

# IxNetwork—Converged Data Center Ethernet Test Solution

Validate Your Converged Data  
Center Ethernet Fabric

## Problem: Data Center Expansion with Unified Networks Introduces New Failure Points

To capture the efficiency and cost-savings promises of cloud computing, server virtualization, and data center consolidation, organizations need highly flexible, scalable, and low-latency data center architectures. Data center operators converging LANs and SANs onto a single unified fabric need to ensure a lossless transport layer by consolidating and optimizing their networks. But each new and multiple-domain technology required to realize seamless server virtualization, converged storage, and cloud federation brings complexity and failure points. To ensure quality in these converged data center Ethernet networks, each new technology must be thoroughly tested in a silo, then validated end-to-end as a whole system, prior to deployment.

## Solution: A Comprehensive Data Center Ethernet Test Solution for a Converged Data Center

Keysight's IxNetwork Data Center Ethernet test solution covers technologies from Storage Area Network (SAN) migration to Ethernet, to data center consolidation with Layer 2 Multi-Path (L2MP), to virtualization overlay technologies for server virtualization. It enables users to emulate various network components to test converged data center networks from end to end.

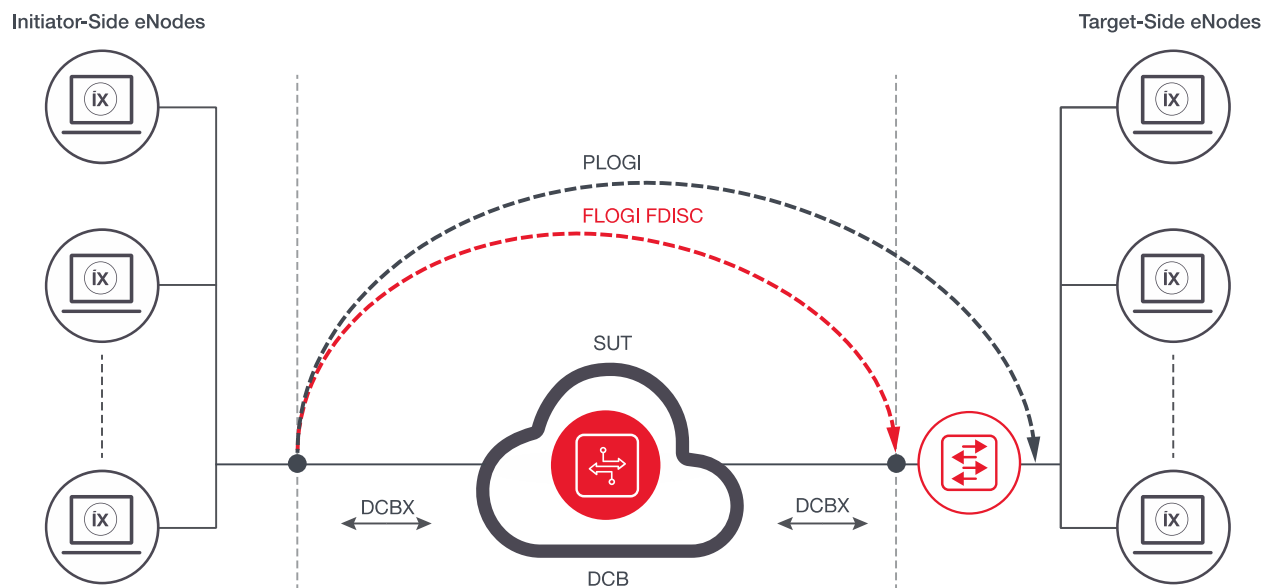
## Highlights

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- Validate the consolidation and convergence of Fibre Channel and Ethernet into a unified fabric for energy-efficient, high-performing data centers
- Qualify the Layer 2 Ethernet infrastructure with active-active multipath to support highly scalable and highly redundant next generation data center fabric
- Benchmark DUT forwarding performance for delivering converged data center traffic
- Use real-world scenario emulation to put design to the test before deployment; for equipment manufacturers, system integrator, and data center operators

## Key features

- Emulates DCBX and FCoE and traffic generation to evaluate the functionality, performance, and scalability of a DCB/FCoE switch providing lossless Ethernet transport for FCoE while still servicing native Ethernet traffic
- Supports 2G/4G/8G Fibre Channel integrated with DCB/FCoE in the same test
- Supports Priority Flow Control (PFC) to test DUT's capability to prevent frame loss during congestion
- Emulates Layer 2 Multipath (L2MP) / Equal Cost Multi Path (ECMP) technologies, including IETF TRILL, IEEE SPBM, and Cisco FabricPath
- Supports Virtual Ethernet Port Aggregator (VEPA) and Cisco proprietary VNTAG/VIC emulation
- Includes IxCloudPerf QuickTest to determine the traffic delivery performance of a data center fabric in forwarding a variety of north-south and east-west traffic in cloud computing applications



Testing Converged Data Center Ethernet

## Specifications

DCBX/LLDP	
<b>Standards</b>	<ul style="list-style-type: none"> <li>• CIN 1.0</li> <li>• CEE (IEEE Baseline 1.01)</li> <li>• IEEE Std. 802.1Qaz</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• LLDP Tx/Rx</li> <li>• LLDP Neighbor Count</li> <li>• LLDP Age Out</li> <li>• LLDP Error</li> <li>• LLDP TLVs Tx/Rx for supported TLVs</li> </ul>

DCBX/LLDP	
	<ul style="list-style-type: none"> <li>• DCBX Tx/Rx</li> <li>• DCBX TLVs Tx/Rx for supported TLVs</li> <li>• DCBX Duplicated TLVs</li> <li>• DCBX Mismatches</li> <li>• DCBX Invalid PDUs</li> </ul>
<b>Per-TLV Statistics</b>	<ul style="list-style-type: none"> <li>• TLV name</li> <li>• TLV state</li> <li>• TLV local/remote configuration for each DCBX TLV</li> <li>• Local/remote operating version (pre-IEEE)</li> <li>• Local/remote max version (pre-IEEE)</li> <li>• Local/remote enable/error bits (pre-IEEE)</li> <li>• Mismatch (pre-IEEE)</li> <li>• Willing bits</li> </ul>

FCoE/FIP	
<b>Standards</b>	<ul style="list-style-type: none"> <li>• INCITS/T11 FC-BB-5</li> <li>• FC-LS-2</li> <li>• FC-FS-2</li> <li>• FC-GS-2</li> <li>• IEEE 802.1Qbb</li> </ul>
<b>Protocols</b>	<ul style="list-style-type: none"> <li>• FCoE (FLOGI/FDIC, PLOGI, Name Server)</li> <li>• FCoE Initialization Protocol (FIP)</li> <li>• FIP VLAN Discovery</li> <li>• Priority-Flow Control (PFC)</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• FLOGI Tx</li> <li>• FLOGI LS_ACC Rx</li> <li>• FLOGI LS_RJT Rx</li> <li>• FDISC Tx</li> <li>• FDISC LS_ACC Rx</li> <li>• FDISC LS_RJT Rx</li> <li>• F_BSY Rx</li> <li>• F_RJT Rx</li> <li>• FLOGO Tx</li> <li>• PLOGI Tx</li> <li>• PLOGI Requests Rx</li> <li>• PLOGI LS_ACC Rx</li> <li>• PLOGI LS_RJT Rx</li> </ul>

FCoE/FIP	
	<ul style="list-style-type: none"> <li>• PLOGO Tx</li> <li>• PLOGO Rx</li> <li>• NS Registration Initiated</li> <li>• NS Registration Successful</li> <li>• FIP Discovery Solicitations Tx</li> <li>• FIP Discovery Advertisements Rx</li> <li>• FIP Keepalive Tx</li> <li>• FIP Clear Virtual Links Rx</li> <li>• Interfaces Up</li> <li>• Interfaces Down</li> <li>• Interfaces Fail</li> </ul>
<b>Per-Session Statistics</b>	<ul style="list-style-type: none"> <li>• VN_Port Status</li> <li>• Error Status</li> <li>• Assigned FC_ID</li> <li>• Assigned MAC</li> <li>• Fabric MAC</li> <li>• FC-MAP</li> <li>• FCF Priority</li> <li>• Fabric Name</li> <li>• Switch Name</li> <li>• FIP VLAN IDs</li> <li>• D-bit status</li> <li>• FKA Tx/Rx</li> <li>• CVL Rx</li> </ul>

FC	
<b>Standards</b>	<ul style="list-style-type: none"> <li>• FC-LS-2</li> <li>• FC-FS-2</li> <li>• FC-GS-2</li> </ul>
<b>Protocols</b>	<ul style="list-style-type: none"> <li>• FC FLOGI/FDIC</li> <li>• PLOGI</li> <li>• Name Server</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• FLOGI Tx</li> <li>• FLOGI LS_ACC Rx</li> <li>• FLOGI LS_RJT Rx</li> <li>• FDISC Tx</li> <li>• FDISC LS_ACC Rx</li> </ul>

FC	
	<ul style="list-style-type: none"> <li>• FDISC LS_RJT Rx</li> <li>• F_BSY Rx</li> <li>• F_RJT Rx</li> <li>• FLOGO Tx</li> <li>• PLOGI Tx</li> <li>• PLOGI Requests Rx</li> <li>• PLOGI LS_ACC Rx</li> <li>• PLOGI LS_RJT Rx</li> <li>• PLOGO Tx</li> <li>• PLOGO Rx</li> <li>• NS Registration Initiated</li> <li>• NS Registration Successful</li> <li>• Interfaces Up</li> <li>• Interfaces Down</li> <li>• Interfaces Fail</li> </ul>
<b>Per Session Statistics</b>	<ul style="list-style-type: none"> <li>• N_Port Status</li> <li>• NPIV FDISC Status</li> <li>• Error Status</li> <li>• Assigned FC_ID</li> <li>• Assigned MAC</li> <li>• Fabric MAC</li> <li>• FC-MAP</li> <li>• FCF Priority</li> <li>• Fabric Name</li> <li>• Switch Name</li> </ul>

L2MP ECMP Emulation	
<b>Standards</b>	TRILL <ul style="list-style-type: none"> <li>• RFC 6325</li> <li>• RFC 6326</li> <li>• RFC 6327</li> </ul> SPBM <ul style="list-style-type: none"> <li>• IEEE 802.1aq</li> </ul> FabricPath <ul style="list-style-type: none"> <li>• Cisco FabricPath specifications</li> </ul>
<b>Statistics</b>	<ul style="list-style-type: none"> <li>• L1 Sessions Configured</li> <li>• L1 Sessions Up</li> </ul>

L2MP ECMP Emulation	
	<ul style="list-style-type: none"> <li>• L1 Init State Count</li> <li>• L1 Full State Count</li> <li>• L1 Neighbors</li> <li>• L1 CSNP Tx/Rx</li> <li>• L1 Hellos Tx/Rx</li> <li>• L1 PSNP Tx/Rx</li> <li>• Unicast MAC Group Record Tx/Rx</li> <li>• Multicast MAC Group Record Tx/Rx</li> <li>• Unicast IPv4 Group Record Tx/Rx</li> <li>• Multicast IPv4 Group Record Tx/Rx</li> <li>• Unicast IPv6 Group Record Tx/Rx</li> <li>• Multicast IPv6 Group Record Tx/Rx</li> <li>• RBridges learned</li> </ul>
<b>Learned Information</b>	<ul style="list-style-type: none"> <li>• System ID</li> <li>• Sequence Number</li> <li>• Host Name</li> <li>• MT ID</li> <li>• Common MT ID</li> <li>• Extended Circuit ID</li> <li>• Nickname (TRILL)</li> <li>• Bridge Priority</li> <li>• Bridge Role (TRILL)</li> <li>• FTAG (FabricPath)</li> <li>• ECT-Algorithm (SPBM)</li> <li>• Base V-ID (SPBM)</li> <li>• I-SID (SPBM)</li> <li>• T-bit/R-bit (SPBM)</li> </ul>

VEPA and VNTAG/VIC	
<b>Standards</b>	<ul style="list-style-type: none"> <li>• VEPA - 802.1Qbg draft 2.1</li> <li>• VNTAG/VIC – Cisco proprietary</li> </ul>

CloudPerf QT				
Traffic Profile	Direction	Name	Client/Request Frame Size (byte)	Server/Response Frame Size (byte)
	NS	HTTP	83	305
	NS	YouTube	500	IMIX (5x1518, 2x512, 1x64)
	NS	SQL(TDS)	500	150
	NS	RTSP	492	IMIX (2x1518, 1x500, 1x 128)
	NS	POP3	100	1518, 64
	NS	IMAP4	100	1518, 64
	NS	SMTP	IMIX (2x1500, 1x128)	80
	NS-EW	CUSTOM	ALL	ALL
	EW	iSCSI	64, 512, 1518, 4096, 9216	64, 512, 1518, 4096, 9216
	EW	HTTP	128	IMIX (1x64, 2x1518)
	EW	Database	64, 128	IMIX (2x64, 5x1518, 2x9216)
	EW	Amazon (EC2)	628	628
	EW	Microsoft Exchange	1518	1518

## Platform Options

Visit <a href="http://www.keysight.com">www.keysight.com</a> for More Information on IxNetwork Platform Options	
<b>Virtual Platform</b>	<ul style="list-style-type: none"> <li>IxNetwork Virtual Edition (VE)</li> </ul>
<b>Chassis</b>	<ul style="list-style-type: none"> <li>XGS12-HSL/SDL/SD Chassis</li> <li>XGS2-HSL/SDL/SD Chassis</li> </ul>
<b>Fixed Chassis</b>	<ul style="list-style-type: none"> <li>AresONE-S 400G 16PHW QSFP-DD 400/200/100/50GE</li> <li>AresONE-S 400G 8PHW QSFP-DD 400/200/100/50GE</li> </ul>

Visit [www.keysight.com](http://www.keysight.com) for More Information on IxNetwork Platform Options

	<ul style="list-style-type: none"> <li>• AresONE-400G QSFP-DD 400/200/100/50GE</li> <li>• AresONE-400G OSFP 400/200/100/50GE</li> <li>• AresONE-400G High Performance QSFP-DD 400/200/100/50GE</li> <li>• NOVUS ONE PLUS 10GE/5GE/2.5GE/1GE/100M</li> </ul>
<b>Appliances</b>	<ul style="list-style-type: none"> <li>• NOVUS ONE 10GE/1GE/100M</li> </ul>
<b>Load Modules</b>	<ul style="list-style-type: none"> <li>• K400 QSFP-DD 400/200/100/50GE</li> <li>• K400 CFP8 400GE</li> <li>• NOVUS High Density QSPF28 100/50/40/25/10GE</li> <li>• NOVUS High Density SFP28/QSPF28 100/50/25/10GE</li> <li>• NOVUS 10GE/1GE/100M</li> <li>• NOVUS 10GE/5GE/2.5GE/1GE/100M</li> <li>• Xcellon-Multis QSFP28 100/50/25GE</li> <li>• Xcellon-Multis CFP4 100GE</li> <li>• Xcellon-Multis CXP 100/40/10GE</li> <li>• Xcellon-Multis QSFP 40/10GE</li> <li>• Xcellon-Lava CFP 100/40GE</li> <li>• Xcellon-Flex QSFP/SFP+ 40/10GE</li> </ul> <p><b>Note 1:</b> FCoE is only supported on following load modules:</p> <ul style="list-style-type: none"> <li>• NGY SFP+/BASE-T 10GE</li> <li>• XMVDC Dual PHY 1GE</li> <li>• NOVUS 10GE/1GE/100M</li> <li>• NOVUS 10GE/5GE/2.5GE/1GE/100M</li> <li>• NOVUS ONE Appliance</li> </ul> <p><b>Note 2:</b> FC is only supported on following load modules:</p> <ul style="list-style-type: none"> <li>• Fibre Channel 2/4/8 FC</li> </ul>

## IxNetwork Technology Solutions

Visit [www.keysight.com](http://www.keysight.com) for More Information on IxNetwork Technology Solutions

- IxNetwork Overview—L2/3 Network Infrastructure Performance Testing
- IxNetwork Software Defined Networking (SDN) Test Solution
- IxNetwork Routing and Switching Test Solution
- IxNetwork MPLS Test Solution
- IxNetwork Industrial Ethernet Test Solution
- IxNetwork Data Center Ethernet Test Solution
- IxNetwork Broadband and Authentication Test Solution



- IxNetwork MACsec Test Solution

## Ordering Information

### DCBX/FCoE/FC Emulation

#### 930-2039

IxNetwork, Software Option, Fibre Channel over Ethernet (FCoE) Emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

#### 930-2043

IxNetwork, Optional Software, DCBX emulation, includes IEEE 802.1AB Link Layer Discovery Protocol emulation of mandatory functions; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

#### 930-2049

IxNetwork, Optional Software, FCF Emulation; REQUIRES purchase of a supported 10GE load module with FCoE option enabled; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

#### 930-2074

IxNetwork, Optional Software, FC N\_Port Emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

#### 930-2078

IxNetwork, Optional Software, VIC Client Emulation; REQUIRES 930-2043 DCBX Emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

#### 930-2099

IxNetwork, Optional Software, FC F\_Port Emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

### L2MP\_ECMP Emulation

#### 930-2042

IxNetwork, Software Option, Data Center Ethernet IS-IS (DCE IS-IS) Emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

### **930-2084**

IxNetwork, Optional Software, SPBM (Shortest Path Bridging MAC-in-MAC); REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

### **930-2093**

IxNetwork, Optional Software, IxNetwork, Optional Software, VEPA (Virtual Edge Port Aggregator), IEEE 802.1Qbg EVB (Edge Virtual Bridging); REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

### **930-2098**

IxNetwork, Optional Software, TRILL (Transparent Interconnect of Lots of Links) emulation; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

## **Bundles**

### **930-2508**

IxNetwork Software Bundle, FCoE and FC QuickTest Bundle with FCF Emulation. INCLUDES: IxNetwork DCBX, FCoE, FC N\_Port, and FCF Emulations, and IxNetwork Quick Test FCoE Performance Test Suite. REQUIRES: Pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

## **QuickTest**

### **930-2411**

IxNetwork, Optional Software, IxCloudPerf QuickTest, REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

### **930-2405**

IxNetwork, Optional Software; FCoE/FC Performance QuickTest; This QuickTest performs binary and step search to find the max no-drop and no-PAUSE throughput performance of a DCB switch, an FCoE switch, or an FC switch; REQUIRES 930-2039 IxNetwork FCoE-Client Emulation; REQUIRES 930-2043 IxNetwork DCBX emulation if DCBX is required; REQUIRES 930-2049 IxNetwork FCF emulation if FCF emulation is required; REQUIRES 930-2074 IxNetwork FC N\_Port emulation if Fibre Channel is required; REQUIRES pre-existing 930-1999 IxNetwork Base license OR new purchase of either IxNetwork Base PLUS (930-2056) or IxNetwork Base PREMIUM (930-2076)

Learn more at: [www.keysight.com](http://www.keysight.com)

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus)

