Network Emulator 3

100GE, 50GE, 40GE, 25GE, and 10GE impairment

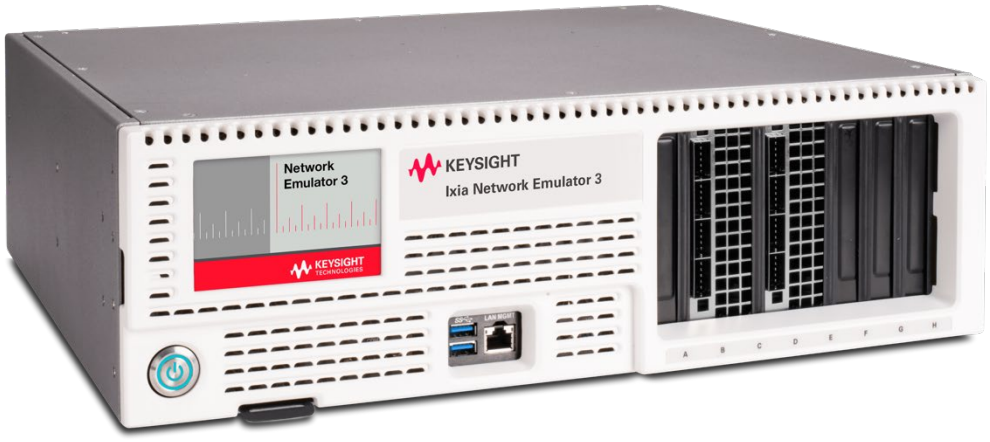
Problem: Knowing How Networks and Devices Will Behave Under Real-world Conditions

Effective testing requires a real-world environment that reproduces realistic network conditions and behavior. All software and hardware should be subjected to a realistic test environment before deployment.

Solution: Real-World Network Impairment Testing

Network Emulator 3 (NE3) is a precision test instrument for 100GE, 50GE, 40GE, 25GE, and 10GE Ethernet impairment. The device allows users to accurately emulate the real network conditions that occur over live production LAN/WAN networks. By emulating realistic and worst-case network conditions in the lab, users can validate and test performance of new hardware, protocols, and applications to prevent failures in production networks. The Network Emulator 3 offers a rich feature-set to allow testing in a controlled lab environment with repeatable and predictable impairments. The NE3 enables user to perform the following tests:

- Test 5G networks and the impact of delay and impairments
- Test the effect of delay on the network and application performance
- Determine how applications will perform when distributed across data centers
- Cause outage and degrade scenarios to trigger and validate fail-over protection



KEYSIGHT

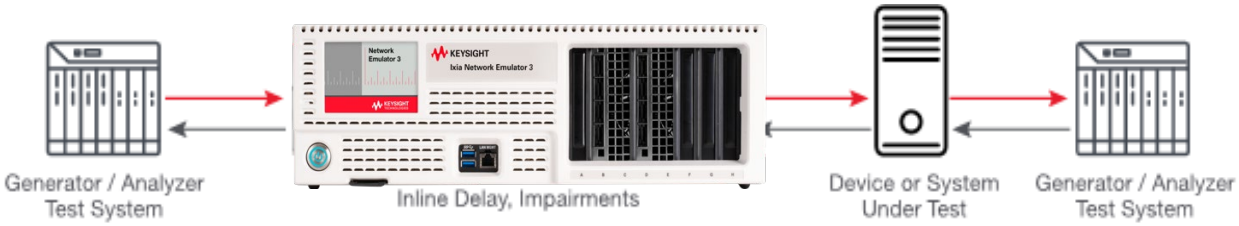
Highlights

Emulate real-world networks in the lab

- Enables validation, performance, and interoperability testing
- Test products and applications to characterize end user experience under real-world conditions
- Precisely reproduce and quickly resolve issues occurring in the field

Key features

- 100GE / 50GE / 40GE / 25GE / 10GE impairment emulation
- 1 or 2 impairment engines FPGA hardware architecture allows 100 % line-rate performance
- Test mixed speeds at the same time with one device
- Flexible resource management



Key Features

- High port count 100GE, 50GE, 40GE, 25GE, and 10GE FPGA emulator
- FPGA hardware-based architecture provides maximum precision and accuracy
- Modular appliance allowing impairment of one or two data lines
- One impairment engine per card enables impairment of one data line
- Optional second impairment card available
- Dedicated FPGA processors per card ensures high performance
- Flexible Resource Management enables allocation of resources as needed by allowing automatic or manual memory allocation
- Precisely emulates delays and impairment that exist in Ethernet networks
- Transparent to any higher-layer L2/7 protocols
- Optical media physical layer clock transparency for SyncE support
- Test automation through RESTful Web API, which allows control by TCL and languages such as Python
- Packet Capture and Replay

Primary Use Cases

- 5G delay and impairment testing
- Performance testing of critical applications over Ethernet with realistic network conditions and impairments
- Combine with IxNetwork, IxLoad, and BreakingPoint test systems to create a complete real-world test environment
- Real-world interoperability and customer Proof-of-Concept (PoC) testing
- Corporate LAN/WAN emulation
- Business continuity and disaster recovery testing
- Server consolidation/migration
- Application cloud migration and storage extension
- Wireless/mobile delay and impairment simulation
- Satellite network delay emulation
- Reuse and build proprietary or standard-based Layer 2–7 protocol filter with the Customizable Filter Library
- Cause outage and degrade scenarios triggering fail-over protection

Network emulator 3 specifications

Key specifications	Details
Modular appliance	• Timing and Impairment Appliance (TAI) • 1 or 2 impairment lines • Each impairment line has dedicated FPGA, which enables line rate performance
Ports	• Each card has dedicated FPGA engine, which enables line rate performance for one impairment line • Each card/impairment engine can run a different speed and totally independent • Each card/impairment engine supports one user configurable speed at a time. These can be 2 - 100G ports, 2 – 50GE ports, 2 – 40GE ports, 2 - 25G ports, or 2 - 10G ports. Selection of speed/ports is made during configuration time. • Users need license for only the required speeds • Flexible Resource Management provides performance when you need it
Max packet size	10,000 bytes
Traffic Selection	• Classifier pattern matching allows selection of specific traffic • Standard filters available such as MAC, IP, VLAN, and eCPRI • Custom Byte Offset with up to 32 bytes for matching
16 classifier profiles per impairment line	• Flexible Resource Management provides the ability to allocate resources in the required manner • Flexible Resource Management allows Profiles to be configured from the Profile Pool as needed, allowing for the most efficient use of system resources • 16 Profiles per impairment line • 1 default profile is allocated to each port • 8 profiles for each traffic direction • Flexible Resource Management allows efficient memory allocation for each profile • FPGA hardware-driven implementation ensures accuracy and repeatable testing • Network Profiles support emulating multiple ‘network clouds’ per interface: emulate different paths through a network or different classes of service • Each profile is defined by any combination of VLAN tag, MPLS label, MAC/IP address (IPv4, IPv6), TCP/UDP port, or any data within an Ethernet frame • Define bandwidth, delay, and impairments per profile • Classify up to any 32 bytes within an Ethernet frame
Delay	

	100GE	50GE	40GE	25GE	10GE
Max delay at line rate in 1 direction *	544 ms	1088 ms	1360 ms	2176 ms	5440 ms
Max delay at line rate bi-directional	280 ms	559 ms	700 ms	1120 ms	2800 ms
Max delay at limited line rate **	31 seconds	31 seconds	31 seconds	31 seconds	31 seconds

* Flexible Resource Management allows all delay memory to be allocated to one direction

Key specifications	Details
	** Note: When line rate is less than 100 percent, delay can be increased to a maximum of 31 seconds, depending on the actual line rate and memory allocation. If the incoming data exceeds the buffer limit, the packets are dropped. • Variable by Constant, Gaussian, Gamma, Uniform (Sawtoothed), Uniform (uncorrelated) and user defined
Drop	• Packet Drop impairment allowing single or multiple packets to be dropped • Variable by Periodic, Uniform, Gaussian, and Poisson distributions
Reorder	• Packet Reorder allows several packets to be reordered on a defined interval
Duplication	• Duplication impairment allowing packet duplication
PTP Transparent Clock	• The NE3 supports a 1-step end-to-end transparent clock mechanism. • For PTP event messages, the residence time (the time the message takes to traverse the NE3 chassis) will be measured and added in the Correction field of the PTP event messages as 1-step transparent clock operation
Modification	• Packet Modification allows for the value within a defined location in a packet to be modified; up to 4 modification rules are available and each can modify up to 16 consecutive bytes
Correction	• Modified packets can optionally have the CRC Checksums corrected
Fuzzing modification	• Fuzzing involves providing invalid, unexpected, or random data as inputs to a computer program and then monitoring the program for exceptions such as crashes, failing built-in code assertions, or potential memory leaks.
Rate Shaping	• Line Shaping controls outgoing traffic to prevent buffer overflow and reduces the burstiness of traffic • Can be applied at the line or profile level • Allows 100GE, 50GE, 40GE, 25GE, and 10GE shaping tests
Media Impair	• Media Impair allow the following impairments • Laser Off (LOS) • SERDES Off • Send Idles • Send Local Faults • Send Remote Faults • Media Impair allows CONSTANT and BLINK mode options
Packet Capture	• Real time packet capture and packet timing • Wireshark compatible format • Large buffer size • Profiles enable multiple concurrent captures
Packet Replay	• Replay NE3 captured traffic • Replay standard PCAP traffic • Packet IPG/timing preserved supporting speeds up to line rate
Statistics	• Robust statistics support with customizable overview with the option to save to local file
NetPlay3	• Network Playback enables the reproduction of customer and standard based impairment profiles accurately duplicating conditions found in actual production networks

Key specifications	Details
	• Facilitates the creation of specific use case impairment models which can replayed with the NE3 • Deterministic replay timing for impairment models
User interface	• Remote monitoring and control through the 10/100/1000 RJ45 Ethernet port • Intuitive and interactive web GUI interface • Multiple user accounts and account management • Display-only accounts • RESTful API allows test automation and complete control of all functionalities • The following browsers are supported: ◦ Chrome, Edge and Internet Explorer, Firefox, Safari
SyncE	• Compliant to ITU G.8262 Always enabled Supported on Ethernet 100G, 50GE, 40GE, Ethernet 25G, and Ethernet 10G.
Chassis	• Rack mount and desktop mounting hardware included • Dimensions: 3RU 17.27 in (438 mm) x 14.61 in (371 mm) x 5.21 in (132 mm) • Dimensions: 3U • Weight: 26.40 lbs (11.97 kg) • DB Level: 60 db max, 55 db nominal • Thermal ◦ Operating temperature: 5° C to 40° C (41° F to 104° F) ◦ Operating humidity: 10 % to 85 % (RH), non-condensing ◦ Storage temperature: -20° C to 70° C (-4° F to 158° F) ◦ Storage humidity: 5 % to 95 % (RH), non-condensing • Input power ◦ 100–127 Vac / 200–240 Vac, 10 / 5A, 50/60 Hz (x2) or ◦ 100–127 Vac / 200–240 Vac, 10 / 5A, 50/60 Hz (x1) • Max power consumption: ◦ 1 Impairment Line (947-0100): 540W typical and 600W max ◦ 2 Impairment Lines (947-0101): 630W typical and 700W max
Safety	This product conforms to the following Safety Certifications: • EN 62368-1 / IEC 62368-1 • UL 62368-1 / CSA C22.2 No. 62368-1
Emissions and immunity	This product shall conform to the following Electromagnetic Emissions Certifications: • FCC Part 15B, Class A • ICES-003 • EN 55032/35 • AN/NZS CISPR 32/35 • KN C 9832/35
Regulatory approvals	• CE (Europe); CSA (USA, Canada) • RCM (Australia, New Zealand); UKCA (United Kingdom); KCC (Korea)
Environmental	• RoHS Directive 2011/65/EU; Annex II, Directive (EU) 2015/863 • WEEE Directive 2012/19/EU • China RoHS • Russia RoHS

Product ordering information

Network Emulator 3 can be ordered either by purchasing one of the bundled products or by selecting the needed component products.

Bundled products	Bundles are available in 1 or 2 impairment line versions
947-0100	Network Emulator 3 Hardware Software Bundle with 1 Impairment Line
947-0101	Network Emulator 3 Hardware Software Bundle with 2 Impairment Lines

Component products	Component products allow customization of features
946-0071	Network Emulator 3 and Impairment Software
946-0072	Network Emulator 3 Impairment Card
Speed options	
930-2714	Network Emulator 3 Speed Enablement 100GE/50GE/40GE/25GE/10GE Bundle Port Pair
930-2715	Network Emulator 3 Speed Enablement 100GE Port Pair
930-2718	Network Emulator 3 Speed Enablement 50GE Port Pair
930-2719	Network Emulator 3 Speed Enablement 40GE Port Pair
930-2716	Network Emulator 3 Speed Enablement 25GE Port Pair
930-2717	Network Emulator 3 Speed Enablement 10GE Port Pair
Option group	
930-2740	Network Emulator 3 Software Option Group 1 - Modification, Media Impair and NetPlay3
930-2741	Network Emulator 3 Software Option Group 2 – Reorder and Duplication
930-2742	Network Emulator 3 Software Option Group 3 – Capture and Replay
930-2743	Network Emulator 3 Software Option Bundle Includes Option Group 1, 2 and 3
942-7001	IXIA TAI Appliance Optional Spare Power Supply, spare, 1000W: 100-140VAC/1600W: 180-240VAC

Supported transceivers	Description	Speeds supported
QSFP28-SR4-XCVR	QSFP28 100GBASE-SR4 100GE pluggable optical transceiver (multimode), 850 nm, 100 m reach	100/50/40/25GE
QSFP28-LR4-XCVR	QSFP28 100GBASE-LR4 100GE pluggable optical transceiver, SMF (single mode fiber), 1310 nm, 10 km reach	100/50/40/25GE
SFP28-SR-XCVR	SFP28 Dual-Rate 25GBASE-SR 25GE and 10GBASE-SR 10GE pluggable optical transceiver, MMF (multimode), 850 nm	25GE
SFP28-LR-XCVR	SFP28 Dual-Rate 25GBASE-LR 25GE and 10GBASE-LR 10GE pluggable optical transceiver, SMF (single mode), 850 nm	25GE
942-0092	Cable, 100GE QSFP28 PT-PT Active Optical AOC, 3m length	100/50/40/25GE
SFP-PLUS-SR-XCVR-D-T	TAA compliant, SFP+ 10/1GBASE Dual Rate SR pluggable optical transceiver, MMF, 850nm, 300m reach, LC	10GE
SFP-PLUS-LR-XCVR-D-T	TAA compliant, SFP+ 10/1GBASE Dual Rate LR pluggable optical transceiver, 1310nm, MMF, 10km reach, LC	10GE