Isocore Summary Report

Ixia Gigabit Ethernet LSM1000XMV16 GigE LAN Services Module (XMV16) Scalability Verification in Realistic Test Environment

Maximum Routing Scaling for IPv4 and IPv6

ISOCORE Internetworking Lab
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About Isocore
Isocore provides technology validation, certification and product evaluation services in emerging and next generation Internet and wireless technologies. Isocore is leading validation and interoperability of novel technologies including Carrier Ethernet, IPv6, IP Optical Integration, wireless backhauling and Layer 2/3 Virtual Private Networks (VPNs) and currently focuses on IPTV service deployment architecture validation and design. Major router and switch vendors, Service Providers, and test equipment suppliers participate in Isocore activities. Isocore has major offices in the USA (the Washington DC area), Europe (Paris, France) and Asia (Tokyo, Japan).

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1 EXECUTIVE SUMMARY

This report summarizes the findings of a comprehensive test conducted independently by Isocore to validate the scalability of a single port on the Ixia's 16-port Gigabit Ethernet LAN service Modules (LSM1000XMV16 GigE LAN Services Module - XMV16). To validate the scalability of a single port in a "testing the tester" environment, a network router designated as the "black box" was used to verify the number of routing adjacencies, and routes that can be advertised by a single port on XMV16 LAN service module. Numerous iterations were carried out to confirm the capability of a single port in a multi-protocol scenarios where 4 protocol versions including OSPF, OSPFv3, BGP, and BGP4+ were enabled on a single port.

The test was performed in accordance to Isocore's unique carrier multi-service single port scaling benchmarking methodology which requires a single tester port to support multiple protocols with routes which further helps the user to test the routing capability of a device under test (DUT) with minimal number of tester ports. Considering Isocore requirements, the test was designed to verify the ability of XMV16 ports to sustain large number of protocol adjacencies while pushing large number of IPv4 and IPv6 routes into the DUT. The test primary focus was on verifying the control plane capability XMV16 LAN service module, rather than forwarding capabilities evaluation.

The main device under test was a single port[1] on a XMV16 LAN service module connected to the black box that is capable of supporting large number of protocol adjacencies, and hold large number of routes in its forwarding and routing information base (FIB/ RIB). The XMV16 LAN service module was configured in an XM2 Ixia multiservice test chassis. Testing for the entire effort was conducted at Isocore Internetworking lab in Reston, VA.

Test Summary:

Test Description	Observed Results
OSPFv2 adjacencies per port on XMV16 LAN Service Module	150 neighbors in full state with DUT use in the test
OSPFv3 adjacencies per port on XMV16 LAN Service Module	150 neighbors in full state with DUT use in the test
BGP adjacencies per port in XMV16 LAN Service Module (iBGP)	250 peers in established state with DUT used in the test
BGP4+ adjacencies per port in XMV16 LAN Service Module (iBGP)	250 peers in established state with DUT used in the test
Number of OSPFv2 Routes per port pushed to the DUT	100,050 routes with 667 routes per neighbor
Number of OSPFv3 Routes successfully pushed on to the DUT	100,050 routes with 667 routes per neighbor
Number of BGP route entries pushed on to the DUT (RIB entries)	4,500,000 with 18,000 route entries per peer
Number of BGP4+ routes entries pushed on to the DUT	6,882,000 routes with 2000 routes, and 100,000 routes per peer
Total Number of Route entries pushed from a single port on XMV16 LAN Service Module	11,582,100 route entries across 800 peers (including OSPv2/v3, and iBGP (4/ 4+)

Based on this comprehensive evaluation, Isocore confirms the ability of Ixia's XMV16 service modules to support multiple protocols in a highly scalable environment, thus helping Network

[1] The testing configuration was not replicated to other 15 ports on the XMV16 module. Only one port out of 16 ports was used in the test.

Equipment Manufacturers and Service Providers to validate the multi-service capabilities of any DUT in a network testbed. Ixia's XM2 chassis with a single XMV16 service module constituted as the tester, and was being evaluated against a carrier class routing and switching platform constituting the DUT, in this test. The results obtained from this test the ability of XMV16 port to provide high-density test environment.

2 INTRODUCTION

This report provides an overview of the test methodology, test setup details, and overall observations of the verification of scalability of XMV16 ports in a real testbed environment rather than evaluating the scalability of tester port in a typical back-to-back environment. Isocore test methodology uniquely verifies the ability of the tester ports to scale in a stateful environment while keeping all the state machines active and responsive across all the peering relationships as expected by any routing equipment in a real network. Any adjacency flapping is considered a failure of the test, and forces the test configuration to be scaled back. This methodology assures in setting thresholds which are very realistic, and are typically lower than any back-to-back test conducted for specifying the protocol scalability per port.

The test effort focused on evaluating the scalability of a single port on XMV16 LAN service modules in the following areas:

1. Adjacency scalability while enabling IPv4 and IPv6 routing protocols on the same tester port
2. Verifying simultaneous scalability of IPv4 routing protocols (OSPFv2, iBGP) while IPv6 protocols (OSPFv3, iBGP4+) configured at a scale.
3. Verifying the maximum number of routes that can be pushed while maintaining large number of routing adjacencies per port

For the entire test series, Isocore used one Ixia XM2 chassis, 1 XMV16 16 port LAN service Module and a device under test in a black box type of testing.

3 TESTING HIGHLIGHTS

Table 1 highlights the key findings of the entire test validating the capability of a single port on XMV16 LAN Service Module for simultaneous configuration of 4 routing protocols.

Table 1: Key findings

Verified Capabilities	Observations/Measured Results
OSPFv2 adjacency and route scaling	o 150 Routing Adjacencies per port in FULL state with total of 100,050 routes per same port o 667 route entries per peer pushed on to the DUT
OSPFv3 adjacency and route scaling	o 150 Routing Adjacencies per port in FULL state with total of 100,050 routes per same port o 667 route entries per peer pushed on to the DUT
iBGP adjacency and route scaling	o 250 Routing iBGP adjacencies per port in ESTABLISHED state with 4,500,000 route entries (RIB entries) o 18,000 route entries per peer pushed on to the DUT
iBGP 4+ adjacency and route scaling	o 250 Routing iBGP 4+ adjacencies per port in ESTABLISHED state with 6,882,000 route entries (RIB entries) o 2,000 route entries per peer for first 91 peers o 100,000 route entries per peer for next 67 peers
Total Routing Adjacencies and Routes Per Port on XMV16 Service Module	o 11,582,100 route entries pushed on to the DUT per port (RIB entries) o 800 Peers per port

4 TEST ENVIRONMENT

4.1 IXIA CHASSIS XM2 FORM FACTOR (XMFF) AND LSM1000XMV16 GIGE LAN SERVICES MODULE (XMV16)

The Isocore testbed utilized Ixia's Optixia XM2 chassis combined with the LSM1000XMV16 GigE LAN Services Module (XMV16) and DUT.

Ixia's Optixia XM2 chassis supports up to 32 10/100/1000 interfaces, 6 ports of 10 Gigabit Ethernet and 4 Packet over SONET (POS) or Asynchronous Transfer Mode (ATM) ports. Ixia's XMV16 LAN Services Module (LSM) can be used for testing Layer 2-7 network and application functionalities. A single XMV16 card supports 16 copper (RJ-45) or fiber (SFP) based 1G ports and each port has an independent PowerPC CPU, 1G RAM and a RISC processor running Linux and a TCP/IP stack. A single XMV16 module contains 16 PowerPC and 16G of RAM. However, for this test a single port with SFP was used, although all 16 ports were made available for the test with SFPs.

Ixia's IxNetwork test application software used for performing all the configurations on the XM2 chassis. IxNetwork 5.30 Patch 2 was used for the entire testing along with IxOS version 5.00 SP6.

4.2 TEST METHODOLOGY AND TESTBED OVERVIEW

The primary goal of the test effort was to demonstrate the scalability, and stability of the new range of IXIA test ports which are capable of allowing user to configure large number of routing protocols and services on a single port in order to offer intense testing ability to any test bed. This was industry's first effort which focused on evaluating the control plane capabilities of a tester. All of the tests were using the testing equipment provided by Ixia for this effort, and a DUT used, which was used to verify the validity of the routes pushed by Ixia XMV16 port, and to assure if tester port is capable of sustaining large number of adjacencies over the same port. The focus of the test was not to evaluate the scalability across all 16 ports of the IXIA XMV16 LAN Service Modules but to focus on the single port scalability and performance.

The test conducted as part of this effort was to overlay multiple routing protocols on a single port, and push the routes on to the DUT and ensure none of the routing adjacencies flap due to hold timer expiry. This type of test is very complicated especially due to large configurations that one needs to deal with both on the tester and on the DUT. Both systems during the test showed stability. The final results confirmed that large number of routing protocols at utmost scalability can be configured on a single port on the IXIA XMV16 LAN Service Module.

Figure 1 shows a general testbed that was used to evaluate the features listed in table 1. A few variations were performed on testbed in Figure 1 to accommodate the requirements of individual test cases.

The basic system testbed was constructed using a single port on XMV16 LAN Service Module on 2 slot XM2 chassis, and one Gigabit Ethernet port on the DUT with 1000 virtual LAN interfaces.

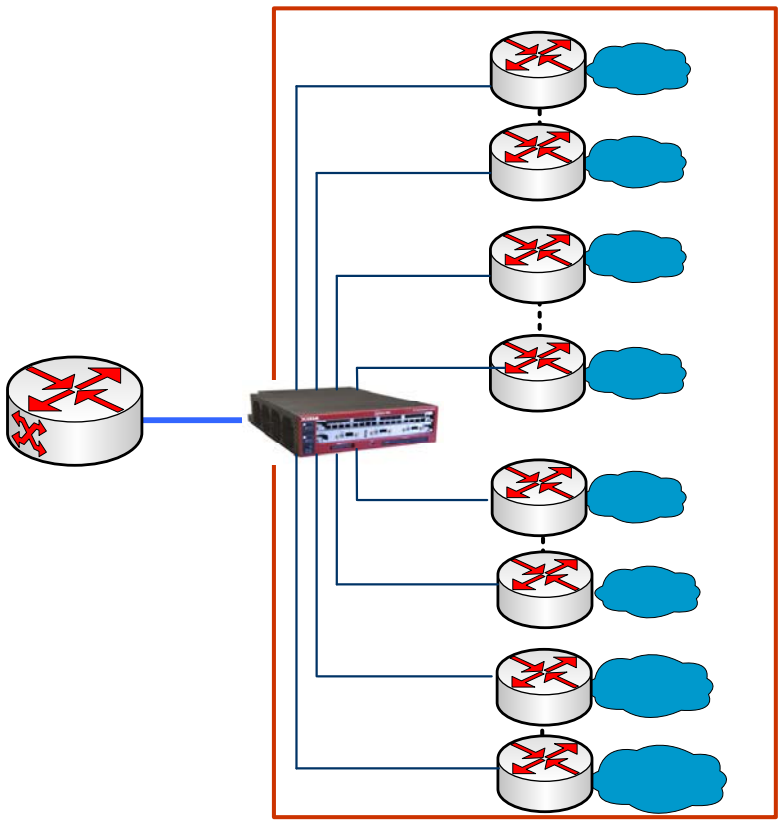

Figure 1 IXIA XMV16 LAN Service Module Verification Testbed

5 TEST DETAILS AND OBSERVATIONS

The primary objective of the test was to evaluate the maximum scalability of a single port of the XMV16 LAN Service module in a realistic environment, when connected to a real DUT. The test was started with basic configuration of 1000 Virtual LAN interfaces (VLAN) and OSPF was enabled on the first 500 of these. During the initial verification and basic sanity, 500 OSPFv2 neighbors were successfully established on a single port with 244,100 IPv4 routes. The number of routes advertised per peer for first 300 peers was 667 routes, 200 routes per peer for the remaining 200 peers.

After initial verification, the number of OSPF peers was scaled back from 500 to 150 peers and configurations for OSPFv3, and iBGP (for IPv4 and IPv6) was added to the port configuration using Ixia's Aptixia IxNetwork test software that was running on a separate client machine connected to the XM2 chassis. Default BGP timers were not used during this test. During the test a total of 800 active peers were established over a single port. Once the network converged and all adjacencies were operational, OSPF routes for both IPv4 and IPv6 were flooded. Following the OSPF route convergence on the DUT, BGP routes were pushed on to the DUT across the same XMV16 port. At the end of the test the DUT had converged close to 1,200,099 unique route entries with 11,582,100 route instances.

Following the convergence of all the routes, the test bed was monitored for stability, and adjacency flapping. This was the basic criteria for establishing the scalability of the test port on XMV16 module. This is a critical parameter as compared to back to back test where the scaling numbers are directly proportional to the memory associated with each port of the tester. The results demonstrated that a single port on XMV16 card on Ixia's XM2 chassis offers flexibility to

enable multiple protocols on a single port. During the test not even a single reboot or crash of the tester port was observed on the XMV16 LAN Service module.

Figures 2, and 3 provide screen captures of protocol adjacencies and number of LSAs, and BGP updates sent from a single port on XMV16 module towards the DUT, which also showed commendable stability due to multiple iterations performed during this test.

Throughout the test event the system under test proved to be very stable under considerable setup and tear down of large number of adjacencies and routes that were repeatedly flooded, and withdrawn from the network. Due to the complexity of the test and time constraints, testing to maximum scale of any particular area was beyond the scope of this event. Based on the memory statistics and CPU utilization on both the port on XMV16 module, and DUT the testbed could have scaled higher with different permutations and combinations of protocols.

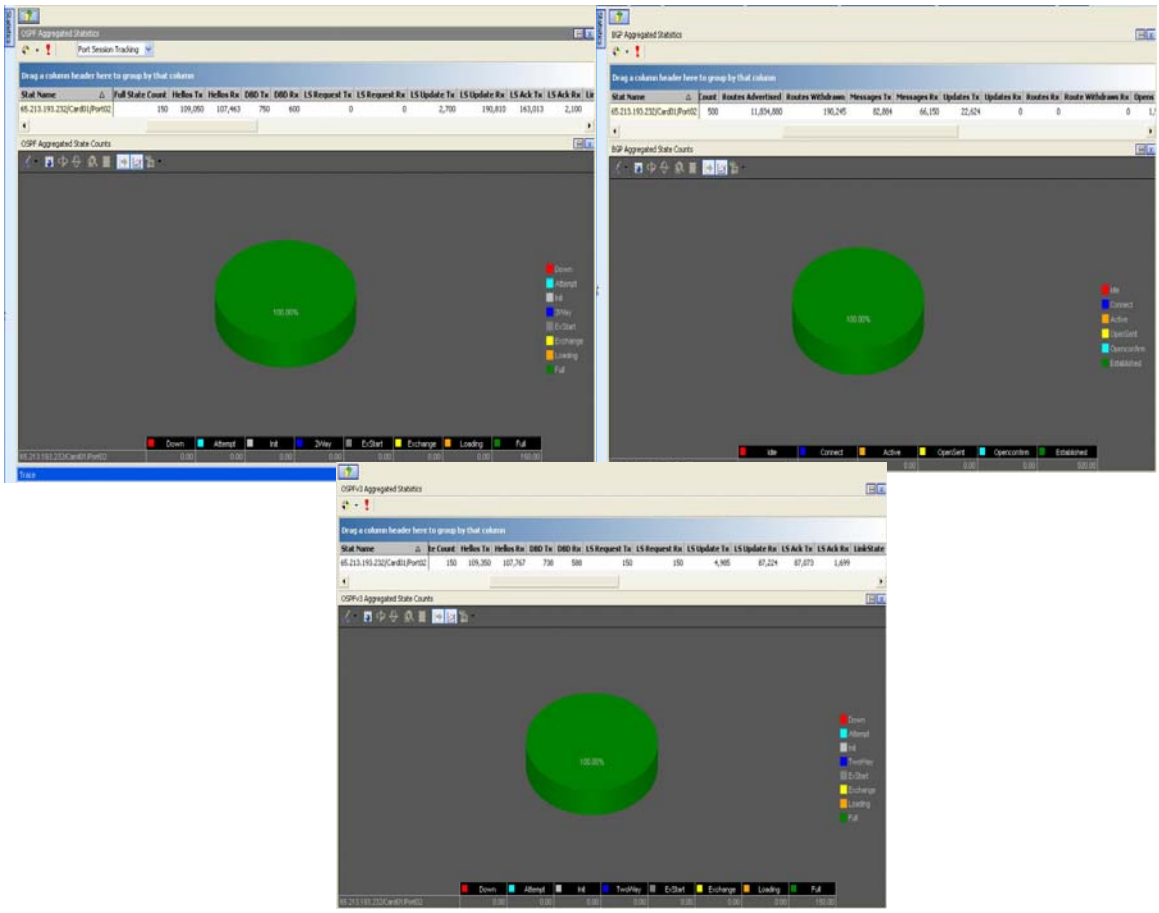

Figure 2: State of All routing protocols as captured in IxNetwork – clockwise OSPFv2, BGP (aggregated statistics), OSPFv3 statistics

6 CONCLUSION

Isocore's recent testing of IXIA's XM2 chassis, and XMV16 LAN Service module proves that a single port in a realistic test environment can be scaled in a multi-protocol configuration

environment while maintaining the stability of the system under test. The capabilities that constitute multi-service features on a test port were evidently met during the test conducted at Isocore Internetworking Lab. Total scalability of approximately 11 Million routes across 800 peers presented a stressful test configuration, single port of Ixia XMV16 module handled this configuration by showing little or no signs of stress on the IxNetwork GUI or on the XMV module itself. No reboots of the card were observed during the entire test cycle, which is one of the key performance requirements of any tester ports that can be used in a highly scalable multi-service testbed.

Isocore concludes that Ixia XMV16 Service Module implementation can scale in a multiprotocol environment and offers flexibility and high-density test configurations that are demanded by service providers to evaluate high-capacity network equipment.

7 LIST OF ACRONYMS

XMFF	XM (Style of Chassis) Form Factor
LAN	Local Area Network
DUT	Device Under Test
BGP	Border Gateway Protocol
BGP4+	BGP with IPv6 routing extensions
OSPF	Open Shortest Path First
RIB	Routing Information Base
FIB	Forwarding Information Base
OSPFv3	OSPF with IPv6 routing extensions
GE	Gigabit Ethernet
VC	Virtual Circuit
AAL	ATM Adaptation Layer

8 HARDWARE USED

DUT	Black Box
IxNetwork	Release – 5.30 Patch 2
IxOS	Release – 5.00 SP6
XM2 Chassis	XMFF
XM2 Line Cards	Gigabit Ethernet XMV LAN Service Modules-LSM1000XMV16-01