#210146
October 2010
Commissioned by
Gigamon™

Gigamon GigaVUE-212, 420 & 2404 Data Access Switches

Performance and Functionality Evaluation

Executive Summary

Network monitoring is a critically important function for data center, enterprise and service provider networks. Given the high cost of network monitoring and diagnostic tools, data access switches provide a cost-effective, strategic solution to providing maximum coverage with minimal cost.

Gigamon commissioned Tolly to evaluate the performance and functionality of the GigaVUE line of data access switches. Tests show that the GigaVUE-212, 420 and 2404 devices provide line-rate throughput across all 1Gbps and 10Gbps ports while exhibiting very low latency even at 100% load.

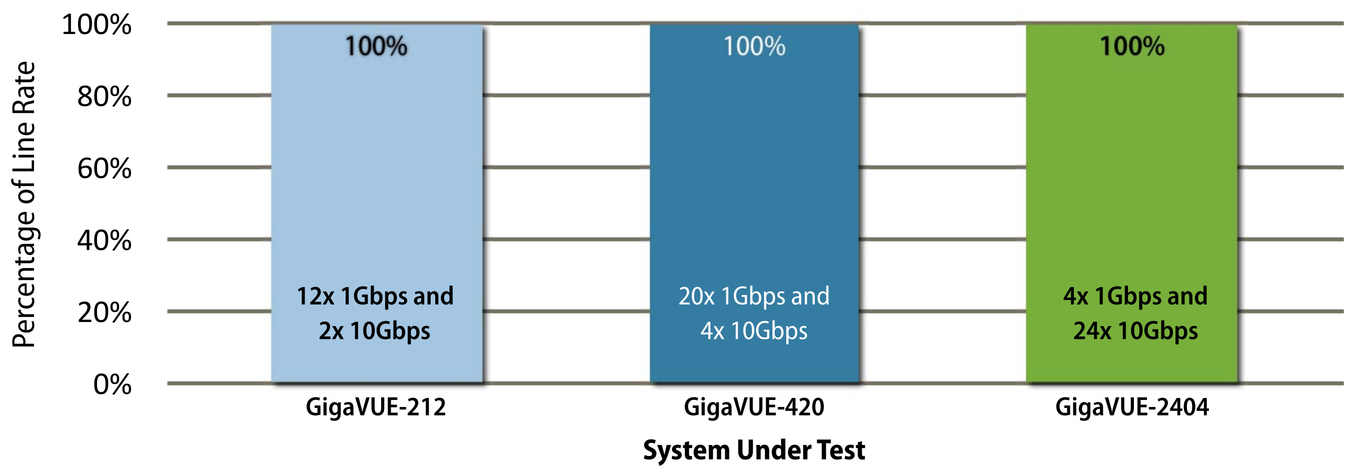
Additionally, Tolly engineers verified a wide range of features across the line including: multiple port mapping options, protocol and bit-map filtering, up to 4,000 simultaneous ingress and 100 egress filters per device, and various SNMP and syslog integration features.

Test Highlights

Gigamon GigaVUE-212, 420 & 2404 data access switches:

1. Exhibited very low latency across all major connection scenarios even in a fully utilized chassis
2. Demonstrated line rate throughput at all frame sizes using all available GbE and 10GbE ports
3. Implemented mapping technology to enable high filtering capacity
4. Supported a broad range of filtering criteria to filter and redirect network traffic at line rate on a fully utilized chassis.

Gigamon GigaVUE Family: Aggregate System Throughput
All Ports Active with Combination of 10Gigabit Ethernet and Gigabit Ethernet Ports
(as reported by Ixia IxAutomate 6.90)



Note: Values represent average, aggregate throughput for the system under test using the port configuration shown within each bar. Tests run at various frame rates ranging from 64-bytes to 1,518-bytes. Results equivalent for all tests.

Source: Tolly, September 2010

Figure 1

Introduction

It is essential that data access switches provide high throughput and low latency in order to process bursts of traffic in busy networks and to avoid becoming a bottleneck when the devices are deployed as TAP.

Equally important is the capability to detect and redirect traffic to the desired output (test tool) ports in a simple, flexible and granular manner.

Finally, any network infrastructure device needs to be to integrated using standard and widely-deployed security and management systems such as RADIUS, SNMP and syslog systems.

The Gigamon devices delivered outstanding results in all of these areas.

Test Results

Throughput

As noted already, all of the GigaVUE products tested were able to deliver 100% line rate throughput on all Gigabit Ethernet and 10Gigabit Ethernet ports handling layer 2 traffic with the ports configured in pairs of same-speed ports when tested using the Ixia Optixia XM12 traffic generator.

Tests were conducted using streams of same-sized frames ranging from 64 bytes to 1,518 bytes. All of the GigaVUE systems tested delivered 100% line rate aggregate throughput at each and every frame size tested.

Latency

Tolly engineers measured the device latency in all port configurations available: pairs of 10Gigabit Ethernet, pairs of Gigabit Ethernet and 10Gigabit Ethernet to Gigabit Ethernet. Latency was measured while the port pair under test was processing traffic at 100% line rate.

Results were consistently good across the GigaVUE family. Tolly engineers ran the latency test using 7 different frame sizes on all combinations of ports on the GigaVUE devices. (See Table 1.)

In all cases and in all port combinations, the GigaVUE systems demonstrated a latency as low as 3.30 microseconds and a maximum latency of just 16.21 microseconds. On 10GbE-to-10GbE connections, all the GigaVUE systems delivered less than 5 microseconds of latency.

Gigamon

GigaVUE-212, 420 & 2404 Data Access Switches

Performance & Functionality Evaluation

Tested September 2010

Port-Level Filtering

The port-level filtering capabilities of the GigaVUE family provide for flexible mapping of input ports to output ports, that is, network traffic to test tool ports.

Tolly engineers verified that ingress network ports could be mapped to one or more egress tool ports in any combination: any-to

Gigamon GigaVUE-212, 420 and 2404: Average System Latency (microseconds)
Port Pairs - Various Frame Sizes at 100% load
(as reported by Ixia IxAutomate 6.90)

Frame Size (bytes)	GigaVUE-212			GigaVUE-420			GigaVUE-2404		
	GbE-to-GbE	10GbE-to-10GbE	10GbE-to-1GbE	GbE-to-GbE	10GbE-to-10GbE	10GbE-to-1GbE	GbE-to-GbE	10GbE-to-10GbE	10GbE-to-1GbE
64	4.50	3.80	4.00	4.58	3.81	4.00	4.04	3.30	3.04
128	5.00	3.80	4.00	5.08	3.85	4.03	4.02	3.29	3.12
256	6.00	3.90	4.10	6.10	3.96	4.16	5.04	3.40	3.21
512	8.00	4.10	4.30	8.15	4.17	4.24	7.07	3.60	3.38
1,024	12.10	4.50	4.70	12.23	4.57	4.73	11.12	4.01	3.80
1,280	14.10	4.70	4.90	14.29	4.78	4.89	13.19	4.21	3.99
1,518	16.00	4.90	4.90	16.21	4.95	4.99	15.12	4.39	4.06

Source: Tolly, September 2010

Table 1

any, many-to-any and any-to-many. (See Table 2.)

In the any-to-any combination, Tolly engineers configured the systems such that the data received on a given port be replicated on a single tool port and verified that input and output data were the same.

In the many-to-any combination, Tolly engineers configured the systems such that specific data received on multiple ingress ports was aggregated on a single tool port and verified that all the traffic streams from the network ports appeared on the tool port.

In the any-to-many combination, Tolly engineers configured the systems such that specific data received on a single ingress port be replicated on multiple tool ports, and verified that the desired traffic stream was replicated on all the tool ports.

Tests were run on all three systems under test and all systems passed all tests.

Gigamon GigaVUE Family: Port-Level Filtering Capabilities

Port Filtering Scenario	Description	Result
Any-to-Any	One network port to one tool port	✔
Many-to-Any	Many network ports to one tool port	✔
Any-to-Many	One network port to many tool ports	✔

Source: Tolly, September 2010 Table 2

Packet-Level Filtering

Just as important as port-level filtering is packet-level filtering. Given the volume of traffic found in most networks, network engineers will almost always want to capture and evaluate a subset of that traffic. Packet-level filtering allows the network engineer to use flexible criteria to select the data that will be captured for processing by one or more test tool egress ports. (See Table 3.)

The GigaVUE systems provide for easy selection of filtering criteria by layer 2, 3 and 4 protocol fields. Additionally, the "bit-mask" options allows network engineers to select any bits of interest in the packet to use as a filtering criterion.

Tests were run on all three systems under test and all systems passed all tests.

Gigamon GigaVUE Family: Packet-Level Filtering Capabilities

Packet Filtering Scenario	Verified
Bit-Mask	✔
Ethertype	✔
VLAN	✔
TOS (Type of Service)	✔
Source IP Address	✔
Destination IP Address	✔
Source TCP/UDP Port	✔
Destination TCP/UDP Port	✔
Source MAC Address	✔
Destination MAC Address	✔
User-defined Filter (e.g. MPLS)	✔
DSCP (Differentiated Services Code Point)	✔
Fragmentation Field	✔
IP Protocol	✔

Note: The GigaVUE-212 and 420 support a maximum for 4,000 active ingress/map/egress filters, the 2404 supports 2,000.

Source: Tolly, September 2010 Table 3

Multi-Layer Filtering

While a simple, single filter might suffice for certain needs, it is more likely for network engineers to intercept a more refined subset of network traffic. For example, it might be necessary to capture only VoIP traffic on a particular VLAN from a particular IP address.

To easily filter for complex multi-layer filter routines, the GigaVUE devices employed a powerful and flexible mapping mechanism. Mapping creates complex filter distribution maps that direct specific traffic received on the network ports to specific tool ports.

Maps allow easy modification of traffic distribution policies without the need to rewrite several lines of filters for every network port. Once data is directed to a specific tool port, users can further filter data with egress filters or use Gigamon's pass-all technology which allows users to dynamically add additional monitoring tools without disturbing current filters.

The GigaVUE-212 and 420 systems can support 4,000 filters and the GigaVUE-2404 can support 2,000 filters. In addition, each GigaVUE device supported another 100 egress filters.

Tolly engineers validated the filter capacity by creating a map that contained the maximum number of ingress and egress filters for the system under test. Engineers then created a data stream that contained the corresponding number of different IP addresses. Then, on the egress side, 100 filters were created each one of which specified to drop traffic corresponding to an IP address. Engineers verified that all of the IP addresses specified in the ingress filter were replicated to the egress tool port and that the 100 IP addresses selected to be dropped on egress were, in fact, dropped.

All GigaVUE systems performed to their advertised filtering capacity levels.

System Management Capabilities

Feature	Description	Verified
IP Connectivity	Ability to be managed via an assigned IP address.	✔
Integrated Web Server	Ability to be managed via Web-browser based interface by using an integrated Web Server.	✔
SNMP	Ability to send SNMP traps on network events to an SNMP server	✔
SYSLOG	Ability to send syslog messages on network events to an SNMP server	✔
Terminal Server	Ability to be managed via terminal connections over a serial port	✔

Source: Tolly, September 2010 Table 4

Management

The GigaVUE systems support a variety of system management protocols and access methods. (See Table 4.)

Tolly engineers verified that the GigaVUE devices could be configured and function as standard IP-based network devices by configuring IP addresses, subnet masks and default gateways. Engineers were able to communicate with the devices via standard Telnet and SSH sessions.

It is important for network devices to be able to report their condition to network management systems. Tolly engineers verified that the GigaVUE devices implement SNMP support and accurately report state change information via SNMP. Additionally, engineers confirmed that the GigaVUE devices successfully report log information to a configured syslog server.

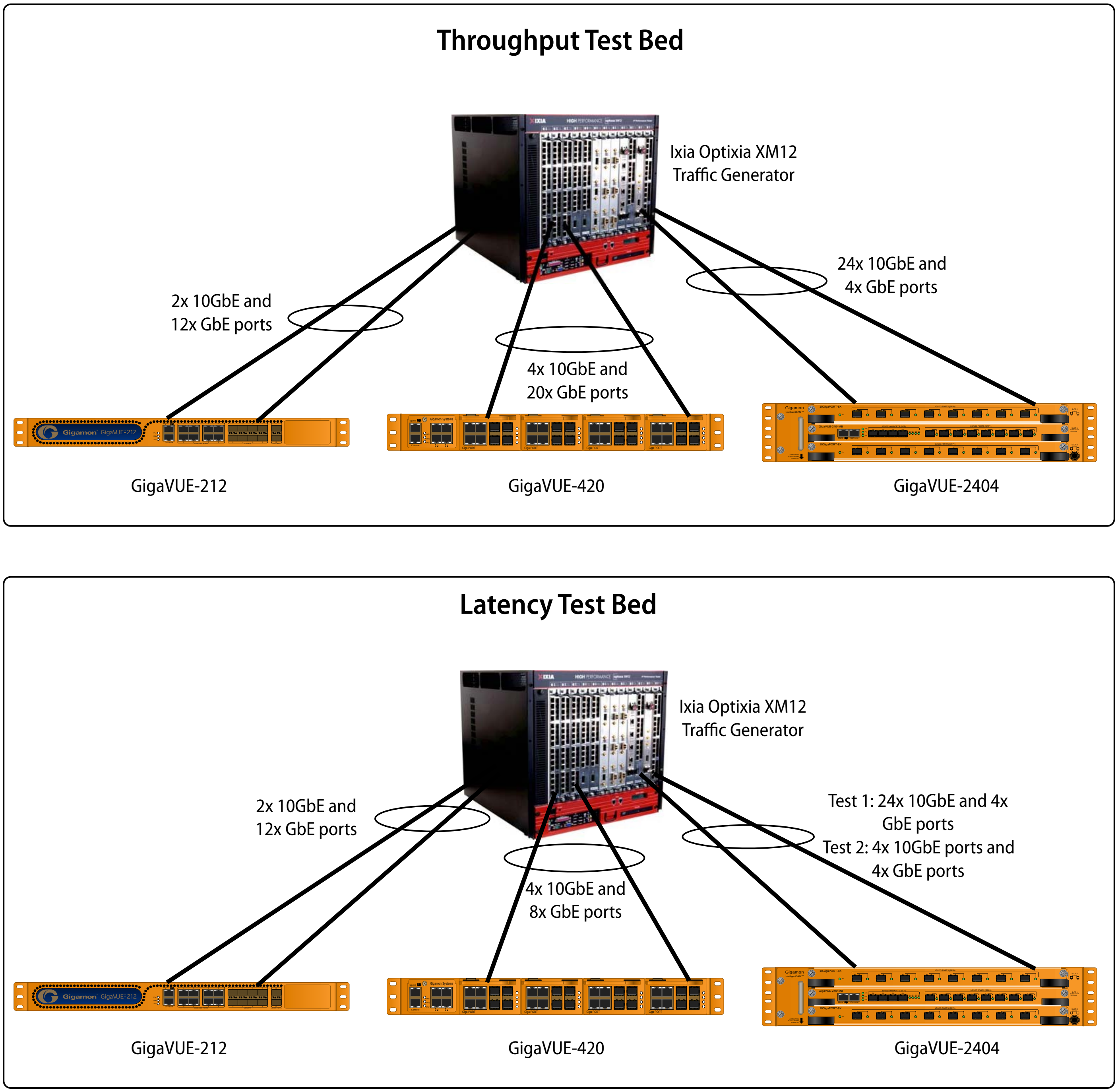
Solutions Under Test

Device	Optional Modules Installed	Quantity	Software Version	1Gbps Ports	10Gbps Ports
GigaVUE-212	PRT-202 - 4 Port 10/100/1000 Expansion Modules	1	7.1	12	2
GigaVUE-420	PRT-400 - 10/100/1000 4-Port GigaPort module	4	7.1	20	4
	GLK-312 - 10 Gigabit SR Expansion Module	4			
GigaVUE-2404	PRT-438 - 8 Port 10G/1G SFP+ Blade	2	7.1	4	24

Source: Tolly, September 2010 Table 5

Test Bed Setup

The test bed consisted of the GigaVUE device(s) under test (one each of GigaVUE-212, 420 and 2404 models) connected to an Ixia Optixia XM12 traffic generator for test traffic generation and validation purposes. All devices were connected to a LAN for management purposes. A laptop running Microsoft Windows 7 was connected to the LAN to manage the GigaVUE devices as well as



Note: Generic image shown for the Ixia Optixia XM12.

Source: Tolly, September 2010

Figure 2

configure the Ixia traffic generator using Ixia IxExplorer and Ixia IxAutomate applications.

Test Methodology

Layer 2 Throughput

The test traffic consisted of unidirectional streams of Layer 2 traffic consisting of frames of 64-, 128-, 256-, 512-, 1,024-, 1,280-, 1,518-bytes at 100% line-rate (i.e. at 1 Gbps going to the GbE ports on GigaVUE, and at 10Gbps going to the 10GbE ports on the GigaVUE.)

Test traffic received back to the Ixia was verified to make sure that 100% of the traffic sent was received back.

GigaVUE-212

For this test, the GigaVUE-212 was connected to the Ixia using two 10GbE ports and 12 GbE ports. On the GigaVUE-212, the two 10GbE ports were configured in a port pair, and the 12 GbE ports configured in port-pairs outside-in -- meaning traffic into port 1 mapped to port 12 and out to the Ixia; similarly port 2 mapped to port 11, and so on.

GigaVUE-420

For this test, the GigaVUE-420 was connected to the Ixia using four 10GbE ports and 20 GbE ports. On the GigaVUE-420, a 10GbE port was mapped to copy traffic to ten GbE ports. These ten GbE ports were then connected to the remaining ten GbE ports on the GigaVUE-420. The traffic coming into these ten GbE ports were then mapped to go out of a 10GbE port, and back to the Ixia. The remaining two 10GbE ports on the GigaVUE were configured in a port pair.

GigaVUE-2404

For this test, the GigaVUE-2404 was connected to the Ixia using 24 10GbE ports and four GbE ports. The 10GbE ports were connected in port-pairs with 12 network ports and 12 tool ports; and the four GbE ports were connected in port-pairs with two network ports and two tool ports. Once again, the 10GbE port-pairs were connected outside-in, i.e. port 1 acting as the network port mapped to port 24 acting as the tool port; port 2 (network port) mapped to port 23 (tool port), and so on. Similarly, the four GbE ports were connected as port g1 connected to port g4, and port g2 connected to port g3.

The Ixia ports sent test traffic coming at line rate into each set of network ports on the GigaVUE-2404, which was mapped internally to the set of tool ports, and then returned back to the Ixia ports.

Layer 2 Cut-Through Latency

The latency was calculated with test traffic consisting of unidirectional streams of Layer 2 traffic consisting of frames of 64-, 128-, 256-, 512-, 1,024-, 1,280-, and 1,518-bytes at 100% line-rate (i.e. at 1 Gbps going to the GbE ports on GigaVUE, and at 10Gbps going to the 10GbE ports on the GigaVUE.) Test traffic received back to the Ixia was verified to make sure that 100% of the traffic sent was received back.

GigaVUE-212

For this test, the test bed topology was configured similar to the throughput test. The two 10GbE ports were configured as a pair in one group, and the 12 GbE ports were configured as six pairs in a separate group.

Latency was measured at line rate for 10GbE-to-10GbE port group and the GbE-to-GbE port group. When testing latency going from a 10GbE port to a GbE port, test traffic was sent at 1 Gbps or at 10% of the line rate on the 10GbE port.

GigaVUE-420

For this test, the test bed topology was configured similar to the throughput test. The four 10GbE ports were configured as port-pairs in one group, and eight GbE ports were configured as four pairs in a separate group.

Latency was measured at line rate for 10GbE-to-10GbE port group and the GbE-to-GbE port group. When testing latency going from a 10GbE port to a GbE port, test traffic was sent at 1 Gbps or at 10% of the line rate on the 10GbE port.

GigaVUE-2404

For the first latency test, the test bed topology was configured similar to the throughput test. The 24 10GbE ports were configured in port-pairs, and the four GbE ports were configured as two pairs in a separate group. Test traffic was sent at 100% line rate to each port group. Latency was reported as average latency at line rate for 10GbE-to-10GbE port group and the GbE-to-GbE port group.

For the second latency test, four 10GbE ports and four GbE ports were used. Each 10GbE port acting as a network port was connected to a GbE port acting as the tool port. Latency was reported as average latency, going from a 10GbE port to a GbE port with test traffic sent at 1 Gbps or at 10% of the line rate on the 10GbE port.

About Tolly

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http://www.tolly.com

Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment/software used in this project.

Vendor	Product	Web
Ixia	Chassis Type: Optixia XM2 Interfaces: 12 x 10Gbps 12x 1Gbps Software: IxAutomate 6.90 GA Patch 2	http://www.ixiacom.com/

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