust application and software settings under replicated network characteristics to optimize performance for different user groups.

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.

Use Calnex SNE to test:

- Video/voice applications (IPTV, VoIP, etc.)
- Mobile subscriber networks (VoLTE, eMBMS, etc.)
- Content delivery networks
- Cloud computing/migration
- CoS/QoS levels
- WAN acceleration/network optimization
- 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 WiFi
- Cable/broadband networks.

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.

Accurately simulate:

- VoIP
- Microwave
- T1 and T3
- WiFi and WiMAX
- Satellite
- OC-3
- E1 and E3
- RoIP
- Cloud
- 3G and 4G
- GPRS
- Dial Up
- DSL, ADSL and XDSL.

Key Features

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

"Any Port to Any Port"™ Capabilities
Calnex 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. Calnex SNE can fragment packets to simulate MTU changes down to 64 bytes. Packets can also be reordered either by displacing the packets "X" number of frames or time into the future.

Automation Ready
We understand that everyone's automation environments are different. Calnex SNE can be controlled externally through a network of methods. You are provided with a CLI application (Windows, Linux or Mac) for controlling execution from the command line. Whilst developers can directly issue XML requests to the emulator to gain deeper and full control of its operation.

Load Generation
Very few networks are silent; 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.

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

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.

Video and Audio
Dedicated impairments allow smart degradation of video (H.264), 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
Calnex SNE provides all the common impairments including delay, jitter, throttle, etc. Furthermore, it also provides advanced impairments including fragmentation, video corruption, BER corruption, reordering and many more.

Comprehensive Settings
Not only do we include 55+ impairments with our emulators, 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. Calnex 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).

Flexible UI with Wizards and Easy Licensing
The user interfaces runs on Windows, Linux or Mac and provide a fast and responsive environment for you to build emulations. We've included some handy wizards to help you quickly create example networks and which don't lock you down to restrictive licensing (plus, install them on as many machines as you want).

Virtual Routers
Routers effectively sit at the edge of most networks; they provide your ADSL connection in your business or accessibility to a cloud server through an ISP backbone.

Calnex SNE contains full Virtual Router simulation, providing a method for simulating multi-hop WAN networks. These Virtual Routers provide DHCP or Static IP address assignment, automatic and manual routing table and multiple virtual interfaces. They will respond to both local and WAN pings and provide detailed analysis on packets received.

They also include OSPF to allow for the simulation of complex ring, double ring and double star topology networks with the ability to self-heal when injected faults are detected.

Specifications

Technical specifications	PRODUCT RANGE		
	1G	10G	25G*/40G*
Physical			
Network Interfaces	up to 16	up to 12	TBD
Standard Network Interfaces	GbE Copper	SFP+	SFP28/QSFP+
Optional Network Interfaces	SFP+	SFP+	SFP28/QSFP+
Max. Packet Rate Per Port (bi-directional)	2.96 million	29.6 million	TBD
Dimensions	2u Rack	2u Rack	2u Rack
Intrinsic Latency	<20µs	<20µs	TBD
General (Refer to table on page 9)			
Timing Precision	10µs	10µs	10µs
Any Port to Any Port [tm] 4, 8, 16 ports – packets can be sent between each and any port for complete flexibility	✓	✓	✓
Live Changes Real-time modification of any impairment setting or network map	✓	✓	✓
Traffic Capture and Replay with Looping Option	optional	optional	optional
Bi-directional, Independent Emulations	✓	✓	✓
Timeline Schedule changes to emulation settings with no manual intervention required Option: Loop timeline for continuous playback	✓	✓	✓
Modes of Operation			
Virtual Routing (Simulate routers / ADSL Gateways) Protocols: DHCP, ARP, ICMP, IGMP, etc DHCP: Enable / Disable Routing Table: Auto generate, manual Multiple WAN Links	✓	✓	✓
Cloud / Data Center Simulation Simulate multi-hop routed networks OSPF Support for self healing and Internet simulation	✓	✓	✓
Bridged Mode Option to impair all traffic sent and received (protocol filtering available)	✓	✓	✓
Delay Emulation – 0 ms to 4 secs at 10GbE; 0ms to 10secs at 1GbE			
1GbE Delay Emulation - 0ms to 1.25secs	✓	✓	✓
10GbE Delay Emulation - 0ms to 0.5secs	✓	✓	✓
1GbE Extended Delay Emulation - 0ms to 10secs	optional	optional	optional
10GbE Extended Delay Emulation - 0ms to 4secs	optional	optional	optional
Fixed Latency	✓	✓	✓
Variable Latency	✓	✓	✓
Ramp	✓	✓	✓
Normal / Gaussian	✓	✓	✓
Sinusoidal Wave	✓	✓	✓
Jitter 0.1 ms to 100 ms or 0.1 to 100% of constant delay	✓	✓	✓
Timing Constraints (Specify start and duration of impairments activity) Start / Duration 0.1 ms to 360,000 ms (in 0.1 ms increments)	✓	✓	✓

✓ **Provided as Standard**

(*) Future release

Technical specifications (continued)	1G	10G	25G*/40G*
Bandwidth Emulation			
Constant Throttle	500 bps to 1 Gbps	500 bps to 10 Gbps	TBD
Random Range (min to max with time constraints)	500 bps to 1 Gbps	500 bps to 10 Gbps	TBD
Random Range Duration 0.1 ms to 10 minutes* (in 0.1 ms increments)	✓	✓	✓
Background Traffic Generation			
Fixed Data Rate: 500 bps to 40 Gbps Percentage of available link: 1 to 99% Generate broadcast packets Range (min to max with time constraints)	500 bps to 1 Gbps	500 bps to 8 Gbps	TBD
Range Duration 0.1 ms to 360,000 ms (in 0.1 ms increments)	✓	✓	✓
Reordering			
Time Based Re-order Displace packet from 0.1 to 500 ms	✓	✓	✓
Position Base Re-order Displace packet up to 1,000,000 places	✓	✓	✓
Corruption			
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: 128 to 1580	✓	✓	✓
Bit Error Rate (Per) Simulation x bits in y received (1 bit to IE-14)	✓	✓	✓
Enable/Disable FCS	✓	✓	✓
Duplication			
Simple (single duplication) Packets received on link will be immediately duplicated once	✓	✓	✓
Timed (duplicated every x seconds) Single duplication after specified delay (1 to 1,000 ms)	✓	✓	✓
Complex (multiple, timed duplication) Specified multiple duplications after specified time delay (1 to 1,000 ms)	✓	✓	✓
Loss			
Standard Drop x packets in y received	✓	✓	✓
Percentage Drop 0.1% to 100% (in increments of 0.1%)	✓	✓	✓
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 0.1 ms to 360,000 ms (in 0.1 ms increments)	✓	✓	✓

✓   **Provided as Standard**

(*)   Future release

Technical specifications (continued)	1G	10G	25G*/40G*
Modification			
Generic Packet Modifier Modify up to 6 bit / byte sections per packet	✓	✓	✓
TAP (Test Access Point) Devices (Extract analysis information from any part of the emulation)			
Bandwidth Graph Show bandwidth utilisation – export, clipboard, peak and averaging, etc.	✓	✓	✓
Packet Rates Show packet utilisation, Inter Packet Gap	✓	✓	✓
RTP Analyser Output detailed information on RTP streams	optional	optional	optional
RTCP Analyser Output detailed information on RTCP streams	optional	optional	optional
Stateless load generation with multiple load distribution models			
Generic/RAW Load Generator Generic any type of load with extensive stream options	optional	optional	optional
TCP Client Simulate clients with data streams	optional	optional	optional
TCP Server Simulate servers with data streams	optional	optional	optional
DDOS Simulation Simulate extremely stressful DDOS environments	optional	optional	optional
Audio Visual (AV) Pack			
RTP Filter	optional	optional	optional
MPEG H.264 Filter	optional	optional	optional
MPEG H.264 Corruptor	optional	optional	optional
G.1050 Wizard (TIA-921)	✓	✓	✓
Management			
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	✓	✓	✓
Open XML for Test Automation Easy integration with test environments to schedule, run and report on emulations without recourse to user interface	✓	✓	✓
Command Line Interface Powerful CLI (with source code) for Windows, Linux and Mac	✓	✓	✓
SNMP Operational based SNMP traps and alerts	✓	✓	✓
Smart Start-up Automatically launch previous map on boot	✓	✓	✓
Multi-User Support Unlimited users / GUI instances, share maps, admin password control, assign ports to individual users	✓	✓	✓
Hardware NTP / PTPv2 Time Stamping Lock hardware and packet timings to accurate internal / external clocks	✓	✓	✓

✓   **Provided as Standard**

(*)   Future release

Technical specifications (continued)	1G	10G	25G*/40G*
Filtering (UDP, TCP, Packet count)			
Maximum Filter Connect multiple filters in any way to create complex filter rules	unlimited	unlimited	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) TCP Packet length filtering	✓	✓	✓
MAC Address Src/Dst single or range	✓	✓	✓
Ethernet Payload	✓	✓	✓
Packet Counting Fail or Pass filters based on packet count or percentage	✓	✓	✓
Advanced Filtering			
Generic Filter Filter on multiple bit / byte values with logic operations	✓	✓	✓
IP Protocol: Payload Type and Value	✓	✓	✓
MPLS: MPLS Label, QoS Value, TTL Value	✓	✓	✓
VLAN: VLAN ID, User Priority	✓	✓	✓
MPEG Video	optional	optional	optional
RTP A/V	optional	optional	optional
Flow Control (simulation link switching)			
Output Switcher: Up to 4 available outputs	✓	✓	✓
Input Switcher: Up to 4 available inputs	✓	✓	✓
Merge Tool	✓	✓	✓
Network Analysis			
Latency Measurement Measure live hardware and network latency to microsecond levels	✓	✓	✓
Network Conditions Monitor Automatically build networks using any wireshark file	✓	✓	✓
Instancers (create unique impairments for hundreds of streams)			
VLAN Instancer	✓	✓	✓
MPLS Instancer	✓	✓	✓
Reporting			
Live Monitoring Bandwidth monitoring, packets per second, export to CSV max / average values, etc.	✓	✓	✓
Wireshark Integration (on up to 200 protocols) Allows for live traffic capture and root cause analysis; replay 3rd party traffic streams under impairments, record traffic and replay at a later date	✓	✓	✓

✓ **Provided as Standard**

(*) Future release

Port Configuration and Performance:

1. Select the number of SNE ports required at each interface rate.
2. The standard specification performance is labelled 'STD' in the configuration table below.
3. The high port count specification is labelled 'HPC' in the configuration table below.

Configuration Table

	10GbE/1GbE Optical Ports (SFP+)							
1GbE Electrical Ports (RJ45)	No. of Ports	0	2	4	6	8	10	12
	0		STD	STD	STD	STD	HPC	HPC
	2	STD	STD	STD	STD	HPC	HPC	HPC
	4	STD	STD	STD	STD	HPC	HPC	HPC
	6	STD	STD	STD	HPC	HPC		
	8	STD	STD	STD	HPC	HPC		
	10	STD	STD	HPC				
	12	STD	STD	HPC				
	14	STD						
	16	STD						

STD	Combination of 2-port 10G modules and 4-port 1G modules - "Standard" Performance specification
HPC	Combination of 4-port 10G modules and 4-port 1G modules -"High port count" performance specification

STD (Standard Specification)
- Wire Rate with 128 byte traffic on all ports (up to 8 10GbE ports)
- Wire Rate with 64 byte traffic on any 2 10GbE ports or all 1GbE ports.

HPC (High Port Count Specification)
- Wire Rate with iMix traffic on all ports (up to 12 10GbE ports)
- Wire Rate with 64 byte traffic on any 2 10GbE ports or all 1GbE ports.

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:
tel: +44 (0) 1506 671 416
email: info@calnexsol.com

calnexsol.com

Calnex
Insight and Innovation