ethernet alliance

OFC/NFOEC 2011
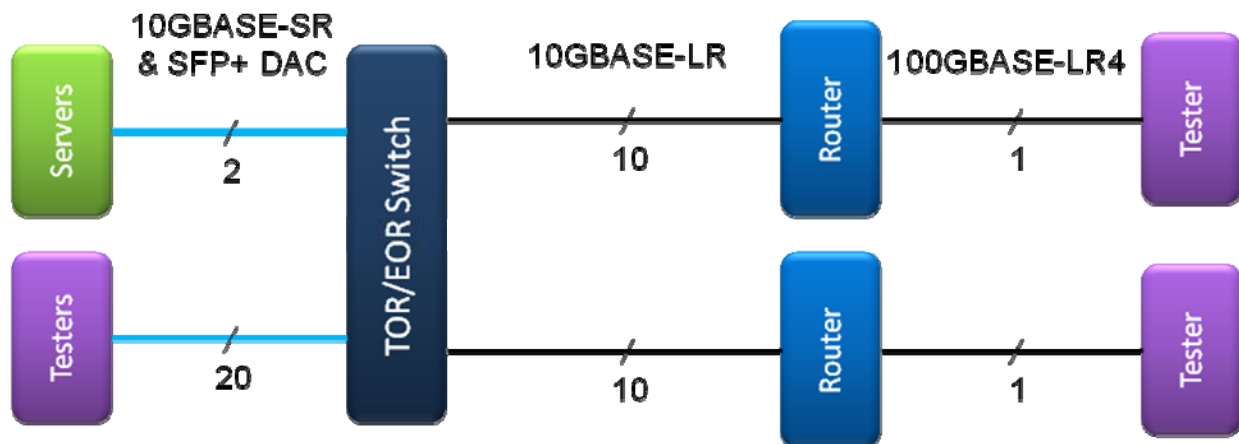# Interoperability Demonstration

March 7, 2011

1. Overview

The Ethernet Alliance has twelve members participating in the OFC/NFOEC 2011 demonstration. The participating companies include: ADVA Optical Networking, AppliedMicro, Amphenol, Cisco, CommScope, Ixia, Mellanox, NetApp, Opnext, Siemon, Spirent and Tyco Electronics. One part of the live demonstration showcases 10 Gigabit Ethernet links being sourced from Ixia and Spirent testers, passing through a Mellanox top-of-rack switch that is handling RDMA over Converged Ethernet (RoCE) traffic, aggregating into two 100 Gigabit Ethernet links in the Cisco routers, and terminating on the testers. The other part of the live demonstration showcases two back-to-back servers streaming 40 Gigabit Ethernet between them using Mellanox adapters.

2. 10 and 100 Gigabit Demonstration

Starting on the left, the Ixia XM12 tester is equipped with 16 ports of 10GbE using the SFP+ form factor, and the Spirent TestCenter tester is equipped with 8 ports of 10GbE also using the SFP+ form factor. Mellanox Vantage 6048 top-of-rack/end-of-row (TOR/EOR) switch is equipped with 48 ports of SFP+, and each port on the switch is capable of operating in either 1GbE or 10GbE mode. For this demonstration, the switch operated all its ports in 10GbE mode.

Four ports of the Spirent tester are connected to the Mellanox switch using SFP+ direct attach copper cabling (DAC) supplied by Amphenol, Siemon and Tyco Electronics. The passive DAC are specified with a reach of up to 7 m. Longer reaches with DAC are capable if active cables are used. The four remaining ports on the Spirent tester are connected using 10GBASE-SR SFP+ optical modules to the Mellanox switch using multimode fiber (MMF). The MMF fiber is provided by Amphenol, CommScope, Siemon and Tyco Electronics. The aqua colored fiber is the newer laser-optimized OM3 MMF and is capable of a reach of at least 300 m. The orange colored fiber is older OM2 MMF and is capable of a reach of at least 82 m.

The Ixia XM12 uses 12 of its 10GbE SFP+ ports to drive traffic to the Mellanox switch over 10GBASE-SR using MMF. The Mellanox servers also connect via 10GBASE-SR over MMF to the Mellanox switch. The servers are running RDMA (Remote Direct Memory Access) over Converged Ethernet, or RoCE, to enable streaming of RDMA traffic through the switch while it is also handling 400 Gb/s of traffic streaming to and from the testers and the routers.

The two Cisco CRS-3 routers are equipped with 14 ports of 10GBASE-LR and one port of 100GBASE-LR4. 10GBASE-LR SFP+ optical modules were placed into twenty Mellanox SFP+ ports to permit connection between the switch and the router using OS1 single-mode fiber (SMF). The yellow colored SMF is capable of a minimum reach of 10 km and is supplied by Amphenol, CommScope, Siemon and Tyco Electronics. To save space on the demonstration floor, the MMF and SMF cables were all limited to be 20 m or less.
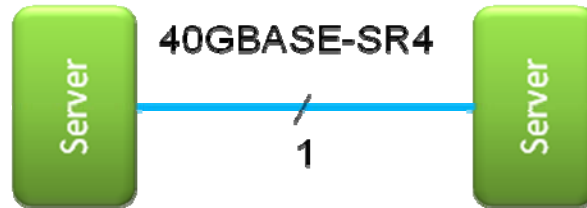
The 100GBASE-LR4 ports on the Cisco routers then connect to the Ixia and Spirent testers via SMF. This loop permits the testers to verify data sent in each direction is received at the corresponding end. The 100GBASE-LR4 optical modules come in the CFP form factor. Opnext supplied the 100GBASE-LR4 CFP optical modules used in the Ixia and Spirent testers, and many of the 10GBASE-SR and 10GBASE-LR SFP optical modules used in the Mellanox switch.

100GBASE-LR4 uses four wavelengths centered around 1300 nm and running at approximately 25.78 Gb/s per wavelength. The wavelength division multiplexing permits 100GbE to be carried over a single strand of SMF.

In this demonstration, all the SFP+ optics use the LC connector and all the CFP optics use the SC duplex connector.

3. 40 Gigabit Demonstration

The 40 Gigabit Ethernet demonstration uses a Mellanox 40GbE adapter inside each server. Both servers are contained with a single chassis. The Mellanox 40GbE adapters use the QSFP+ form factor, and Tyco Electronics supplied the QSFP+ 40GBASE-SR4 optical modules and the 4-lane parallel MMF. The MMF uses the MPO connector. This demonstration highlights the ability to stream content from one server to another over a 40GbE link. While there are not many servers today that can handle 40GbE due to limitations of their host bus architecture, the Mellanox 40GbE adapters are being shown to demonstrate that the technology is available and the capability to use a single-port adapter to achieve such high bandwidth throughput.

4. Optical Modules

All the optical modules used in the OFC/NFOEC 2011 demonstration are hot-pluggable modules. The enhanced small form factor pluggable (SFP+) optical modules are based upon the SFF-8431 specification created by the SFF Committee for use in high-speed datacom applications such as Ethernet and Fibre Channel. The quad SFP+ (QSFP+) optical modules are based upon the SFF-8436 specification also created by the SFF Committee. More information on QSFP+ and SFP+ can be found on the Ethernet Alliance website (www.ethernetalliance.org) or on the SFF Committee website at www.sffcommittee.org. The CFP optical modules are based upon the CFP multi-source agreement (MSA) which defines the form factor for optical modules that can support 40 Gb/s and 100 Gb/s interfaces for Ethernet and telecom applications. More information on CFP can be found at www.cfp-msa.org.

In this demonstration, Opnext was the supplier of the two 100GBASE-LR4 optical modules used in Ixia and Spirent testers and also supplied many of the 10GBASE-SR

and 10GBASE-LR SFP+ modules. Tyco Electronics was the supplier of the 40GBASE-SR4 optical modules used in the Mellanox 40GbE adapters.

5. Cabling

This goal of this demonstration was to showcase as many cabling options as possible. The cabling suppliers – Amphenol, CommScope, Siemon and Tyco Electronics – were all capable of provide both copper and fiber cabling to meet the needs of the demonstration.   SFP+ direct attach copper cabling (DAC) that was used in the demonstration is based upon the SFF-8431 specification. The MMF and SMF is based upon that specified in IEEE Std. 802.3™-2008 and IEEE Std. 802.3ba.

The new laser optimized MMF is the aqua colored fiber. The traditional MMF is the orange colored fiber. The yellow colored fiber is SMF. For 10GbE, traditional MMF is specified up to a reach of 82 m and the laser optimized MMF for a reach up to 300 m. For 40GbE and 100GbE, the OM3 laser optimized MMF is specified for a reach up to 100 m and the OM4 laser optimized MMF is specified for a reach up to 150 m. Because new parallel fiber is required to support 40GbE and 100GbE, there is no specification for the traditional MMF.   The SMF fiber used in this demonstration with the 10GBASE-LR optics and the 100GBASE-LR4 are specified for a reach up to 10 km.

6. Summary

The OFC/NFOEC 2011 demonstration showcases some of the newest Ethernet technologies available for deployment in data centers, campus backbones and metropolitan networks.   The equipment was hot-staged at Ixia's iSimCity prior to being brought to the show. Within hours of having all the equipment at the hot-stage, the network was up and running.   Shortly after assigning the IP addresses, the equipment was passing traffic. There were no issues with the pluggable optics or in establishing a link once the cabling was connected. The peak bandwidth through the Mellanox switch is 420 Gb/s.   The bandwidth sum for all the equipment in the demonstration is over 1.3 Tb/s.

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7. About the Ethernet Alliance

The Ethernet Alliance is a global community of Ethernet end users, system and component vendors, industry experts and university and government professionals who are committed to the continued success and expansion of Ethernet. The Ethernet Alliance brings Ethernet standards to life by supporting activities that span from incubation to interoperability. For more information, visit www.ethernetalliance.org.

8. Glossary

CFP	100G form factor pluggable
DAC	direct attach copper cabling
EOR	end-of-row
GbE	Gigabit Ethernet
Gb/s	gigabits per second
IP	internet protocol
MMF	multimode fiber
QSFP+	quad enhanced small form factor pluggable
RDMA	Remote Direct Memory Access
RoCE	RDMA over Converged Ethernet
SFF	small form factor
SFP+	enhanced small form factor pluggable
SMF	single-mode fiber
Tb/s	terabits per second
TOR	top-of-rack