Converged Network Lifecycle

Solutions

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"What made this test achievable for us was the ease of use of the Ixia test equipment..."

– Lindsay Newell,
VP Marketing, IP Division, Alcatel-Lucent

Ixia provides the industry's most comprehensive converged test, visibility, security, and wireless networking solutions. Enterprises, equipment manufacturers, service providers, and government agencies use Ixia's solutions to design, verify, secure, and monitor a broad range of wired, Wi-Fi, and 3G/LTE equipment and networks.

Ixia's solutions emulate realistic media-rich traffic and network conditions so that customers can optimize and validate the design, performance, and security of their pre-deployment and production networks. Ixia's solutions flow across all networks types and designs: from enterprises, to government agencies, to service providers -- we can help create, develop, and sustain complex deployments involving high-powered data centers, cloud computing, and virtualization.

Ixia helps its customers provide an always-on user experience through fast, secure delivery of dynamic connected technologies and services. Through actionable insights that accelerate and secure application and service delivery, Ixia's customers benefit from faster time-to-market, optimized application performance, and higher-quality deployments.

Our always-on, always available Internet experience has fundamentally changed the way we do business. Networks are no longer simply connected machines providing bits and bytes of uncomplicated data, but vast multi-technological powerhouses that reach all over the globe to provide media of all types. We rely on these networks to reach other people, other places, and other businesses.

Ixia's has been there from the beginning -- providing testing, assessment, security, and visibility solutions that help design, validate, and monitor just about any data communications equipment, protocol, technology, or standard.

Founded in 1997, Ixia is an international, public company with more than 2000 employees. Operating in worldwide, has a vast expertise in working with our customers to help meet their networking goals:

- **Ixia test solutions** provide an end-to-end approach for organizations to test devices and systems prior to deployment, and assess the performance of networks and data centers after upgrades or changes. To verify new service implementation, new device insertion, or network expansion, Ixia helps organizations perform extensive pre-deployment testing to ensure current network function isn't compromised. This testing must be high capacity, and simulate network and applications over-subscription in order to stress network upgrades to their limits.
- **Ixia security solutions** allow organizations to assess network security and resiliency by testing and validating network and security devices with real-world application traffic and attacks. Using Ixia, organizations can perform assessments before production deployment and establish ongoing assessment best practices that harden security by assessing individual devices, networks, and data centers.
- **Ixia visibility solutions** are uniquely positioned to help you manage and monitor change in your network through our deep expertise and early involvement in validating new technologies. Ixia has the most complete visibility portfolio in the market, allowing our customers to build a Visibility Architecture that best fits the need of their network today – and tomorrow.
- **Ixia's wireless test solutions** address the complex challenges mobile operators face in rolling out high-quality, differentiated services. Mobile operators can use Ixia's award-winning LTE and Wi-Fi test systems and services to subject devices and configurations to high stress, high scale conditions, and a wide mix of voice, video, and data applications. Operators are able to evaluate the subscriber experience in the face of mobility, system overload, and even device failure on a large-city scale.

Scenarios for Success

As you continue to browse this document, you'll see specific scenarios that describe testing, security, wireless, and visibility challenges and how Ixia can help you overcome them. We have built our business by helping our customers solve very specific problems, while at the same time enabling a flexible chassis/load module/application approach that can cost-effectively evolve with their needs. We know that your success drives our success. Join our ever-growing customer base of successful service providers, NEMs/TEMs, enterprises, government agencies, data center operators, and cloud providers.

Higher-Speed Ethernet

Ixia is the leading provider of test solutions for higher-speed Ethernet components, devices, and systems.

Ixia Xcellon-Lava interfaces provide:

- Comprehensive physical through application, layer 1-7, measurement and analysis
- BERT testing for physical layer verification
- PCS lane features to verify IEEE-802.3ba-2010™ operation
- Full set of 40GbE, 100GbE, and combined-speed test interfaces
- Support for CFP and QSFP+ interfaces
- Error injection and detection

Ixia Xcellon-Lava modules generate and analyze line rate traffic, with up to 1 million unique flows per port.
Key performance metrics include:

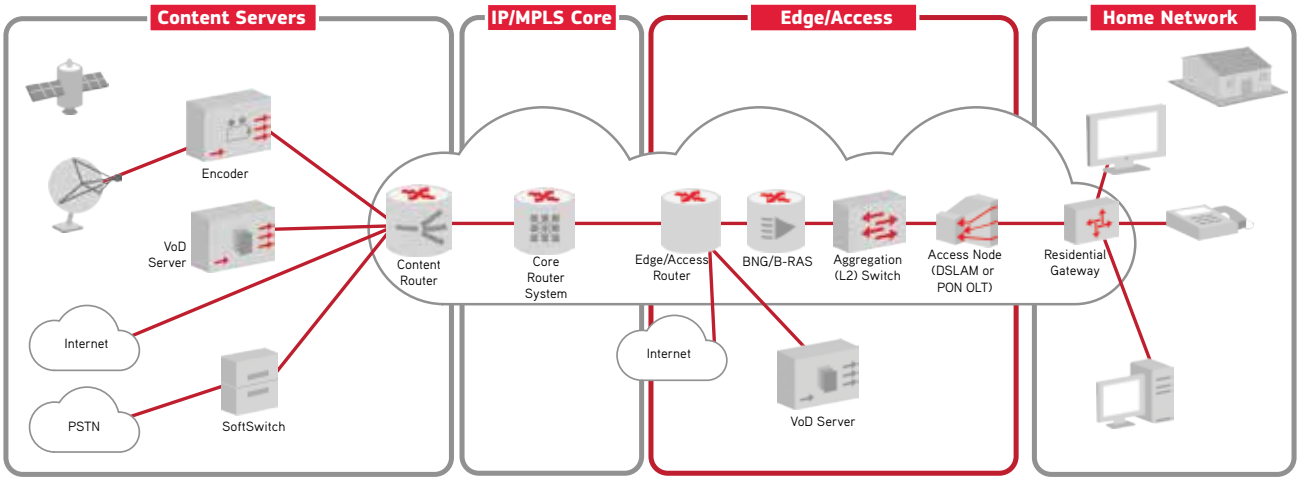
- Real-time latency
- Inter-arrival time
- Packet loss
- Data integrity
- Sequence checking
- Packet capture

The Xcellon-Flex™ Combo 10/40 Accelerated Performance load module provides the ultimate in test capabilities for combined 10GbE and 40GbE systems. Multiple CPU cores and memory are combined to provide high-scaling layer 4-7 testing.

With the new fan-out technology inherent in our Xcellon-Multis load modules, Ixia has moved to anticipate our customer's needs. Using cable fanout technology, we deliver the needed HSE Ethernet testing – testing that allows higher port speeds to fan-out to several ports (links) of another speed

Leading the way to a new testing paradigm, Ixia is also the first to market with a 400GbE solution. The Ixia 400GbE Jumpstart Test System is a developer tool kit to help network equipment manufacturers shorten development and test time – accelerating pre-standard 400GbE networking hardware.

Available Load Module	
LAVAAP40/100GE2P	Dual-speed, load module, CFP MSA interfaces, full performance L1-3 support
LAVAAP40/100GE2RP	Dual-speed, load module, CFP MSA interfaces and full featured L1-3 data plane support
Xcellon-Flex Combo 10/40GE AP	16-port 10GbE SFP+ and 4-port 40GbE QSFP+ interface, 48 ports per chassis
Xcellon-Flex 4x40GE	4 port 40GbE QSFP+ interfaces, 48 ports per chassis
400GbE Jumpstart Test System	Features wire rate packet generation at 400Gbps below the minimum and above the maximum Ethernet frame sizes.
Xcellon-Multis XM100GE4CXP	100-Gigabit Ethernet, single rate load module, 1-slot with 4-ports native CXP multimode fiber interfaces, L2-7 support
Xcellon-Multis XM100GE4CXP+FAN	100/40-Gigabit Ethernet, multiple rate load module, 1-slot with 4-ports native 100GbE CXP multimode interfaces and up to 12-ports of 40GbE via fan-out cables
Xcellon-Multis XM40GE12QSFP+FAN	40-Gigabit Ethernet, load module, 1-slot with 12-ports of 40GbE via multimode fan-out AOC cables
Xcellon-Multis XM10/40GE 12QSFP+FAN	40-Gigabit Ethernet QSFP load module, 1-slot with 12-ports of 40GbE QSFP with L2-7 support.
Xcellon-Multis XM10-40GE 6QSFP+FAN	40-Gigabit Ethernet QSFP load module, 1-slot with 6-ports of 40GbE QSFP with L2-7 support
Xcellon-Multis XMR40GE12QSFP+	40-Gigabit Ethernet QSFP+ Reduced load module, 1-slot with 12-ports of 40GbE QSFP+ with L2-7 support, full featured L1-3 data plane support
Xcellon-Multis XMR40GE6QSFP+	40-Gigabit Ethernet QSFP+ Reduced load module, 1-slot with 6-ports of 40GbE QSFP+ with L2-7 support, full featured L1-3 data plane support



Scenario

"Broadband" describes high-speed Internet access for end customers, via wireless, cable, or DSL. Broadband requires numerous protocols and devices to work together seamlessly to provide reliable customer Internet access, especially when rolling out new services that consume larger and larger amounts of bandwidth. Without sufficient testing of broadband network protocols, equipment, and network topologies, business will suffer due to unreliable customer access.

Testing services over broadband access is a critical factor in providing excellent quality of experience (QoE) to end-users, whether they are enterprises, providers, or individual customers. Coupled with this, the impending switchover to IPv6 to accommodate the loss of IPv4 address space requires that networks run both IPv4 and IPv6 seamlessly in order to mitigate the transition risks.

Ixia Solutions

Ixia specializes in testing network components and topologies, helping to ensure broadband reliability. Ixia's platform emulates network protocols and simulates network devices to help answer critical questions, such as:

- Does my broadband implementation conform to industry standards?
- Does my ANCP implementation allow full monitoring of my network topology and state?
- Can my BRAS, LAC, or LNS scale and still meet QoS objectives?
- Can I test and verify service-level agreements (SLAs)?
- Is my network able to handle subscriber session flapping?
- Can my network support IPv4/IPv6 subscribers and services, while maintaining SLAs?

Ixia is a market leader for broadband testing solutions. Network equipment manufacturers and service providers meet the challenges of broadband deployment and maintenance using Ixia's award-winning solutions that ensure performance, conformance, and scalability.

Suggested Applications and Platforms	
IxExplorer	Line-rate packet generation and capture with full control of traffic contents.
IxNetwork)	Full layer 2/3 testing with optional wire-rate traffic generation and protocols: • PPPv4/v6/Dual-Stack PPP (PPPoE, PPPoEoA, PPPoA), L2TPv2, ANCP, DHCPv4/v6, DS Lite, 6rd, IGMP/MLD, *802.1x, *Cisco and HP Web-Auth, *Cisco NAC
IxAutomate	Pre-built benchmark tests for PPP
IxANVL	Protocol conformation testing with: • PPP, L2TP, DHCPv4/v6, 802.1x
IxLoad	L4-7 services testing over broadband access
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Flex – 16-port 10GbE SFP+, up to 128 ports per chassis • LSM1000XMVDC – 16-port 1GbE Dual-Phy, up to 192 ports per chassis
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
PerfectStorm/ PerfectStorm ONE	Blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis. Ensure enterprise security resiliency and perform proof-of-concept (POC) testing against vendor claims.

Scenario

Networks and network devices are becoming increasingly complex. Enterprise expansion, data center convergence, and new service deployments require that diversified networking technologies and devices operate together seamlessly.

Remote locations and changeover from dedicated circuits have multiplied the use of layer 2 and 3 virtual private networks (L2VPN and L3VPNs). VPNs both protect sensitive information and provide virtual network security using authentication and encryption.

The flexibility, pervasiveness, and availability of low-cost switches have given rise to Carrier Ethernet. Making Carrier Ethernet a viable alternative to router-based networks and requiring a number of new protocols and techniques. (Carrier Ethernet testing is separately discussed on page 5.)

As multiple, special-purpose networks converge to a single network carrying voice, video, data, and wireless traffic, it is critical that device manufacturers verify the scalability, stability, and performance of their switches and routers.

Service providers must carry multiplay services on a single IP network in order to offer increasingly popular applications such as YouTube, Facebook, and peer-to-peer exchange. The demand for larger capacity and more services increases the complexity and scale of modern networks and devices. Providers must validate service differentiation based on configured quality of service (QoS) policies and SLAs, as well as determine the service impact on existing network structures from new applications.

Within the data center, local area network (LAN) and storage area network (SAN) traffic have traditionally used separate Ethernet and fibre channel networks. Cost-effective 10GbE networks have provided the economic incentive to combine these networks using a new generation of data center bridging (DCB) components, including fibre channel over Ethernet (FCoE) switches and SANs.

Ixia Solutions

Ixia's solutions comprehensively test the interoperability, performance, and scale of networking devices. Ixia's IxNetwork test applications offer the industry's most complete test solution for functional and performance testing by emulating routing, switching, MPLS, IP multicast, broadband, and authentication protocols.

Ixia test ports accurately emulate an Internet-scale networking environment containing thousands of routers and switches and millions of routes and reachable hosts. Millions of traffic flows can be easily customized to stress and track data plane performance.

Subscriber modeling simulates user communities that match the behavior of city-size groups using multiplay services such as web, e-mail, FTP, peer-to-peer (P2P), voice over IP (VoIP), and video. Ixia's testing capabilities scale to stress the largest and most powerful networking devices.

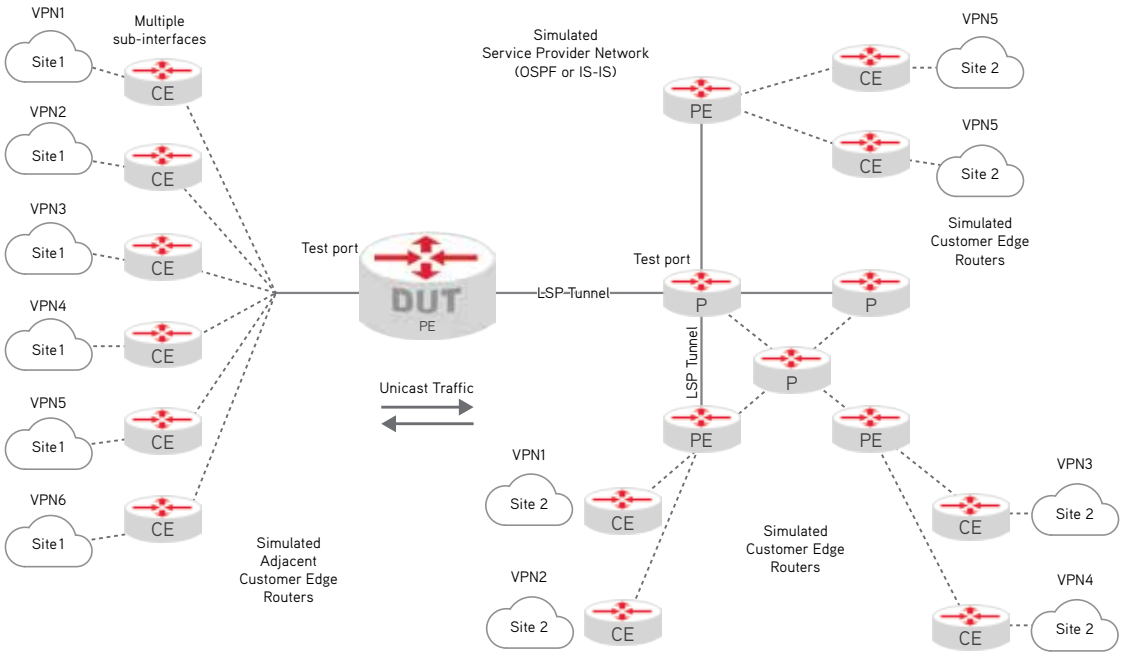
Ixia load modules, consisting of multiple test ports, provide network interfaces of all types. Our mainstay Ethernet interfaces operate over the full range from 10Mbps through 10, 40, and 100Gbps speeds. In addition, asynchronous transfer mode (ATM) and packet over SONET (POS) interfaces are available. Line-rate traffic is generated to characterize the performance and reliability of data forwarding.

To test complex scenarios, Ixia's solutions:

- Model millions of services with deterministic traffic profiles
- Define different rate-controllable traffic profiles on a per-service basis
- Validate SLAs through dynamic modification of traffic profiles
- Produce service- and subscriber-level statistics

Full simulation of authenticated, large-scale broadband network communities is supported with web-based, 802.1x, network access control (NAC), and other authentication mechanisms. Encapsulations, including PPP, L2TP, and IPsec are likewise available for exercising broadband access concentrators.

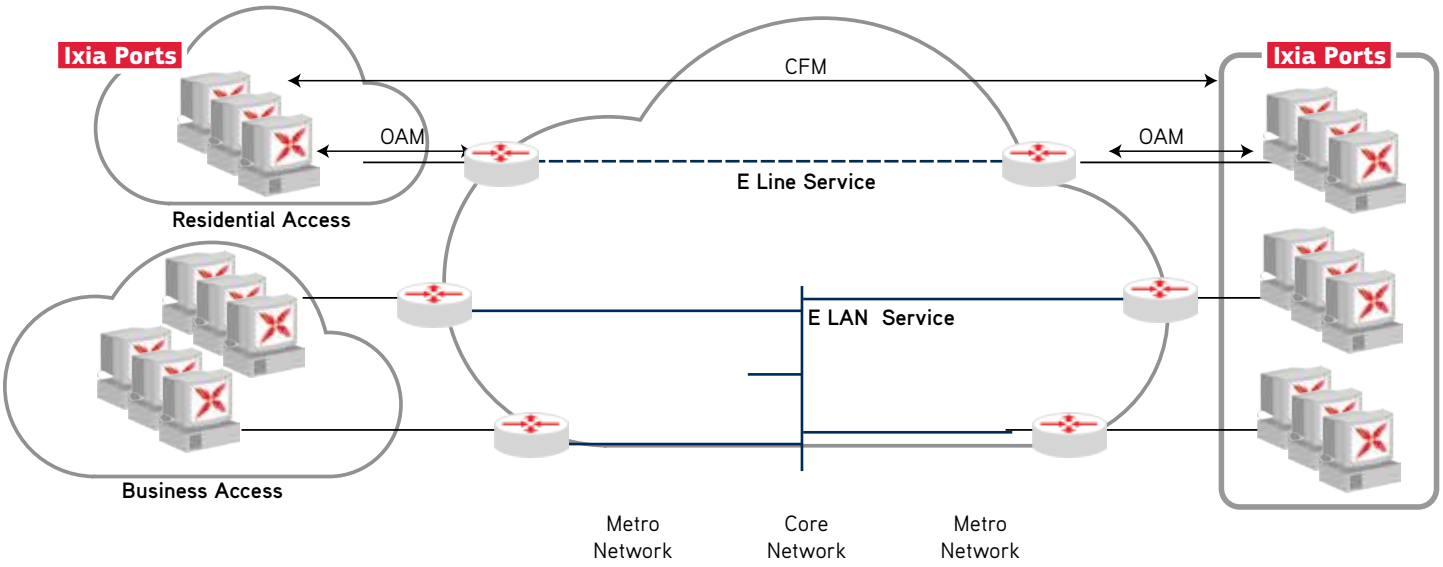
Use the IxNetwork GUI to easily configure complex layer 2/3 VPN topology simulations. Tests scale to stress the performance of the most powerful border gateway protocol (BGP)- and multiprotocol label switching (MPLS)-capable routers. Each central processing unit (CPU)-equipped test port advertises hundreds of label distribution protocol (LDP) sessions and thousands of forwarding equivalence classes (FECs), as well as hundreds of VPN sessions and thousands of VPN routes. Wire-speed traffic can be generated over the VPN topology to simultaneously test data and control planes.



Routing and Switching Protocol Emulation	
Technology	Protocols
Routing	RIP, RIPng, OSPFv2/v3, ISISv4/v6, EIGRP, EIGRPv6, BGP4+, BGP+
MPLS	RSVP-TE, RSVP-TE P2MP, LDP, PWE, L3 MPLS VPN, 6PE, GMPLS, MPLS-OAM
VPLS	VPLS-LDP, VPLS-BGP
High availability	BFD
IP multicast	IGMPv1/v2/v3, MLDv1/v2, PIM-SM/SSM, PIM-BSR, Multicast VPN, VPNv6, MSDP
Switching	STP/RSTP/MSTP, PVST+, RPVST+, Link Aggregation (LACP)
Broadband	ANCP, PPPoX, DHCPv4/v6, client/server, L2TPv2, RADIUS Attributes for L2TP
Authentication	802.1x, WebAuth, Cisco NAC
Traffic	Ethernet, IPv4, IPv6, VLAN, MPLS multi-label, L2/L3 MPLS, VPN, VPLS, 6VPE, Multicast, Multicast VPN

Ixia test applications are perfect for both interactive test development and automated execution. Easy-to-use graphical user interfaces (GUIs) and wizards help you create complex emulations and traffic. Aggregated, per-user, per-VLAN, and per-VPN statistics quickly identify any failure or diminished service. The event scheduler provides powerful GUI-based automation, and its ScriptGen tool offers an easy, one-click GUI-to-script automation solution. A number of integrated tests provide standards-based test methodologies. Both IxNetwork and IxN2X supply full-featured APIs for automated testing.

Suggested Applications and Platforms	
IxNetwork	Full layer 2/3 switch and router testing, with optional protocols: • Routing protocols • Broadband testing • Application traffic over routes
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Flex AP – 16-port 10GbE SFP+ and 4-port 40GbE QSFP+ • Xcellon-Flex – 16-port 10GbE SFP+ • Xcellon-Flex FE – 4-port 40GbE QSFP+ • LSM1000XMVDC – 16-port 1GbE Dual-Phy



Scenario

Carrier Ethernet services are growing rapidly, driven by next-generation VPN services and mobile backhaul. A suite of protocols is required to achieve carrier-grade scale, reliability, and management. Carrier Ethernet requires the use of Ethernet at the user-to-network interface (UNI) and can be delivered via a variety of metro and core technologies, including an Internet protocol (IP)/ MPLS core.

The Metro Ethernet Forum (MEF) has defined technical specifications to advance the development and deployment of Carrier Ethernet services.

- **MEF 9** outlines conformance-oriented service testing and is the basis for performance tests
- **MEF 14** defines testing of performance service attributes, including QoS functional requirements
- **MEF 21, 24,** and **25** constitute a test suite for UNI type 2, including link OAM, E-LMI, service OAM, protection, enhanced UNI attributes and L2CP handling

The MEF specifications allow carriers to deliver services using any underlying technologies. The table lists the protocols used for routing, switching, and network management.

As the demand for Carrier Ethernet E-Line and E-LAN services continues to grow, so does the need for fault management. Ethernet operation, administration, and maintenance (OAM) covers Ethernet link monitoring and diagnosis. Ethernet connectivity fault management (CFM) defines protocols that monitor end-to-end services.

Ixia Solutions

Ixia's MEF conformance tests verify both Carrier Ethernet conformance requirements and network performance. IxANVL has a widest coverage of Carrier Ethernet and MEF conformance in the industry. Ixia emulation functionality tests common Carrier Ethernet routing protocols, including MPLS, layer 2 switching, and PBB-TE.

Ixia's solutions include support for IEEE 802.3ah, IEEE 802.1ag, and ITU-T Y.1731.

Use	Protocol
Routing	MPLS, VPLS, BFD (bidirectional forwarding detection)
Switching	QinQ (802.1ad), PBB-TE (802.1Qay) PBB/MAC-in-MAC (802.1ah) RSTP/MSTP, LACP, MVRP/MMRP VLAN (802.1Q)
Management	Ethernet OAM (802.3ah) Service OAM (ITU-T Y.1731) E-LMI (MEF 16)
Timing	1588v2 (IEEE) Synchronous Ethernet (ITU-T) CES (MEF18)

Suggested Applications and Platforms	
IxANVL	Protocol conformance testing, with: • MEF9, MEF21, MEF24, and MEF25 conformance suites • PBB, 802.1Q, and MVRP/MMRP conformance suites
IxANVL CE 2.0 Conformance Validation	Testing based on CE 2.0 Certification Test Plan, including: • E-Line, E-LAN, E-Tree, and E-Access • EPL, EVPL, EP-LAN, EVP-LAN • EP-Tree, EVPTree, Access EPL, and Access EVPL
IxAutomate	Prebuilt tests for network testing of all types, including: • MEF14 test suite • Metro performance test suite • STP/RSTP/MSTP test suite
IxNetwork	Full layer 2/3 testing, with emulation of: • Link OAM (802.3ah), Service OAM - IEEE 802.1ag, ITU-T Y.1731 • QinQ, PBB/PBB-TE, STP/RSTP/MSTP, LACP
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Flex – 16-port 10GbE SFP+, up to 128 ports per chassis • LSM1000XMVDC – 16-port 1GbE Dual-Phy, up to 192 ports per chassis
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.
Anue 3500	The Anue 3500 is an intuitive test case driven solution that validates the performance of synchronization services and Carrier Ethernet functions required by next generation carrier grade Ethernet/IP based networks.

Scenario

The "virtualization" of traditional networks promises vast and enduring benefits — if the challenges inherent in the process can be overcome. In replacing proven technologies with unproven techniques, a new approach is needed to reduce complexity, mitigate risk, and get it right the first time.

Technology becomes more open, provisioning more fluid, and networks more application-aware. Through increased agility and software-based control, virtualization delivers dramatic cost-savings, and a new networking model that fast-tracks delivery of high-value services. But at the very least, virtualized network functions (VNFs) need to deliver the same or better performance than the traditional network. With false starts likely to impact the brand as well as the budget, new and old strategies are needed to quantify the benefits, and overcome challenges.

Demystify the Process, Deliver on the Promise

With virtualization, everything known — and proven — becomes unknown and unproven again. Complexity increases. New network elements introduce new vulnerabilities. Visibility is lost as the traditional physical boundaries become blurred in the cloud.

To transcend the hype, and achieve the very real benefits, vital questions need to be answered:

- What benefits do we hope to achieve?
- Which functions should be virtualized and when?
- How will migration to commercial hardware — and the cloud — impact the user experience?
- How do we maintain visibility as everything scales?

And last but not least:

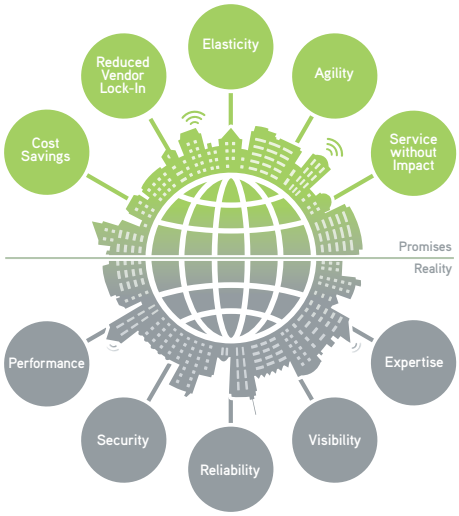
- How do we know it worked?

Throughout the migration process, enterprises and service providers must weigh the trade-offs between quality and cost; flexibility and control.

Ixia Solutions

Today's networks need to adapt quickly, and facilitate change. Strategies like Network Functions Virtualization (NFV) and Software Defined Networking (SDN) provide powerful flexibility gains by moving functions like CPE, BRAS, load balancing, firewalls, and EPC/IMS components off dedicated hardware onto virtualized servers.

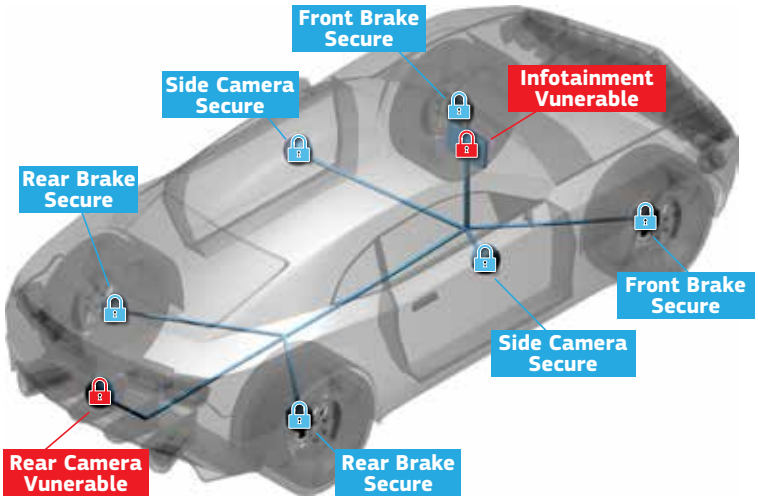
Moving too fast, and not fast enough. That's where Ixia comes in, with the industry's only life-cycle solution for eliminating the guesswork, and validating the benefits of virtualization each step of the way.



Suggested Applications and Platforms	
RackSim	Virtualized data center simulation emulating large numbers of virtualized hosts running multiple hypervisors.
IxNetwork VE	Powered by IxVM. Full layer 2/3 testing, with emulation of: • Link OAM (802.3ah), Service OAM - IEEE 802.1ag, ITU-T Y.1731 • QinQ, PBB/PBB-TE, STP/RSTP/MSTP, LACP
IxLoad VE	Powered by IxVM. Full layer 4-7 testing, with options for: • SIP, H.323, MGCP, H.248, SCCP • RTP/RTCP/SRTP • Audio, video, fax, instant messaging
IxVM	Virtualized versions of Ixia test applications, including: • IxExplorer – interactive packet generation and capture • IxNetwork VE – layer 2/3 testing • IxLoad VE – layer 4-7 testing
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
Phantom vTap	Captures and sends inter-VM traffic of interest to the tools that are already monitoring your physical network.

Scenario

Automotive technology over time has changed to a moving combination of integrated computer systems-advanced driver assistance systems (ADAS), adaptive cruise control, hybrid engines, Internet access, and Bluetooth connection. Automakers are looking to standard Ethernet technologies to provide a single, flexible, scalable, more cost-effective in-vehicle networking backbone. To ensure optimal design, functionality, performance, safety, security, and interoperability of these connected cars, automakers and their suppliers need comprehensive test solutions to validate devices, systems, applications, and even the entire in-vehicle network.



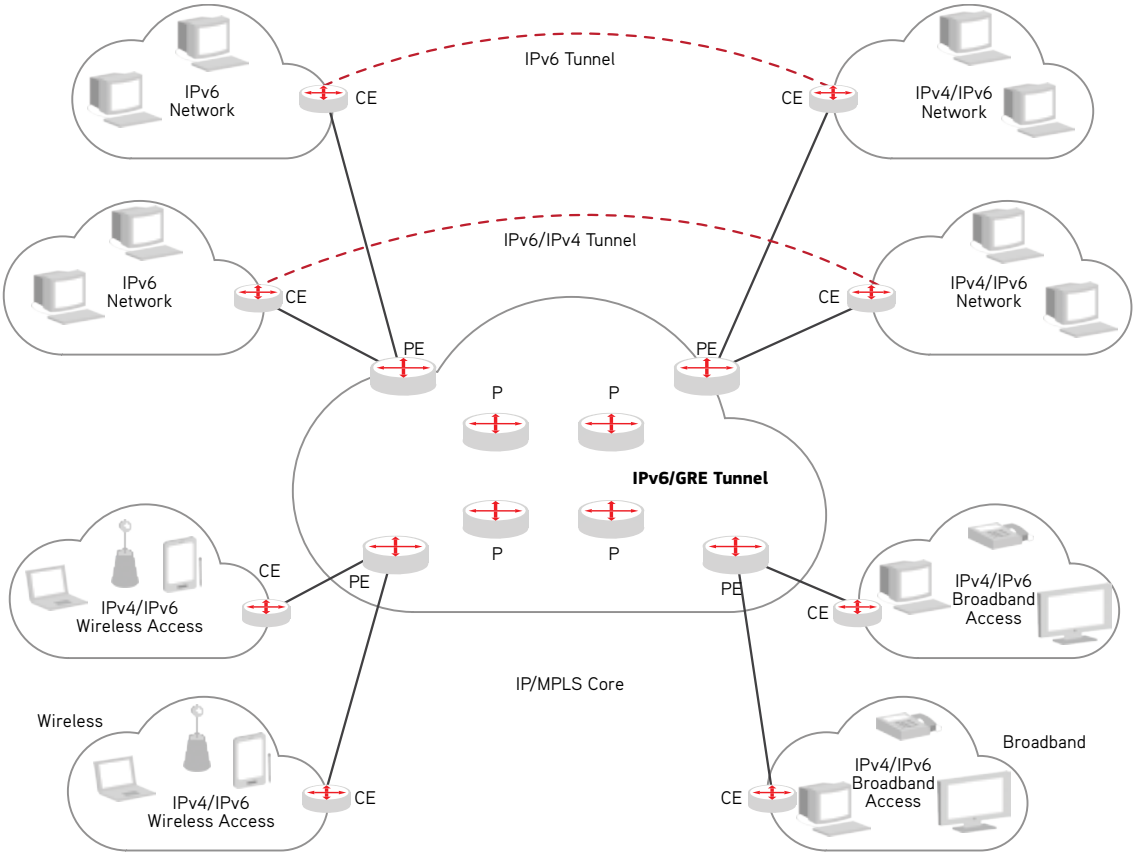
The role of testing is to verify proper functionality at each stage of system evolution. Effective testing means conducting development, integration, verification, conformance, and performance checks as efficiently, quickly, and accurately as possible. Automotive manufacturers have relied on complex and custom solutions to perform testing as they develop and integrate new technologies. The use of an Ethernet backbone now requires open, standard solutions that deliver testing across the whole automotive ecosystem. Ixia's unique automotive Ethernet test solutions include conformance, wireless, application, and security validation.

Ixia Solutions

Ixia products enable real-world validation of in-vehicle fixed, wireless, and security technologies, empowering the automotive industry to build best-in-class in-vehicle infotainment and always-on networking. Ixia is a leader in network, device, application, and security testing for automotive Ethernet functionality, accelerating new in-vehicle features and delivering a safe driving experience.

- Automotive Conformance Testing: Quickly validate interoperability and standards compliance of vehicle technology that links autos and mobile devices to each other and to the transportation infrastructure with Ixia's conformance test solution.
- Automotive Wireless Testing: Ensure an always-on user experience by validating connectivity within the vehicle to onboard systems, sensors, and user devices-and beyond the vehicle, to ensure mobile data services and security. Ixia solutions include: Wi-Fi assessment, mobile device test, mobile backhaul test, and LTE test.
- Automotive Applications Testing: Validate that multimedia applications perform optimally over any device and network by understanding how your applications and services will perform under real-world in-car conditions, attacks, and impairments. Assess and optimize user experience and security effectiveness with Ixia's application load test solutions. (Note: need to fix the BP link on this page: change BreakingPoint Application Load Testing Services to BreakingPoint)
- Automotive Security Testing: Ensure the safety and security of connected cars by testing the systems designed to protect the in-vehicle network from cyber attacks. Ixia security solutions validate security capabilities using line-rate application traffic and real-world security attacks.

Suggested Applications and Platforms	
IxNetwork	Full layer 2/3 testing, with emulation of: • Link OAM (802.3ah), Service OAM - IEEE 802.1ag, ITU-T Y.1731 • QinQ, PBB/PBB-TE, STP/RSTP/MSTP, LACP
IxLoad	Full layer 4-7 testing, with options for: • SIP, H.323, MGCP, H.248, SCCP • RTP/RTCP/SRTP • Audio, video, fax, instant messaging
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
IxANVL	• Validate protocol conformance to specific standards • Increase interoperability between devices • Identify software issues in early product lifecycle



Scenario

IPv4 addresses are exhausted and the change over to IPv6 is occurring now. Given the extent to which IPv4 addresses are embedded in networks and applications, IPv4 and IPv6 addresses will coexist for decades. Upgraded network architectures need to support IPv4 and IPv6 technologies, the associated transition/translation mechanisms, and scale to accommodate a significant increase in clients and services.

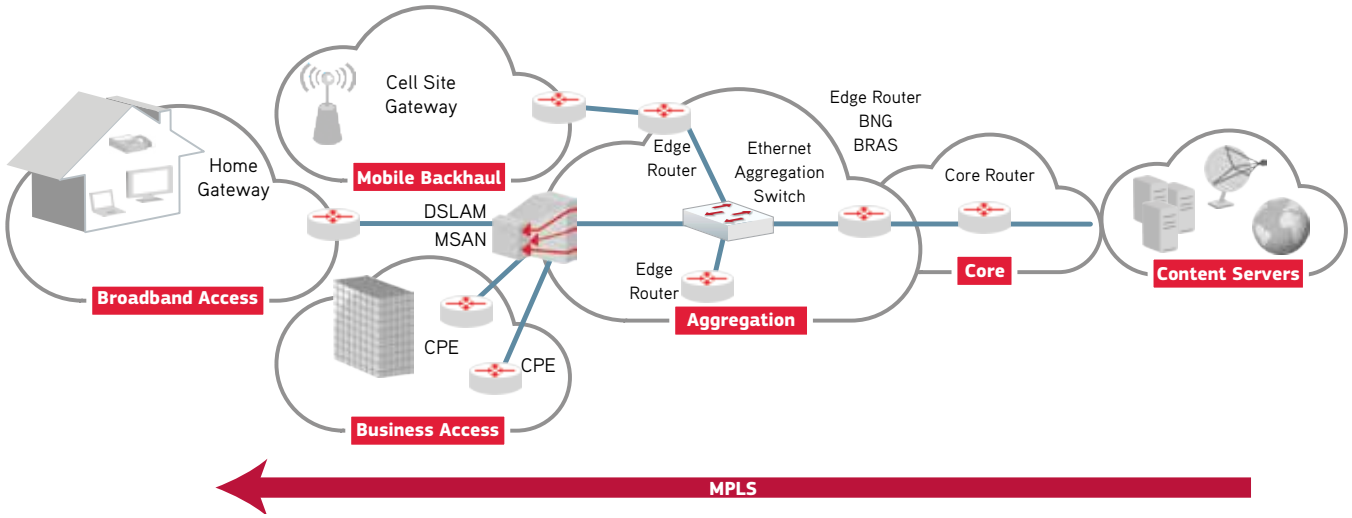
IPv6 testing requires emulating the full range of protocols used in today's IPv4, IPv6, and transitional dual-stack networks, as well as fully stressing the data plane and associated tunneling/translation implementations of each device.

Ixia Solutions

Ixia's IPv6 Transition Readiness Kit equips NEMs and service providers with test plans and tools to fully evaluate the readiness of each device, system, or end-to-end network. Testing will answer critical questions such as:

- Can my system correctly assign and scale IPv4 and IPv6 addresses for Internet access?
- Is my system capable of ensuring QoS for both IPv4 and IPv6 traffic for increasing subscribers and load?
- Are my tunneling and translation implementations robust?
- What is my network address translation (NAT) table capacity and forwarding performance?
- How is application responsiveness and performance impacted when transition or translation mechanisms are pushed to their limits?
- Is my dual-stack core network capable of supporting the increased load of mixed IPv4/IPv6 routing?

Suggested Applications and Platforms	
IxNetwork	Full layer 2/3 switch and router testing, with optional traffic generation and protocols: • Routing – BGP4/BGP4+, OSPFv2/OSPFv3, ISISv4/ISISv6, RIP/RIPng, PIM-SM/SSMv4, PIM-SM/SSMv6 • Broadband access – PPPv4/v6/dual-stack PPP, DHCPv4 client/server, DHCPv6 client/server, PPPv4/PPPv6/dual-stack PPP over L2TPv2 LAC and LNS, IGMP/MLD, IPv6 stateless autoconfiguration, DS Lite, 6rd
IxANVL	Protocol conformance testing, with: • Routing – RIP, RIPng, OSPFv2/v3, ISISv4/v6, BGP-4, BGP4+ • MPLS – RSVP-TE, RSVP-TE P2MP, LDP, VPWS/PWE3, VPLS-LDP, VPLS-BGP, L3 MPLS VPN, 6VPE • IP multicast – IGMPv1/v2/v3, MLDv1/v2, PIM-SM/SSMv4/v6, PIM-BSR • Switching – STP/RSTP, MSTP, link aggregation (LACP) • Broadband – PPPoX, DHCPv4 client/server, DHCPv6 client/server, L2TPv2
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Flex AP – 16-port 10GbE SFP+ and 4-port 40GbE QSFP+ • Xcellon-Flex FE – 4-port 40GbE QSFP+ • Xcellon-Flex – 16-port 10GbE SFP+ • LSM1000XMVDC – 16-port 1GbE dual-Phy • NGY 8-port – 10GbE with XFP, SFP+, and 10G Base-T interfaces
Ixia BreakingPoint	Test the performance, security, and stability of devices and systems under dual-stack conditions using real-world application traffic on both IPv4 and IPv6



Scenario

Driven by massive growth in data traffic, service providers are moving toward a single packet network infrastructure that supports multiple services at lower operational costs.

Success and familiarity with MPLS in the core is driving service providers to deploy it into non-core network services such as access, aggregation, and backhaul networks supporting broadband, business, and mobility services.

Additionally, with MPLS-transport profile (MPLS-TP) an industry standard is emerging to enable connection-oriented packet transport to meet the growing demand. MPLS is under active development with new mechanisms and applications emerging from the standards bodies, continually increasing its popularity.

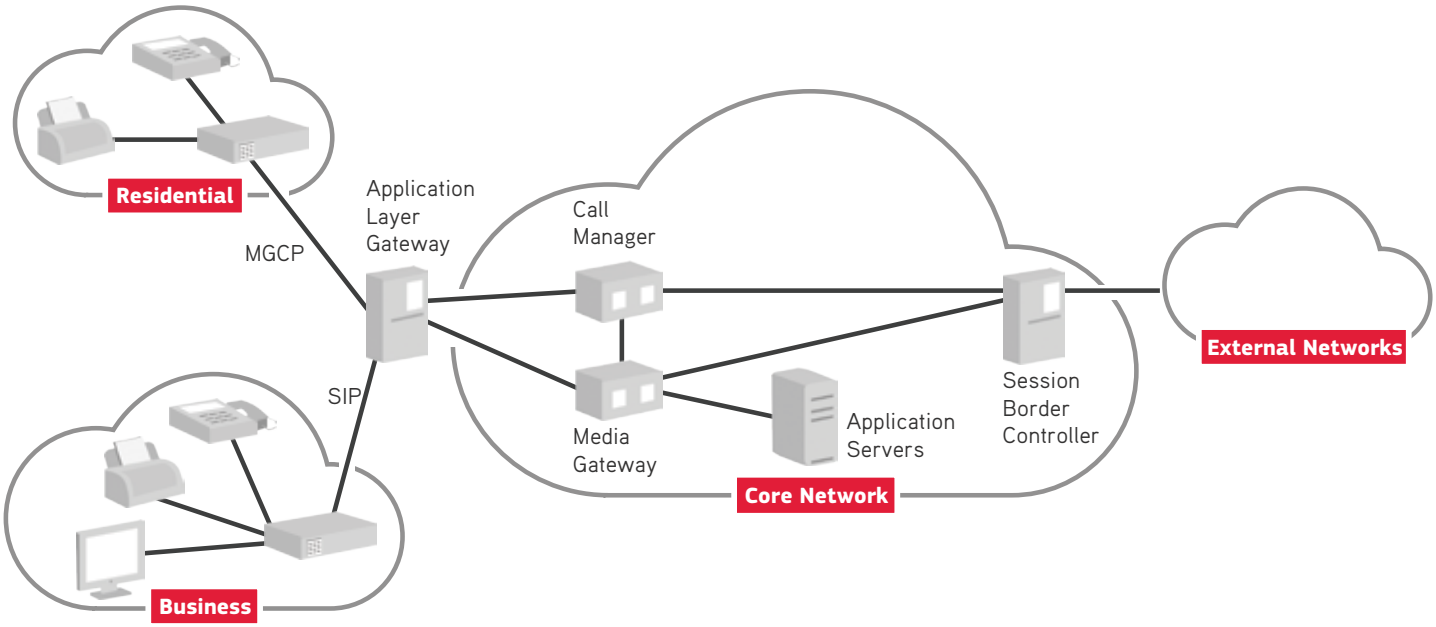
As MPLS-based technologies and services continue to evolve, deploy, and increase in scale, the test challenges become increasingly more complex. Ixia continues to provide the most comprehensive test capability for validating the MPLS infrastructure and the services it supports.

Ixia Solutions

Ixia helps answer critical MPLS questions, such as:

- Can my device or network reliably deliver, simultaneously, multiple MPLS-based VPN services - L2, L3 (unicast, multicast)?
- Does my device maintain thousands of MPLS tunnels and pseudowires with the required level of forwarding performance?
- Are MPLS-TP features working properly? Can I interoperate with other vendors?
- Does my device conform to the latest MPLS-related standards?
- Does MPLS traffic engineering provide sub-50ms recovery?

Suggested Applications and Platforms	
IxNetwork	Full layer 2/3 switch and router testing, with integrated traffic generation and optional protocols and features, including: • Routing and switching protocols • MPLS protocols • MPLS-TP protocols and features (supported on IxNetwork only) • VPLS protocols • IP multicast protocols • High availability • IPv4/IPv6 traffic generation
IxANVL	Protocol conformance testing, with: • RIP/NG, OSPFv2/v3, BGP4/4+, ISISv4/v6, VRRP • LDP, RSVP-TE, MPLS, PWE3, L2 VPN, L3 VPN, VPLS, LSP-Ping, VCCV, mLDP
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Flex AP – 16-port 10GbE SFP+ and 4-port 40GbE QSFP+ • Xcellon-Flex FE – 4-port 40GbE QSFP+ • Xcellon-Flex – 16-port 10GbE SFP+ • LSM1000XMVDC – 16-port 1GbE Dual-Phy
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.



Scenario

Voice over IP (VoIP) is a major component of service providers' consumer and business offerings. Modern deployments now call for millions of simultaneous VoIP endpoints. NEMs, carriers, service providers, and enterprises must create and deploy next-generation hardware to handle growing VoIP demands, and need testing options that can simulate large volumes of real-world voice traffic.

Although VoIP connections have a low bandwidth requirement, they are very sensitive to latency and jitter. Care must be taken to enforce appropriate QoS policies for voice traffic, balanced with the QoS requirements associated with video and data services. Authentication, authorization, and accounting (AAA), IP multimedia subsystem (IMS), and other support services are required to support VoIP call initiation and accounting.

Ixia Solutions

The IxANVL SIP suite tests the conformance of devices to session initiation protocol (SIP) protocols.

IxLoad VoIP is the perfect tool for functional, performance, and stability testing of voice devices and networks prior to deployment.

Ixia BreakingPoint offers very high capacity (tens of thousands of concurrent users) VoIP calling capacity and extensive configurability.

Ixia supports video and data protocols in addition to VoIP – making it perfect for testing a wide variety of components, including:

- SIP proxies and registrars
- MGCP and H.248 media gateways and media gateway controllers
- H.323 gatekeepers
- Call agents and call managers
- Session border controllers (SBCs) and application-layer gateways (ALGs)
- Multiplay delivery networks
- VoIP services in NGN and IMS architectures

IxLoad includes features essential for full VoIP protocol testing:

- Very large-scale operation – emulating more than 1 million subscribers per chassis
- Realistic, complex call flows
- Flexible test-case creation through state machine and message content control
- Broad audio CODEC support: G.711 A-Law, G.711 µ-Law, G.729 A/B, G.726, G.723.1, and iLBC
- Support for H.264 CODEC media: video-conferencing
- Full user authentication and registration parameters
- Link layer and security protocols
- Library of prebuilt test cases
- Capture/replay can be used to test other protocols

IxLoad provides extensive statistics, including per-call predictive mean opinion score (MOS), average and per-flow statistics, VQM, PESQ, and ladder diagrams with a built-in protocol analyzer and media decoder.

IxLoad's VoIP capabilities, combined with T1/E1 modules, validate and stress public switched telephone network (PSTN)-capable devices. IxLoad's PSTN test solution pushes the limits of convergent telephony systems by sending generic PSTN call flow and media streaming messages across the TDM interfaces.

Suggested Applications and Platforms	
IxANVL	Protocol conformance testing, with: • SIP conformance suite
IxLoad	Full layer 4-7 testing, with options for: • SIP, H.323, MGCP, H.248, SCCP • RTP/RTCP/SRTP • Audio, video, fax, instant messaging
IxChariot	Live network testing, with: • SIP call emulation
IxChariot Pro	Network assessments with active monitoring to measure, control, solve, and verify network infrastructure.
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12 slot high performance chassis, with optional load modules: • Xcellon-Ultra™ NP – 12-port 1GbE, with special RTP emulation firmware
Ixia BreakingPoint	Harden and optimize IP contact centers by providing massive-scale, high-fidelity simulation and testing conditions
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.

Scenario

Media convergence is fueling the growth and complexity of today's IP networks. To effectively compete, service providers must deliver differentiated multiplay services, including VoIP, P2P, gaming, IPTV, streaming media, high-speed Internet, and mobile services over converged networks. There are numerous challenges associated with delivery of multiplay services due to the different characteristics of voice, video, and data traffic:

- Voice traffic consumes fairly low bandwidth, but is highly sensitive to network jitter
- Video services require a steady stream of high bandwidth traffic, and are severely impacted by packet reordering and loss
- Data services such as web browsing, file transfer, and other end-user interactive applications have varying requirements

Proper QoS provisioning, performance analysis, and capacity planning are key requirements for ensuring a successful service rollout and sustained growth.

Today's data center networks support a complex application delivery infrastructure that must recognize, prioritize, and manage application traffic with differentiated classes of service. The emergence of integrated service routers (ISRs), application-aware firewalls, server load balancers, wide-area network (WAN) accelerators, and devices that use deep-packet inspection (DPI) enable service providers to deliver superior application performance and security while improving user QoE.

Equipment vendors need a comprehensive test solution for validating the functional capabilities, performance, and scalability of their next-generation hardware platforms. Enterprises and service providers face similar challenges as they attempt to ensure that their networks can deliver on performance and availability requirements, while maintaining proper QoS for all mission-critical data, voice, and video traffic.

Multiplay Application Emulation

Protocol	Options
Data	HTTP (1.0,1.1), SSLv2, SSLv3, TLSv1, FTP, TFTP, SMTP, POP3, IMAP, RTSP, RTP/UDP, RTP/TCP, Telnet, SSH, CIFS, DNS, DHCP, LDAP, RADIUS
Peer-to-Peer	BitTorrent, eDonkey
Stateful Replay	Application replay
VoIP	SIP, RTP, H.323, MGCP, H.248/MEGACO, SCCP/Skinny
Video	Multicast TV and video on demand IGMPv2, IGMPv3 RTSP, RTP/UDP, RTP/TCP MPEG2, MPEG4/H.264 Video quality analysis for IPTB, VOD Adobe Flash player (RTMP, RTMPT) Microsoft Silverlight player Apple HLS

Ixia Solutions

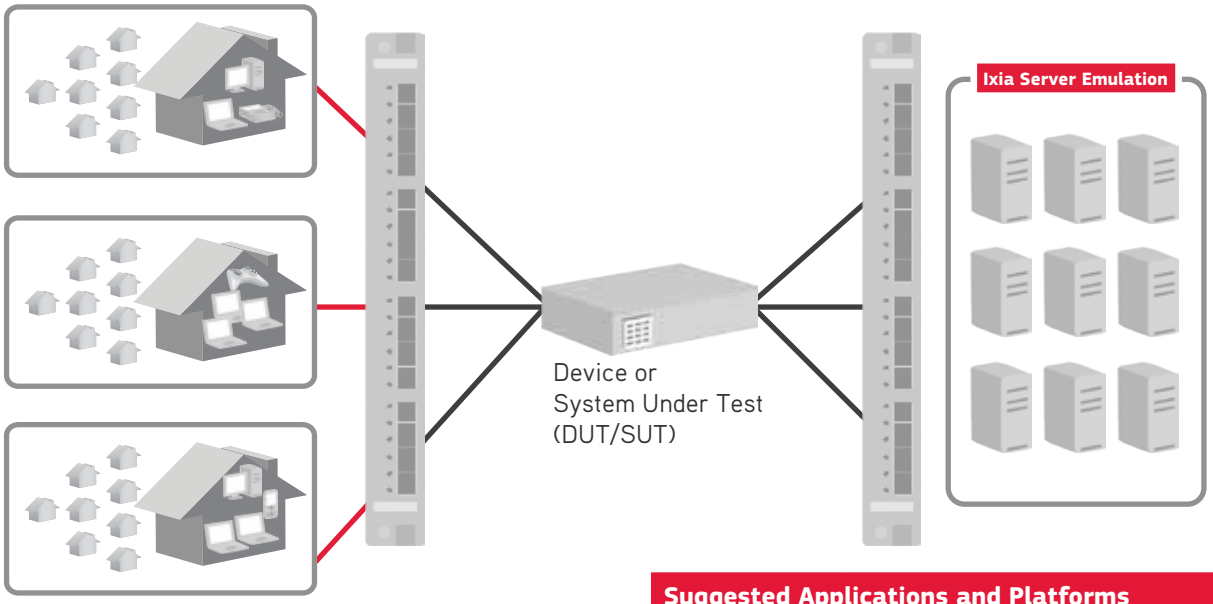
The requirements for testing application-aware devices are complex and resource-intensive. Devices need to be exercised beyond their limits to ensure optimum functionality, performance, availability, and reliability.

Ixia's IxLoad is the industry's most scalable and integrated solution for converged multiplay service delivery testing. It is an ideal solution for assessing the performance of application-aware DPI-capable devices.

IxLoad delivers multiplay service emulation in a single testbed, including IPTV/VoD, VoIP, P2P, web, FTP, streaming, and e-mail as described in the table to left. Ixia's platform delivers ultra-high performance that scales to millions of subscribers. Subscriber modeling accomplishes true traffic testing by emulating dynamic user community behavior. Generate per-subscriber QoE analysis on key metrics, including video and audio quality, channel change times, application latency, and response times.

IxLoad supports AAA/RADIUS services, DNS, DHCP, and LDAP to assess critical infrastructure components. Distributed denial of service (DDoS) and vulnerability attack traffic generation is used to validate the impact of malicious traffic on multiplay services.

IxLoad emulates subscribers with a complete mix of multiplay traffic, measures the scalability of the converged service delivery infrastructure, validates the impact of peer-to-peer (P2P) on revenue-generating services, such as IPTV and VoIP, and ensures QoE on a per-subscriber and/or per-service basis.



The Ixia BreakingPoint, IxNetwork, and IxN2X solutions also compliment IxLoad's functionality.

IxLoad enables application performance testing using:

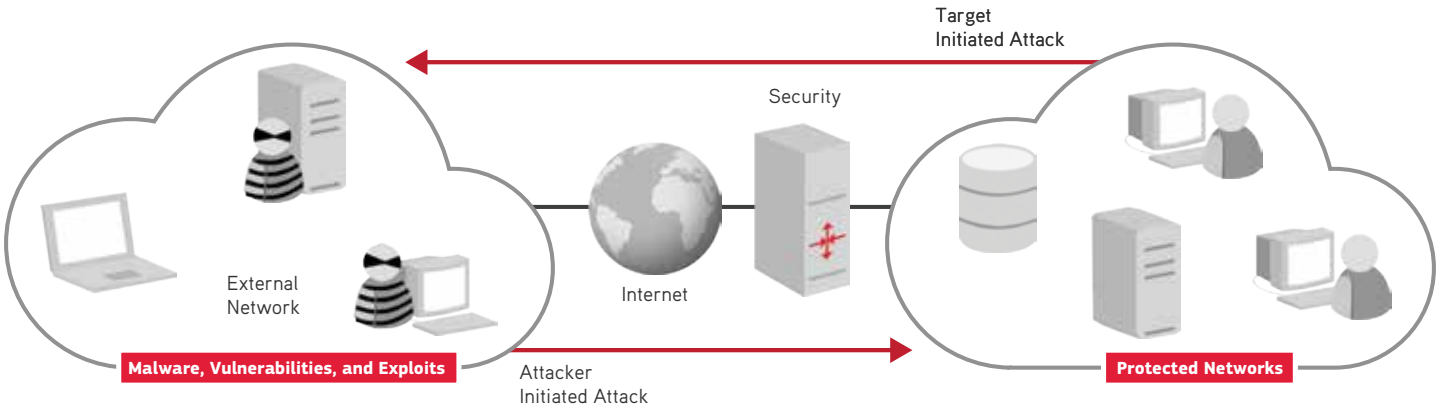
- Realistic stateful emulation of application services
- Application replay to record and replay stateful transactions to test devices that handle emerging and proprietary protocols
- QoE detective for granular instant insight into per-user, per-IP and per-VLAN issues

IxNetwork provides wire-rate traffic generation with service modeling that builds realistic, dynamically-controllable data-plane traffic. IxNetwork offers the industry's best test solution for functional and performance testing by using comprehensive emulation for routing, switching, MPLS, IP multicast, broadband, authentication, Carrier Ethernet, and DCB protocols.

The Ixia IxN2X multiservice test solution is designed to test IP forwarding devices such as routers and switches that deliver video, VoIP, data services and business VPNs. It is used in "out-of-service" lab environments to test network components at real-world scale, prior to their deployment in live networks.

BreakingPoint offers robust CIFS and web application testing capabilities for WAN acceleration.

Suggested Applications and Platforms	
IxLoad	Full layer 4-7 multiplay network testing, with optional protocols: • Data protocols • Peer-to-peer protocols • Stateful replay • Voice over IP protocols • Video protocols
IxNetwork	Full layer 2/3 switch and router testing, with optional protocols: • Routing protocols • Integrated broadband access protocol emulation with service traffic generation testing • Application traffic over routes
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules:
Xcellon Ultra XT/XTS	• Xcellon-Ultra XT – very-high performance application traffic to 80Gbps • Xcellon-Ultra XTS – very-high performance with IPsec encryption to 40Gbps
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.
PerfectStorm	Blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.
PerfectStorm ONE	Ensure enterprise security resiliency and perform proof-of-concept (POC) testing against vendor claims.



Scenario

Network security is a top concern of every enterprise. Each computer with access to the Internet or offering a service to the Internet must be protected from security threats. By the end of 2011, the average total cost of a data breach for medium to large size enterprises is $8.4M (up 39% from the previous year).[1]

Malware security attacks take many forms: viruses, worms, trojans, rootkits, spyware and malicious adware, and scareware. These attacks often succeed with the cooperation of computer users – through e-mail, web pages, FTP transfers, instant messaging, peer-to-peer file sharing, online games, and careless software installation. Other attacks happen just by virtue of being connected to the Internet: denial of service attacks against company sites, vulnerability attacks against web, email, FTP, and other services and password-login attacks.

In addition to user education, enterprises use a variety of network security devices to protect their sites and services. These include:

- **Firewalls** – the first of the security devices. They serve to filter access to a network based on IP addresses and protocols. Modern advances in DPI now allow firewalls to filter based on internal protocols and contents.
- **VPN gateways** – used to provide secure access to remote employees and partners. These devices use IPsec encryption to protect traffic from trusted sites.
- **Intrusion detection/prevention (IDS/IPS) systems** – protection against hacking. These sophisticated devices recognize a wide range of unusual network usage, looking for indications of misuse.
- IDS systems notify administrators of possible breaches, whereas IPS systems block access, often by programming the firewall.
- **URL filtering** – preventing access to suspect web sites. These devices watch all web, FTP, and other access and prevent access to sites on a vendor-supplied list.
- **Anti-malware, anti-spam gateways** – prevent malware from entering the enterprise. These similar functions look at the content of e-mail, web, FTP, and other data entering the enterprise. This type of prevention is often also present on individual computer systems.
- **Data loss prevention (DLP) gateways** – prevent valuable data from leaving the enterprise. This appliance inspects traffic exiting the enterprise, looking for proprietary or improper data sent by deliberate user action or as a result of malware attacks.

Many of these functions are now combined into a single appliance, called a unified threat management (UTM) system, on a next-generation firewall.

Ixia Solutions

Ixia offers a complete network test and assessment product that measures security:

- **Effectiveness** – the ability to detect and prevent all forms of attacks.
- **Accuracy** – the ability to accurately perform its function, without significant "false-positive" results.
- **Performance** – the ability to enforce security mechanisms while maintaining acceptable network performance. Security enforcement mechanisms must continue to pass good" traffic even under the most aggressive attacks.

[1] Navigant, Information Security & Data Breach Report, 2012

The Ixia BreakingPoint Actionable Threat Intelligence (ATI) service provide comprehensive service and support program for optimizing and hardening the resiliency of IT infrastructures, including product updates, authentic application protocols, real-world security attacks, and responsive support responsive support:

- **Known vulnerabilities** – 38K+ known security vulnerabilities, organized by type are available. Attacks are updated frequently to stay current with hacker activity.
- **Attack evasions** – attacks are frequently masked by use of packet fragmentation and other sophisticated techniques. Ixia applies evasions to known vulnerability to increase effectiveness testing.
- **Massive DDoS attacks** – simulate distributed denial of service (DDoS) and Botnet attacks to measure cyber infrastructure resiliency. Ixia uses Ixia test ports' customized logic and scale to mount very large-scale DDoS attacks.
- **Encryption** – IPsec encryption is used in two ways. Encryption with "good" traffic serves to measure VPN gateway throughput. Encryption with "attack" traffic tests security effectiveness and accuracy for attacks delivered over secure connections.
- **Multiplay traffic** – sends real-world, stateful traffic to measure security appliance performance. This means that the true, realistic performance, including QoE, of security mechanisms can be measured – not just raw throughput.

Feature	Options
Known vulnerabilities	• Tens of thousands of known vulnerabilities • Over 180 simulated applications • Bi-directional application • Evasion techniques
DDoS	• 20+ attack types • Virtually unlimited scale
Encryption	• IPsec • SSL/TLS
Multiplay traffic	• Data • Voice • Video • City-scale subscribers • QoE measurements

In conjunction with Ixia's hardware and other test applications, Ixia offers a complete test solution for network devices that provide functions other than security.

Ixia's IxLoad-IPsec is designed to measure the performance of VPN gateways that are used to connect organizations' multiple sites and to connect remote users to corporate networks. IPsec is likewise used in 3G and 4G networks to protect communications between handsets and internal wireless gateways.

IxLoad-IPsec tests performance of VPN gateways of all types in several ways:

- **Connections** – how many site-to-site and user connections can be concurrently supported
- **Connection rate** – how rapidly can new connections be established
- **Throughput** – what is the maximum data rate that a gateway can sustain
- **Interoperability** – can the gateway support the numerous encryption and authentication protocols in use today

Suggested Applications and Platforms	
IxLoad-Attack	Full network security testing with plug-ins for known vulnerability attacks.
IxLoad-IPsec	IPsec encryption for good and attack traffic.
IxLoad	A highly-scalable, integrated test solution for assessing the performance of multiplay networks and devices.
IxANVL	The industry standard for automated network/protocol validation. Developers and manufacturers of networking equipment and Internet devices rely on IxANVL to validate protocol compliance and interoperability.
IxNetwork	Characterizes the performance and scalability of routers and switches. IxNetwork includes the facilities for testing the authentication protocols associated with 802.1x, PPP, and NAC.
Ixia BreakingPoint	Control global threat intelligence at Internet-scale to create massive, high fidelity simulation and testing conditions for battle-testing infrastructures, devices, applications, and people.
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.
PerfectStorm	Blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.
PerfectStorm ONE	Ensure enterprise security resiliency and perform proof-of-concept (POC) testing against vendor claims.

Scenario

Long-term Evolution (LTE) is the fastest-growing mobile technology of all time. With subscriber numbers and network traffic from smartphones and media-rich applications exploding worldwide, evolving 4G deployments present mobile operators and infrastructure equipment providers with complex new challenges as they transition from 2G and 3G networks.

Faced with rampant change, mobile service and equipment providers must be fully confident in the performance, scalability, security, mobility, and interoperability of their products and services. Most failures occur at high scale or under extreme conditions, and the risks of rolling out devices, networks, and services without conducting comprehensive testing beforehand are tremendous.

Vendors and network operators need an efficient means of prototyping live networks in the lab on a metro/city scale to validate performance under load. End-to-end, pre-deployment service validation should include closely modeling the services the live network will carry using real application traffic and measuring the QoE users will receive.

Proactively stressing networks and components in the lab prior to live deployment addresses today's toughest challenges:

- Increased capacity requirements in both the access (base stations) and core networks
- Improved performance requirements –throughput, lower latency, etc.— for increasing video traffic and data-hungry applications
- Higher QoE expectations among customers – voice quality and video quality
- New business models and tiered rate plans that maximize revenue
- Security threats increasing in number and complexity

With many networks involving equipment from multiple vendors, specific configurations and traffic mixes must be modeled in order to benchmark scalability, avoid bottlenecks, and ensure security. Lifecycle testing is required to:

- Evaluate scalability and breaking points of individual devices and configurations
- Optimize network design and system test in the lab
- Debug problems occurring on the deployed network
- Streamline change as new devices, firmware upgrades, and other changes are introduced

Optimizing for the Long-Term

In deploying modern LTE access networks, optimizing the performance of evolved node B (eNodeB) base stations and "small cell" low-power access points proves essential. In the evolved packet core (EPC), operators now also must cope with dramatic spikes in signaling traffic that can overwhelm infrastructures and increase the risk of network outages and billing errors.

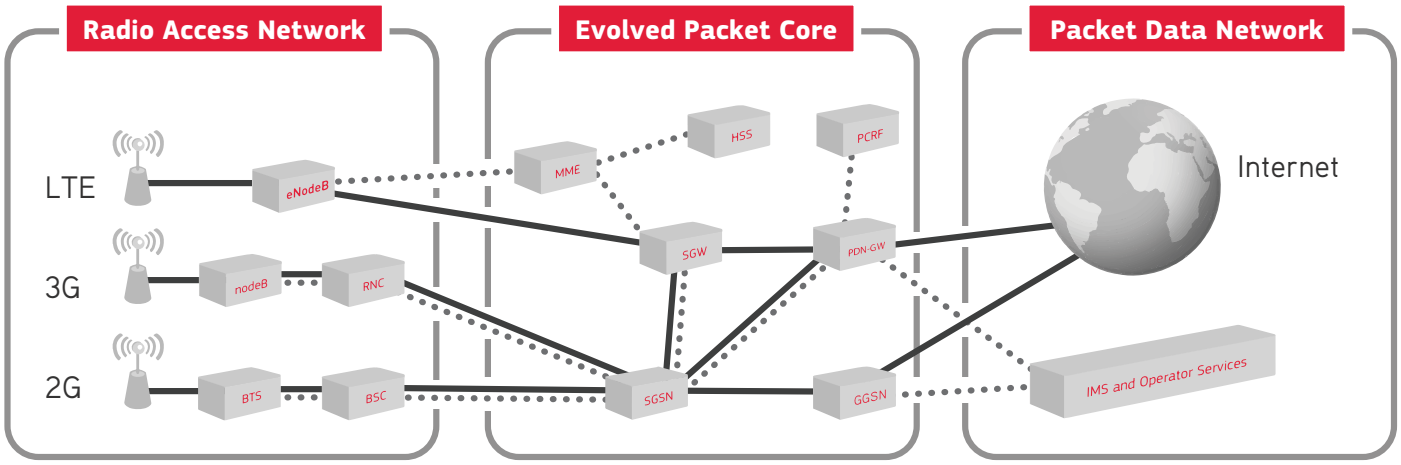
Mobile network operators and infrastructure equipment manufacturers will continue to invest hundreds of millions each year to deliver and deploy scalable, resilient LTE infrastructures. To ensure the success of new products and services, the ability to support and deliver converged voice, data, and video services based on guaranteed quality must first be validated.

Ixia's breakthrough wireless test solutions and deep wireless expertise help vendors and mobile operators to develop and implement best practices for existing and emerging wireless technologies in the most cost-effective and efficient manner.

Ixia Solutions

Ixia provides the industry's most comprehensive wireless test portfolio, encompassing both deep functional testing and high-scale capacity and performance testing across multiple technology generations. Equipment manufacturers and mobile operators rely on Ixia's solutions to fulfill their entire wireless testing needs. Our industry-leading test capabilities cover wireless access and wireless core, including the 3G packet core, 3G circuit switched core, 3G radio access network, LTE access, LTE evolved packet core, IMS, and SS7/PSTN interconnect.

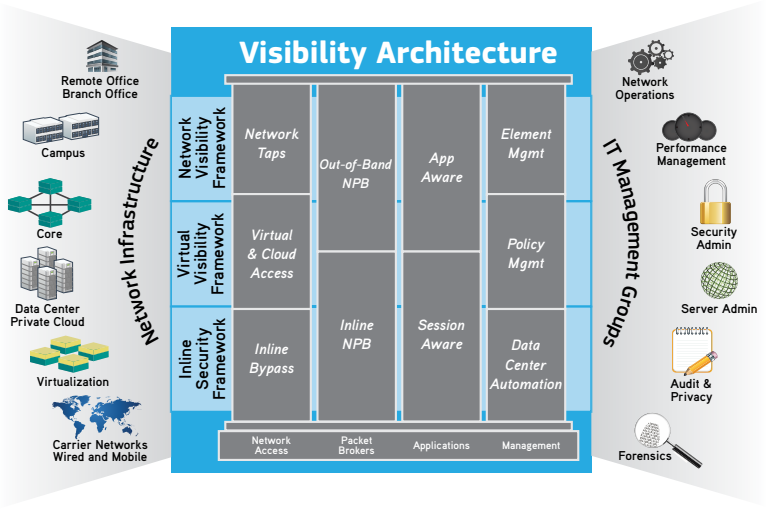
Ixia Device Emulations	
DUT	**Emulated Nodes**
eNode B	UE, eNode B, MME, SGW
MME	HSS, eNode B, SGW, MME
SGW	MME, eNode B, PDN-GW
PDN-GW	SGW, PCRF, SGW, IP Core
Network	UE, IP Core



Ixia's wireless solutions are best of breed for:

- Complete end-to-end testing from the wireless edge to the Internet core
- Traffic and subscriber scalability and capacity planning
- Real-world subscriber modeling
- Quality of experience measurements
- Multi-UE emulation
- VoLTE testing

Suggested Applications and Platforms	
IxCatapult	Full wireless protocol testing for: • LTE, 3G, and 2G wireless edge components • Enhanced packet core components
IxLoad	Full layer 4-7 testing, with protocol emulation for: • Data protocols • Peer-to-peer protocols • Voice over IP protocols • Video protocols
IxCatapult Chassis	• m500 main chassis plus interface cards for central computation and connections • r10 chassis for LTE radio frequency bands
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: Xcellon-Ultra NP – 12-port 1GbE that can be aggregated to a single 10GbE port
Ixia BreakingPoint	All-in-one LTE/4G/3G test lab to validate the performance, security, and stability of mobile networks and equipment using real-world behavior of millions of mobile users
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services prior to deployment.
PerfectStorm	Blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.
PerfectStorm ONE	Ensure enterprise security resiliency and perform proof-of-concept (POC) testing against vendor claims.



Scenario

Today's networks are growing in both size and complexity, presenting new challenges for IT and network administrators. More mobile devices are now connecting to more data from more sources—and much of that is due to virtualization. IT challenges are further complicated by increasingly high customer expectations for always-on access and immediate application response. This complexity creates network "blind spots" where latent errors germinate, and pre-attack activity lurks.

Blind spots are commonly caused by the following issues: lack of SPAN and tap ports which limit tool access to data; dropped and duplicated packets, which suppress or delay actionable information; and monitoring plans that are behind migration cycles. Stressed-out monitoring systems make it hard, if not impossible, to keep up with traffic and filter data "noise" at a rate that they were not designed to handle.

Network blind spots have become a costly and risk-filled challenge for network operators. Further, unseen inter-VM and cross-blade data center traffic leaves the network vulnerable to threats, noncompliance, loss of availability, and impaired performance. Today, up to 80 percent of data center traffic can travel between servers, making end-to-end visibility a real challenge.

The answer to these challenges is a highly scalable visibility architecture that helps eliminate blind spots, while providing resilience and control without complexity. Ixia's Visibility Architecture delivers a new perspective on network visibility.

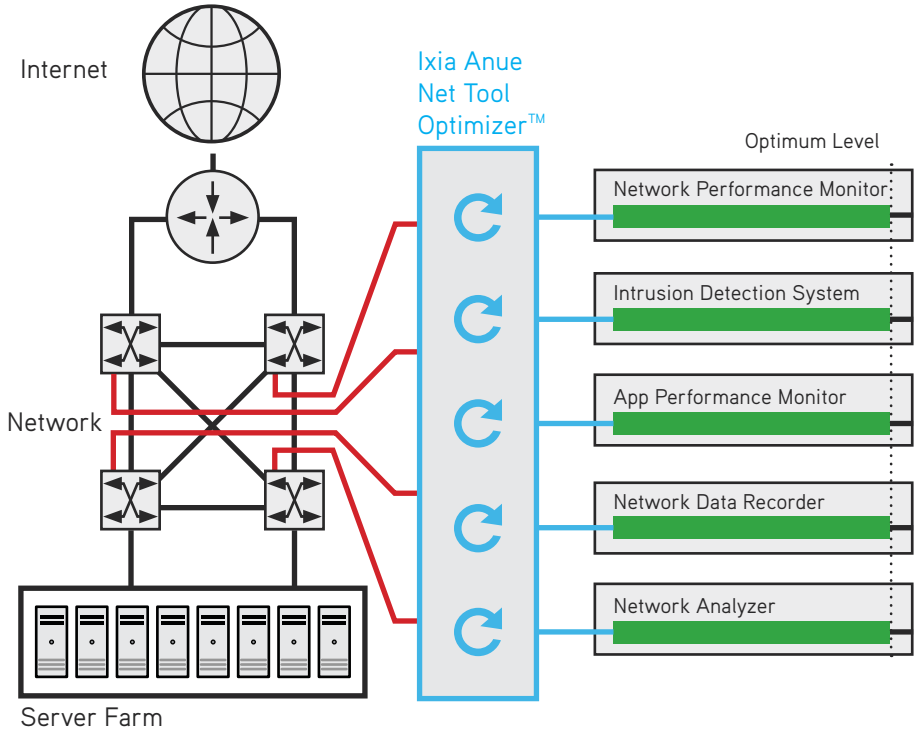
Ixia's Visibility Solutions

Ixia's new Visibility Architecture, is founded on a comprehensive product portfolio of high-performance taps, virtual taps, bypass switches, and network packet brokers (NPBs), all easily deployed and managed.

Ixia's Visibility Architecture helps speed application delivery and enables effective troubleshooting and monitoring for network security, application performance, and service level agreement (SLA) fulfillment—and allows IT to meet compliance mandates.

All three integrated elements of the Ixia Visibility Architecture enable a key component of a total, end-to-end visibility architecture. The Network Visibility Framework provides a solution to support out-of-band monitoring in the physical network. The Virtual Visibility Framework is integrated with the Network Visibility Framework and provides a solution to support out-of-band monitoring of all traffic in the virtual network . The Inline Security Framework enables fail-safe deployment of multiple inline security enforcement tools such as IPS's, NGFW's, etc.

Suggested Platforms	
NTO 5293 Carrier-Grade	• NEBS level 1 certified • 16 40GbE ports or up to 64 10GbE ports
NTO 5288 High-Density 40G	• Up to 64 10GbE ports • Offers an efficient and scalable solution to monitor 1, 10, and 40GbE
NTO 5273 High-Availability, Carrier Class	• Designed for telecommunication and cable service providers • NEBS level 3 certified
NTO 5236 Enterprise Class	• 10GbE visibility for fibre network monitoring tools • Up to 24 SFP/SFP+ Ethernet ports
NTO 5204 Small Enterprise	• Ideal in the lower-speed portions of the network
NTO 2112/2113	• Extend core enterprise Elass network monitoring feature sets to branch offices
Ixia ControlTower™ NTO 5260/5268	• A network visibility architecture for centralized, intelligent monitoring.
AFM	• Enhance NTO's capability to aggregate, replicate, and filter network monitoring traffic.
NTO 7300 Chassis	• The most scalable network visibility framework in the industry.
Net Optics taps, NPBs, link aggregators	• Captures and sends traffic of interest to the tools that are monitoring your physical network.



Improved Data Center Performance with Ixia Visibility Architecture

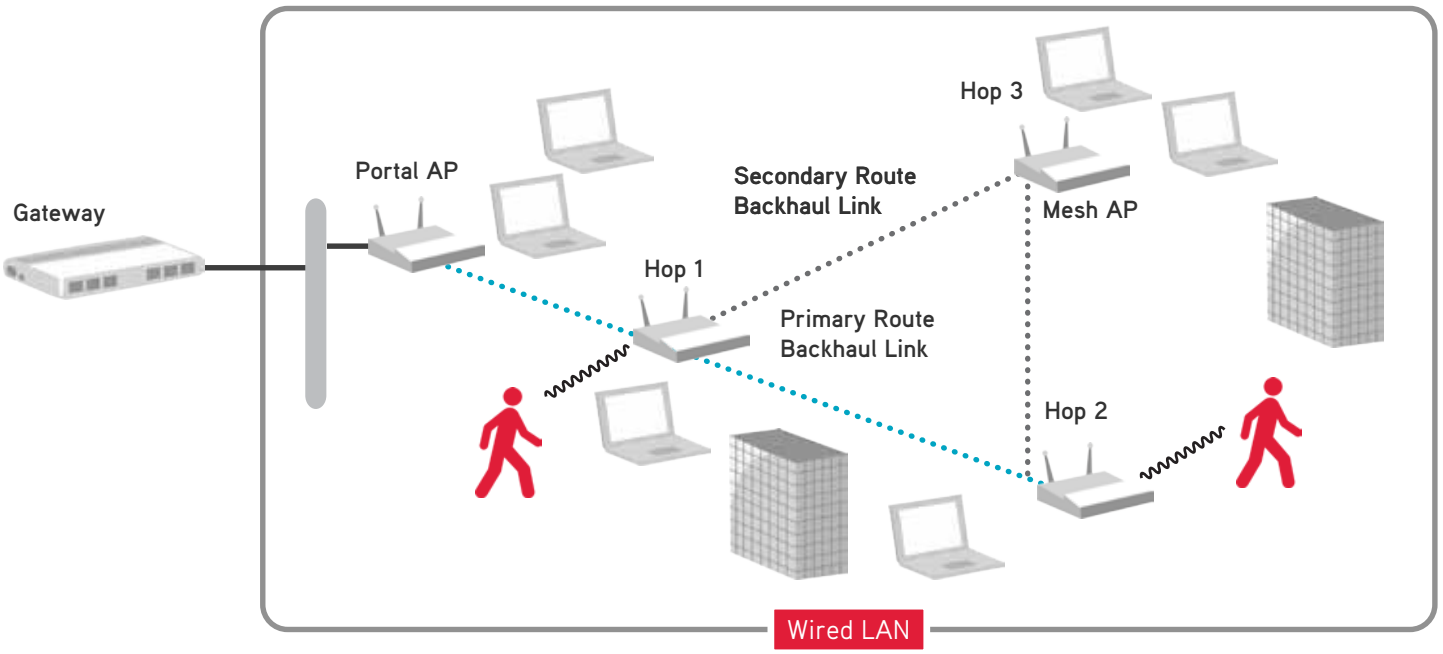
- **Full network visibility** – Consistently send all the right data to the right tools by matching multiple filter criteria so that you can eliminate dropped packets due to overlapping filter conflicts.
- **Automated response technology** – Instantly re-route traffic to monitoring tools based on suspicious activity so that you can reduce time and cost of human intervention to remediate network problems.
- **Load balancing** – Distribute monitoring traffic to several analysis tools so that you can fully use network bandwidth and boost the efficiency of your monitoring tools, even if they are lagging the network in bandwidth.
- **Sophisticated filtering and de-duplication** – Increase monitoring tool performance by eliminating unnecessary data before it reaches the tool so that you can more-easily adhere to compliance standards and generate more accurate tool statistics.
- **Network taps, NPBs, link aggregators** – A full spectrum of high-performance, scalable, intelligent, and comprehensive family of application-aware NPM, network packet brokers, virtual/cloud, taps, and visibility management system (VMS) solutions.

Easiest To Use

- Ixia's Anue Net Tool Optimizer (NTO) is powered by a user-friendly, drag-and-drop interface that allows you to easily connect monitoring tools to appropriate SPAN and TAP ports with the simple click of a mouse.
- Ixia's Net Optics taps provide the need information to the tools that analyze traffic.

Simplified Management

- Create network connections and filters by using in the intuitive GUI so that you can aggregate, filter, and distribute network traffic to monitoring tools with a few clicks of the mouse and virtually eliminate the need to rewire equipment.
- Restrict access to specific filters, ports, or monitoring tools by delivering improved access control management to meet compliance and regulatory requirements.
- From within the NTO, monitor key SNMP statistics from any network management system so that you can view and report on key information such as the amount of traffic each tool receives and instant notification of oversubscribed tools.
- Accommodate your organization's increasing need for more IP addresses by easily accessing the NTO using IPv4 or IPv6 addresses.



Scenario

Once used mainly for low-priority data, today's Wi-Fi networks carry real-time, multimedia traffic in consumer, service provider, and enterprise network environments worldwide. Mobile clients continue to grow in both numbers and complexity of application usage, with Wi-Fi supporting voice, video, unified messaging, medical patient monitoring, pubic hotspots, cloud-based services, and the offload of real-time data transactions from over-taxed cellular networks.

With Wi-Fi evolving from a "nice to have" to a primary network medium, poor performance now places brand reputation, profitability models, customer satisfaction, and even lives at risk. Today's wireless LANs (WLANs), Wi-Fi-enabled devices, and mobile applications must deliver unprecedented quality, reliability, and security—without fail—to mitigate these risks and fully leverage mobility. Wi-Fi needs to become "carrier grade."

Each critical component of the dynamic WLAN ecosystem must be tested, assessed, and optimized throughout the product or service lifecycle:

- Enterprise and service provider access points (APs)
- WLAN controllers
- Wi-Fi-enabled client devices (laptops, smartphones, printers, scanners, healthcare monitors, etc.)
- Live deployed WLANs and future upgrades

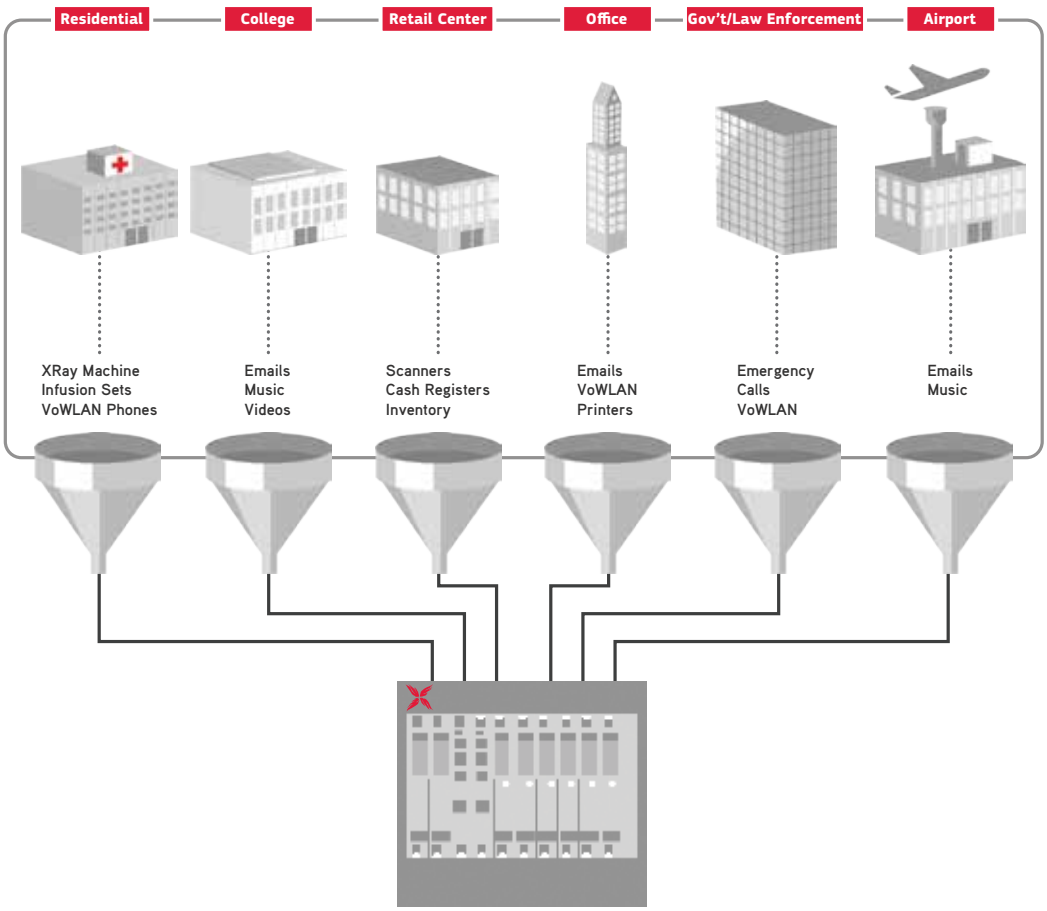
Equipment manufacturers, service providers, and users alike need actionable insight into performance if they're to thrive in today's highly competitive market. This means validating:

- Mobility: performance while roaming from and between APs
- Interoperability with other clients and WLAN infrastructure equipment
- Performance /Quality of Experience (QoE) from the end-user perspective
- Scalability

Assessments should begin by obtaining baseline performance measurements and progress to load testing to simulate realistic live network environments. The quality of the user experience should be measured in metrics relevant to each individual application—voice, data, video, etc.—in the presence of diverse client and traffic mixes.

Wi-Fi continues to evolve to meet demand. Next-generation 802.11ac-compliant infrastructures are emerging, promising much higher speeds and capacities. To fully leverage this integral technology into the future, product roadmaps, site assessments, and performance optimization strategies must encompass 802.11ac and even more dramatic change.

Vertical Market Profiles



Ixia Solution

The industry's premier Wi-Fi test solution, Ixia's IxVeriWave represents the gold standard in evaluating Wi-Fi performance and site readiness. The world's leading WLAN infrastructure and mobile device manufacturers, service providers, system integrators, and enterprises use IxVeriWave to measure and optimize performance, reliability, and scalability throughout the product/service lifecycle.

Employing a client-centric, user-focused model, IxVeriWave delivers:

- A lab-to-field solution addressing the needs of product design, development, and deployment in live networks. IxVeriWave enables real-world deployments to be reproduced in test and QA labs, and powerful site assessments and "what if" testing to be conducted in live production networks
- Traffic generation for emulating realistic network and environmental conditions and simulating variables such as distance, roaming, and interference
- Test automation allowing hundreds of tests to be run and repeated quickly, unattended
- Performance analysis used to assess QoE, interoperability, and scalability, and rapidly pinpoint and remediate potential problem areas
- Breakthrough site assessment that eclipses traditional site "surveys" to measure a facility's true readiness for mobility, inform vendor selection and network design, and assess future changes
- Testing as a Service (TaaS) evaluations by veteran Wi-Fi test experts

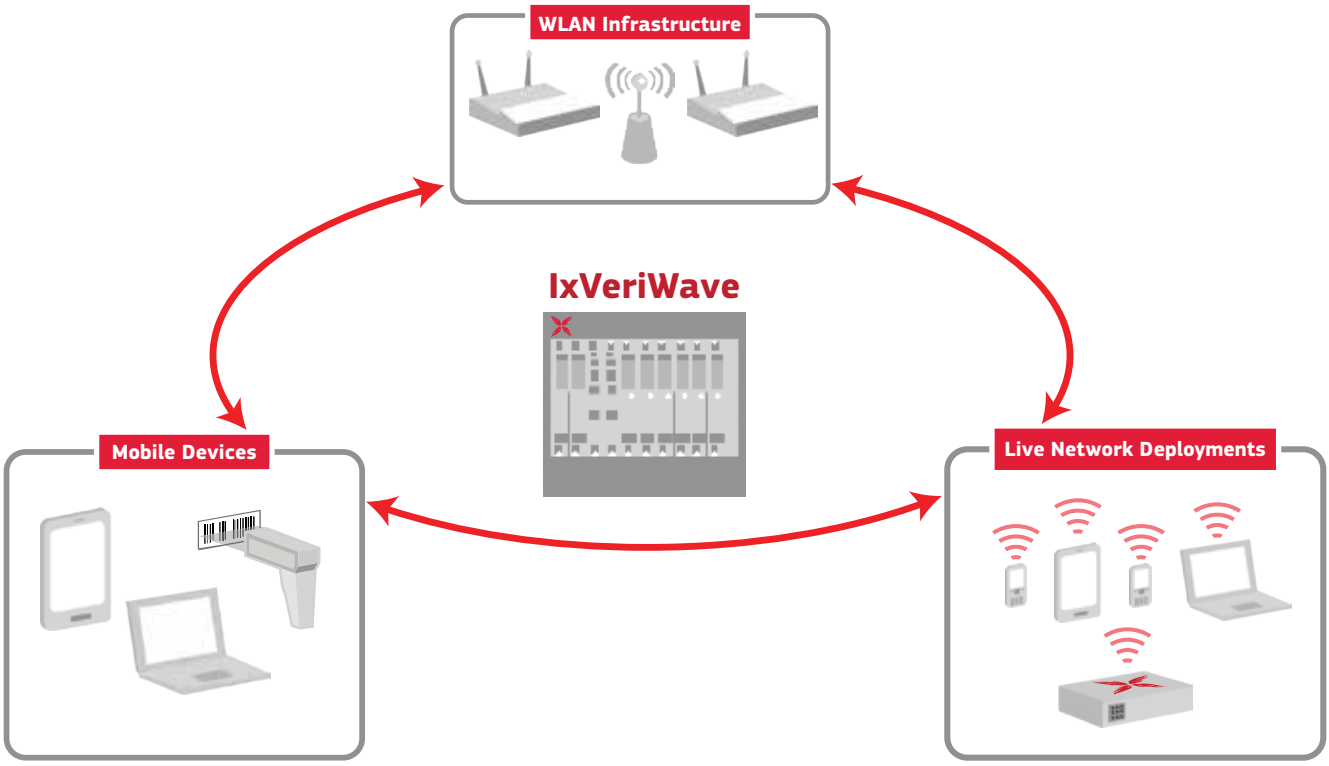
IxVeriWave validates the maximum performance for WLAN networks, devices, and applications in the real world and helps gauge the impact of ongoing changes. A wide array of load modules and test suites address specific assessment needs such as:

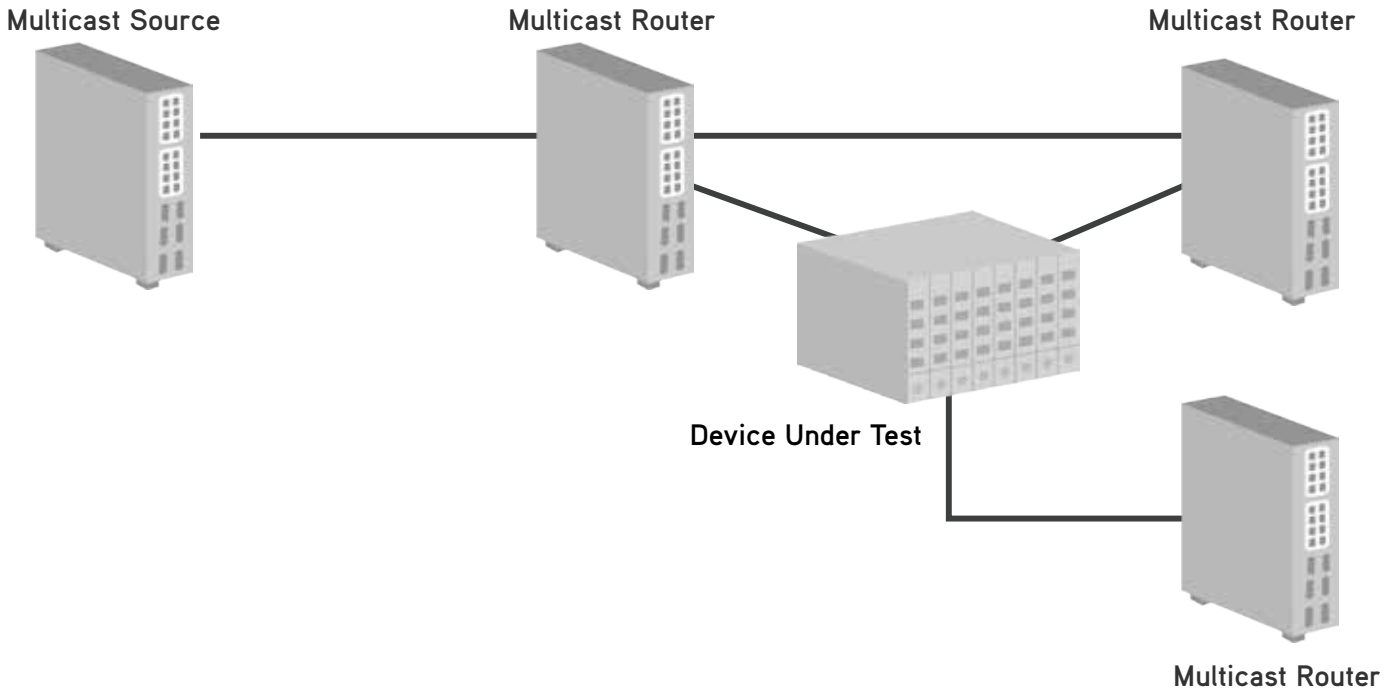
- QoE from the end-user perspective
- Client interoperability
- VoIP QoS
- Large-scale roaming
- SDTV/HDTV wireless video
- Dynamic Frequency selection (DFS) compliance
- Industry-specific deployment scenarios: healthcare, retail, education, etc.

Ixia test systems and services deliver the powerful analytics needed to harden new product designs, reduce time to market, and speed identification of potential issues. Major business benefits include:

- Improved product quality
- Increased efficiency and reduced test costs
- Expanded test coverage with repeatable, large-scale, real-world test scenarios impossible to create by other means
- Successful product launches and deployments out of the gate

IxVeriWave is used throughout the WLAN ecosystem to test 802.11n and legacy access points, and controllers, and mobile devices. Ixia also leads the industry with innovative and comprehensive 802.11ac test solutions needed to make next-generation Wi-Fi networks a reality.





Scenario

Today's communications protocols are complex. Every day, new protocol specifications, RFCs, and enhancements are published by standards organizations such as the Internet Engineering Task Force (IETF) and International Telecommunication Union - Telecommunication Standardization Sector (ITU-T). Service providers must be sure that the devices they deploy perform correctly. Network equipment manufacturers seek to ensure that their products conform to industry standards and interoperate successfully with other vendors' products.

Protocol conformance testing is a very intensive task with hundreds, if not thousands, of test cases that must be frequently executed. Conformance test tools accelerate time to market by reducing the time taken to design, prototype, integrate, and test.

Early conformance testing ensures higher product-quality. This quality has a significant payoff – problems found after deployment can cost 100 times more to fix than those found in the lab. Security loopholes and vulnerabilities resulting from erroneous protocol implementations can damage a company's reputation and incur legal liability.

Ixia Solutions

Ixia's IxANVL (Automated Network Validation Library) is the industry standard and fifteen-year leader for automated network protocol validation. Developers and manufacturers of networking equipment and Internet devices rely on IxANVL to validate protocol compliance and interoperability.

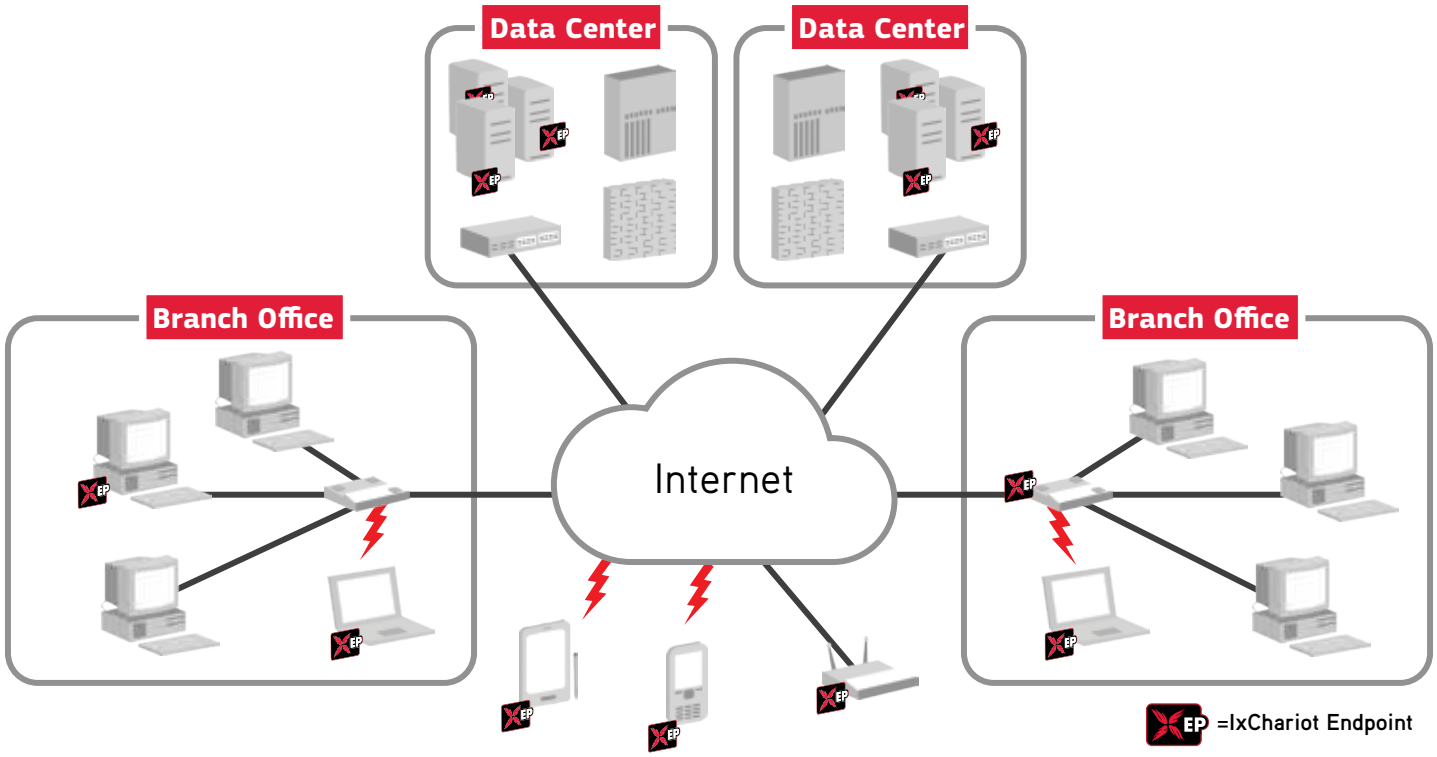
IxANVL offers an easy-to-use GUI and flexible test-automation capabilities. As shown in the table to right, IxANVL offers a broad range of protocol libraries and utilities.

IxANVL runs on any PC using Linux or Windows, equipped with an Ethernet network interface card (NIC). IxANVL can also be used with Ixia's platform interfaces. This makes a wide range of interfaces available: 10/100/1G/10G Ethernet, ATM, serial, async, T1/E1, and POS.

IxANVL's tests are used to determine whether a device's protocol implementation meets specifications, how well a device handles traffic from non-complying network components, and the effect of new features on existing software, through regression testing.

Suggested Applications and Platforms	
IxANVL	Comprehensive protocol conformance testing
PC	Standard Ethernet-equipped PC computer with Windows or Linux
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • LSM1000XMVDC – 16-port 1G Ethernet load module • LSM10GXM8 – 8-port 10G Ethernet load module

Family	Conformance Tests
Routing	RIP/NG, OSPFv2/v3, BGP4/4+, ISISv4/v6, VRRP
MPLS	LDP, RSVP-TE, MPLS, PWE3, L2 VPN, L3 VPN, VPLS, LSP-Ping, VCCV, mLDP
Multicast	IGMPv2/v3, MLDv1/v2, PIM-SMv4/v6, PIM-DM, DVMRP, IGMP/MLD snooping
Carrier Ethernet	MEF9, Ethernet CFM/OAM, service OAM, PBB MEF OAM/ELMI/service OAM, G8031
High Availability	BFD, OSPF-GR
IP	IPv4, DHCPv4/v6, ICMP, IPv6, IPv6CP, ICMPv6, NDP, AutoConfig, PMTU, GRE, GPT, IPv6ov4
TCP	TCP core, TCP advanced, TCP high performance
Data Center	FIP, FCoE, FCF, DCBX
Bridging	STP, RSTP, MSTP, VLAN, GRE, QinQ EAPOL(802.1x), PPP, MLPPP, IPCP, LACP, (802.1ad), LLDP
Layer 4-7	HTTP, telnet
Security	L2TPsec, IPsecv4/v6, IKEv1/v2
Voice	SIP
Storage	iSCSI
Mobile IP	Home agent, correspondent node, mobile node
Broadband	PPP, PPTP, L2TP, ANCP, PPPoX, LACP



Scenario

VoIP, unicast and multicast video, multicast streaming media, peer-to-peer applications, application-based QoS policies, enterprise application traffic – all of these uses and elements of today's enterprise networks are constantly evolving, making it difficult to anticipate network behavior.

As networks and applications grow in size and complexity, maintaining network performance becomes mission-critical. New applications introduce potential network bottlenecks that must be quickly identified and corrected. With the frequency of network changes, the flexibility and availability of network assessment tools is essential.

Ixia Solutions

With IxChariot™, Ixia provides high-precision analysis of application performance across network backbones. Thin endpoint clients that run on most computer operating systems are deployed at key nodes within a network. A mixture of real-world traffic profiles, including multiplay services, is used to characterize network behavior.

When problems are reported, tests are run from central management points, such as the network operations center, and results analyzed to identify network bottlenecks and degraded services.

WAN links can be tested to verify key metrics such as latency, failover time, packet loss, and throughput. Network devices can be put to the test so that new services are deployed with confidence.

IxChariot can be used for any size network, and is capable of simulating hundreds of supplied protocols across thousands of network endpoints. IxChariot assesses the performance characteristics of any application running in a wired or wireless network. Using sophisticated traffic patterns with optional QoS, IxChariot measures throughput, jitter, packet loss, end-to-end delay, MOS, and MDI.

IxChariot Pro is an operational solution for distributed production network and field use. It is designed for network assessments with active monitoring to measure, control, solve, and verify network infrastructure with predictable traffic injection. It is based on an open framework for integration with OSS/EMS and IT environments.

IxChariot's Endpoint Discovery feature and Test Factory component easily manage large-scale, dynamic network tests. Discovery Server finds and catalogs endpoints by working closely with VMware™ and XenServer™ in virtualized environments. Test Factory quickly creates complex test scenarios from the endpoint catalog.

IxProfile™ is a dedicated application that automatically creates traffic generation scripts based on captured data traffic. It provides a comprehensive solution for networks with proprietary protocols.

Sample of IxChariot Supported Protocols	
Topic	**Supported Protocols**
Management	Citrix and Microsoft Remote Desktop
Database	Oracle, SAP, and SQL Server
E-mail	Microsoft Exchange, POP, and Lotus Notes
Peer-to-peer	Kazaa, BitTorrent
IM, Online meeting	RealMedia, NetMeeting AIM, ICQ, MSN Messenger, Yahoo Messenger
Data	HTTP, FTP, DNS, NNTP, POP, Telnet

Suggested Applications and Platforms	
IxChariot	Network assessment software with test scripts for more than 170 protocols, plus: • Discovery Server - discovers and catalogs IxChariot endpoints • Test Factory - automatically builds complex test scenarios
IxChariot Pro	Network assessments with active monitoring to measure, control, solve, and verify network infrastructure.
IxProfile	Captures and generates test scripts for proprietary protocols
Test endpoints	Supplied software endpoints for a wide variety of operating systems, including: • Microsoft Windows, including Vista and Windows 7 • Windows CE/Mobile, including WM5/WM6 • Linux, including Embedded Linux • Sun Solaris • IBM • Novell Netware • Unix • Ixia load modules

Scenario

The adoption of cloud computing is being driven by the proliferation of rich Internet applications, anywhere broadband access, and infrastructure elasticity enabled by virtualization. As consumers and enterprises become more dependent on services and applications running in the cloud, network performance becomes a key metric to ensuring end-user QoE and key SLA requirements are met.

To match increasing demand while minimizing CAPEX and OPEX, data centers must provide state-of-the-art services while lowering cost, power consumption, and design complexity. Blade servers supporting virtual machines (VMs) have become standard due to their ability to more-easily control computing resource allocation. On the networking front, LAN/SAN convergence, fueled by economical availability of 10GbE networks, is significantly reducing both complexity and cost. 40GbE and 100GbE networks are starting to find their home in, and between, data centers.

Proper handling of Ethernet traffic, categorized as north-south traffic between clients and servers or east-west traffic between components of a distributed application, is critical to data center performance – requiring a variety of testing techniques. Individual components, sub-systems, and the data center as a whole must be thoroughly tested to ensure dependable capacity, flexible performance, reliable operation, and high security. Thorough and robust testing is the only way to ensure if a network's evolution to cloud-based infrastructure is properly provisioned, and provides high QoS and QoE to its users.

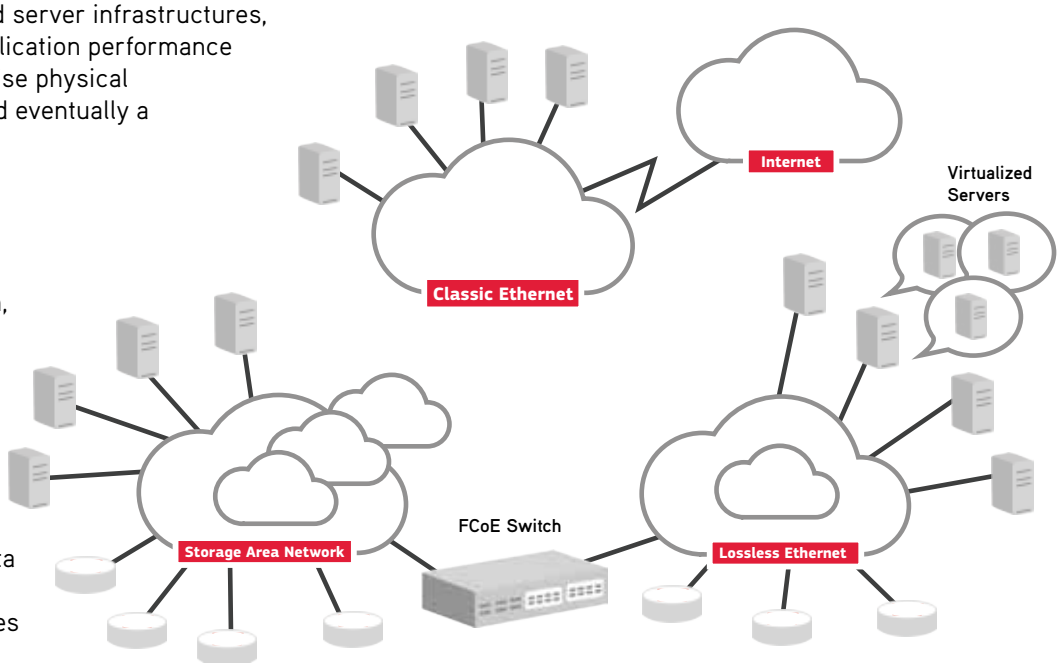
Each area has specialized testing requirements:

- **Data center compute/server infrastructure** – as enterprises migrate their data and applications to the cloud and leverage virtualized server infrastructures, it is essential to measure application performance through all stages – on-premise physical servers, virtual machines, and eventually a fully-hosted cloud
- **Network infrastructure and storage** – the convergence of LAN and SAN traffic requires a multi-level testing approach, from the storage network fibre channel over Ethernet networks – to the Ethernet switching infrastructure – to the convergence of the two with lossless Ethernet
- **Virtualization** – assessing data center virtual infrastructure elasticity and capacity requires tools that can test in the context of an end-to-end environment, measuring performance of virtual switches, firewalls, and servers, as well as generate a diverse set of client-server, server-server, and server-storage application traffic originating from both within and outside of virtual machines
- **End-to-end service delivery** – measurement of end-to-end transactional latencies and application throughput across voice, video, and data applications is essential to ascertaining the collective impact that data center storage, network, and compute infrastructures have on end user QoE
- **Security** – the increasing use of virtualized cloud infrastructures in enterprise and service provider data centers introduces unforeseen security issues that require comprehensive and continuous testing to detect and overcome
- **Higher speed Ethernet** – rapid expansion of intra- and inter-data center Ethernet traffic means that 40 and 100GbE interfaces will need to be tested

Ixia Solutions

Ixia's applications delivers scalable converged data center emulation and integrated traffic generation/wizard for performance testing of data center switches and converged network adapters (CNAs). Combined with the 32-port Xdensity 10G solution and FCoE/FC interfaces, Ixia offers a complete data center cloud simulation to validate switch throughput and low-latency performance.

Ixia's solutions address the testing challenges of application-aware devices and service-delivery infrastructures. IxLoad supports an extensive library of multi-play protocols, realistic subscriber modeling



capabilities, and the industry's highest application scale for assessing DUT/SUT performance and end-user QoE.

Ixia's IxLoad-Attack validates network security appliances – determining that they effectively and accurately block malicious attacks while delivering high end-user QoE for mission-critical applications.

Ixia BreakingPoint addresses the application controller, application delivery, and DPI requirements and key differentiators through the emulation of hundreds of applications, live malware and user behavior.

Ixia Virtualized Testing

Ixia's IxVM is a family of products to validate the performance of virtual and physical data center infrastructures. It offers a unified product portfolio with the flexibility and breadth of applications required to assess the impact of virtualization across the data center. IxVM measures individual server performance, VM performance, the latency and throughput of virtual switches, and the effect of different operating systems on system performance. IxVM virtual ports provide a software-based version of Ixia's traditional hardware ports. These ports are easy to deploy in a virtual environment, and allow quick scaling and test configuration changes.

Ixia's virtualization testing solution offers a user-friendly interface to virtual ports management, which supports asset discovery through integration with popular virtualization platforms. The solution tests:

- Virtualized server capacity
- Service scalability and elasticity
- Virtualized switching and firewall performance
- Virtual desktop infrastructure
- Virtual or physical devices with a realistic mixture of application and data storage traffic using stateful L4-7 traffic generation
- IP protocol functionality and convergence in virtual environments, including QoS, VM migration, VLAN leakage, and IGMP group join/leave latencies using L2-3 protocol emulation and traffic
- I/O storage for CNA manufacturers
- L2MP
- NFV
- SDN/OpenFlow

Suggested Applications and Platforms	
IxExplorer	Line-rate packet generation and capture with full control of traffic contents
IxNetwork	Full layer 2/3 testing, with protocol emulation for: • Fibre channel over Ethernet • Data center Ethernet • Lossless Ethernet protocols
IxAutomate	Prebuilt tests for network testing of all types, including: • Fibre channel over Ethernet • Data center Ethernet
IxLoad	Highly-scalable full layer 4-7 performance testing for application delivery infrastructure (add secuity testing with IxLoad-Attack); with protocol emulation for: • Data protocols • Peer-to-peer protocols • VoIP protocols • Video protocols
IxVM	Virtualized versions of Ixia test applications, including: • IxExplorer VE– interactive packet generation and capture • IxNetwork VE – layer 2/3 testing • IxLoad VE – layer 4-7 testing
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12 Chassis	12-slot high-performance chassis, with optional load modules: • Xcellon-Ultra NP – Twelve 1GbE ports that can be aggregated to a single 10GbE port • Xcellon-Flex AP – 16-port 10GbE SFP+ and 4-port 40GbE QSFP+ • Xcellon-Flex FE – 4-port 40GbE QSFP+ • Xcellon-Flex – high-density 10GbE, up to 128 ports per chassis • LM1000XMVDC – high-density 1GbE, up to 192 ports per chassis; • Xcellon-Lava 40GbE/100GbE – 40Gbps and 100Gbps load modules
Native Fibre Channel Load Module	Native fibre channel load module: • Industry's highest density 2/4/8G FC test solution • Tracks and analyzes up to 1 million flows per port • Sophisticated testing starting from FC-1
Ixia BreakingPoint Solutions	Stress data center/cloud infrastructures using peak application user load from hundreds of applications to configure virtualized environments for optimal performance and capacity
Network Impairment Emulation	Network Emulators precisely emulate real-world network impairment conditions in the lab, for the test and validation of your network-based products, applications, and services.
PerfectStorm/ PerfectStorm ONE	Blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.
Phantom vTap	Captures and sends inter-VM traffic of interest to the tools that are already monitoring your physical network.

Ixia's industry-leading test, security, and visibility applications and hardware provide our customers with solutions that deliver unparalleled power and flexibility. They execute a full range of data, signaling, voice, video, and application testing, monitoring, and security validation – including virtualization validation.

Ixia Test Applications

IxNetwork tests complex routing, switching, and FCoE topologies by emulating a wide range of routing protocols, along with authentication and broadband encapsulations. Powerful traffic generation tools for any type of layer 2/3 testing.

IxN2X tests complex routing and switching topologies across the IP/MPLS core, carrier edge, and broadband access networks. Powerful traffic generation and analysis capabilities for any type of layer 2/3 testing.

IxLoad tests layer 4-7 multiplay networks and devices through emulation of Internet protocols. All common data, voice, and video protocols are supported.

IxCatapult is a complete testing solution for wireless edge and core networks, covering LTE, 3G, UMTS, and IMS technologies.

IxVM validates the performance of virtual and physical data center infrastructures.

IxNetwork VE is designed to work in virtualized environments using Ixia's unique virtual chassis implementation. .

IxLoad VE is designed to work in virtualized environments using Ixia's unique virtual chassis implementation.

IxVeriWave is a complete testing solution for wireless technologies, validating pre- and post-deployment performance, conformance, and capacity.

IxAutomate is an automation engine for Ixia tests that includes a wide range of pre-built tests for layer 2 - 7 testing, including many industry-standard RFC tests and converged FCoE and Ethernet performance tests.

Ixia's Net Tool Optimizer® (NTO) suite of network monitoring switches equips network engineers to meet the growing challenge of testing, assessing and monitoring complex, high-performance networks with limited access points.

Ixia BreakingPoint Actionable Security Intelligence (ASI) creates the same malicious and recreational traffic your network must withstand making it the only product capable of real-world network security testing.

Net Optics taps are fast and reliable, and provide access for security and network management devices on all types of networks.

IxLoad-Attack offers security and robustness testing for application servers and networking devices. A number of protocol suites are available for most Internet applications.

Test Conductor is a complete regression harness that is compatible with key Ixia test tools.

IxExplorer provides access to all Ixia hardware functionality. Direct control over Ixia's powerful stream engines is available to generate and capture any data.

IxChariot simulates real-world applications to predict device and system performance under realistic load conditions. IxChariot simulates hundreds of protocols across thousands of network endpoints.

IxChariot Pro conducts ongoing assessments using predictable traffic injection to measure, control, solve, and verify network infrastructure.

IxProfile automatically creates traffic generation scripts based on captured data traffic to provide a comprehensive solution for networks with proprietary protocols.

GEM, XGEM, and ImpairNet enable users to test products and services against the delay, impairment, and bandwidth conditions that occur on real production Ethernet networks. A wide range of features, line speeds, and protocols are supported to meet your current and future needs.

IxNetwork VE Virtual Edition Powered by IxVM

IxLoad VE Virtual Edition Powered by IxVM

Scenario

Test engineers face numerous challenges today: shorter test cycles, higher-performing devices, and more complex testing scenarios. Furthermore, the complexity and performance of these devices is driving up the capital expenditure required to equip test labs.

Even as pressure mounts to bring high-quality products to market quickly, budgets are being cut and resources are unavailable to handle the demand. Test managers are looking for ways to increase the use of their equipment, along with the productivity of their team.

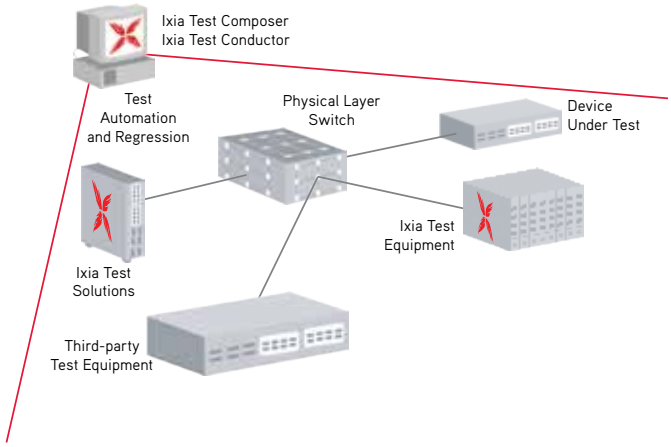
Test automation is a key step toward creating products with high quality, minimal expense, guaranteed interoperability, and quick time-to-market. Automation solutions must support:

- **Multivendor test labs** – integrating test equipment from multiple vendors
- **Home-grown automation** – building and maintaining in-house test automation tools
- **Lab setup time** – setting up and breaking down test configurations
- **Team collaboration** – among QA teams located around the world, operating around the clock
- **Results analysis** - quickly review the results of a test and troubleshoot failing tests

Ixia Test Automation Solutions

Ixia provides the most automatable test products in the industry. IxNetwork's Macro Recorder, for example, provides click-thru test automation without scripting. It works by simply capturing user clicks in the IxNetwork GUI and instantly transforms them into Test Composer commands that you can replay repeatedly as desired. Test Composer also has an intuitive capture/edit/replay feature for interacting with devices under test through their native interfaces.

Additionally, all Ixia applications come with Tcl APIs. Ixia's unique ScriptGen feature uses these API's to produce Tcl scripts that recreate the GUI-based test configurations. Ixia's Test Conductor is a full-featured automation and regression framework for Ixia and third-party test applications. Tight integration with Ixia applications enables you to automate native test configurations quickly, easily, and inexpensively without the need for any scripting. Test Conductor also provides a powerful interface to manage and schedule tests, and analyze the results of the tests. Test Conductor's open APIs provide a wide range of



options for integrating multiple testing technologies into a unified test automation system, thus helping you maximize your CAPEX equipment and reduce your OPEX expenses.

Suggested Applications and Platforms	
Test Composer	An easy-to-use, multi-session, multi-vendor solution for test authoring. Available options include: • Test Composer Value Pack Bundle – provides all the necessary tools to automate DUT configuration, results validation, and report generation • Test Application Plug-ins – automation support for a wide variety of test applications including IxNetwork, IxN2X, IxLoad, IxAutomate, IxChariot, IxCatapult MGTS™, and IxExpore; as well as third-party vendor test tools
Test Conductor	Complete automation and regression framework, supporting many Ixia and third-party test applications. Available options include: • Starter Bundle – perfect as an introduction to automation • IxLoad Lab Bundle – designed for IxLoad automation • L2/3 Lab Bundle - designed for layer 2/3 router performance and conformance testing • Layer 2-7 5-User Bundle - complete automation package for a small- to medium-sized test automation lab • Layer 2-7 10-User Bundle - complete automation package for a large-scale test lab • Jumpstart Implementation Service - professional, customized jumpstart training; recommended with all Test Conductor packages

Ixia offers various platform families:

- Ixia standard chassis and interfaces
- IxCatapult chassis and cards
- IxVeriWave chassis and cards
- Ixia Anue Network Visibility Platforms
- Ixia Anue Test and Measurement Platforms
- Ixia Breakingpoint Application and Threat Intelligence (ATI)
- Ixia BreakingPoint Security Platforms
- Support for IxN2X

Although each chassis is designed to operate in conjunction with specific test applications, many platform elements operate cooperatively.

Ixia Platform

Ixia's test platform distinguishes itself in a number of ways:

- Single platform for layer 2-7
- Ultra-high density and scalability
- Multiuser operation
- Full range of Ethernet interfaces from 10Mbps to 100Gbps
- Hot swap

The following chassis are available:

Chassis	Usage
XGS12	Industry's highest 40GbE, 10GbE port densities in 11RU vertical rack space, reducing space requirements and simplifying management.
XG12	Highest port density and performance in the industry, the 10U-height XG12 holds 12 XM form-factor load modules
XM2	A 3U height portable chassis with 2 XM load module slots
400Tv2	The ultimate in portability, supporting four standard form-factor load modules
AFD1/2	Chassis used to synchronize chassis worldwide using GPS and IRIG-B

XGS12

XG12

XM2

400Tv2

Ixia XM form-factor load modules offer the ultimate in density in performance. The key load modules are:

Family	Usage
Xcellon™	Xcellon-Flex 16-port 10GbE SFP+ and 4-port 40GbE QSFP+ combination load module • High-density 10GbE test ports and high-scaling protocol emulation Xcellon-Ultra NP • Scalable layer 2-7 application performance testing within XM Chassis Xcellon-Ultra XT/XTS • Optimized for generating ultra-high performance application traffic and high volume of encrypted traffic
Xcellon-Lava	Higher-speed Ethernet: • 40Gbps, CFP • 40Gbps, QSFP+ • 100Gbps, CFP • Switchable 40/100Gbps, CFP
Xcellon-Multis	Xcellon-Multis CXP offers three single-slot module types: • 4x100GbE only • 12x40GbE only, using fan-out technology • Dual-rate 4x100GbE and 12x40GbE, using fan-out technology Xcellon-Multis QSFP offers two single-slot module types: • Dual-rate 12x40GbE or 12x10GbE using fan-out technology • Dual-rate 6x40GbE or 6x10GbE, using fan-out technology
PerfectStorm*	The industry's only solution that blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.
PerfectStorm ONE	Ensure enterprise security resiliency and perform proof-of-concept (POC) testing against vendor claims.
NGY	8 port 10GbE with XFP, SFP+, and 10GBase-T interfaces
FUSION	L2-3 load modules: • LSM10GXM8NG/4NG, 8 and 4-port 10GbE with XFP interfaces • LSM1000XMVDC16NG, 16-port 1GbE Dual-PHY interfaces L4-7 load module: • Xcellon-Ultra NG, 12-port 1GbE Dual-PHY/1-port 10GbE XFP interfaces
ImpairNet	The industry's highest-density 1GbE, 10GbE, 40GbE test module for emulating real-life network impairments

Standard form-factor load modules, used in the 400Tv2, offer 10/100/1000 Mbps, 10Gbps, Fibre Channel, OC-3c/OC12c ATM/POS, and OC-48c/OC-192c POS interfaces. Standard form-factor load modules may be used in XM chassis with an adapter card.

*IxLoad-only version available

Xcellon-Flex AP 10/40 Combo

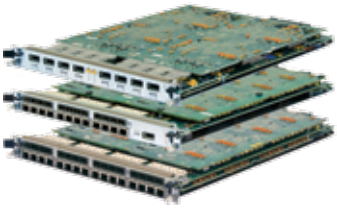
Xcellon-Flex 4-port 40GbE QSFP+ load module

Xcellon-Lava load module

Xcellon-Multis 4-port 100/40GbE CXP load module

PerfectStorm 8-port 10GbE and 2-port 40GbE modules

PerfectStorm ONE 10GbE and 40GbE modules



Industry's highest-density 1Gbps and 10Gbps load modules

FCMGXM8S Fibre Channel load module

ImpairNet load modules (1GbE, 10GbE, 40GbE)

IIxCatapult Platform

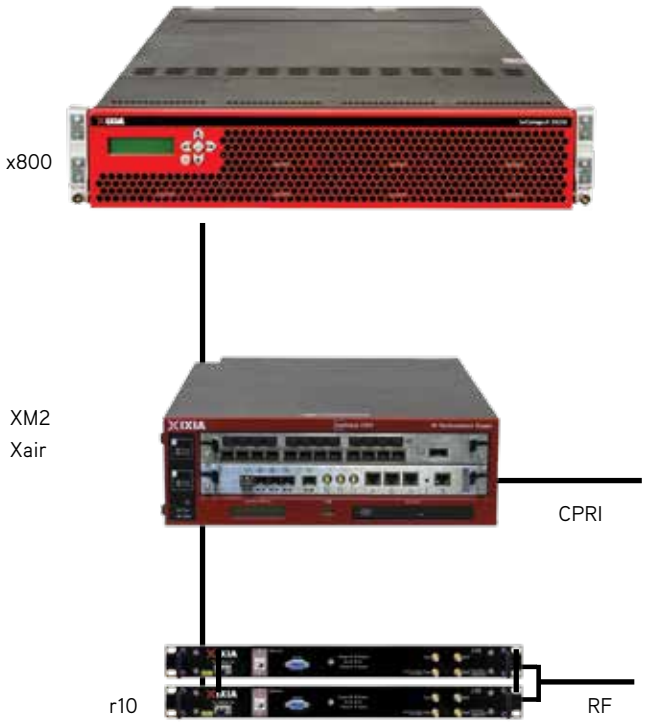
The IxCatapult platforms, specifically designed to test wireless technologies, are used by the IxCatapult test application. The IxCatapult main chassis is the central computation and interface chassis for wireless component testing. Ixia's IxCatapult X800 appliance is an ultra-high-scale platform for testing 3G and 4G-LTE wireless networks and devices.

When testing radio base stations, the X800 can be used in combination with an XM2 and the Xair load modules.

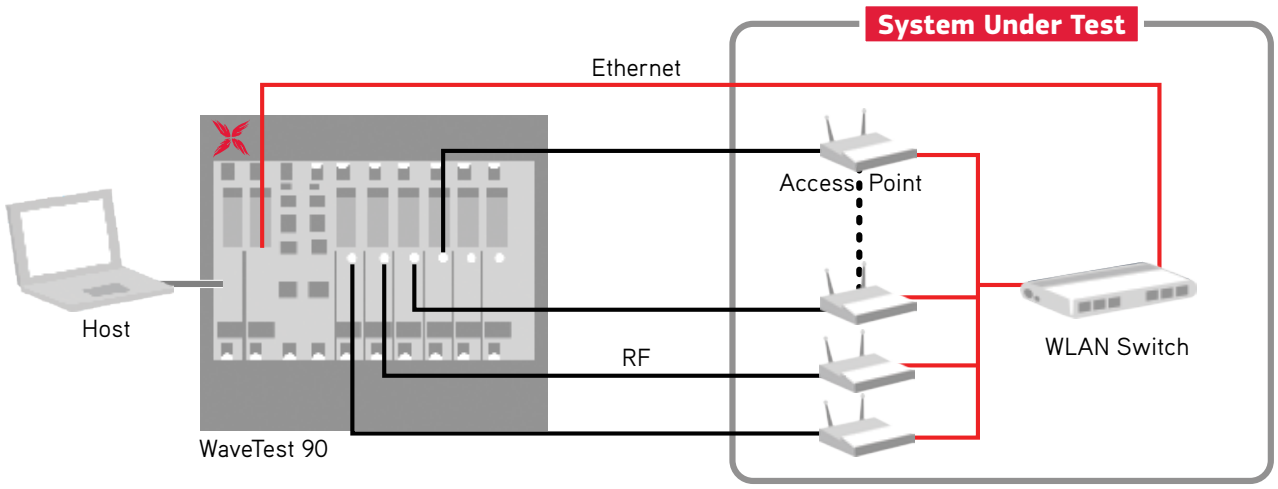
Interfaces
Gigabit 10/100 BASE-T Ethernet and 1000 BASE-T/SX Ethernet
J1/E1/T1
Structured STM-1
OC-1/OC-3/OC-12/STM-1/STM-3

One or more chassis are used for multi-UE LTE testing.

Card	Usage
Xair	The XAir module supports complex subscriber modeling with: • 1000 UEs per sector • Voice (VoLTE), video, and data traffic support • Quality of experience (QoE) analysis and scoring of each traffic stream • Mobility over multiple sectors • Channel modeling per UE



IxCatapult platforms

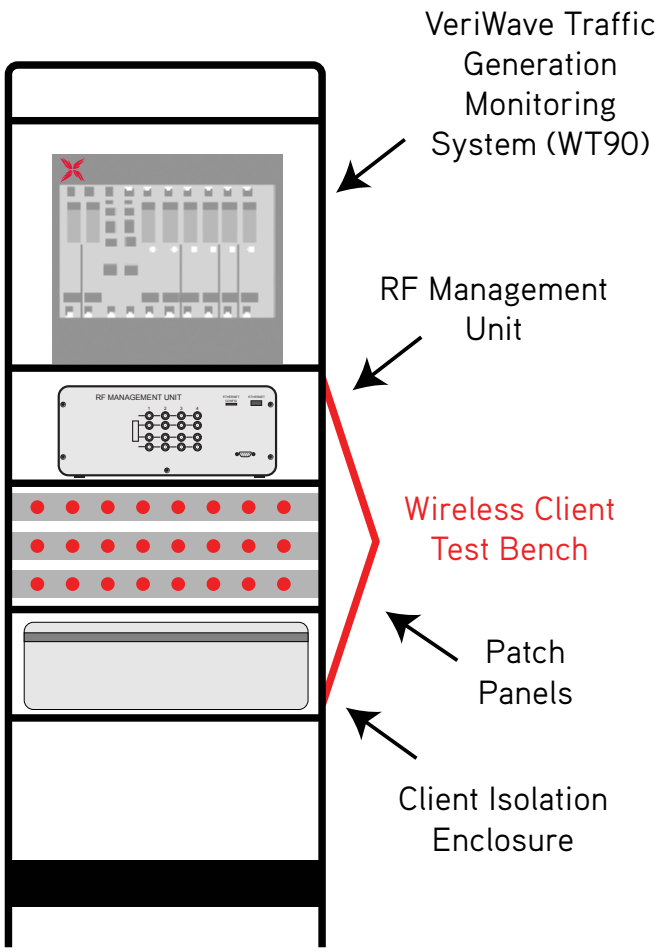


IxVeriWave Platform

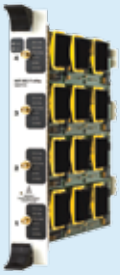
WaveTest is a powerful traffic generator/analyzer capable of generating thousands of independent client sessions, each representing a unique user of the network. It offers native IEEE 802.11 a/b/g/n interfaces as well as 10/100/1000Mbps Ethernet interfaces. Using WaveTest, network traffic is accurately, repeatedly, and precisely created. WaveTest offers unique insight into the functionality, quality, and performance of the device or network under test.

WaveTest 90	Supports up to 9 WaveBlades with a combined capacity of 18,000 individual WLAN clients (STAs)
WaveTest 20	Supports up to 2 WaveBlades with a combined capacity of 4000 individual WLAN clients (STAs)

IxVeriWave's WaveBlade series provides a state-of-the-art and an industry-first test product to evaluate the functionality and performance of WLAN networking products. Designed for testing network infrastructure devices, including consumer access points (APs) and reference designs, enterprise/carrier- grade access points and controllers, and entire WLAN networks, the WaveBlade integrates both traffic generation/analysis and multi-path channel emulation capabilities on a single platform.



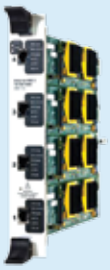
802.11n
3x3 MIMO



4-port
802.11 a/b/g
& 802.11n SISO

1-port
High-power
802.11 a/b/g
& 802.11n SISO

4-port
High-power
802.11
a/b/g/n/ac



4-port
Ethernet

1-port
Ethernet

WaveBlade Ethernet (WBE1104, WBE1101)	4/1 RJ45 ports for testing Ethernet network infrastructure devices such as APs, broadband home gateway, controllers, switches, and routers
WaveBlade Wi-Fi 802.11a/b/g and 802.11n SISO (WBW1101, WBW1104, WBW1101P)	1/4/1 ports for testing wireless LAN network infrastructure devices including enterprise and consumer APs and controllers, as well as wireless-enabled client devices such as PCs, dual-mode phones, patient monitors, and scanner
WaveBlade Wi-Fi 802.11n MIMO (WBW2000)	1 port for testing network 802.11n 1x1, 2x2, and 3x3 MIMO infrastructure devices, including consumer APs and reference designs, enterprise/carrier-grade APs and controllers, and entire WLAN networks
WaveBlade Wi-Fi 802.11a/b/g/n/ac SISO (WBW3601, WBW3604, WBW3601P)	1 port for testing network 802.11ac 1x1, 2x2, and 3x3 MIMO infrastructure devices, including consumer APs and reference designs, enterprise/carrier-grade APs and controllers, and entire WLAN networks
WaveAgent™ Network Device Performance Characterization	Provides device-specific measurements of forwarding rate, throughput, loss, voice MOS, video MDI, round-trip latency, and jitter when enabled by IxVeriWave's WaveInsite, WaveDeploy, WaveQoE, WaveDynamix, and WaveClient applications.
WaveIOT WLAN Interoperability Testing	Fast and automated testing of Wi-Fi performance over distance using real wireless LAN (WLAN) access points and client devices.

WT20

RF Isolation
Chamber

The WaveBlade Wi-Fi line-cards fit into IxVeriWave's WT90 and WT20 chassis and interworks seamlessly with the WaveBlade Ethernet line-cards. They provide the essential tools necessary to complete various types of testing, ranging from functional testing at the AP-level to scale-testing a large infrastructure network.

WaveChamber provides an RF-isolated environment small enough to support rack-mount and desktop use, yet large enough to house most access points. Bulkhead-mounted connections for RF cabling, filtered 10/100/1000Mbps Ethernet, and console ports make interfacing to any AP quick and easy. WaveChamber includes a fan and front-to-back airflow for adequate cooling, whether used on the bench-top or stacked in high-density racks.

WaveChamber 1000	A small, rack-mountable configuration to minimize space requirements
WaveChamber 1100	Designed to house large multi-radio and outdoor APs
WaveChamber 2000	Easily accommodates various types of 802.11n APs

Ixia's Net Tool Optimizer™ 5200 Series

Enterprise and carrier-class network monitoring switches that simplify the management of complex networks and dynamic data centers. For ultimate control with a quick startup time, they include the most robust functionality in the industry, along with the easiest to use drag-and-drop control panel.

Ixia's Net Tool Optimizer™ (NTO) is part of the Visibility Architecture. The Ixia Visibility Architecture is built on the industry's most comprehensive network visibility product portfolio. This portfolio serves as the foundation of the Visibility Architecture and includes network access solutions, network packet brokers, application and session visibility solutions, and an integrated management platform.

The need for speed – enables the monitoring of high-speed networks at 10GbE, 40GbE, and beyond.

The need for a "big picture" – provides complete visibility of the network for thorough and accurate monitoring.

The need for the right data – delivers exactly the right data needed for analysis and helps eliminate tool overload caused by unnecessary data.

The need to optimize – allows you to get the most of monitoring-tool investment by using each tool to its fullest potential.

The need for security – provides controlled access to sensitive information inside the data center.

The need to maximize IT staff productivity and improve data center ROI – reduces troubleshooting time by up to 78 percent and minimizes data center downtime.

NTO sits between network SPANs and taps and network monitoring tools to aggregate, replicate, filter, and de-duplicate network traffic.

NTO ensures that each monitoring tool gets exactly the right data needed for analysis, improving monitoring tool performance and protecting your monitoring tool investment.

NTO 7300 Chassis

The Network Tool Optimizer (NTO) 7300 and Ixia's Visibility Architecture provide the most scalable network visibility framework in the industry. Together, they deliver the expandability and management flexibility that easily integrates into any network or data center environment, as well as the control and simplicity necessary to improve the usefulness of existing IT tools.

The NTO 7300 is a chassis that allows for centralized control of your network monitoring system in a single, simple, rack-mountable unit. It combines disparate solutions into a smaller data center footprint, saving power, rack space, and improving ROI.

The Application and Threat Intelligence (ATI) Processor delivers real-time application data that provides rich data on behavior and location of users and applications, in any format needed – raw packets, filtered packets, or metadata.

The Ixia Packet Capture Module (PCM) provides built-in, single-UI packet capture and Wireshark decode monitoring capability to enable quick troubleshooting of performance, security, and availability problems.

Ixia's Flow Distribution module provides industry-leading density and scalability in a unified visibility platform, and delivers carrier-level reliability for network monitoring and security.

5260/5268 Flexible Centralized or Distributed Monitoring

The ControlTower NTO family allows you to grow and scale monitoring when and where you need it, all while maintaining multi-box configuration and management from a single UI.

2112/2113 Flexible Centralized or Distributed Monitoring

The new Ixia NTO 2112/2113 family of products were built from the ground up to extend core enterprise class network monitoring feature sets to branch offices and distributed deployments.

5293 High-Availability, High-Density 100GbE

The Ixia Anue 5293 Net Tool Optimizer® (NTO) is a carrier-grade, high-density 1GbE, 10GbE, 40GbE, and 100GbE network monitoring switch. It facilitates visibility into the packet network by efficiently connecting multiple network monitoring tools to a large number ports.

5288 High-Density 10/40/100GbE

The Ixia Anue 5288 NTO is a high-density solution designed for large and complex data centers. The 5288 provides an efficient and scalable solution to monitor 1GbE, 10GbE, 40GbE, and 100GbE links while minimizing data center footprint and power consumption.

5273 High-Availability, Carrier Class

The Ixia Anue 5273 NTO is a carrier class, high-availability network monitoring switch designed for telecommunication and cable service providers.

5236 Enterprise Class

The Ixia Anue 5236 NTO network monitoring switch provides high-performance 10GbE visibility for network monitoring tools in all parts of a fiber network. The 5236 offers up to 24 SFP/SFP+ Ethernet ports and the industry's most advanced, easy-to-use, drag-and-drop control panel.

5204 Small Enterprise

The Ixia Anue 5204 NTO network monitoring switch is an entry-level, cost-effective solution for copper networks that predominantly require 1GbE visibility for network monitoring tools. It is ideal in the lower-speed portions of the network, such as the access layers, or where a large number of 1GbE monitoring tools need access to network traffic.

7433 GTP Session Controller

The Ixia GTP Session Controller 7433 helps mobile carriers optimize the performance of their network monitoring solutions. Additionally, the GSC 7433 provides unprecedented scalability and network visibility by ensuring that GTP traffic related to one session is delivered to a single probe.

NTO Advanced Feature Module (AFM)

The NTO Advanced Feature Module (AFM) helps network engineers to improve monitoring tool performance by optimizing the network stream to include only the packets needed for analysis. The advanced packet processing features of the AFM enhance the NTO's capability to aggregate, replicate and filter network monitoring traffic.

Net Optics Taps, Bypass Switches, and Link Aggregators

Ixia's Net Optics is the leading provider of total application and visibility architecture solutions that deliver real-time network intelligence for peak performance in network monitoring and security. As a result, businesses achieve the scalable end-to-end visibility they need to optimize network performance of physical, virtual and private cloud environments, and remote branch offices. Enterprises, service providers, and government organizations trust our comprehensive plug and play family of application-aware NPM, network packet broker, virtual/cloud, and Visibility Management System (VMS) solutions to deliver immediate results.

Our solutions help network IT and security professionals gain 24/7 total visibility, insight, control, and non-intrusive access – reducing CAPEX and OPEX with best-in-class products at the lowest price per port.

Ixia's Net Optics leads the next wave of progress with a growing family of best-in-class solutions that help you access and monitor all traffic at all times, and maintain a healthy, secure, and efficient network. We deliver comprehensive visibility— even in areas you never thought you could access.

Our products reflect deep customer insight plus proven technology expertise encompassing monitoring, control, and access for a total, integrated approach to meeting your monitoring and security needs.

Application Performance Monitoring

Application-Aware Network Performance Monitoring (AA-NPM) solutions offer end-to-end visibility of your network and applications to ensure availability, performance, security and compliance for your organization. AA-NPMs provide real-time network and application visibility across silos and remote sites; that enable monitoring at the core and all points in between through real-time application monitoring for proactive issue alerting and peak business performance. The proactive, comprehensive, and intelligent solutions accelerate troubleshooting to resolve network issues before they interfere with business critical applications. AA-NPMs provide the following capabilities:

- Export NetFlow™ data to external collectors, integrating with third-party solutions and providing dashboards of collected data
- Conduct continuous, on demand, ad-hoc packet capture to monitor performance—ideally by session and by application
- Issue meaningful metrics as Key Performance Indicators (KPIs) pertaining to specific applications including voice, video, HTTP and database protocols.
- Generate alarms based on manual or automatically generated thresholds.
- Provide a clear and timely data set, including DPI, for instant, accurate issue diagnosis

Intrusion Detection System (IDS) Deployments

The security threat landscape is changing constantly as malicious attackers continually find new ways to compromise today's networks. To combat this threat, network security best practices include implementing a layered security approach to minimize the chance of a breach.

In short, any single defensive monitoring tool may be flawed, so a series of diverse defenses can cover any gaps in the protective capabilities of the others. Firewalls, intrusion detection systems, malware scanners, integrity auditing procedures, and local storage encryption tools each serve to protect your information technology resources in ways the others cannot.

Net Optics Taps provide IDS visibility into the traffic flowing over the network. By not limiting a monitoring tool's visibility to only what is available from SPAN ports, Network Taps make certain that your IDS has 100% visibility of the traffic. - See more at: http://www.netoptics.com/solutions/deploying-your-intrusion-detection-system-ids#sthash.pKV92n1N.dpuf

Taps

The Ixia Net Optics family of taps provides 100% visibility and permanent passive access points into the customer's network. When a monitoring tool is needed, simply connect the device to the tap instead of taking down the link and interrupting traffic. Taps pass all network traffic without introducing bottlenecks or points of failure. We provide a tap solution, supporting copper, multimode and single mode fiber at speeds up to 100Gbps.

Net Optics FlexTap 40GbE

Bypass Switches

The Ixia Net Optics family of Bypass Switches offers you trouble-free access ports to support your inline network security and monitoring devices. A "Heartbeat" packet ensures that a monitoring appliance is actually passing traffic: If this packet doesn't return to the Bypass Switch, the switch instantly goes into bypass mode and takes that appliance out of the traffic path.

iBypass Switch 10/100/1000 Copper

Network Packet Brokers (NPB)

Network Packet Broker (NPB) is category of compact, hardware-based, rack-mounted devices that offer a new approach for handling and manipulating network packets. NPBs optimize the access and visibility of traffic from one or many network links to monitoring, security and acceleration tools.

iLink Agg xStream

Monitoring and Performance

Net Optics Spyke is a family of (AA-NPM) products. Application-Aware Network Performance Monitoring (AA-NPM) solutions offer end-to-end visibility of your network and applications to ensure availability, performance, security and compliance for your organization. AA-NPMs provide real-time network and application visibility across silos and remote sites. They enable monitoring at the core and all points in between through real-time application monitoring.

Spyke

Phantom Virtualization Tap

Ixia's Net Optics Phantom Virtualization Tap™ bridges the physical and virtual, so that you can monitor the virtualized network with your existing set of tools. Phantom is capable of capturing and then sending inter-VM traffic of interest to the tools that are already monitoring your physical network.

Phantom vTap

Indigo Pro™

Net Optics Indigo Pro is a unified management platform that enables centralized monitoring and configuration of few to many Net Optics devices. From a single management console, Indigo Pro provides device configuration and element management, event and fault management, bulk upgrades of device software, an integrated device view, and rich graphical visualization of network statistics.

Indigo Pro

Ixia Test and Measurement Solutions

TrueNetwork™ technology enables our test and measurement products to recreate real-world network conditions in the lab with the most accurate and repeatable results possible. Using the simple, intuitive interface, you can configure network impairment conditions for Ethernet, SONET/SDH, Fibre Channel, OTN, or CPRI networks.

In order to uncover and resolve issues before they negatively impact your real production network, it is crucial that you test before deployment under the most realistic and repeatable network conditions possible.

Network Emulators
Ixia's Network Emulators precisely emulate real-world network impairment condition in the lab, for the test and validation of your network-based products, applications and services prior to deployment. With an industry unique field-programmable gate array (FPGA) based platform, Network Emulators deliver the most realistic and repeatable test results possible.

Network Emulators are essential for characterizing and validating the real-world performance and end-user quality of experience (QoE) you expect from your networked applications, disaster recovery, data center migration, and multimedia service solutions.

3500
The Ixia 3500 is an intuitive test-case-driven solution that you can use to validate the performance of synchronization services and Carrier Ethernet functions required by next-generation carrier-grade Ethernet/IP-based networks.

With the 3500, test and development engineers at any level can quickly and easily verify compliance to international standards-based requirements with real-time graphed analysis and automatic pass/fail results. The 3500 provides real-world testing of technologies including synchronous Ethernet (SyncE), IEEE 1588, PTP, circuit emulation services (CES, IETF SAToP, IETF CESoPSN, ITU-T Y.1413), MPLS-TP, and Carrier Ethernet OAM.

Ixia 3500	Benefits: • Realistic and repeatable network impairment conditions in your lab • Improved productivity and time-to-test • Increased reliability of your network, reducing support costs • Precisely reproduce and quickly resolve issues occurring in the field • IEEE 1588/PTP and circuit emulation • Ethernet OAM and protection switching Test Interfaces: • 100M/1GbE Ethernet RJ45, 1GbE Ethernet optical SFP, 10GbE Ethernet optical SFP+, E1 RJ48C, T1 RJ48C, 2.048MHz BNC, 10MHz BNC, 25MHz BNC, 62.5MHz BNC, 125MHz BNC, 1PPS BNC
Ixia Network Emulators	Benefits: • Discover true performance during development vs. deployment • Avoid costly deployment failures • Increase user satisfaction and adoption when deploying new services • Test using industry-standard network models • Troubleshoot field performance problems by recreating your precise network in the lab Test Interfaces: • Ethernet: 10Mbps – 10Gbps • SONET/SDH: OC-3/STM-1 through OC-192/STM-64 • Fibre Channel: 1Gbps – 10Gbps • OTN: OTU1 - OTU2e • CPRI: 614.4Mbps - 2,357.6Mbps

Ixia Test and Simulation Devices

Cyber attackers are constantly evolving their mode of assault as they target sensitive data, financial assets, and operations. At the same time networks are under the strain of ever growing dynamic applications and user behavior. The traditional approach of simply reacting to attacks and traffic evolution is costing organizations and governments billions. The only way to stay one step ahead is to predict the impact before it happens. Only Ixia's BreakingPoint Actionable Security Intelligence (ASI) provides global visibility into emerging threats and applications, along with insight into the resiliency of your IT infrastructure under operationally relevant conditions and malicious attack.

Ixia's BreakingPoint ASI protects enterprises, service providers, and government agencies worldwide by providing global visibility into emerging threats, and actionable insight to harden and maintain resilient defenses. With the exclusive ability to create and control global threat and application intelligence at Internet-scale, Ixia delivers the only platforms capable of battle-testing IT infrastructures, training cyber warriors, tuning systems and policies, and transforming security processes to be proactive and effective. Ixia's easy-to-use and comprehensive Actionable Security Intelligence offering includes:

- **Create** — Application and Threat Intelligence
- **Control** — Simulation and Testing Platforms
- **Transform** — People, Process, and Technology

The BreakingPoint Application and Threat Intelligence (ATI) program provides comprehensive and current application protocols and attacks for Ixia's platforms. The company's simulation and testing platforms are kept current via this exclusive subscription service, which regularly pushes newly discovered attacks, malware, and other intelligence aggregated from proprietary research, strategic customer relationships, and carrier feeds. By delivering these exclusive capabilities, Ixia bridges the gap between IT testing, monitoring, and operations to deliver advance insight and protect highly dynamic converged and mobile networks, virtualized data centers, and applications.

Stay current. Stay protected.

Test and simulation conditions must reflect the latest security threats and applications so that you can ensure your equipment and systems will perform reliably and protect networks from the most advanced and malicious traffic. Ixia does the research for you by identifying and generating security attacks and application protocols that keep you current. Ixia's BreakingPoint ATI provide updates on a regular basis, ensuring delivery of the industry's most complete application and threat intelligence, including 160+ stateful application protocols and 38,000 security strikes, evasion techniques, and live malware and mobile malware.

Ixia's BreakingPoint ATI also provides periodic feature updates, including all-in-one test labs, performance upgrades, and the latest management tools. And all ATI subscription customers receive a full range of support options, discounts on technical training, and consultation on your test plans to ensure they are current, rigorous, and comprehensive.

PerfectStorm

The PerfectStorm™ Fusion is the world's first massive-scale, all-in-one product to test and validate applications, devices, networks, and data centers. It allows you to subject the world's largest infrastructures to high-fidelity simulations in order to harden and optimize your devices, systems, applications, and people.

PerfectStorm™ is the world's only solution that blends application traffic and security attacks at 960 Gigabits per second (Gbps) with the load of 720 million concurrent wired and wireless users from a single 11u chassis.

From vendors that need to test devices in a lab or take a portable lab to a customer for proof of concepts, to enterprises that need to know how changes impact network and application performance and security defend vendor selection and ensure a successful rollout, PerfectStorm is the answer.

PerfectStorm™ Load Modules

PerfectStorm is Ixia's latest testing platform that modularly-scales to nearly a terabit of application traffic in a single, integrated system.

PerfectStorm's complex application workloads make it simple to simulate realistic data, video, voice, storage, and network traffic to ensure high-performing and secure data center infrastructure.

PerfectStorm ONE

Ixia's new PerfectStorm ONE network test and assessment solutions are developed specifically for enterprise IT, operations, and security personnel. Delivered in a compact form-factor, PerfectStorm ONE condenses Ixia's PerfectStorm massive-scale, stateful layer 4-7 testing platform to now support the enterprise. Scaling from 4Gbps to 80Gbps of application traffic simulation, PerfectStorm ONE supports a buy-only-what-you-need business model to align with enterprise budgets and future-proof your growing test needs.

FireStorm

The FireStorm™ takes performance and realism to an unsurpassed level. With the ability to capture current global threats and applications and control them at Internet-scale, it allows you to subject the world's largest infrastructures to high fidelity simulations. The FireStorm is the industry's only solution capable of creating blended application traffic and current security attacks at 120 Gigabits per second (Gbps) with the load of 90 million concurrent wired and wireless users.

FireStorm ONE

The FireStorm ONE™ is a portable and ultra-compact massive-scale performance and security testing solution. This unique combination of portability and performance allows any organization to perform massive-scale performance and security testing anywhere at any time, using the exact application, attack, and load behavior needed to optimize and harden any IT infrastructure.

Ixia 20

Ixia 20, the world's highest port density solution, capable of creating massive-scale online behavior. Providing twenty 10GbE ports and 60 ports per 4U chassis, it combines the high performance, realism, and large port densities needed by the large-scale development and testing labs of equipment manufacturers and carriers. The Ixia 20 is the perfect solution for any organization challenged by introducing sophisticated, real-world application and security testing to support numerous concurrent users, tests, or port pairs.

Storm

The Storm™ captures and controls global threat and application intelligence for cost-effective simulation and testing of IT infrastructures. The compact 3-slot Storm™ 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.

Cyber Security Testing as a Service (TaaS)

Ixia Cyber Range training has been developed with an emphasis on real-world operations and self-enabling. The objective is to instruct students on how to conduct offensive and defensive operations, taking into account personnel roles and responsibilities in a Cyber Range environment.

Learning modules cover offensive operations, including attack and exploit vectors and target simulations, defensive operations from a network/security operations centers (NOC/SOC) perspective, and lab exercises.

Ixia BreakingPoint Application and Threat Intelligence (ATI)

BreakingPoint products expose previously impossible-to-detect vulnerabilities and weaknesses in applications, devices, networks, and data centers before they can adversely affect IT operations.

Every BreakingPoint product is designed for speed, realism, and ease of use. A key aspect of the design is the BreakingPoint Application and Threat Intelligence (ATI) Program, a responsive and all-inclusive service and support program. Our team of dedicated application and security researchers provides everything you need for thorough measurement of the performance, security, and stability of IT infrastructures, including access to all application protocols, security attacks, product enhancements, and full service and support. In one comprehensive program, you can tap into the resources and expertise you need to keep your simulations current and realistic. The ATI Program includes all of the following:

Frequent Application Protocol Updates. With a current ATI Program agreement, you are assured of the most realistic simulation conditions possible with access to the latest applications. The BreakingPoint ATI team uses advanced surveillance techniques and methodologies to identify, capture, and rapidly-deliver the emergent business, consumer, and malicious applications you need to conduct meaningful and thorough performance and security validation. Consistent with BreakingPoint's all-inclusive approach, your ATI Program account gives you automatic access to all newly-released protocols, software fixes, operating system updates, and other resource downloads.

Evergreen Application Protocols. Content-aware network and security devices are at a severe disadvantage if they are not tested using the most current versions of the most popular application protocols. The BreakingPoint Evergreen Applications program addresses this need by providing ever-current versions of popular Web and network applications for validating deep packet inspection (DPI), lawful intercept (LI), and data loss prevention (DLP) products.

Updates from the Industry's Top Security Researchers. Security threats are constantly evolving, with new vulnerabilities discovered each day. Your simulation conditions must reflect the latest security threats so that you can ensure your equipment will perform reliably and protect your infrastructure from the most advanced and malicious traffic. Our team of experts does the research for you by identifying and generating security attacks that meet your needs.

We don't license our security attacks from other vendors: our award-winning staff of application and security researchers provides timely updates, ensuring we deliver the industry's most complete security updates. Currently we provide:

- 4,500+ security strikes and 100+ evasion techniques
- 38K+ pieces of live malware, including mobile malware, which can be launched through multiple transports, including HTTP, SMTP, POP, and IMAP, and embedded within popular file types such as .doc, .pdf, .ppt, and .xls
- Microsoft® Tuesday coverage
- SYN flood attacks with more than 1million connections per second
- The ability to direct attacks at networking devices or target servers
- Application-layer fuzzing to detect previously unknown vulnerabilities

Convenient Technical Support Options. Ixia offers a range of responsive support options to ATI Program customers. You can get answers to questions and requests, including phone-based, email, and online support. Experienced technical representatives are available Monday through Friday, 7:00 am – 7:00 pm central time. Or you can bypass phone support and submit your service requests online. Open a new request or update and check the status of existing requests via email at your convenience.

Authorized Technical Support Contacts. As an ATI Program customer, you may designate people within your organization who are authorized to submit an unlimited number of service requests to our support technicians. If desired, Ixia will designate a support specialist to serve as your single point of contact for requests. This expert will become familiar with your environment and facilitate the delivery of solutions that meet your needs.

Professional Services Engagements. ATI Program customers have free access to all web-based tutorials and may also purchase on-site technical training. Our expert consultants are available on a contract basis to review your simulation and measurement plans and ensure that they are current, rigorous, and comprehensive. Our Professional Services staff can also visit your site to address your most pressing issues and questions or oversee critical projects.

Ixia Global Support

We understand that you must deliver higher-quality, higher-performing products and services to market faster than ever before. Ixia's global support team is committed to helping you successfully achieve these more-demanding business requirements.

Key benefits and services we provide as part of your active Ixia product support include:

- **Get best-practices advice and quick resolution of product issues** by accessing our technology and product experts in global support centers strategically located across APAC, EMEA, and North America, through whatever method best suits your team—via phone, e-mail, or online
- **Gain direct hands-on assistance and local-language support** through field support teams in many regions
- **Obtain proactive assistance with your team's ramp up** on new Ixia products and features
- **Maximize the capability and productivity of your Ixia products** to test new scenarios
- **Reduce risk to your critical projects and time to market** through fast, expert support and managed escalation process to ensure responsive issue resolution
- **Access expert automation advice and script debugging assistance** for your engineers
- **Protect your Ixia test system investment and minimize downtime** with full-service hardware repair (RMA) and rapid on-site interchange of field-replaceable hardware modules
- **Maximize the return on your Ixia solutions investment** through access to the latest software releases with all the new features, enhancements, and patches
- **Access full support materials online at any time** to find answers and solutions in our extensive knowledge base, download the latest software releases, manage licensing, and access the latest product documentation and release notes
- **Upgrade to higher levels of support** with our premium support service, which offers many additional benefits that include expedited hardware repair, increased access and proactive support, customized support plans, and quarterly reporting

The global support team is your advocate within Ixia and key to getting the most from your testing platform. They work seamlessly with your Ixia field sales managers, system engineers, and all other Ixia teams, to ensure that you get what you need, when you need it to be successful.

Enriching Your Test-Solution Experience

Service providers and enterprises frequently have neither the background nor the expertise to properly evaluate the performance and interoperability of the multi-vendor devices and systems that make up their network.

Although critical to successful launches, testing is often downplayed and frequently back-ended in project plans. Even when testing needs are accommodated, sufficient priority is often not given to test automation and full integration of testing into the service-delivery lifecycle process. When proper testing is overlooked, performance and QoS suffer. Test automation and integration into a service-delivery lifecycle are keys to ensuring quality, performance, and efficient time to market.

The Ixia professional services team of highly-experienced testing experts is here to help you achieve the optimal testing solution for your unique requirements. We understand that fast results will drive project success. From project management, best-practice recommendations, and training, to full testing and automation services, we have a robust set of service options that you can combine or use independently.

Comprehensive Integrated Test Solutions

- **Project management** – an experienced Ixia project manager manages your test effort from start to finish. All aspects of a proper QA process -- test plan development, personnel and equipment allocation, test development, automation, regression and reporting -- are actively monitored and documented.
- **Test process optimization** – solutions targeted to your specific test needs help you get the most out of your Ixia test equipment and applications. We help you focus on what, when, and where to test, and include trend analysis.
- **Test automation** – enables you to perform cost-effective, efficient, and repeatable lifecycle testing that enables you to deliver top-quality products. Automation speeds testing from days to hours and helps you meet shipping and deployment deadlines.
- **Strategic placement** – integration of testing into service delivery release lifecycle.

Industry-Leading Testing Resident Expertise

- **Testing solution experts** – with your resources at a premium, Ixia can provide you with critical access to trained experts to assist on urgent and late product development testing, customer proof-of-concepts, real-world solution demonstrations, and test lab setup, development, and on-going maturation.
- **Jumpstart training** – provides personalized, on-site training. We take two days to introduce your team to Ixia products, followed by three days focusing on using Ixia products for your testing requirements. You'll receive specific use examples that can be replicated for future projects.

IxTest – Testing as a Service (TaaS)

- Provides efficient, robust, and cost effective testing services to your organization
- Packages industry-standard test plans, reports, and methodologies that can be applied to various aspects of an infrastructures' lifecycle
- Addresses the needs of QA labs and IT departments, as well as pre- and post-production networks and systems for carriers, enterprises, and NEMs
- Bundles solutions (hardware, software, and services) to leverage our testing expertise along with our best-of-market testing products

IxPro ESP

IxPro ESP (Experience/Services/Portal) provides the power and functional breadth of IxChariot, overlaid with a simpleto-use Web-based GUI. IxPro ESP offers simple and easy integration into existing monitoring and management work flows, and allows our customers to quickly realize the benefits of IxChariot's active testing within their network operations. IxChariot testing resources and test scheduling can be managed and monitored using a straightforward interface, along with real-time alarms and reporting data.

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