

AI Infrastructure Validation Under Realistic Network Conditions

Validate bi-directional 400G AI traffic at full line rate

Maintain RoCE, PFC and DCQCN traffic behavior with transparent flow control

Emulate delay, drop, reordering, corruption, duplication and modification with precision

Optimize PFC for lossless Ethernet over scale-out clusters and long-distance DCI links



Calnex SNE Ignite 400G

Key Highlights

- **400G full line-rate validation**
  Validate AI and HPC traffic over a bi-directional 400G IP stream at full line rate.
- **Designed for RoCE and RDMA environments**
  Test RoCEv2 transport behavior, RDMA connection handling, timeout response, recovery, and retransmission performance under controlled network conditions.
- **PFC transparency for lossless Ethernet testing**
  PFC frames pass through transparently to preserve RoCEv2 congestion control and support realistic, synchronized, lossless test conditions
- **PFC tuning for DCI and scale-across AI clusters**
  Reproduce distance-induced delay in the lab to help tune pause thresholds, resume thresholds, and pause duration for long-haul and inter-DC links.
- **Controlled impairment testing**
  Apply realistic network impairments such as packet delay, jitter, drop, corruption, duplication, reordering, modification with L2/L3/L4 checksum regeneration.
- **Realistic AI cluster behaviour in the lab**
  Validate how AI infrastructure behaves beyond ideal conditions by applying controlled, repeatable impairments to representative 400G AI and RDMA traffic.

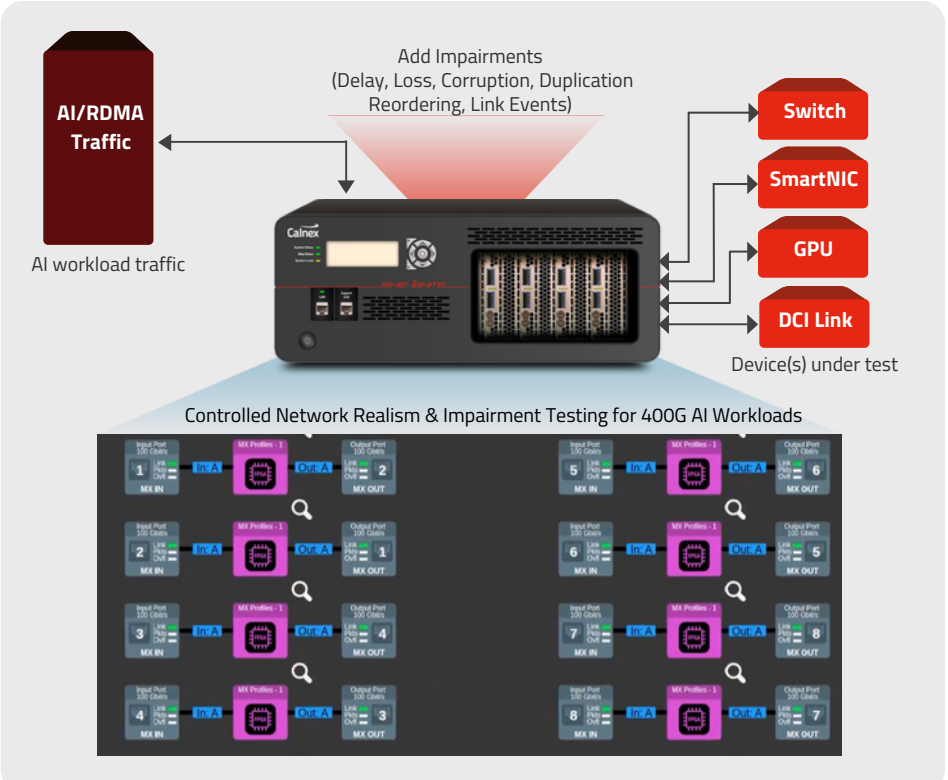
Test AI infrastructure under realistic 400G network conditions

ValidateAI/HPCworkloads,RoCE transport, PFCbehaviour,andlong-distance DCI links with precise, controlled, and repeatable network impairments in the lab.

AI infrastructure is highly sensitive to network performance. Even tiny faults can halt workloads across thousands of xPUs, delay job completion, trigger recovery from previous checkpoints, wasting hugely expensive compute resources. In these environments, the real validation challenge is quaranteeing performance under real-world network conditions where variable delay and packet reordering are commonplace.

Calnex Ignite 400G enables engineers to introduce controlled network realism into AI infrastructure validation. By applying precise and repeatable impairments to live AI traffic paths, teams can recreate adverse production-like conditions in the lab and reveal the subtle network behaviors that can break workload efficiency.

Designed for 400G AI backend and DCI environments, Ignite 400G enables realistic impairment emulation while preserving the native behavior of lossless Ethernet control mechanisms. This allows accurate validation of AI workloads, RoCE transport, congestion control, and PFC tuning under controlled delay, congestion, loss, path asymmetry, and link events across both scale-out and scale-across architectures.



Bring Real-World AI Fabric Conditions Into The Lab

AIfabrics behave differently fromtraditional enterpriseor telecom networks. GPU and xPU workloads can create intense, synchronized bursts, while RDMA transport places strict requirements on latency, ordering, congestion response, and packet delivery. Even small amounts of packet loss, delay variation, or poor congestion control can affect job completion time, fabric utilization, and overall workload efficiency.

As AI clusters scale, new failure surfaces emerge, requiring validation of the combined behaviour of high-radix leaf-spine fabrics, adaptive routing, flow distribution and load balancing, PFC backpressure propagation, ECN marking and DCQCN response, inter-datacenter latency and loss, all of which impact RDMA flow completion, throughput stability and tail latency.

PFC and congestion control testing

PFCand congestion control testing

DCQCN, on the endpoints, together with PFC and ECN on the switches, are central to maintaining high utilization and predictable behavior in best-effort, potentially lossy Ethernet fabrics. When configured correctly, these mechanisms help reduce congestion, protect no-drop traffic classes, and support efficient end-to-end throughput.

Because Calnex's Ignite 400G solution is designed to not terminate PFC frames, rather to be able to intercept and delay or otherwise impair them, engineers can validate XON/XOFF thresholds, pause duration, and buffer management behavior across network distances created by the emulator.



RDMA and RoCE protocol validation

RDMA is designedforhighefficiency andlow overhead, but it depends on a highly reliable transport. In RoCEv2 environments, engineers must validate congestion control, timeout behavior, retransmission handling, and recovery mechanisms before moving to full application-level AI testing.

Ignite 400G enables RDMA traffic to be tested at 400GbE with 100% throughput and zero loss. By understanding RDMA semantics and RoCE headers, the solution allows the protocol to be evaluated end to end under controlled network conditions.

Scale-across and DCI assurance

When AIclusters extendacrosslarger physicaldistances and multiple data centers, engineers need to understand how long-haul delay, packet loss, and congestion behavior affect performance, reliability, and PFC configuration.

Users can recreate long-distance link conditions in the lab without relying on physical fiber spools or hard-to-repeat field conditions. This makes it easier to isolate transport behavior, tune PFC parameters, and validate DCI scenarios under controlled and repeatable conditions.

Ultra Ethernet

UltraEthernet introduces new mechanisms for improving Ethernet performance, reliability, and efficiency in AI and HPC environments. These mechanisms must be validated against specifications and expected behavior before deployment, particularly where interoperability between endpoints, switches, and fabrics is required.

Ignite 400G provides controlled impairment capabilities that help engineers validate Ultra Ethernet mechanisms under realistic adverse conditions. By introducing repeatable delay, loss, corruption, reordering and asymmetry, teams can test recovery behavior, prove compliance, and validate interoperability.

Applications

Chip & Silicon

Accelerator, NIC, or switch silicon. Verify implementation, correctness, limits and performance of the algorithms and on-chip buffers.

Endpoint & NIC

Verify Smart NIC behaviour and its integrated parts altogether, including HW offloading and PFC.

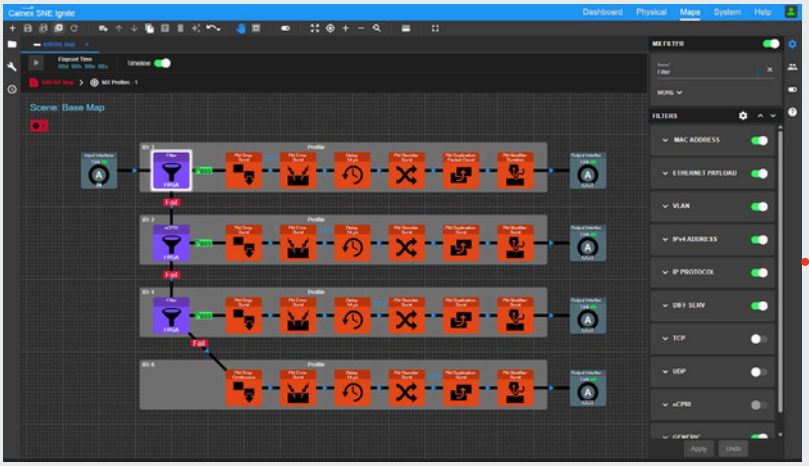
Fabric & Switch

Switch buffers/VOQ, hashing, forwarding, in-switch bandwidth allocation, and its behaviour in fan-in, blocking, or oversubscription scenarios. Validation and tuning of PFC thresholds and pause duration, SONiC testing. Link reliability and impact of flaps or DCI long haul delays.

Protocol

End-to-end validation of RDMA / RoCE transport and recovery behaviour. Verify that the protocol algorithms/ logic react correctly to delay, loss, reordering, timeout, and congestion signalling before moving to full AI application testing.

Easy-to-use visual graphics via web user interface



Ignite's 400G graphical map-based WebUI interface feels instantly familiar, intuitive, and simple to navigate

FPGA Architecture for Precision

Ignite400Grunsona purpose-builtFPGAarchitecture designed for high-speed, high-precision testing. This enables controlled impairment at 400GbE while maintaining full line-rate operation, 100% throughput, and zero loss traffic handling.

With precise timing control, low-latency operation, and repeatable impairment behavior, Ignite 400G provides the accuracy needed to validate sensitive Ethernet, RDMA, and lossless network environments before deployment.

Technical Specifications

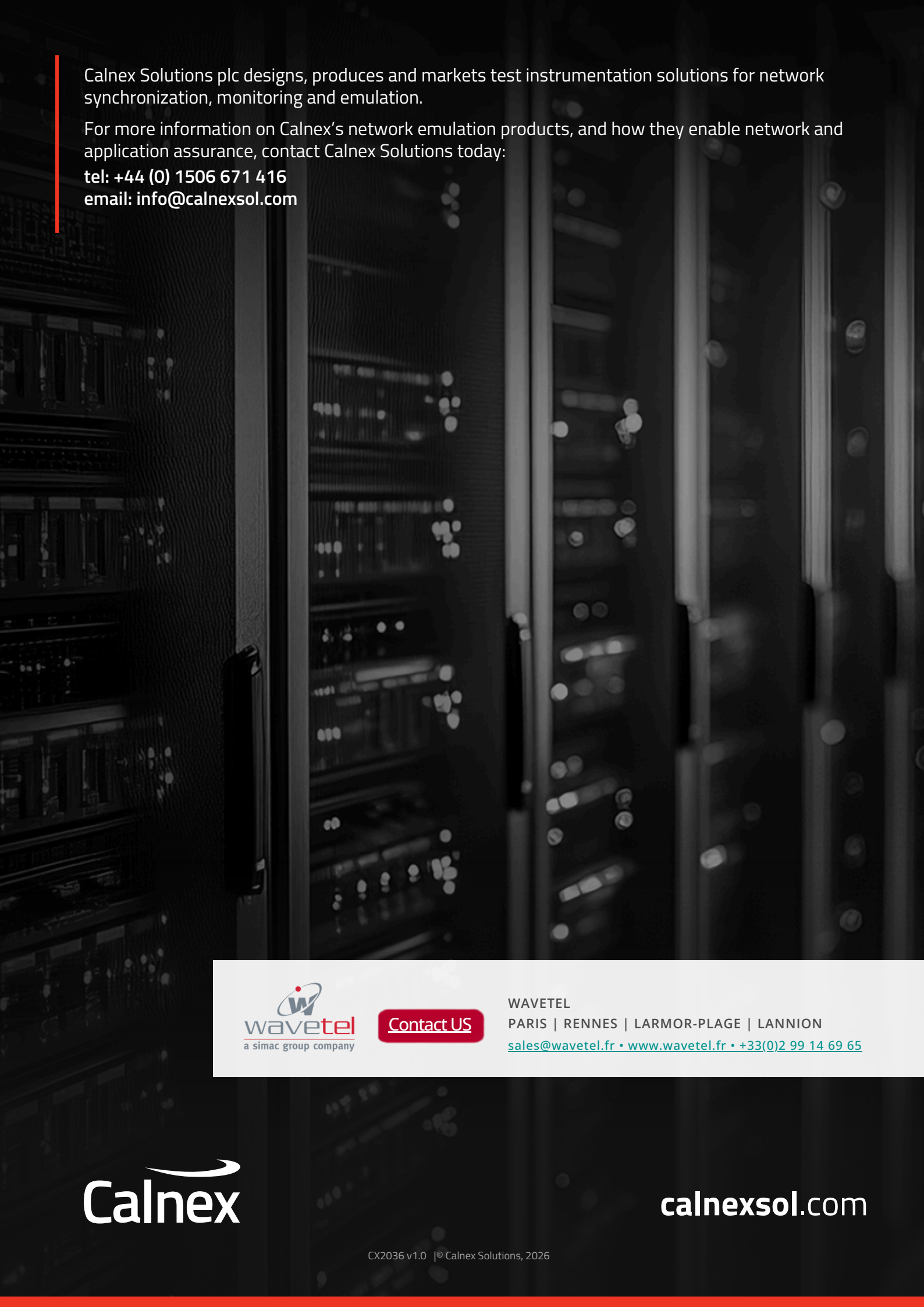
Physical	SNE Ignite 400G
Ports	8 x 100GbE 2 x 400GbE
Network Interfaces	100GbE –QSFP28 400GbE – QSFP-DD
Dimensions	3.7U
Passthrough PFC Frames Transparently	✓
SyncE Passthrough	Clock can be recovered on one port and passed transparently to another.
Clock Reference	Internal or External (10 MHz)

General	SNE Ignite 400G
Live Changes — Real-time modification of any impairment setting	✓
Bi-directional 400G IP Stream at Full Line Rate	✓
100% Throughput of any traffic, including RDMA, PFC, DCQCN/CNP	✓
Timeline — Schedule changes to emulation settings with no manual intervention required. Option: loop timeline for continuous playback	✓

Impairment	SNE Ignite 400G
Impairment profiles	8
Delay	up to 320ms
Jitter	✓
Corruption	✓
Duplication	✓
Drop	✓
Modify (Invert, Static, Increment, Decrement and Fuzz)	✓
Regenerate L2, L3, L4 Checksums	✓

Filtering	SNE Ignite 400G
PFC Frames	✓
MAC Address	✓
IPv4 / IPv6	✓
UDP	✓
VLAN	✓
TCP	✓
MPLS	✓
DiffServ / DSCP	✓

Manage/Monitor	SNE Ignite 400G
Intuitive Web UI	✓
RESTful API for Test Automation	✓
Smart-Start Up – Automatically launch previous map on boot	✓
Map Statistics - Port and impairment node level packet statistics UI, .CSV and .JSON	✓



Calnex Solutions plc designs, produces and markets test instrumentation solutions for network synchronization, monitoring and emulation.

For more information on Calnex's network emulation products, and how they enable network and application assurance, contact Calnex Solutions today:

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