High Performance Market Data Analytics

TradeStack on Vision X and TradeVision

Introduction

Rapidly detecting degradation in the quality of data feeds is a considerable challenge for any market participants who use or transport real-time market feeds. Market data transport technology is primarily based around the use of multicast, which does not have any error correcting mechanisms at the network layer. This means that any packets containing key trade data that have been lost cannot be detected until they are passed through a feed handler system at the end user site.

This creates several challenges:

- Many feed handlers use feed arbitration (between A and B feeds) to autocorrect message drops, so application teams may neither be aware of problems nor quickly pass-on details to their network operations teams.
- Application teams may be aware of the problem, but the tools they use may not be available to the network operations teams who are responsible for diagnosing and resolving the issue.
- Detecting a problem at the feed handler does not tell you where the problem occurred. Was it a problem with the Exchange or Market Data Vendor's ticker plant? Was it a problem in their internal network? Was there a problem in the third-party network carrier or extranet provider used to transfer the market data? Was there a problem with one or more of the upstream production switches? Or, was the problem in the end user's internal network?

All these questions lead to slow decision-making, lengthy problem identification and remediation times that can be measured in days and not minutes. Much of the technology used to monitor this infrastructure today is either not up to the task or involves expensive data capture, storage, and analytics technologies that have remained the same for twenty years. These technologies are expensive and consume valuable power and real estate within expensive colocations and data centers.



Figure 1. TradeVision™ and Vision X

KEYSIGHT

Highlights

- **High Performance Multicast Gap Detection** provides real-time gap detection from 4096 simultaneous multicast channels at 160 Gbps throughput to 16k channels at 1.6 Tbs
- **Advanced Latency Analytics** measures nanosecond latency and jitter from an exchange to remote sites, among WAN colo sites and DCs, and within the same data center
- **High Resolution Microburst Monitoring** detects traffic spikes with 15.2 µs sampling at line rate
- **Time Stamp Insertion** accurately (sub 200 ns accuracy to the external time reference) time stamps all packets and metadata at line rate using PTP time synchronization
- **Channel Health** monitors channel performance and alerts to anomalies, simplifying feed troubleshooting
- **VLAN tag insertion and identification** simplifies management and troubleshooting for data traversal paths across network segments
- **Exchange Feeds are pre-programmed** for easy set up and configuration, updated regularly
- **Super Reliable with FPGAs**, not dependent on error prone CPU-based expensive servers
- **Ixia Fabric Controller (IFC)** enables single pane-of-glass management of multiple TradeVisions or Vision-series NPBs
- **Visual Dashboards and End-of-Day Reports** simplify issue identification and remediation
- **Supports both fan-in and fan-out to increase 10 / 40 port density**
- **TradeStream streaming metadata** enables real-time high-resolution statistics and market

TradeVision and TradeStack on Vision X Solve These Challenges

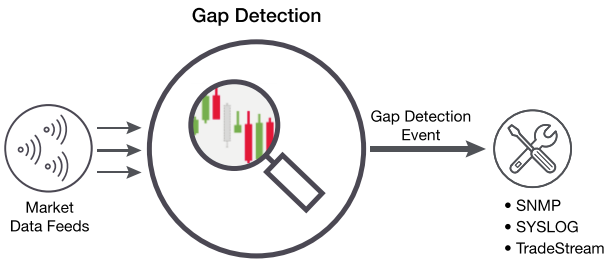
Keysight's family of market data analytics products are supported on two families of next generation network packet brokers – TradeVision and Vision X. TradeVision is ideally suited for both single-site data center and multi-site deployments where high performance, high fidelity, and real-time monitoring at the network edge is crucial. Vision X is a high-density 100GE, 3RU modular chassis comprised of customizable front modules and multi-speed port choices, offering expandability and flexibility with up to 2 Tbps of market data analytics and advanced packet processing.

Both platforms support super accurate and high-performance analytics of real-time market data by combining powerful FPGA-based market data analytics with the best-in-class network packet brokering capabilities on the same physical platform. This allows the user to aggregate and filter incoming market and network wire data before performing advanced market data analytics. TradeVision's powerful user interface leverages Keysight's patented filter complier to make otherwise complex configuration simple.

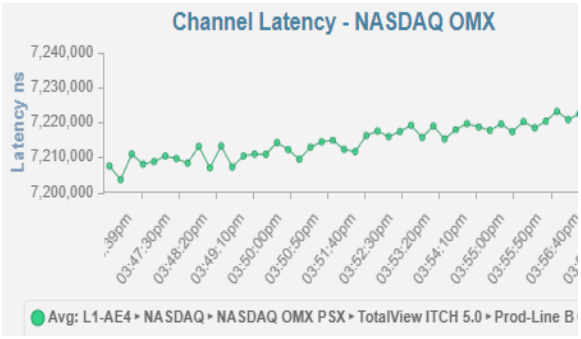
TradeVision and TradeStack on Vision X deliver high-performance monitoring of market data feeds, instantly detecting multicast sequence gaps, microbursts, market data or network latency, and feed failures. TradeVision can provide such analysis simultaneously on up to 4 x 40GE communication links or LAN segments, even when all quality monitoring features are enabled at the same time, and at full line rate of 40 Gbps without the risk of false 'gap' positives. Each TradeStack module on Vision X supports up to 400 Gbps of market data analytics and timestamping at line rate, with up to four (4) modules supported per chassis. Both platforms can detect the absence of market data messages and stream a summary of traffic statistics and gaps to storage devices and management systems. Each TradeVision has the capacity to monitor 240 million trade/quote messages a second, nearly 12 times more than the entire US equities and options markets combined. In addition, TradeVision supports newly added market data latency analytics for real-time application latency and jitter from the exchange to a remote site, and between multiple points across a data center infrastructure. All TradeVision's trade analytics features are now additionally available to the user via real-time dashboards and comprehensive aggregated reports which in turn allow for progressive disclosure of relevant information through intuitive drill-down from any top-level data point to corresponding detailed meta data for events and alerts stored in TradeVision's local syslog data repository.

Key Features

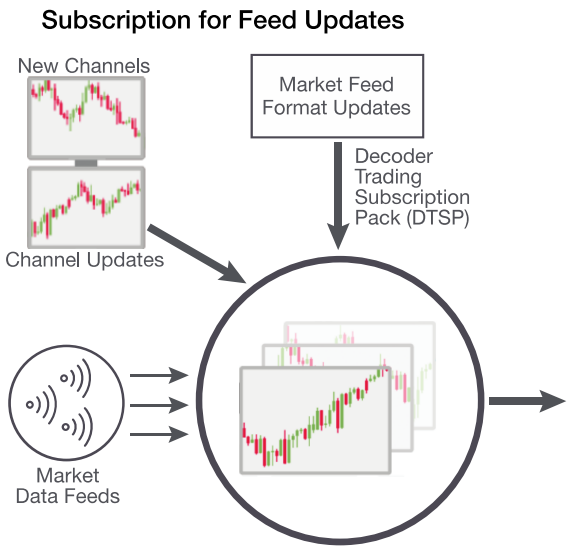
- **Multicast Gap Detection** detects errors in mission critical market data feeds and sends alerts to other tools and systems, so you can quickly recover from market data errors and have correct prices to trade on. Gaps, out of sequence and duplicate packets are rapidly detected and notified to down steam management systems via Syslog, TradeStream, or SNMP messages.



- **One Way Latency (OWL)** measures nanosecond latency and jitter from an exchange to a remote site. OWL is calculated on per packet level by computing the delta time between the embedded exchange application timestamp (TE) and the PTP-synchronized time of arrival (TA), when the packet is received by TradeVision's Analysis Engine (AE).
- **Two Point Latency (TPL)** measures the delta between nanosecond timestamps at two points in the network: upstream timestamp inserted at a production switch, and a downstream TradeVision, both deployed on the same data center in different locations.



- **Feed and Channel Health** detects the lack of traffic on market data feeds so that network operations staff can address without having to wait to be alerted by application IT staff.
- **Microburst Detection** detects excessive traffic and sends alerts to other tools and systems, so that network congestion issues can be quickly addressed. Traffic is sampled in FPGAs at as low as 15.2 µs at 160 Gbps across four analysis engines. Threshold alerts can be configured to be generated via SNMP, Syslog, and TradeStream when the burst threshold on an AE or a given traffic group exceeds configured value(s).
- **Tradestream streams high resolution traffic** statistics and alerts via UDP packets on a designated TradeVision tool port. Detailed information on gap statistics, latency and jitter metadata, and real-time microbust link utilization at traffic group level are streamed to Big Data applications such as Splunk. This allows network engineers to build up data on historical traffic patterns, improve capacity planning, and enable a more tightly coupled integration with local incident management tools.



- **Nanosecond Time Stamping** taps the network pipes that carry the electronic trading communications and time stamps the messages directly off the wire using nanosecond resolution time stamping with sub microsecond accuracy to UTC.

- **Pre-programmed Exchange Feeds** are populated with over 30,000+ unique IP address and destination ports. This amounts to over 250 top level feeds that are continuously updated via DTSP subscription updates.
- **AppStack** classifies traffic in real time and directs it to the correct tool according to parameters such as application type, geolocation, or even handset type—so tools get just the traffic type they need, again optimizing your investment in tool infrastructure.
- **Sophisticated Load Balancing** distributes traffic across several tools for monitoring in serial or parallel to maximize up-time and ensure that no critical data is lost.
- **Ixia Fabric Controller (IFC)** enables single pane-of-glass management of multiple Vision-series packet brokers in same or geographically distributed networks to be managed as a cluster via a single web console login.
- **Visual Dashboards and End-of-Day Reports** simplify issue identification and remediation by displaying relevant event meta-data with high-precision drill-down into associated local syslog viewer event metadata for progressive disclosure and rapid problem resolution.
- **Powerful GUI** allows you to focus on market feed data management rather than configuration the industry-leading user interface and patented filter compiler make configuration simple.
- **Drag and Drop Configuration** allows complex scenarios to be rapidly deployed. For example, Multicast traffic can be sent to inbuilt gap detection capabilities, whilst TCP / IP traffic is routed to trade analytics tools.
- **Auto Detection of Channels** allows the user to scan selected feeds or individual channels for presence of data on the wire.

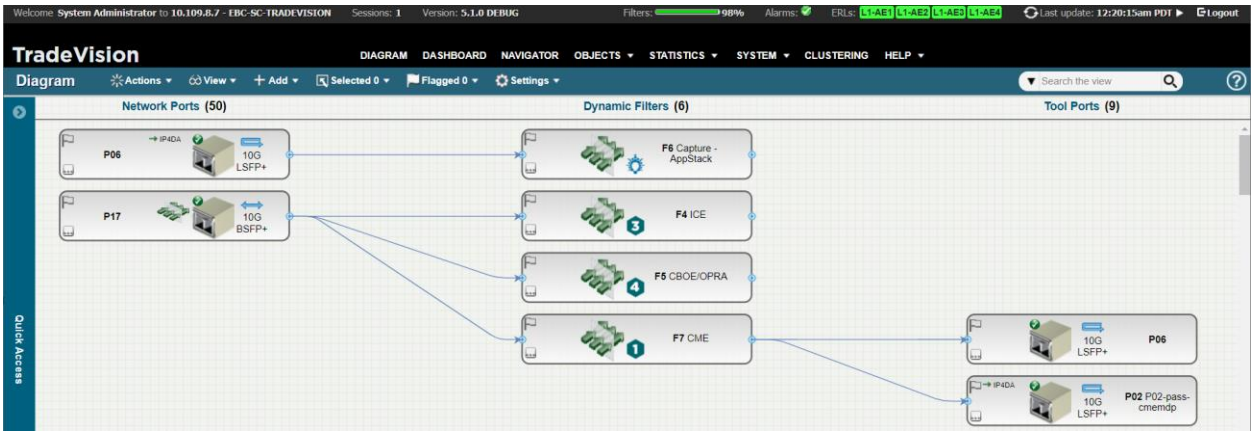


Figure 2. Simple “point-and-click” management

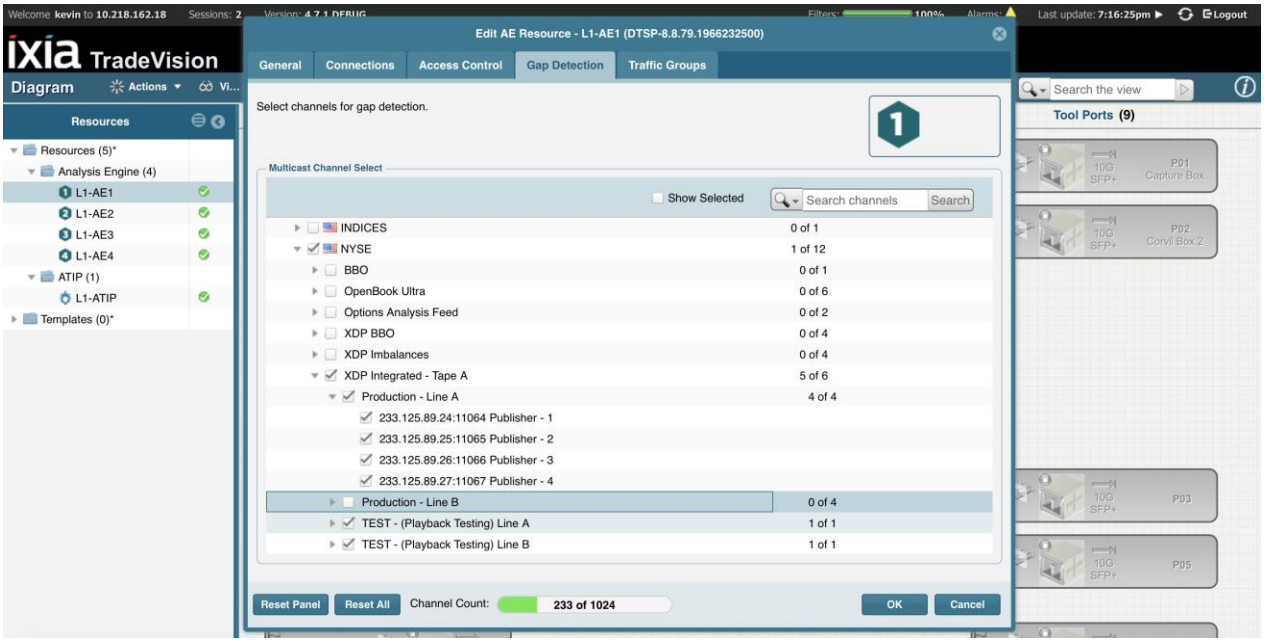


Figure 3. Simple Pre-populated Channel Selection Process

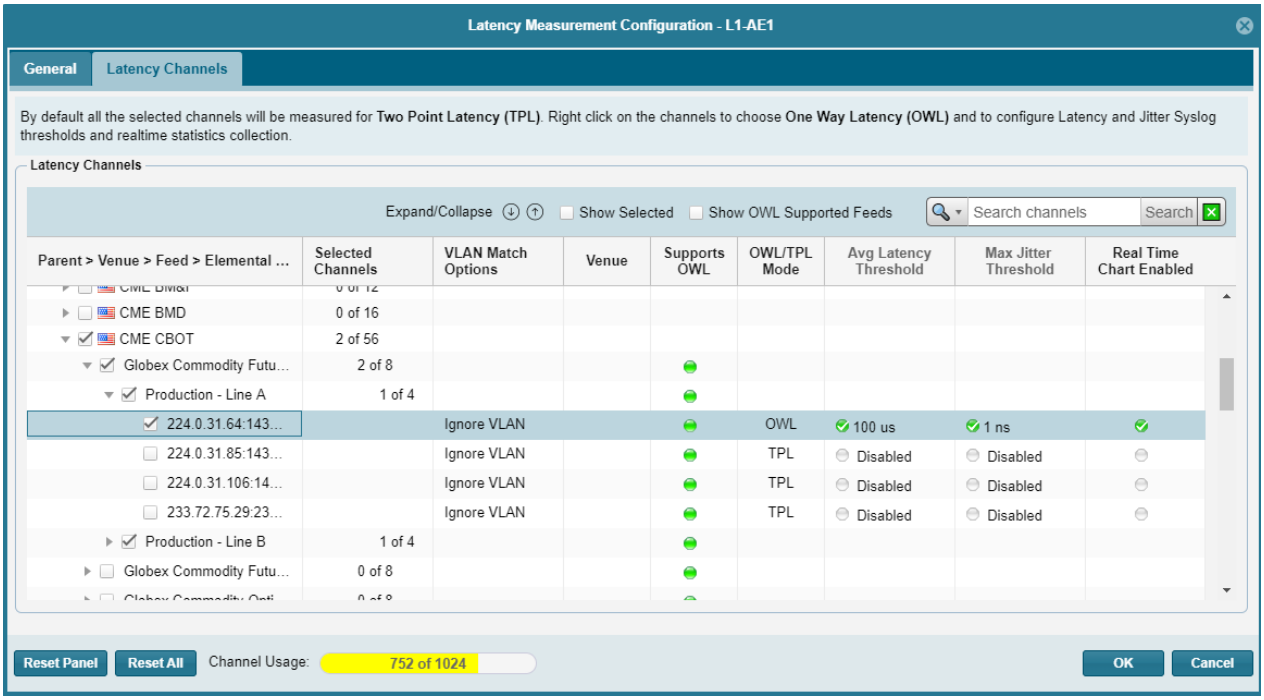


Figure 4. Configuring Channels for One Way Latency Monitoring

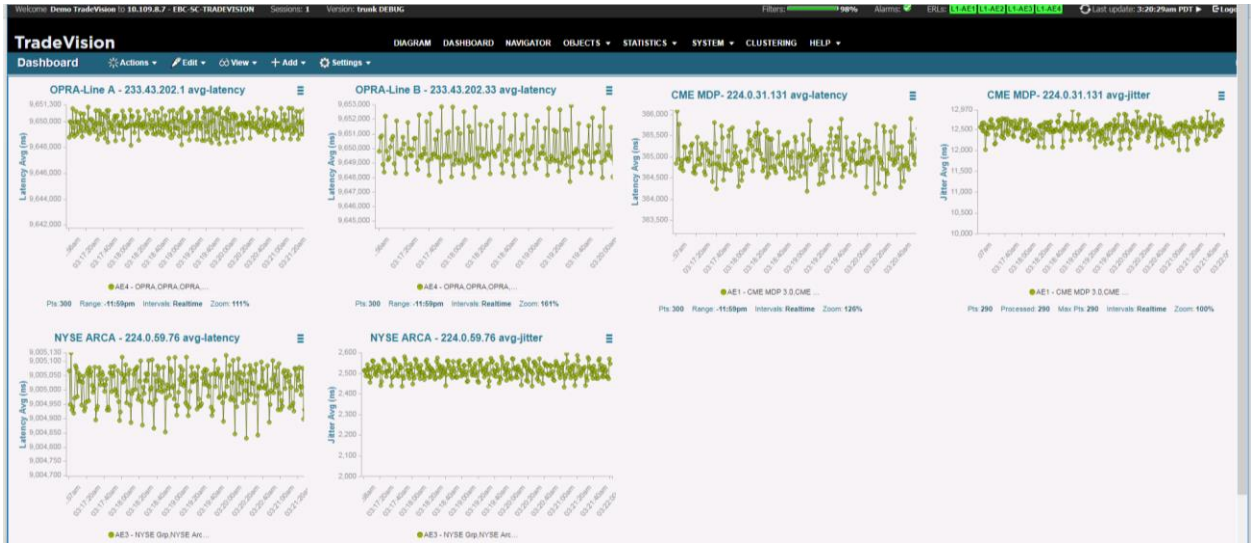


Figure 5. Real-time Visual Dashboard Charts for A & B line Latency Comparison

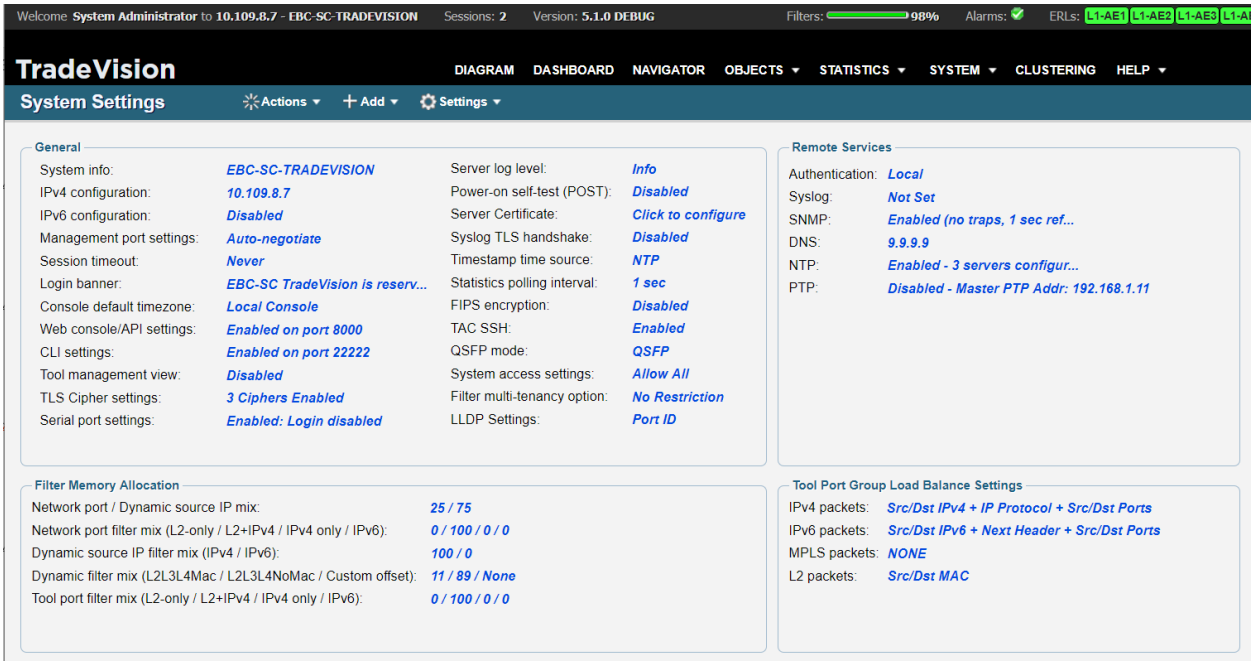


Figure 6. Robust System Settings

Product Capabilities

TradeStack capabilities (TradeVision and Vision X Platforms)

- Gap, Microburst, and Latency Analysis Bandwidth: 160 Gbps (TradeVision) / 1.6 Tbps (Vision X)
- Microburst sampling resolution (NVOS 5.1 or later): 15.2 µs
- One Way (OWL), Two-Point (TPL), and Synthetic Mesh Latency (SML) analytics (NVOS 5.1 +)
- Visual Dashboards (NVOS 5.1 or later)
- End of Data and Running Aggregated Reports
- Auto Detection of Feeds / Channels for detection of data on the wire
- Creation and Configuration of Custom Channels with user-specified channel name and IP:Port info
- Ixia Fabric Controller (IFC) single pane of glass management
- TradeVision Port Speed: 48x10GE + 4x40GE (Standard license includes 40x10GE + 4x40GE)
- Vision X Port Speed: Up to 60x100GE, 76x40GE, 108x10GE (Ports licensed separately)
- Time stamp insertion – standard trailer – sub 200 ns accuracy to time reference via PTP
- 'Events' timed to sub 200 nSec accuracy to the time reference via PTP
- Aggregate Maximum of Multicast Feed Channels Monitored: 4096 (TradeVision), 16384 (Vision X)
- Maximum Data Rate of Monitored Messages per Port: 60 M messages / second (TradeVision)
- Aggregate Maximum Messages Monitored: 240 M messages / second (TradeVision)
- Event Reporting: TradeStream, Syslog and SNMP
- Number of VLANs supported for per AE for VLAN 'discrimination': 7
- Meta Data Streaming: Traffic Group Statistics, Gap Statistics, Channel Statistics, Traffic Group Summary Statistics, AE Conig Beacon Metadata, Latency Metadata, Jitter Metadata
- Supports both fan-in and fan-out to increase 10 / 40G port density
- Supported Feeds for GAP Detection**: Over 250 feeds are supported, including Alpha, AQUIS, ASX24, BYX and BZX Equities, BZX Options, CBOE, CBOT, CFE, ChiX Canada, Chi-X Europe, B3 S.A., Borsa Italiana (Main and TAH), CME (BM&F, BMD, COMEX, CTA, DME, Green Exchange, Hong Kong Exchange(Orion), JSE, KCBT, KOSPI, KOSDAQ, KRX, MICEX, MexDer, NYMEX) Edge A, Edge X, Eurex, Euronext Cash Markets, ICE, ISE, LSE, MICEX, NASDAQ OMX, NLX, NYSE, OPRA, OTC, SIX, STRIKE Microwave Network, TMX, TMXV, TMX Select, Tokyo Stock Exchange, Turquoise, UTP, and Xetra

NetStack capabilities

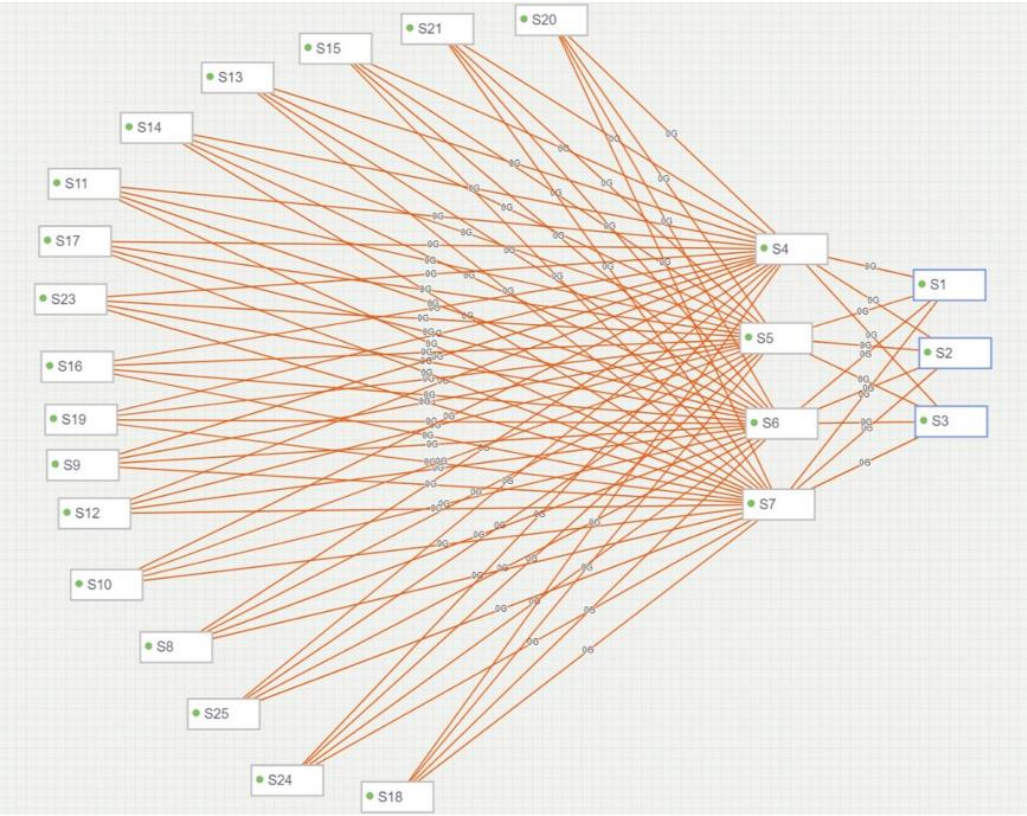
- Filtering at port ingress, egress and within Dynamic Filters
- Filter by Layer 2, Layer 3, Layer 4 and VLANs
- Non-blocking architecture
- Pass All, Pass by Criteria, Deny All, and Deny by Criteria filtering
- IPV4 and IPV6 support
- Port Traffic Statistics and Utilization
- VLAN Tagging support
- Transceiver status information
- Port and Filter Naming
- Port Groups
- NTP and PTP support

Appstack capabilities

- Improves visibility solutions through highly accurate application identification
- Simple point-and-click management interface allows operators to simply select application traffic types of interest
- Filter application traffic to tools or enhance data provided to tools with enhanced NetFlow
- Greatly improves monitoring platforms by adding a much richer set of geographical, application and device information
- Application signatures are managed and maintained by Ixia, allowing tools to expand awareness automatically as new applications come online
- Performs analytics to identify traffic per:
  - Application, geography, device information, and service provider
  - Application signatures are regularly updated via ATI subscription
  - Regular expression matching
  - Multiple actions can be taken on matching sessions
  - Forward all related packets to an analysis tool
  - Enhanced NetFlow v9 and v10 and IPFIX can be generated and sent to up to 10 collectors

Ixia Fabric Controller (IFC) clustering

- Ixia Fabric Controller (IFC) clustering offers a single pane of glass management for your network packet brokers. Manage and configure NPBs in a distributed environment using a single user interface as if one centralized visibility and security fabric
- IFC clustering supports any combination of Vision Edge 40 / 100 / 10S, Vision ONE / 7300 / X platforms
- Typical topologies supported include hub-and-spoke, spine-and-leaf, tree, ring, full mesh, partial mesh, or any combination of above
- User configurable number of controller nodes vs. fabric nodes to maximize resiliency. Full redundancy among controller nodes
- Supports direct connection for interconnects, or GRE encapsulated interconnects (limited to Vision ONE and 7300 only) when going thru DWDM or WAN devices
- Supports both single-hop and multi-hop cluster topology
- Best routes are calculated based on the least hop count using the Shortest Path First (SPF) algorithm
- Intelligent load balance among Equal Cost Multiple Paths (ECMP) to guarantee session integrity and avoid packet reordering
- A single IFC cluster can scale to more than 50 nodes
- LLDP auto-discovery of interconnect links makes cluster configuration easy and error-proof
- Automatic or user-triggered path re-optimization to avoid failed links or nodes
- IFC cluster offers the industry's best resilient architecture for OOB monitoring



Specifications

Specification	Description
Performance	1U Market Data Network Packet Broker Full line rate across all ports with blocking enabled Reporting, blocking, or fail-safe bypass operation Heat / power dissipation for module at 100% traffic load: 660 W / 2252 BTU / hour
Management	SNMP v1, v2, v3 support Supports IEEE / Precision Time Protocol (PTP) time synchronization Local, RADIUS, and TACACS+ support (members and groups) Granular access control features - RBAC Event monitoring and logging Syslog Export IT Automation control with RESTful API
Size and weight	1RU high 19” rack-mountable chassis Dimensions: 17.5 W x 29.5 L x 1.75 H (inches) / 44.5 W x 75.0 L x 4.5 H (cm) Weight: 36.4 lb / 16.5 kg ROHS IEC-60950-1:2005, UL60950-1, and CSA C22.2 No. 60950-1, EN 60950-1, CE, FCC, AS / NZS CISPR 22 & 24, 55022, 55024, IEC-003
Power for Keysight TradeVision (AC)	Hot swappable - AC power supplies Nom. current: 6.6 A @ 100 VAC, 2.75 A @ 240 VAC Max. operating input current: 7.7 A @100 VAC Max. operating input current: 3.2 A @ 240 VAC
Operating temperature	Operating: 5 °C to 40 °C Short-term [1]: -5 °C to 55 °C Short-term [1] with fan failure: -5 °C to 40 °C
Humidity	Operating: 5% to 85% (non-condensing) Short-term [2]: 5% to 90% (non-condensing)

1. Not to exceed 96 consecutive hours.
2. Not to exceed 96 hours.

Vision X Specifications

Specification	Description
Performance	Fully non-blocking 6.4 Tb one-way or 12.8 Tb full-duplex switch capacity Line rate across all ports with filtering enabled 10GbE / 25GbE / 40GbE / 50GbE / 100GbE support
Management	• SNMP v1, v2, v3 support • Local, RADIUS, TACACS+ support (members and groups) • Granular access control features • Event monitoring and logging • Syslog • IT Automation control with REST API • 2 management interfaces • Supports management port IP whitelisting
Size and weight	3RU high rack-mountable Dimensions: 5.25” H x 17.5” W x 31” D (inches) 125 lbs. (57 kg)
AC power	Quad hot swappable AC power supplies Input AC Voltage: 90 - 240 VAC RMS Maximum power, each power supply: 100 VAC input – 1260 W 110 - 120 VAC input – 1400 W 200 - 240 VAC input – 1500 W Maximum power / heat dissipation for system: 2400 W / 8200 BTU / hour
DC power	Quad hot swappable DC power supplies Operating input voltage: 40-to-72 VDC operation 1500 W max source per power supply Maximum heat/power dissipation for the system: 3000 W / 11942BTU / hour
Normal operation	Four (4) power supplies deployed, with 600 W per power supply as the typical max load.
Safety certifications and compliance	IEC/UL/CSA 60950-1, IEC/UL/CSA 62368-1, CE, ETSI EN 300 386, FCC Part 15B - Class A, ICES-003 - Class A, AS/NZS CISPR 32 and 24, KN 32 and 35, BSMI
Country of origin	Malaysia

Ordering Information

Solution ordering information

Solutions include Keysight TradeVision hardware with 48 physical SFP / SFP+ ports and 4 QSFP+ ports, and the Vision X chassis with PacketStack and AppStack hardware modules. Transceivers are not included. Compatible transceivers are available and may be purchased from Keysight. All solutions are configured with dual power supplies. Additional licenses may be added to a system to enable additional ports, TradeStack market features, AppStack, or SecureStack features.

Vision X chassis

Part number	Description
SYSVX-BASE-AC Keysight Vision X Base system, AC	Includes chassis, 12-port 100G Switch card, 4 AC power supplies, 5 fans and 4+1 smart blanks
SYSVX-BASE-DC Keysight Vision X Base system, DC	Includes chassis, 12-port 100G Switch card, 4 DC power supplies, 5 fans and 4+1 smart blanks
SYSVX-CHAS-AC Keysight Vision X Base system	Includes chassis, 4 AC power supplies, 5 fans, and 4+1 smart blanks, main switch card not included
SYSVX-CHASE-DC Keysight Vision X Base system	Includes chassis, 4 DC power supplies, 5 fans, and 4+1 smart blanks, main switch card not included

Vision X main switch and interface modules

Part number	Description
MVX-SWCH	Keysight Vision X Switch Card with (12) 100G ports
MVX-NS12PC	Keysight Vision X, NetStack 12-port 100G module
MVX-PS8PC	Keysight Vision X, PacketStack 8-port 100G module (Front)
MVX-PS-R	Keysight Vision X, Rear PacketStack module
MVX-AM4PC	Keysight Vision X, App Module (4) port 100G module; Port and feature licenses sold separately

Port and feature licenses

Part number	Description
LIC-VX-1PC	Keysight Vision X Port License for (1) 100G multispeed port
LIC-VX-PS2C	Keysight Vision X, 200 Gbps, PacketStack feature license. Includes Data Masking, Packet Trimming, Packet Time stamping, Add trailer with original packet length, Trailer Stripping
LIC-VX-DDUP	Keysight Vision X, (1) Packet deduplication feature license
LIC-VX-STRP	Keysight Vision X, (1) Header stripping feature license
LIC-VX-TUNL	Keysight Vision X, (1) Tunneling feature license
LIC-VX-SPR	Keysight Vision X, (1) Cold spare system license
LIC-VX-IFC	Keysight Vision X, (1) Fabric connectivity Feature license

TradeStack licenses (NVOS 5.9.1 or later)

Part number	Description
SUB-VX-TS400	Keysight Vision X annual subscription for TradeStack 400G market data analytics - decoders required for multicast gap detection, microburst monitoring, and feed health. Licensed per PacketStack module. PacketStack hardware module required.
909-5027	Keysight Renewal of annual subscription to the TradeStack decoders required from multicast gap detection and feed health (909-5027)

Out-of-Band decryption licenses

Part number	Description
LIC-VX-PSSL	Keysight Vision X Decryption Out-of-Band perpetual feature; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module
SUB-VS-PSSL	Keysight Vision X, one (1) year Decryption Out-of-Band subscription; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module

Inline decryption licenses

Part number	Description
LIC-VX-ASSL	Keysight Vision X, Active SSL perpetual feature; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module
SUB-VX-ASSL-HCS	Keysight Vision X, Host Categorization Service subscription; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module
SUB-VS-ASSL	Keysight Vision X, one (1) year Active SSL and Host Categorization Service subscription; Licensed for one (1) CPU on MVX-AM4PC module; Max (2) per module

TradeVision appliance licenses and options

TradeVision base unit	Number of physical ports		Licensed ports		
Solution part number	1 / 10G HW ports included	40G HW ports included	Ports licensed for 1G Use	Ports liicensed for 10G Use	Ports licensed for 40G Use
SYS-TV	48	4	48	48	4

License ordering information

Software licenses can be added to any of the Keysight Vision ONE hardware components or solutions. A fully licensed chassis supports 48 ports of 1G / 10G, 4 ports of 40G, and AppStack.

TradeVision

Component part number	Description
SYS-TV	Keysight TradeVision - Vision ONE System AC power with (4) 40G and 48 (1 / 10G) ports enabled plus TradeStack capabilities (991-0124)

TradeStack – Market data features

License	Description
SUB-TV-TS	Keysight TradeVision, initial (first year) annual subscription for TradeStack capabilities - decoders required for multicast gap detection and feed health (993-0122)
909-5027	Renewal of annual subscription to the TradeStack decoders required from multicast gap detection and feed health (909-5027)

Ixia fabric controller features

License	Description
LIC-TV-IFC	Keysight TradeVision license, enables Ixia Fabric Controller (IFC) Clustering for direct connection to other Vision devices supporting IFC Clustering (E100, E40, Vision ONE, TradeVision) (993-0167)

Keysight AppStack* (ATIP) hardware enablement licenses

Component part number	Description
LIC-V1-SSAS-E	Keysight Vision ONE hardware enablement license for SecureStack (Passive SSL Decryption) and AppStack (ATIP) at entry-level performance - QTY (1) (993-0101)
LIC-V1-SSAS-F	Keysight Vision ONE hardware enablement license for SecureStack (Passive SSL Decryption) and AppStack (ATIP) at full performance - QTY (1) (993-0102)
LIC-V1-SSAS-U	Keysight Vision ONE hardware enablement upgrade license to enable SecureStack (Passive SSL Decryption) and AppStack (ATIP) capabilities (from entry-level to full performance) - QTY (1). Requires additional licenses for features (993-0104)

Latency analytics features

License	Description
SYS-TV-LTNCY	Keysight TradeVision one-year subscription for Advanced Latency Analytics, with decoders required for One Way Latency (OWL) and Two Point Latency (TPL) (993-0129)
909-5028	Renewal subscription, annual, for Advanced Latency Analytics capabilities, with decoders required for One Way Latency (OWL) and Two Point Latency (TPL) (909-5028)

Keysight AppStack* (ATIP) subscription licenses

Component part number	Description
SUB-V1-SSAS	Keysight Vision ONE subscription of one-year SecureStack (Passive SSL Decryption) and AppStack (ATIP) license. Includes Passive SSL Decryption and all AppStack features, including the ATI Subscription. (993-0113)
909-5018	Keysight AppStack (ATIP) + SecureStack - renewal of one-year Subscription License. (909-5018)
SUB-V1-APTL	Keysight Vision ONE AppStack (ATIP) one-year subscription license. Includes Application Identification & Filtering, Geolocation & tagging, Application and Threat Intelligence (ATI) data feed - QTY (1) (993-0112)
909-5019	Keysight Vision ONE AppStack (ATIP) renewal license for SUB-V1-APTL. Includes Application Identification & Filtering, Geolocation & tagging, Application and Threat Intelligence (ATI) data feed - QTY (1). (909-5019)
LIC-V1-NTFL	Keysight Vision ONE PacketStack - NetFlow feature license - QTY (1) (993-0109)
LIC-V1-PSSL	Keysight Vision ONE SecureStack - Passive SSL Decryption feature license - QTY (1) (993-0110)

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