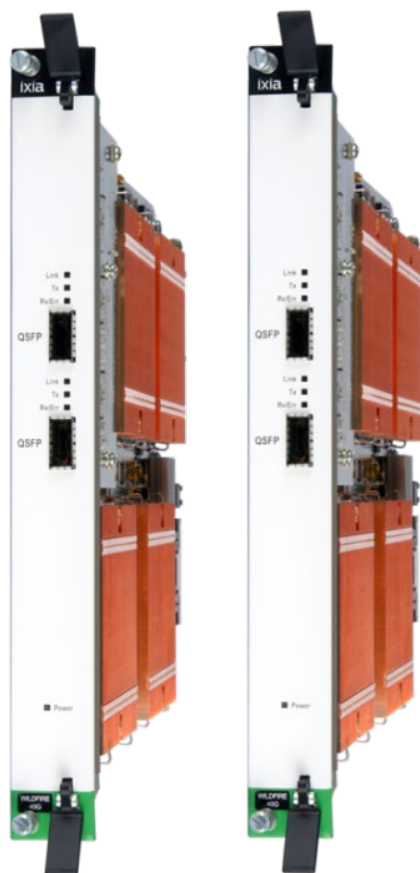


PerfectStorm 40GE — High-Performance Application and Security Load Modules

Keysight's PerfectStorm family of 40GE load modules delivers the industry's most scalable solution for testing converged multi-play services, application delivery, and network security platforms for both wired and wireless networks.

The architectural breakthrough of the PerfectStorm family adopts the technology innovations built around Keysight's Xcellon-Ultra and BreakingPoint Firestorm hardware families, resulting in a revolutionary converged solution with optimal flexibility and performance, to meet the requirements of today's and future next-generation networks.



PerfectStorm 40GE (PS40GE2) and PerfectStorm Fusion 40GE (PS40GE2NG) load modules

Highlights

- Unified applications and security test platform, with support for BreakingPoint and IxLoad software
- Massive-scale and realistic traffic conditions
- Hardware-based acceleration for SSL and IPsec
- Multi-user environment leverages the per-port user ownership model for all ports on the test modules installed into the chassis
- Resource aggregation
- Native 40GE QSFP+ interfaces with support for 4 x 10GE SFP+ per port via fan-out cables
- The Keysight PerfectStorm is the essential solution to:
 - Evaluate next-generation content-aware security devices
 - Benchmark and validate performance of network infrastructures and network devices
 - Harden 3G/4G/LTE mobile networks
 - Deploy compact cyber ranges and train cyber warriors
 - Optimize virtualized data centers
 - Tune systems and policies
 - Mitigate IT risk
 - Rollout converged multiplay service
 - Evaluate storage infrastructure and devices

The proliferation of dynamic and evolving applications, along with an increase in advanced malicious attacks, has created a dangerous lack of control and visibility into both the performance and security of IT infrastructures.

The world is becoming an always-connected, mobile environment, with massive volumes of traffic flowing through WANs, LANs, and data centers. The increase in network traffic scale, complexity, and types is causing a huge upswing in data center port counts and technology diversity.

As bandwidth requirements press the limits of networking devices towards the terabit level and users drive 10x more TCP connections per second compared with the last 2-3 years, equipment manufacturers, datacenters, and service providers must keep pace by introducing even higher-density 10GE, 40GE, and 100GE equipment.

Equipped with powerful multi-core, multi-threaded network processors, PerfectStorm is Keysight's next-generation architecture designed to satisfy the testing needs of those manufacturers. As service providers and large enterprises implement this same equipment in their own networks, they must also test and verify performance and functionality prior to deployment.

A single, integrated system equipped with 12 PerfectStorm blades, allows control of application traffic to nearly a terabit, up to 720 million concurrent connections, and new TCP connections rates of up to 24 Million. The hardware-based acceleration supports massive encryption levels with up to 240Gbps of SSL traffic and 480Gbps of IPsec traffic per system. The system uses inline field programmable gate arrays (FPGAs) for enhanced accuracy pertaining to latency measurements with a resolution of 10ns.



XGS12-HS Chassis and PerfectStorm 40GE Load Modules

Massive-Scale, Easy-To-Use and High-Fidelity Simulations to Battle-Test Today's High-Volume, Dynamic, Converged Networks and Data Center Infrastructures

The modular PerfectStorm platform creates real-world, high-stress conditions and user behavior to provide organizations the insight to battle-test IT infrastructures, train cyber warriors, tune systems and policies, and transform security processes to be proactive and effective.

The Keysight PerfectStorm is the essential solution to:

- Evaluate next-generation content-aware security devices
- Rollout converged multiplay services
- Benchmark and validate performance of network infrastructures and network devices
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- Deploy compact cyber ranges and train cyber warriors
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Modes of operation

On PerfectStorm 40GE load module, the two ports can function as two 40G ports (40G mode) or eight 10G ports (10G mode). 10G mode is also known as breakout mode, and requires a breakout or fan-out cable to separate the traffic. The advanced aggregation capabilities of the PerfectStorm family allow the blades to operate in two different modes, providing extra flexibility and performance:

Non-Aggregated, Mode: In this mode, each 40GE port uses of $\frac{1}{2}$ of the network processor and memory resources available on the load module, allowing delivery of application traffic at wire-speeds for each port, with up to 80 Gbps per module.

40GE Aggregated, Mode: This mode provides extra flexibility to allocate all network processor and memory resources available on a load module to a single 40GE port, doubling the performance the performance achieved per 40GE port. Keysight test applications transparently configure the allocation of NP resources to achieve the maximum performance.

Hardware variants

The PerfectStorm 40GE load module consists of 2-port 40GE QSFP+ interfaces and is available in two variants:

- PerfectStorm Fusion, 2-port 40GE QSFP+ load module
- PerfectStorm 2-port 40GE QSFP+ load module

Both variants provide support for 8 x 10GE SFP+ via fan-out cable (MT-to-4x10GE LC fan-out, MMF, 3-meter or 5-meter cables) and QSFP+ 40GE optical transceiver, MMF, 850nm (948-0031).

PerfectStorm Specifications

Specification	PerfectStorm Fusion PS40GE2NG	PerfectStorm PS40GE2
Keysight Applications Support		
IxOS	Yes	Yes
IxExplorer	No	No
IxLoad	Yes	Yes
IxNetwork	No	No
BreakingPoint	Yes	No
TCL API	Yes	Yes
Hardware, Load Module Specifications		
Physical Interfaces	<ul style="list-style-type: none"> • 2-port, 40GE QSFP+ (native) • 8-port, 10GE SFP+ via fan-out cable 	
Transceiver Support	QSFP+, 40GBASE-SR4 (pluggable transceivers)	
Memory	64GB	64GB
Hardware Encryption Offload	Yes	Yes
Hardware-Based Traffic Capture (available in BreakingPoint)	1GB per 40GE interface 256 MB per 10GE interface	N/A
Software-Based Traffic Capture Buffer (available in IxLoad)	Maximum between 2GB or 2 Million packets, per interface	Maximum between 2GB or 2 Million packets, per interface
FPGA Offload	Yes	Yes
IPv4, IPv6, UDP, TCP	Hardware checksum generation	
Load Module Dimensions	16" (L) x 1.3" (W) x 12.00" (H) 406 mm (L) x 33 mm (W) x 305 mm (H)	
Operating Temperature Range	41°F to 95°F (5°C to 35°C), ambient air	
Chassis Capacity		
Cards per Chassis	12	12
Port Density per XGS12 Chassis	24-port, 40GE QSFP+	24-port, 40GE QSFP+
Chassis Compatibility	XGS12 & XGS2	XGS12 & XGS2
XGS12 Chassis Bundles	XGS12-HS (940-0006) XGS12-HSL (940-0016) XGS2-HS (940-0012) XGS2-HSL (940-0014)	XGS12-HS (940-0006) XGS12-HSL (940-0016) XGS12-SD (940-0011) XGS2-HS (940-0012) XGS2-HSL (940-0014) XGS2-SD (940-0010)

PerfectStorm, BreakingPoint Performance

Per-blade performance numbers provided in back-to-back using a single blade. Published SSL metrics were measured with 2K key-size in ideal test configurations to maximize performance.

Applications Throughput	80Gbps	960Gbps
TCP Connections per Second	2M	24M
Applications Concurrent Flows	60 Million	720 Million
SSL Bandwidth	20Gbps	240Gbps
SSL Connection Rates	200,000	2.4 Million
SSL Concurrent Flows	1 Million	12 Million
Applications Throughput over SCTP	14Gbps	168Gbps
Applications Throughput over IPsec	25Gbps	300Gbps
IPsec, Concurrent Tunnels	500,000	6 Million
IPsec, Tunnel Setup Rates	2,000	12,000
Applications Throughput over GTP	40Gbps	480Gbps
GTP, UE Attachment Rate (per second)	450K	5.4M
GTP, Tunnels	3M	36M

PerfectStorm, BreakingPoint test components

Test Components	<ul style="list-style-type: none">• Application Simulator• Session Sender• Security• Security NP• Recreate• Stack Scrambler
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PerfectStorm, BreakingPoint mobility

Mobility (3G/4G)	<p>Interfaces Supported</p> <ul style="list-style-type: none">• S1-U (eNodeB and SGW sides)• S1-MME (eNodeB side)• SGi (PDN side)• S5/8 (SGW and PGW sides)• S11 (MME and SGW sides)• Gn (SSGN and GGSN sides) <p>Wireless Protocols Supported</p> <ul style="list-style-type: none">• S1AP• GTP-C v1, GTP-C v2, GTP-U v1• SCTP (over UDP or IP)
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3G/4G Operational Modes

- eNodeBs + UEs
 - PDN
 - MME
 - SGW + PGW + PDN
 - eNodeBs + UEs + MME, SGW + PGW + PDN
 - SGSN + UEs
 - GGSN + PDN
 - UE/eNB/MME/SGW
 - PGW/PDN
 - UE/eNB vs. MME/SGW/PGW/PDN
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PerfectStorm performance with IxLoad

Per-blade performance numbers provided in back-to-back using a single blade. Published SSL metrics were measured with 2K key-size in ideal test configurations to maximize performance.

Applications Throughput	64Gbps	64Gbps	768Gbps
HTTP Throughput	40Gbps / 76Gbps	40Gbps / 76Gbps	480Gbps / 912Gbps
HTTP Connections per Second	1.5M	1.5M	18M
HTTP Concurrent Connections	30M	30M	360M
SSL Throughput	20Gbps	20Gbps	240Gbps
SSL Connection Rates	200,000	200,000	2.4 Million
SSL Concurrent Flows	1 Million	1 Million	12 Million
IPsec, Concurrent Tunnels	500,000	500,000	6 Million
IPsec, Tunnel Setup Rates	10,000	10,000	120,000

IxLoad, application support

Application Delivery	<ul style="list-style-type: none">• AppLibrary• TCP Plugin• Application Replay• HTTP• HTTPS• FTP• SMTP• POP3
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	<ul style="list-style-type: none"> • DNS • TFTP • IMAP • Stateless Peer
Video Delivery	<ul style="list-style-type: none"> • VoD (RTSP, QoE) • RTSP (RTP/TCP) • IPTV Multicast IPv4 • Silverlight • Adobe HDS • Apple HLS • Flash Player • MPEG DASH • Video Quality
VoIP	<ul style="list-style-type: none"> • Advanced SIP • SIP Cloud/SIP Proxy • RTP/RTCP • SRTP & TLS • Audio, Voice, Video • Video Telepresence • MSRP • Voice Quality / Video Quality
IPsec	<ul style="list-style-type: none"> • IKEv1, IKEv2, IPsec Suites B • IPsec Quick Tests
Storage	<ul style="list-style-type: none"> • CIFSv1 • SMB 2.1 • SMB 3.0 • iSCSI • NFSv3, NFSv4, NFSv4.1
Stack Manager	<ul style="list-style-type: none"> • Static ARP • GratARP • IPv4 / IPv6 • PPP • L2TP • DNS • DHCPv4 • DHCPv6 • IPv6 SLAAC • 6rd • DSLite • 802.1x • WebAuth • EAPoUDP

Hardware Ordering Information

Part Number	Description
940-0006	XGS12-HS 12-slot chassis bundle with High Performance Controller
940-0016	XGS12-HSL 12-slot chassis bundle with High Performance Controller
940-0011	XGS12-SD 12-slot chassis bundle with Standard Controller
940-0012	XGS2-HS 2-slot chassis bundle with High Performance Controller
940-0014	XGS2-HSL 2-slot chassis bundle with High Performance Controller
940-0010	XGS2-SD 2-slot chassis bundle with Standard Controller
944-1201	PerfectStorm 40GE Fusion 2-port (PS40GE2NG)
944-1205	PerfectStorm 40GE, 2-port (PS40GE2)

Transceivers and cables

Part Number	Description
948-0028	QSFP+ 40GBASE-SR4 optical transceivers (incompatible with fan-out)
948-0031	QSFP+ 40GBASE-SR4 optical transceivers (required for fan-out)
942-0041	MT 12-fiber MMF cable, 3-meter length
942-0067	MT-to-4x10GE LC fan-out, MMF, 3-meter cable to support the fan-out option
942-0068	MT-to-4x10GE LC fan-out, MMF, 5-meter cable to support the fan-out option

BreakingPoint ordering information

Part Number	Description
909-0856	BreakingPoint - Application & Threat Intelligence Program

IxLoad Ordering Information

Part Number	Description
925-3371	<p>IxLoad Multiplay-2016, Software Bundle, Layer 4-7 Performance Test Application Data-Video-Voice-Security package. Includes:</p> <ul style="list-style-type: none">• Data: Enables support for HTTP, HTTPS, TCP Session, FTP, DNS, Mail (SMTP, POP3 and IMAP), Database, SSH, RADIUS, TFTP, Application-Replay, DHCP, LDAP, Telnet, Stateless-Peer and StreamBlaster emulations.• Video: Enables support for basic RTSP, IPTV (Multicast), Video-ADVANCED (VoD), Adobe Flash Client, Apple HLS Client, Microsoft Silverlight Client, Adobe HDS Client and DASH Client emulations. Includes Video Quality VQMON engine for up to 10Gbps and TCP VQ Video quality for TCP video traffic for up to 10 Gbps.• Voice: Advanced VoIP SIP & RTP, Audio Codecs, VoLTE extensions, and Bulk SIP & MGCP. Includes: Voice Quality engine for up to 10Gbps, Video Quality engine for up to 10Gbps conversational video traffic.• ADVNET: Enables support for Advanced Access networking protocols such as DHCP for IP address acquisition, DHCP Server, PPP, L2TP and IPsec.• Storage: iSCSI, CIFSv1, CIFSv2 (SMB2), SMB3, NFSv3 Client, NFSv4 Client, NFS4.1 Client, Cloud Storage Client, DCBX, FCoE and FC; Note the FCoE and FC emulation is only supported on selected load modules.• Access: DHCP, PPP, L2TP, L2TP, IPsec, IPsec Performance Benchmarking QuickTest & SuiteB Cryptographic, 6RD, DSLITE and IPv6 SLAAC, 8021X, NAC and WEBAUTH.• Security: Enables support for a collection of vulnerabilities and malware attacks with 1-year subscription service and DDoSv2.• Software Impairment. <p>Note: some of the features are available only on specific load modules</p>
925-3461	<p>IxLoad AppLibrary Slot Bundle, Software Bundle, Layer 4-7 Performance Test Application; Enables support for AppLibrary on a single load module. It includes AppLibrary Slot Feature (925-3462) and Slot Subscription service (925-3460) to access new application flows for one year; Requires previous purchase of 925-3040 (IXLOAD Base) or higher bundle.</p>

IxLoad Bundles per technology (Data, Video, Voice, Access and VPN, Storage, Security) are also available.

For more information on Keysight Technologies' products, applications, or services, please visit: www.keysight.com