DATA SHEET

IxLoad — Data Test Solution

Validate That Application Service Meets Customer Expectations

Problem: Endangered QoE for End User Data Applications

In today's highly competitive landscape, organizations must meet stringent network quality requirements to deliver the best customer experience. However, a widening array of applications and an increasing number of users, is making it harder—and more expensive—than ever to ensure high-quality end-user experience across converged multiplay services and application delivery platforms.

Solution: A Comprehensive Test Solution for Data Application Delivery Platforms

Ixia's IxLoad Data test solution delivers the industry's most scalable and flexible solution for testing high-performance application-aware devices and networks. Network operators now have the means to measure independent- and multi-protocol performance, session capacity, and transaction latencies of applications and data center infrastructures in a single integrated platform.

Highlights

- Rollout new web, email, database and storage services with confidence
- Quickly resolve performance and security issues with comprehensive analytics
- Minimize post-production issues and improve QoE by validating in the lab
- Automate end-to-end with REST and other APIs to meet automation and orchestration requirements
- Reduce test time and learning curve with library of pre-built test cases and call flows
- Evaluate security effectiveness, detection accuracy, and service availability with DDoS simulations and a library of published vulnerabilities and malware

KEYSIGHT TECHNOLOGIES

Key features

- Test the scalability and performance of application-aware networks and devices by emulating HTTP, HTTP/2, SSL – including TLS 1.3, FTP, and Email clients and servers as well as NAS/SAN/Cloud Storage and Database sessions
- Test the performance limits and long-term stability of content-aware devices such as application delivery controllers, web servers, firewalls, web caches, and WAN acceleration devices
- Measure the ability of a multiservice transport network to deliver data, voice, and video by intermixing data traffic with delay- and jitter-sensitive multimedia traffic

Product Capabilities

Data application protocols

IxLoad delivers a wide variety of fully stateful web, data transfer, email, database, and storage protocols to emulate a complete multiplay user environment. Combined with the CloudStorm or PerfectStorm hardware platforms, IxLoad delivers unprecedented scale and performance. In addition, IxLoad's comprehensive network support, advanced test timelines, and automatic goal seek capabilities enables users to comprehensively assess the performance of their service delivery networks and determine application-level performance in a single integrated solution.

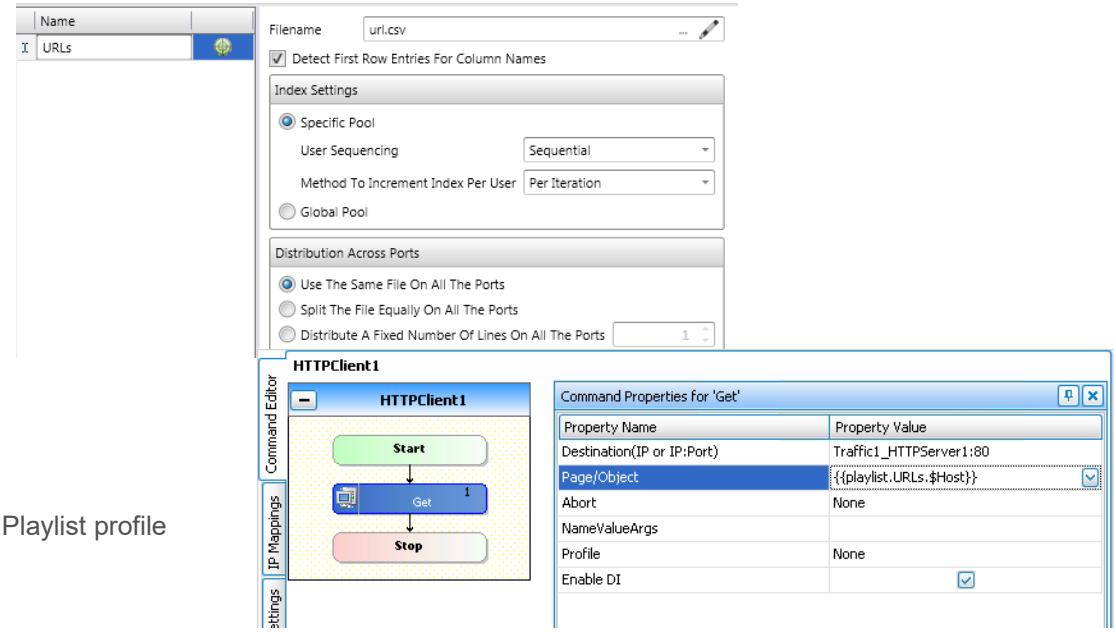
IxLoad data protocol emulations enables users to validate the following capabilities:

Technology	Capabilities
Web, File Transfer	• Validate performance limits and long-term stability of content-aware devices such as application delivery controllers, web servers, firewalls, web caches, and WAN acceleration devices
Email	• Benchmark the capacity of email servers and mail transfer agents • Assess the impact of content filtering of spam and other malicious content on the performance of mail delivery systems
Database	• Benchmark the impact of database workload on the server performance in terms of CPU, memory, and I/O utilizations • Validate integrity of the data retrieved from the database
Storage	• Validate data center storage infrastructures by simulating RoCEv2, SAN, NAS, and other data center application traffic • Simulate various workload profiles to validate the impact of storage on enterprise applications
Infrastructure Services	• Validate the performance of critical network services like DNS, DHCP, RADIUS (AAA Services), and Telnet under high loads • Measure the capacity of user management systems using LDAP clients
Network Security	• Evaluate security effectiveness, detection accuracy, and service availability • Proactively practice your DDoS mitigation services and processes

Technology	Capabilities
TCP / UDP	• Benchmark the baseline Layer 4 and stateless forwarding performance on content and application-aware devices before attempting more complex test scenarios
Replay	• Reproduce anomalous behavior that may be caused by a particular packet exchange or inter-packet delay • Determine the performance impact of unclassified or proprietary application traffic on multiplay networks

Playlist

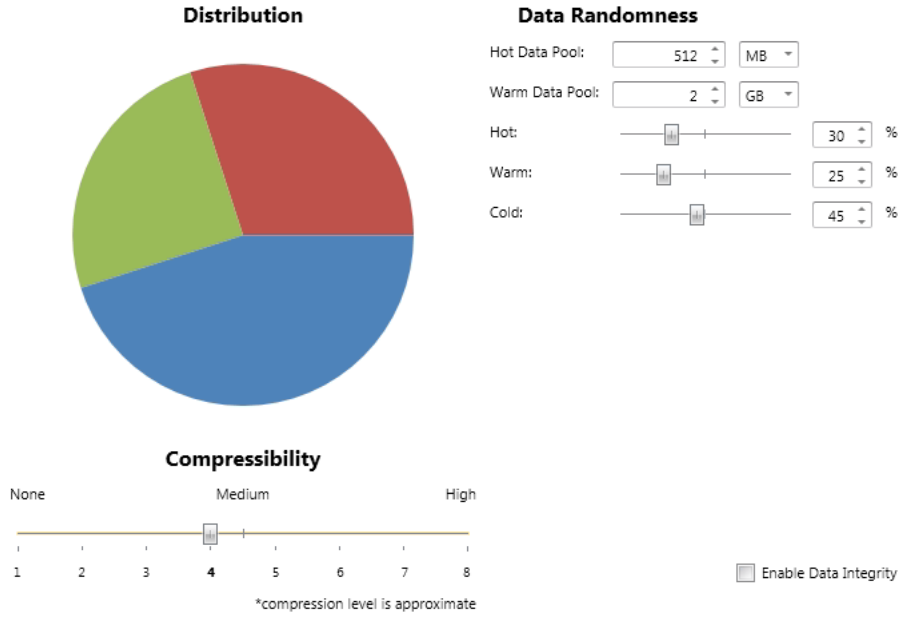
Playlist is an IxLoad infrastructure feature that is used to sequence through a contiguous list of items such as filenames, usernames/passwords, web pages, DNS queries. The playlist is a CSV file that typically contains columns with contiguous data. IxLoad supports the playlist functionality for selected protocols like HTTP, SSL, and DNS, and selected fields of those protocols.



Playlist profile applied to HTTP

Random data generation engine

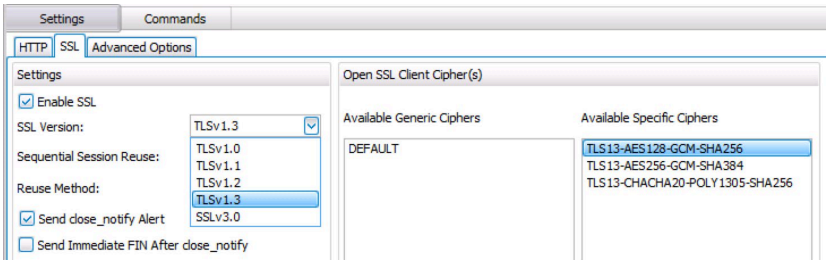
Random Data Generation Engine (RDGE) enables user to generate traffic with varying randomness and compressibility to stress different components of WAN optimizers and caching devices such as CPU, disk, and memory. IxLoad supports the RDGE functionality for selected protocols like those for HTTP and Storage.



Random Data Generation Profile

TLS 1.3

By realistic emulating of HTTP client and servers with TLS 1.3 support conforming to RFC 8446, IxLoad helps validating and benchmarking the TLS 1.3 capable network devices and architectures.



TLS 1.3 configuration page for HTTP client activities

Specifications

HTTP/2	
Version	HTTP/2
IP Support	IPv4 and IPv6
Emulation	Client and Server
Features	• Supports HTTP cookies and HTTP redirection on HTTP/2 clients • Supports HPACK compression/decompression on HTTP/s clients • Supports all mandated frame types (except PRIORITY) • Option to enable/disable SSL • Support for ALPN • Option to use multiple streams per connections • Supports playlists that easily create large numbers of user sessions and URLs with unique credentials • User realism with control of HTTP commands using transaction aborts and “Think” times • Configurable TOS and DSCP bit settings • User-configurable HTTP server page responses • Support for customizing response code, page size, and page content on servers • Supported on CloudStorm, PerfectStorm and PerfectStorm ONE hardware and on IxLoad VE (Virtual Edition)
Commands	GET, HEADER, PUT, POST and DELETE
Web Browsers	• Microsoft Internet Explorer 5/6, Mozilla, Firefox and Safari • Custom headers that can be saved and reused
Statistics	• Average server response times, Total transaction times • HTTP state level statistics, HTTP Response code statistics

HTTP	
Version	HTTP 1.0 and HTTP 1.1
IP Support	IPv4 and IPv6
Emulation	Client and Server
Features	• Supports HTTP pipelining, cookies, and HTTP redirection • Supports proxy server commands • Supports decompression on HTTP clients • Supports Content-MD5 integrity check • Supports Chunked Encoding processing on HTTP clients

HTTP	
	• Option to use multiple TCP connections per user • User realism with control of HTTP commands using transaction aborts and “Think” times • User-defined pages on HTTP server • Supports sequence generators and playlists that easily create large numbers of user sessions and URLs with unique credentials • Data integrity validation that pinpoints the exact offset of data corruption during transit • Data randomization with user-defined Hot/Cold/Warm and Compressibility profiles to validate WAN optimizers’ data reduction performance and application latency improvements • Configurable TOS and DSCP bit settings • Configurable HTTP headers for each request • Inspection of data payloads for user-specified text • Option for HTTP servers to listen on multiple TCP ports • User-configurable HTTP server page responses • Support for customizing response code, page size, cookies, and page content on servers
Commands	GET, HEADER, PUT, POST, DELETE
Web Browsers	• Microsoft Internet Explorer 5/6, Mozilla, Firefox and Safari • Custom headers that can be saved and reused
Statistics	• Detailed HTTP Client and Server statistics • Average server response times, HTTP state level statistics • HTTP Response code statistics, Per-URL statistics

SSL	
Version	SSLv3.0, TLS v1.0, TLS v1.1, TLS v1.2 and TLS v1.3
Features	• SSL session reuse • Selectable ciphers and keys for SSL handshake • Hardware acceleration for selected ciphers including ECC ciphers • Support for 1K, 2K, 3K and 4K Key sizes • Configurable client- and server-side certificates for HTTPS connections • Supports DH ephemeral key exchange • Configurable SSL record size per transaction
Statistics	• Detailed SSL/TLS Client and Server Statistics • Average server response times • SSL state level statistics • SSL Response code statistics • Per-URL statistics

FTP	
IP Support	IPv4 and IPv6
Emulation	Client and Server
Modes	Active and Passive
Commands	LOGIN, PASSWORD, CD, GET, MKD, RETRIEVE, PUT, STORE, QUIT
Features	• Configurable TOS and DSCP bit settings • Option for FTP server to listen on multiple TCP ports • User-defined pages on FTP server • User realism with control of FTP commands and timing using “Think” times
Statistics	• Detailed FTP Client and Server Statistics • Average server response times

SMTP	
IP Support	IPv4 and IPv6
Emulation	Client and Server
Commands	OPEN, EHLO, HELO, MAIL, NOOP, RSET, SLEEP, QUIT
Features	• Option to send user specified email messages using SMTP and IMAP clients and POP3 servers • Option to use sequence generators to create thousands of user sessions and various values in email headers • Support for importing emails from a standard format and customize • Option to configure email servers to listen for requests on multiple TCP ports • Ability to customize email headers (from, to, cc, bcc), mime types, mail body and attachments. Custom mail headers can be inserted. The size of email body and attachments can also be randomized • Ability to create complex command sequences using the built-in programming structures such as ‘Loop Begin’ and ‘Loop End’ • User realism with control over user commands using Think times • Support for POP3 authentication based on passwords or APOP shared secrets • Configurable TOS and DSCP bit settings
Statistics	• Detailed • SMTP Client and Server statistics

POP3	
IP Support	IPv4 and IPv6
Emulation	Client and Server
Commands	• OPEN, STAT, DELE, NOOP, RSET, LIST, UIDL, RETR • TOP, QUIT
Features	• Option to send user specified email messages using SMTP and IMAP clients and POP3 servers • Option to use sequence generators to create thousands of user sessions and various values in email headers • Support for importing emails from a standard format and customize • Option to configure email servers to listen for requests on multiple TCP ports • Ability to customize email headers (from, to, cc, bcc), mime types, mail body and attachments. Custom mail headers can be inserted. The size of email body and attachments can also be randomized • Ability to create complex command sequences using the built-in programming structures such as ‘Loop Begin’ and ‘Loop End’ • User realism with control over user commands using Think times • Support for POP3 authentication based on passwords or APOP shared secrets • Configurable TOS and DSCP bit settings
Statistics	Detailed POP3 Client and Server statistics

IMAP	
IP Support	IPv4 and IPv6
Emulation	Client and Server
Commands	• OPEN, CAPABILITY, NOOP, LOGOUT, LOGIN, SELECT • FETCH, LIST, STORE, CREATE, DELETE, EXPUNGE, CLOSE
Features	• Option to send user specified email messages using SMTP and IMAP clients and POP3 servers • Option to use sequence generators to create thousands of user sessions and various values in email headers • Support for importing emails from a standard format and customize • Option to configure email servers to listen for requests on multiple TCP ports • Ability to customize email headers (from, to, cc, bcc), mime types, mail body and attachments. Custom mail headers can be inserted. The size of email body and attachments can also be randomized

IMAP	
	• Ability to create complex command sequences using the built-in programming structures such as ‘Loop Begin’ and ‘Loop End’ • User realism with control over user commands using Think times • Support for POP3 authentication based on passwords or APOP shared secrets • Configurable TOS and DSCP bit settings
Statistics	Detailed IMAP Client and Server statistics

RoCEv2	
IP Support	IPv4
Emulation	RoCEv2 Requesters and Responders
Commands	• Read • Write
Features	• Emulate RoCEv2 operations with control of throughput, number of Queue Pairs and congestion control parameters (DCQCN). • Mix of RoCEv2 and HTTP traffic to validate the congestion mechanisms of the two protocols do not interfere with negative effects. • Stateful RoCEv2 traffic at linerate with full support for ECN, CNP and PFC.
Statistics	Aggregated and per Queue Pair statistics are exposed: • RoCEv2 Throughput, Connections, Transactions, Latency • Number of I/Os sent, received, successful, failed per command type • Congestion control metrics: number of ECNs, CNPs and PFCs; number of CNP before PFC

Database	
IP Support	IPv4
Emulation	MySQL, Oracle and MSSQL Clients
Commands	• Connect • Query • Disconnect
Features	• SQL commands are transparently sent to the server and user can import the SQL command/procedure from a text file

Database	
	• Data integrity option ensure the output will be parsed and the named fields will be matched against the expected values
Statistics	10+ Database Statistics

CIFS	
Version	CIFSv1, CIFSv2/2.1 and SMB3.0
IP Support	IPv4 and IPv6
Emulation	Client and Server
CIFSv1 High-Level Commands	• Session Setup, Write to file, Read from file, Copy download, Copy upload, Copy, Delete, Move download, • Move upload, Move, Create, Delete, Rename, • Browse, Scan all, Exit
CIFSv2 High-Level Commands	• Session Setup, Read from File, Write to File, • Copy upload, Copy download, Move upload, • Move download, Delete, Exit
CIFSv2 Low-Level Commands	Negotiate, Session Create, Tree connect, Create, Read, Write, Set Info, Query Info, Cancel, Flush, Change Notify, Echo, Close, Tree Disconnect, Logoff, IOCTL, Query Directory, LOCK
SMB3.0 High-Level Commands	Session Setup, Read from File, Write to File, Copy upload, Copy download, Move upload, Move download, Delete, Exit
SMB3.0 Low-Level commands	Cancel, Change Notify, Close, Create, Echo, Flush, Log Off, Negotiate, Query Info, Read, Session Create, Set Info, Tree Connect, Tree Disconnect, Write
Client Options	• Authentication mechanism, Dialect Selection • Primary domain selection, Unicode support • Lock Selection – Exclusive, Batch and Lease • Pipeline, Command timeout, Data chunk size • Enable Random Data, Max Connection per Second • Unique Random Number Settings • Signing Settings, Encryption
Server Options	• Authentication level and mechanism • User login credentials, Random data, Data integrity • Date modifier per read command • Server file structure, Signing Settings
Features	• CIFS client and server emulation

CIFS	
	• Compliant with SMB 1.0, 2.0/2.1, and 3.0 dialect • Support for NTLM, NTLMv2, and Kerberos authentication • High-level commands designed to deliver ease of use by emulating user-level actions such as copy, delete, move, rename, read, and write files • Low-level atomic commands for complete flexibility to emulate various OS behaviors by providing commands that match the specification • Byte-by-byte data integrity validation • Per-command transactional latency measurements • Scalable file system simulation on the sever side • Complete integration with the Random Data Generation engine to validate the caching mechanisms in WAN optimization devices • Unique Random number generation support. • DEC-RPC support in SMB2 • SMB2 and SMB3.0 signing, SMB3.0 encryption
Statistics	Detailed SMB Client and Server statistics

NFS	
Version	NFSv3, NFSv4 and NFSv4.1
IP Support	IPv4 and IPv6
Emulation	Client
NFSv3 High-Level Commands	Open, Read, Write, Delete, Move, Rename, Copy upload, Copy download, Move upload, Move download, Scan all, Exit
NFSv3 Low-Level Commands	• MNT, UMNT, Mount Connect, Mount Close, NFS Connect, • NFS Close, Create, Remove, Read, Write, Get Attribute, • Set Attribute, Lookup, Access, Make Directory, Read Directory, • Remove Directory, ReadDirPlus, Commit, FS Info, • FileSystem Stats, Link, Lookup, Make Node, Path Conf, • Make Node, Read Link, Symbolic Link
NFSv4 High-Level Commands	• Open, Read, Write, Delete, Move, Rename, Copy upload, • Copy download, Move upload, Move download, Scan all, Exit
NFSv4 Low-Level Commands	• Connect, NFS Connect, NFS Close, Create, Remove, ReadDIR, • Putrootfh, Open, Confirm, Set Client ID, Set Client Id_Confirm, • Write, Get Attribute, Set Attribute, Lookup, Access, Lock, LockU, • Lookup, Release Lock Owner, Set Client ID Confirm
NFSv4.1 Low-Level Commands	• NFS Connect, Open, Read, Write, Access, Close, NFS Close, • Create Session, Destroy Session, Destroy Client ID, • Exchange ID, Get Attribute, Set Attribute, Lock, LockU, Lookup,

NFS	
	• PutRootFH, Reclaim Complete, Remove
Client Options	• Authentication mechanism, Command timeout • Data chunk size, Enable ESM • Enable TOS/DSCP, Command timeout
Features	• NFSv3, v4, and v4.1 client emulation • High-level commands designed to deliver ease-of-use by emulating user-level actions such as copy, delete, move, rename, read, and write files • Low-level atomic commands for complete flexibility to emulate various OS behaviors by providing commands that match the specification • Byte-by-byte data integrity validation • Per command transactional latency measurements • File and byte range locking • Access Control list with ACE • Share reservation • Playlists and sequence generators • Conversion of workload trace or captures to emulate and customize field workloads • Stop on error • Compounding support in NFSv4 and above • User-level debugs and logs
Statistics	• 140+ NFSv3 Client Statistics • 160+ NFSv4 Client Statistics

ISCSI	
IP Support	IPv4 and IPv6
Emulation	Initiator and Target
Commands	Login, Logout, I/O, Nop-Out, Loop Begin/End, Think
Initiator Options	• Auto Discovery • Authentication method: CHAP or None • User login credentials • Data integrity with Synthetic Payload and User-defined pattern • Pipeline, Multiple Connections per session • Error Recovery, Login Redirection and Async Logout • Key Value Pair custom configuration for: Header Digest, Data Digest, InitialR2T, Immediate Data, MaxRecvDataSegmentLength, MaxBurstLength, FirstBurstLength, MaxConnection, ErrorRecoveryLevel, DefultTimeToWait and DefaultTime ToRetain • Support for ESM, ToS/DSCP and VLAN Priority

ISCSI	
Target Options	Authentication method: CHAP with MD5 or None • User login credentials • Data integrity with Synthetic Payload • Key Value Pair custom configuration for: Header Digest, Data Digest, InitialR2T, Immediate Data, MaxRecvDataSegmentLength, MaxBurstLength, FirstBurstLength • Custom target pool configuration • Support for ESM, ToS/DSCP and VLAN Priority • Customizable target port
I/O Configuration Options	• Command type selection: Read, Write, Read Then Write, Write Then Read and Random Read/Write • Read: 6, 10, 12, 16 • Write: 6, 10, 12, 16 • Random read percentage • Payload type for Write IO: Dummy or Synthetic Pattern Generation • Logical block address: Sequential. Random and Full Random Access • Specify data transfer length as Total Transfer Length, iSCSI per Command Transfer length and Alignment size • Block Address Overflow Handling: Truncate transfer length or Adjust start position
Features	• Stateful iSCSI Initiator and Target emulations • Authentication method: CHAP with MD5 or None • Automatic discovery of the external Targets • Complete flexibility to control the I/O operations ◦ Read/Write distribution ◦ User can control the number of SCSI Read and Writes needed to complete a high-level IO ◦ Flexibility introduced to have randomness in Logical Block Address access within an IO ◦ Ability to specify Alignment Block sizes per SCSI read/write commands • Data integrity validation with Ixia pattern and user specified 32 Bit data pattern • Customizable target portal with arbitrary Target LUNs and capacity
Statistics	• 110+ iSCSI Client Statistics • 100+ iSCSI Server Statistics

TELNET	
IP Support	IPv4
Emulation	Client and Server

TELNET	
Commands	OPEN, LOGIN, PASSWORD, SEND, EXIT, CLOSE
Options	Suppress Go Ahead, Line mode, Echo mode
Features	• Ability to configure server to listen on multiple TCP ports • Sequence generator support to create hundreds of login sessions using unique user credentials
Statistics	Detailed Telnet Client and Server statistics

DNS	
Version	DNSv4
IP Support	IPv4 and IPv6
Emulation	Client and Server
Queries	A, AAAA, CNAME, SOA, NS, MX, PTR
Features	• Ability to configure server to listen on multiple TCP ports • Sequence generator support to create hundreds of login sessions using unique user credentials • UDP and TCP transport • Option to use multiple zones and unique/non-unique resource records • Ability to import named configurations to DNS server
Statistics	Detailed DNS Client and Server Statistics

DHCP	
IP Support	IPv4
Emulation	Client
Commands	DHCP, DISCOVER, REQUEST, DECLINE, REJECT, INFORM
Options	• Pad (0), Subnet Mask Value (1), • Time Offset in Seconds from UTC (2), • Router addresses (3), DNS Server addresses (6), • Hostname string (12), DNS domain name of the Client (15), • Interface MTU Size (26), All Subnets are Local (27), • Broadcast Address (28), Perform Mask Discovery (29), • Perform Router Discovery (31), ARP Cache Timeout (35), • Vendor Specific Information (43), Requested IP Address (50),

DHCP	
	• IP Address Lease Time (51), Overload "sname" or "file" (52), • DHCP Message Type (53), DHCP Server Identification (54), • Parameter Request List (55), DHCP Error Message (56), • DHCP Maximum Message Size (57), • DHCP Renewal (T1) Time (58), • DHCP Rebinding (T2) Time (59), (Vendor) Class Identifier (60), • Client Identifier (61), User Class Information (77) • DHCP Relay Agent (82), End (255)
Features	• Support for BOOTP • Ability to configure option 82 _ relay agent emulation with sub-options circuit-id and remote-id • Ability to emulate trusted network element in networks containing DHCP relay agents • Support to configure DHCP options (mandatory and informational)
Statistics	Detailed DHCP Client statistics

LDAP	
Version	LDAPv2 and LDAPv3
Emulation	Client
Commands	• BIND, UNBIND, SEARCH, COMPARE, MODIFY, ADD • DELETE, MODIFYDN
Authentication Modes	Anonymous, Clear text, Digest-md5 authentication
Statistics	Detailed LDAP Client statistics

Application Replay	
IP Support	IPv4
Emulation	Peers – Initiator, Responder and Both
Commands	• Custom flow – TCP, Custom flow – UDP, • Custom flow – IP, Custom flow - ETH
Options	• TCP/UDP Replay ◦ Destination Peer or DUT ◦ Override responder port derived from the capture during replay ◦ Specify the PCAP file location ◦ Configure filters for initiator’s and responder’s IP and ports

Application Replay	

	• IP/Ethernet Replay
	  ◦ Preserver the IP headers
	  ◦ Maintain the inter-packet timing or modify the timing of the original capture by a factor
	• Advanced Options
	  ◦ Concurrent flow support to simulate users initiating more than one flow at one time
	  ◦ Persist flows over single TCP connection Validate Per-flow and Latency statistics with the advanced statistics option
	  ◦ Out of sequence packet handling for UDP
	  ◦ Payload Verification Options
	  ◦ Verify content of payload against expected payload
	• Verify length of payload against expected length

Features	• Industry's first solution to replicates captured traffic at variable performance levels • Replay application flows with IP replay while maintaining inter-packet timing and packet boundaries • Ethernet packet injection from a capture file using unidirectional Ethernet replay • Emulates application traffic alongside other IxLoad emulated traffic, including HTTP, VoIP, and IPTV • Replay application traffic targeted at a DUT such as a server load balancer (SLB). Supports detailed measurement statistics and real-time graphs • Supports conditional statistics (per-IP, per-VLAN, per-User), per-flow statistics, and latency statistics • Emulate line rate traffic application traffic
Statistics	• 40+ Application Replay Statistics • 40+ Application Replay Per Flow Statistics

TCP	
IP Support	IPv4 and IPv6
Emulation	Client and Server
Commands	TCP Exchange, TCP Send, TCP Idle and Think

Options	• Payloads
	  ◦ Payloads can be either Synthetic or Real Files for both TCPExchange and TCPSend commands
	  ◦ For Synthetic payloads users can define ranges. Payload will be picked randomly from the range during run time
	• Receive Mode

TCP	
	◦ Defines how much data/payload client must expect from server in TCP Exchange command ◦ In “Automatic” mode client expects same amount of data as it sends ◦ In “Byte Count” mode client expects to receive byte count specified in the “Receive Length…” field. Byte Count mode only applies to External Servers
Features	• Leverages the AppLibrary Engine to deliver high scale and very realistic TCP traffic • Works with external/real servers and DUTs that terminate TCP Connections for One Arm Tests • Can be used in conjunction with other AppFlows and even other TCP Protocol Flows • Allows users to select payload types (real/synthetic), payload sizes, destination ports, connection teardown methods etc. • Still uses all existing TCP and IP settings in network stack • Deterministic performance distributions • Comprehensive real-time analysis with per-flow granularity level
Statistics	Extensive real time per flow stats

Stateless Peer	
Features	• Peer-to-peer activity allows initiators and responders to source and sink UDP and IP packet streams • Dynamic Control Plane • Allow network and traffic to work in tandem to emulate real subscriber behavior • Header definition for each packet • Sequence field – per-packet counters • Sequence field – per-stream counters • Length field • Static numeric and ASCII fields • Unique identifier field • Stream configuration: Payload size, Packet frequency, Parallel streams per IP address • Device under test may modify the streams (IP addresses and port numbers) • DiffServ control allows the configuration of the TOS for each stream • May be combined with all other multiplay activities in IxLoad
Statistics	• Initiator and Responder Peer Counts • Active Streams Transmitting • Total Bytes and Packets Sent

Stateless Peer	
	• Total Bytes and Packets Sent/second • Tx Jitter (ns), Tx Packets Dropped • 15+ Global Receive Statistics • Per-Stream Statistics (Transmit and Receive)

Stream Blaster	
IP Support	IPv4 and IPv6
Emulation	Peers – Initiator, Responder
Commands	• IP Blaster • UDP Blaster
IP Blaster Options	• Responder Peer • IP protocol (protocol field in the IPv4 header) • Static traffic mode or IMIX distribution • Packet payload size • Custom headers with static or variable fields
UDP Blaster Options	• Responder Peer • Source and Destination UDP ports • Static traffic mode or IMIX distribution • Packet payload size • Custom headers with static or variable fields
Features	• Peer-to-peer activity for high-performance UDP and IP packet stream generation • Line-rate performance over 1GE and 10GE interfaces • Fixed or random source and destination UDP ports • Custom header definition with fixed or variable values • Configurable packet payload size • IMIX frame distributions
Statistics	• Total Packets Sent and Received Counts • Packets Sent and Received Rate

Published Vulnerabilities and Malware (PVM)	
Features	• 20,000+ vulnerabilities and malware • Highest coverage of Microsoft vulnerabilities • Subscription service with online and offline malware and vulnerabilities updates • Measures security effectiveness

Published Vulnerabilities and Malware (PVM)	
	• Emulates attacks over IPv4, IPv6, IPsec, and GTP • Comprehensive attack metadata • Packet capture using IxLoad's embedded Analyzer • Attacker/server-initiated attacks • Target/client-initiated attacks (client-based attacks)
Statistics	• Attack counters and rates • Attack throughput • Per attack counters and rates • Per attack throughput • Drill down per port, attack, and network

DDOSV2	
Features	• Both IPv4 and IPv6 • Botnet and target emulation • Attacks against live servers • Attacks against intermediate devices • Emulation of large botnets with millions of unique IP addresses • Line-rate attacks over 1GE, 10GE, and 40GE interfaces • Mix of voice, data, video, and DDoS traffic on same port • Mix multiple attack patterns on same port • Attacks initiated from spoofed IPs or real IPs • Attack rate and attack throughput test objectives

DDoS Patterns	• ARP Attacks
	  ◦ ARP Flooding
	• ICMP Attacks
	  ◦ Fragmented ICMP
	  ◦ Host Unreachable
	  ◦ NDP Exhaustion attack
	  ◦ Nuke attack
	  ◦ Ping of Death attack
	  ◦ Ping Sweep attack
	  ◦ Smurf attack
	  ◦ TIDCMP attack
	• UDP Attacks
	  ◦ DNS Flooding attack
	  ◦ Evasive UDP attack
	  ◦ UDP Flooding attack
	  ◦ UDP Port Scan attack
	  ◦ UDP Fragments attack
	• NTP Attacks
	  ◦ Monlist attack
	• TCP Attacks

DDOSV2	
	◦ TCP ACK Flooding ◦ Fragmented ACK Flood ◦ PUSH ACK Flood ◦ Fake Session ◦ TCP SYN Flooding ◦ TCP FIN Flooding ◦ TCP RST Flooding ◦ TCP Land attack ◦ TCP Port scanning attack ◦ TCP SYN/ACK Flooding ◦ TCP Xmas tree attack • IP Attacks ◦ Fragmented IP attack ◦ IPv6 Extension Header Fragmentation ◦ Malformed IP Options attack ◦ Nestea attack ◦ Short Fragment ◦ Teardrop • IGMP Attacks ◦ Fragmented IGMP attack ◦ Membership Query
Statistics	• Attack counters and rates • Attack throughput • Per attack counters and rates • Per attack throughput • Drill down per port, attack, and network

Platform Options

Visit Keysight.com for More Information on IxLoad Platform Options	
Virtual Platform	• IxLoad Virtual Edition (VE)
Public Cloud	• IxLoad on AWS • IxLoad on Azure
Chassis	• XGS-12 HSL/SD/SDL Chassis • XGS-2 HSL/SD/SDL Chassis
Load Modules	• CloudStorm Fusion 10GE, 40GE, 25GE, & 100GE • CloudStorm 10GE, 40GE, 25GE, & 100GE • PerfectStorm Fusion 10/1GE, 40GE, & 100GE • PerfectStorm 10/1GE, 40GE, & 100GE • Novus-NP 10G/1G/100M

Visit Keysight.com for More Information on IxLoad Platform Options	
	• Novus 10G/1G/100M • Novus 10G/5G/2.5G/1G/100M • Data Center Storage 10G/25G/40G/100G (RoCEv2 & HTTP only)
Appliances	• PerfectStorm ONE Fusion 10/1GE, 40GE, & 100GE • PerfectStorm ONE 10/1GE, 40GE, & 100GE • Novus ONE appliance • Novus ONE Plus appliance
Limited Functionality and Performance	• Xcellon-Multis QSFP28 100/50/25GE • Xcellon-Multis CFP4 100GE • Xcellon-Multis CXP 100/40/10GE • Xcellon-Multis QSFP 40/10GE • Xcellon-Lava CFP 100/40GE • Xcellon-Flex QSFP/SFP+ 40/10GE

Technology Solutions

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• IxLoad Overview—Converged Multiplay Service Validation • IxLoad Virtual Edition (VE) L4-7 Application Performance Testing • IxLoad Data Test Solution • IxLoad Video Test Solution • IxLoad Voice Test Solution • IxLoad IPsec and Network Access Test Solution • IxLoad on AWS – Cloud Application Performance Testing • IxLoad on Azure – Cloud Application Performance Testing

IxLoad Ordering Information

Chassis licenses

Part Number	Description
925-3379	**IxLoad Multiplay,** Software Bundle, Layer 4-7 Performance Test Application Data-Video-Voice package. Includes: • **Data:** Enables support for HTTP, HTTPS, TCP Session, FTP, DNS, Mail (SMTP, POP3 and IMAP), Database, SSH, RADIUS, TFTP, Application-Replay, DHCP, LDAP, Telnet, Stateless-Peer and StreamBlaster emulations

Part Number	Description
	• **Video:** Enables support for basic RTSP, IPTV (Multicast), Video-ADVANCED (VoD), Adobe Flash Client, Apple HLS Client, Microsoft Silverlight Client, Adobe HDS Client and DASH Client emulations. Includes Video Quality VQMON engine for up to 10Gbps and TCP VQ Video quality for TCP video traffic for up to 10 Gbps • **Voice:** Advanced VoIP SIP & RTP, Audio Codecs, VoLTE extensions, and Bulk SIP & MGCP. Includes: Voice Quality engine for up to 10Gbps, Video Quality engine for up to 10Gbps conversational video traffic • **ADVNET:** Enables support for Advanced Access networking protocols such as DHCP for IP address acquisition, DHCP Server, PPP, L2TP and IPsec • **Storage:** iSCSI, CIFSv1, CIFSv2 (SMB2), SMB3, NFSv3 Client, NFSv4 Client, NFS4.1 Client, Cloud Storage Client, DCBX, FCoE and FC; Note the FCoE and FC emulation is only supported on selected load modules • **Access:** DHCP, PPP, L2TP, L2TP, IPsec, IPsec Performance Benchmarking QuickTest & SuiteB Cryptographic, 6RD, DSLITE and IPv6 SLAAC, 8021X, NAC and WEBAUTH Note: some of the features are available only on specific load modules
925-3040	**IxLoad Base,** Optional Software, Layer 4-7 Performance Test Application; Enables support for HTTP, HTTPS and FTP client/server emulations. Also includes support for ADVNET-DHCP, WAP and Software Impairment on selected load modules.
925-3366	**IxLoad PLUS,** Software Bundle, Layer 4-7 Performance Test Application. Enables support for HTTP, HTTPS, TCP Session, FTP, Application-Replay, Stateless Peer, Stream Blaster, DNS, DHCP, LDAP and Telnet emulations. Includes: support for ADVNET-DHCP to emulate DHCP enabled clients, and Software Impairment. Note: some of the features are available only on specific load modules.
925-3367	**IxLoad Data-ADV,** Software Bundle, Layer 4-7 Performance Test Application. Advanced data package. Enables support for HTTP, HTTPS, TCP, FTP, DNS, Mail (SMTP, POP3 and IMAP), SSH, RADIUS, TFTP, Application-Replay, Database, WAP, DHCP, LDAP, Telnet and Stateless-Peer Stream Blaster, SMB, NFS, iSCSI, FCoE and Cloud Storage emulations. Includes: HTTP & iSCSI QuickTest, ADVNET-DHCP to emulate DHCP enabled clients, and Software Impairment. Note: some of the features are available only on specific load modules.
925-3343	**IxLoad Storage,** Software Bundle, Layer 4-7 Performance Test Application; It enables support for iSCSI, CIFSv1 CIFSv2 (SMB2), SMB3, NFSv3 Client, NFSv4 Client, NFS4.1 Client, Cloud Storage Client, DCBX, FCoE and FC storage protocol emulations to validate NAS and SAN storage devices. Note the FCoE and FC emulation is only supported on selected load modules. Also includes iSCSI Performance Benchmarking QuickTest, ADVNET-DHCP to emulate DHCP enabled clients and Software Impairment on selected hardware.

Part Number	Description
925-3461	**IxLoad AppLibrary Slot Bundle,** Software Bundle, Layer 4-7 Performance Test Application; Enables support for AppLibrary on a single load module. It includes AppLibrary Slot Feature (925-3462) and Slot Subscription service (925-3460) to access new application flows for one year; Requires previous purchase of 925-3040 (IXLOAD Base) or higher bundle.

Appliance licenses

Part Number	Description
925-6321	IxLoad Appliance Multiplay, Software Bundle, Layer 4-7 Performance Test Application. Enables **Data, Storage, Voice, Video and Access & VPN** on PerfectStorm ONE and Novus ONE appliances. Includes: • 925-6121 IxLoad Appliance **DATA & Storage** • 925-6112 IxLoad Appliance **VIDEO** • 925-6113 IxLoad Appliance **VOICE** • 925-6117 IxLoad Appliance **ACCESS & VPN**
925-6104	**IxLoad Appliance Basic,** Optional Software, Layer 4-7 Performance Test Application. Enables IxLoad Basic functionality on PerfectStorm ONE and Novus ONE appliances. Includes: HTTP, HTTPS, DNS, ADVNET-DHCP, WAP, Stateless Peer. Requires IxLoad Framework, 925-0001, which is free with adjoining software purchase.
925-6121	**IxLoad Appliance Data,** Software, Layer 4-7 Performance Test Application. Enables IxLoad DATA functionality on PerfectStorm ONE and Novus ONE appliances. Includes: 925-6104 IxLoad Appliance BASIC (HTTP, HTTPS, DNS, ADVNET-DHCP, Stateless Peer) FTP, DHCP, IMAP, POP3, SMTP, TFTP, App-Replay, TCP session HTTP Quick Test, RFC 3511 Quick Test. Includes Storage: NFSv3, NFSv4, NFSv4.1, SMBv3, CIFS, CIFSv2 iSCS, iSCSI Quick Test Requires IxLoad Framework, 925-0001, which is free with adjoining software purchase.
925-3461	**IxLoad AppLibrary Slot Bundle,** Software Bundle, Layer 4-7 Performance Test Application; Enables support for AppLibrary on a single load module. It includes **AppLibrary Slot Feature** (925-3462) and **Slot Subscription** service (925-3460) to access new application flows for one year; Requires previous purchase of 925-3040 (IXLOAD Base) or higher bundle.

Virtual edition licenses

Part Number	Description
939-9511	**IxLoad VE Tier-1 1G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP). Enables 1 Gig throughput per unit.

Part Number	Description
939-9512	**IxLoad VE Tier-2 1G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP), Storage (SMB, NFS, iSCSI, Storage I/O). Enables 1 Gig throughput per unit.
939-9513	**IxLoad VE Tier-3 1G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP), Storage (SMB, NFS, iSCSI, Storage I/O), Voice (VoIP SIP, VoLTE), Video (DASH, Flash,HDS, HLS, IPTV VoD, MS IPTV, Silverlight), IPsec, IxLoad- Attack and IxLoad-AppLibrary. Enables 1 Gig throughput per unit.
939-9533	**IxLoad VE Tier-3 10G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP), Storage (SMB, NFS, iSCSI, Storage I/O), Voice (VoIP SIP, VoLTE), Video (DASH, Flash,HDS, HLS, IPTV VoD, MS IPTV, Silverlight), IPsec, IxLoad- Attack and IxLoad-AppLibrary. Enables 10 Gig throughput per unit.
939-9514	**IxLoad VE Tier-4 1G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP), Storage (SMB, NFS, iSCSI, Storage I/O), Voice (VoIP SIP, VoLTE), Video (DASH, Flash,HDS, HLS, IPTV VoD, MS IPTV, Silverlight), IPsec, IxLoad- Attack and IxLoad-AppLibrary. Includes EPC and Wi-Fi Offload protocols. Enables 1 Gig throughput per unit.
939-9534	**IxLoad VE Tier-4 10G Floating SUBSCRIPTION** License. Includes the following IxLoad protocols supported on IxLoad VE for a duration of 1-Year: Data (HTTP, HTTPS, FTP, TFTP, DNS, DHCP, LDAP, Radius), Mail (IMAP, POP3, SMTP), Storage (SMB, NFS, iSCSI, Storage I/O), Voice (VoIP SIP, VoLTE), Video (DASH, Flash,HDS, HLS, IPTV VoD, MS IPTV, Silverlight), IPsec, IxLoad- Attack and IxLoad-AppLibrary. Includes EPC and Wi-Fi Offload protocols. Enables 10 Gig throughput per unit.

Learn more at: www.keysight.com

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