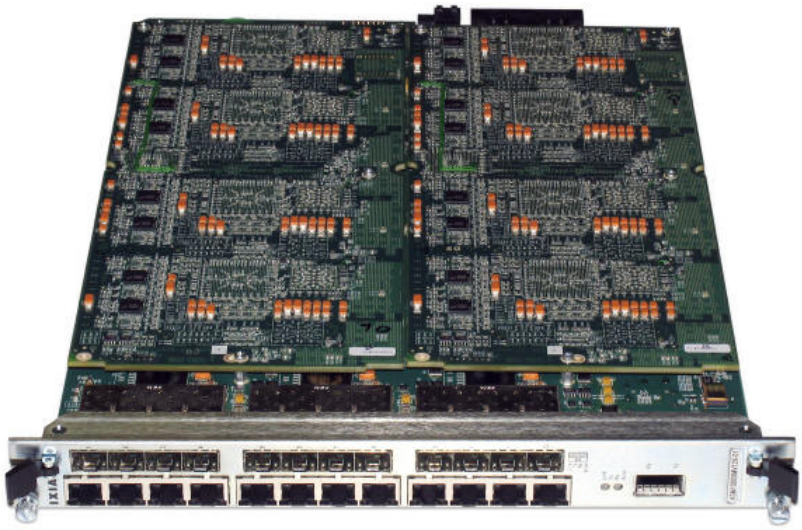
22 IXIA 1GbE and 10GbE Aggregation Load Modules

Ixia's Gigabit and 10 Gigabit Ethernet application and streams modules ASM1000XMV12X is an Ethernet module with additional aggregation capability. It features 12 ports of 10/100/1000Mbps Ethernet configurable in either aggregation mode, stream mode, or as 1 port of 10GE aggregation. It can provide 144 GigE ports in the Optixia XM12 or 24 GigE ports in the Optixia XM2. The ASM1000XMV12X-01 module is shown in Figure 22-1.

Figure 22-1. ASM1000XMV12X-01 Application Load Module



The ASM1000XMV12X module offers complete Layer 2-7 network and application testing functionality in a single Optixia XM load module. The twelve Gig Ethernet ports may either be used individually or aggregated through a 10 Gigabit Ethernet port. This architecture allows the processing power and resources of up to twelve per-port CPUs to be combined into one physical port, providing the highest Layer 4-7 line-rate performance, unmatched in any other Layer 4-7 test solution. Each test port supports wire-speed Layer 2-3 traffic generation and analysis, high-performance routing/bridging protocol emulation, and true Layer 4-7 application traffic generation and subscriber emulation. Using 12 GbE ports per module, ultra-high density test environments can be created for

auto-negotiable 10/100/1000 Mbps Ethernet over copper as well as fiber. With 12 slots per Optixia XM12 chassis, up to 144 Gigabit Ethernet and 12 10GbE test ports are available in a single test system.

Application Layer Performance Testing

The Gigabit Ethernet ASM1000XMV12X module supports high performance testing of content-aware devices and networks through the Aptixia IxLoad application. IxLoad creates real-world traffic scenarios at the TCP/UDP (Layer 4) and Application (Layer 7) layers, emulating clients and servers for Web (HTTP, SSL), FTP, Email (SMTP, POP3, IMAP), Streaming (RTP, RTSP), Video (MPEG2, MPEG4, IGMP), Voice (SIP, MGCP), and services such as DNS, DHCP, LDAP and Telnet. Each GE XMV port can be independently configured to run different protocols and client/server scenarios.

Modes of Operation

The ASM1000XMV12X module can operate in three different modes providing a flexible, scalable and powerful layer 4-7 performance.

Non-Aggregated Mode

In this mode, the twelve 10/100/1000Mbps ports provide L2-L7 XMV functionality. Each port is capable of providing high performance packet generation and application layer testing by employing its own port CPU resources as well as the dedicated hardware stream engine. In this mode the 10GE Aggregation Port is disabled.

Gigabit Aggregated Mode

Gigabit Aggregated Mode allows the twelve PCPUs to be assigned to any of 12 GbE test ports through the switch fabric. Aggregation of the processing power allows application layer testing at line rate regardless of the test objective. A cluster of PCPU's can be assigned to any of the physical ports. Multiple clusters and their assigned physical ports can exist on the same module. Aptixia applications transparently configure the available PCPU resources and make the assignment to the physical port(s) to achieve the test objectives. This mode is exclusive to L4-7 testing and there is no support for hardware stream engine. In this mode the 10GE Aggregation Port is disabled.

10GE Aggregated Mode

In 10GE Aggregated Mode, all of the twelve PCPUs are assigned to the 10GE Aggregation Port through the switch fabric. Aggregation of the processing power allows application layer testing at line rate (10 Gbps). Aptixia applications transparently configure the PCPU resources to achieve the test objectives. This mode is exclusive to L4-7 testing and there is no support for hardware stream engine. In this mode the twelve Gigabit ports are disabled.

Flexible Packet Generation

Each ASM1000XMV12X test port is capable of generating precisely controlled network traffic at up to wire speed of the network interface using Ixia's IxExplorer test application. Up to millions of packet flows can be configured on

each port with fully customizable packet header fields. Flexible header control is available for Ethernet, IPv4/v6, IPX, ARP, TCP, UDP, VLANs, QinQ, MPLS, GRE, and many others. Payload contents can also be customized with incrementing/decrementing, fixed, random, or user-defined information. Frame sizes can be fixed, varied according to a pattern, or randomly assigned across a weighted range. Rate control can be flexibly defined in frames per second, bits per second, percentage of line rate, or inter-packet gap time.

Real-Time Latency

Packets representing different traffic profiles can be associated with Packet Group Identifiers (PGIDs). The receiving port measures the minimum, maximum, and average latency in real time for each packet belonging to different groups. Measurable latencies include:

- Instantaneous latency and inter-arrival time where each packet is associated with one group ID
- Latency bins, where PGIDs can be associated with a latency range
- Latency over time, where multiple PGIDs can be placed in ‘time buckets’ with fixed durations
- First and last time stamps, where each PGID can store the timestamps of first and last received packets

Transmit Scheduler

There are two modes of transmission are available - Packet Stream and Advanced Stream Scheduler:

Packet Stream Scheduler

In Packet Stream Scheduler mode, the transmit engine allows configuration of up to 4096 unique sequential stream groupings on each port. Multiple streams can be defined in sequence, each containing multiple packet flows defined by unique characteristics. After transmission of all packets in the first stream, control is passed to the next defined stream in the sequence. After reaching the last stream in the sequence, transmission may either cease, or control may be passed on to any other stream in the sequence. Therefore, multiple streams are cycled through, representing different traffic profiles to simulate real network traffic.

Advanced Stream Scheduler

In Advanced Stream Scheduler mode, the transmission of stream groupings is interleaved per port. For example, assume a port is configured with three streams. If Stream 1 is defined with IP packets at 20% of line rate, Stream 2 is defined with TCP packets at 50% of line rate, and Stream 3 is defined with MPLS packets at 30% of line rate, data on the port is transmitted at an aggregate utilization of 100% with interleaved IP, TCP, and MPLS packets.

Extensive Statistics

- Real-time 64-bit frame counts and rates
- Spreadsheet presentation format for convenient manipulation of statistics counters

- Eight Quality of Service counters (supporting 802.1p, DSCP, and IPv4 TOS measurements)
- Six user-defined statistics that use a trigger condition
- Extended statistics for ARP, ICMP, and DHCP
- Transmit stream statistics for frame counts and rate
- External logging to file for statistics and alerts
- Audible and visual alerts with user-definable thresholds

Data Capture

Each port is equipped with 64 MB of capture memory, capable of storing tens of thousands of packets in real time. The capture buffer can be configured to store packets based on user-defined trigger and filter conditions. Decodes for IPv4, IPv6, UDP, ARP, BGP-4, IS-IS, OSPF, TCP, DHCP, IPX, RIP, IGMP, CISCO ISL, VLAN, and MPLS are provided.

Data Integrity

As packets traverse through networks, IP header contents may change, resulting in the recalculation of packet CRC values. To validate device performance, the data integrity function of the Gigabit Ethernet ASM1000XMV12X module allows packet payload contents to be verified with a unique CRC that is independent of the packet CRC. This ensures that the payload is not disturbed as the device changes header fields.

Sequence and Duplicate Packet Checking

Sequence numbers can be inserted at a user-defined offset in the payload of each transmitted packet. Upon receipt of the packets by the Device Under Test (DUT), out-of sequence errors or duplicated packets are reported in real time at wire-speed rates. You can define a sequence error threshold to distinguish between small versus big errors, and the receive port can measure the amount of small, big, reversed, and total errors. Alternatively, you can use the duplicate packet detection mode to observe that multiple packets with the same sequence number are received and analyzed.

Routing/Bridging Protocol Emulation

Ixia's Gigabit Ethernet ASM1000XMV12X module supports performance and functionality testing using routing/bridging protocol emulation through the Aptixia IxNetwork and Aptixia IxAutomate applications. Protocols supported include IPv4/IPv6 routing (BGP-4, OSPF, IS-IS, and RIP), MPLS (RSVP-TE, LDP, L2 MPLS VPNs, L3 MPLS VPNs, and VPLS), multicast (IGMP, MLD, and PIM-SM), and bridging (STP, RSTP, MSTP). Highly scalable scenarios can be created emulating up to thousands of routers advertising millions of routes per test port. Up to wire-speed Layer 2/3 traffic can be automatically created to target routes and MPLS tunnels.

Part Numbers

The part numbers are shown in *Table 22-1*.

Table 22-1. Part Numbers for Gigabit Modules

Load Module	Price List Name	Description
ASM1000XMV12X-01	ASM1000XMV12X-01	10 Gigabit Ethernet, Application and Stream Load Module, 1-10G or 12-Port Dual-PHY (RJ45 and SFP) 10/100/1000 Mbps, for OPTIXIA XM2 or OPTIXIA XM12 chassis; CPU with 1Gigabyte of memory per GbE port; On-Board Port Aggregation; GbE Fiber Ports REQUIRE SFP transceivers, options include SFP-LX or SFP-SX; and 10GbE port requires a XFP transceiver, options are either 948-0003 (XFP-850), XFP-1310, or XFP-1550
	SFP-SX	850nm SX SFP transceiver
	SFP-LX	SFP Transceiver - 1310nm LX
	XFP-850 (948-0003-01)	XFP 850nm Transceiver
	XFP-1550	XFP 1550nm Transceiver
	XFP-1310	XFP 1310nm Transceiver

Specifications

The load module specifications are contained in *Table 22-2* on page 22-5. The limitations of -3, Layer 2/3, and Layer 7 cards are discussed in *Ixia Load Modules* on page 1-5.

Table 22-2. Load Module Specifications

	ASM1000XMV12X-01
Number of ports	12 GbE (10/100/1000) + 10GbE
Maximum Ports per Chassis	144 GbE + 12 10GbE
Connector	RJ-45 and SFP for GbE ports; XFP for 10GbE port
Interfaces	Port 1 to port 12: 1000Base-X 100Base-FX 1000Base-T 100Base-TX 10Base-T Port 13: 10GBase-X
Port CPU	PowerPC 750GL x12 Port CPU Speed: 800 MHz Port CPU Memory: 1GB

Table 22-2. Load Module Specifications

	ASM1000XMV12X-01
Ambient Operating Temperature Range	41°F to 86°F (5°C to 30°C) **Note**: Using this load module in the XM2 or XM12 chassis lowers the chassis maximum operating temperature.
Connection rate (cps)	200K (in aggregated mode)
Layer 2-3 Routing Protocol and Emulation	Yes
Layer 4-7 Application Traffic Testing	Yes
Capture Buffer per Port	32MB (Packet Group Engine Enabled) 64MB (Packet Group Engine Disabled)
Number of Transmit Flows per Port (sequential values)	Bilions
Number of Transmit Flows per Port (arbitrary values)	98K
Number of Trackable Receive Flows per Port (PGIDs)	128K
Number of Stream Definitions per Port	Up to 4K in Packet Stream Mode (sequential) or Advanced Stream (interleaved) modes. Each Stream Definition can generate millions of unique traffic flows.
Transmit Engine	Wire-speed packet generation with timestamps, sequence numbers, data integrity signature, and packet group signatures.
Receive Engine	Wire-speed packet filtering, capturing, real-time latency for each packet group, data integrity, and sequence checking.
User Defined Field (UDF) Features	Fixed, increment or decrement by user-defined step, value lists, range lists, cascade, random, and chained. Value list = 48K; Range list = 6K.
Table UDF Feature	Comprehensive packet editing function for emulating large numbers of sophisticated flows. Up to 786K table UDF entries are supported on the XMV12X.
Filters	48-bit source/destination address, 2x128-bit user-definable pattern and offset, frame length range, CRC error, data integrity error, sequence checking error (small, big, reverse).

Table 22-2. Load Module Specifications

	ASM1000XMV12X-01
Data Field (per stream)	Fixed, increment (Byte/Word), decrement (Byte/Word), random, repeating, user-specified up to 13K bytes.
Statistics and Rates: Counter Size: 64-Bit	Link State, Line Speed, Frames Sent, Valid Frames Received, Bytes Sent/Received, Fragments, Undersize, Oversize, CRC Errors, VLAN Tagged Frames, User-Defined Stat 1, User- Defined Stat 2, Capture Trigger (UDS 3), Capture filter (UDS 4), User-Defined Stat 5, User-Defined Stat 6, 8 QoS counters, Data Integrity Frames, Data Integrity Errors, Sequence Checking Frames, Sequence Checking Errors, ARP, and Ping requests and replies.
Error Generation	CRC (Good/Bad/None), Undersize, Oversize.
Packet Flow Statistics	Real-time statistics to track up to 128K packet flows on the XMV12X with throughput and latency measurements.
Latency Measurements	20 ns resolution.
IPv4, IPV6, UDP, TCP	Hardware checksum generation.
Frame Length Controls	Fixed, random, weighted random, or increment by user-defined step, random, weighted random.
Applications	Aptixia IxLoad: Layer 4-7 performance testing of content-aware devices and networks. Aptixia IxNetwork: Integrated Layer 2-3 data/control plane performance and functional testing, supporting routing, bridging, MPLS, and multicast protocols. Aptixia IxAutomate: Automation environment providing pre-built tests for Layer 2-7 data and control plane testing. IxExplorer: Layer 2-3 wire-speed traffic generation and analysis. IxChariot®: Emulated application performance testing over Layer 4. IxAccess: Broadband access performance testing, including PPPoX and L2TPv2/v3. IxVPN: Performance verification of IPSec devices and networks. Tcl API: Custom user script development for Layer 2-7 testing. Linux Software Development Kit (SDK): Custom user application development. Full TCP/IP connectivity through management interface (Telnet, FTP, and so on.)

Port LEDs

Each ASM1000XMV12X port incorporates a set of two LEDs, as described in Table 22-3. The 1GbE LEDs are used in Normal and 1GbE Aggregate modes. They behave identically in both modes, except that due to switch limitations, the 'CRC Error' LED is non-operational in 1GE Aggregate mode (that is, it never indicates error). The 1GE LEDs are disabled (always off) in 10GE Aggregate mode.

Table 22-3. 1GE Port LEDs for ASM1000XMV12X

LED Label	Copper	Fiber
1GE Link/Tx (Upper LED)	Color is used to indicate the link speed: • 1000Mbps–Green • 100Mbps–Orange • 10Mbps–Yellow Flashing indicates transmit activity. Off if link is down.	Green indicates link has been established and flashes during transmit activity. No link = off.
1GE Rx/ Error (Lower LED)	Three conditions apply: • Full duplex or master (in 1000 Mbps case): Green with extended pulses off to indicate receive activity. • Half duplex or subordinate (in 1000 Mbps case): Off with extended pulses to indicate receive activity. • Error: Overrides the other two modes and pulses red (supported only in Normal mode). • No link: Off.	Green indicates link has been established and flashes during receive activity. Continuous red indicates a receive error (supported only in Normal mode).

10GE LEDs are disabled (always off) in Normal and 1GE Aggregate modes. In 10GE Aggregate mode, the two LEDs behave as described in Table 22-4.

Table 22-4. 10GE Port LEDS for ASM1000XMV12X

LED Label	Usage
10GE Link/ Tx (Upper LED)	Green indicates link has been established. Flashes during transmit activity. No link = off.
10GE Rx/ Error (Lower LED)	Green indicates link has been established. Flashes during receive activity. No link = off.

Statistics

Statistics for 10/100/1000 cards, under various modes of operation may be found in the Appendix B, *Available Statistics*.