THE NEED FOR SPEED! – 40GbE & 100 GbE Connections for Network Growth

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June 2011
Agenda

- High-Speed Ethernet Drivers
- 40GbE
- 100GbE
- Q&A
High-Speed Ethernet Drivers (Source IEEE)

Market Drivers for More Bandwidth

- Content Providers
- Server Virtualization
- Video on demand
- Blade Server
- Service Providers & IXCs
- Fabric Consolidation
- High Performance Computing
- Data Center
- Research and development

IEEE 802.3 Higher Speed Study Group - TUTORIAL
High-Speed Ethernet Server Adoption

Faster servers → Faster aggregation links

x86 Server Units

IEEE 802.3 HSSG April 2007 Interim Meeting

10G server driven by 10G LAN-On-Motherboard integration
At-a-Glance

The Cisco 40GBASE QSFP+ modules are introduced in 3 different flavors:

- The Cisco QSFP-40G-SR4 fiber module for multimode fiber links
- The Cisco 40G QSFP+ to 4 10G SFP+ direct-attach copper breakout cables in lengths of 1, 3 and 5 meters
- The Cisco QSFP-40G-CR4 direct attach copper cables in lengths of 1, 3, and 5 meters
Copper and Fiber reaches

Copper

- Passive Direct-attach Assemblies
  - 1m
  - 3m
  - 5m

Multi Mode

- Parallel (Ribbon) Fiber OM3/OM4
  - 100m OM3
  - 150m OM4
40G Ethernet: highest density in Data Center

40G QSFP+ pluggable transceiver modules are high-density interfaces addressing deployment of high-performance computing in data center clouds. A variety of short-reach copper and longer reach fiber options are made available to enable connectivity between server access, top-of-rack, and end-of-row switches.

Nexus 3000

- 48 1/10GE SFP+ Ports
- 4 QSFP+ Ports
Main features

- Support for 40GBASE Ethernet
- Hot-swappable input/output device that plugs into a 40-Gigabit Ethernet QSFP+ Cisco switch port
- Flexibility of interface choice
- Interoperable with other IEEE-compliant 40GBASE interfaces available in various form factors
- Support for "pay-as-you-populate" model
- Support for the Cisco quality identification (ID) feature which enables a Cisco switch to identify whether the module is certified and tested by Cisco
QSFP+ SR4 modules block diagram

- XLPPI lanes to the host card
- Limiting Amplifiers
- Micro-Controller (Alarm/Control/Monitoring)
- Unified IC
- On-board array of Photo Diodes w/ TIA
- Laser Drivers
- On-board 850nm VCSEL array
- MPO Ribbon Fiber Connector
## QSFP-40G-SR4 specifications

### Cable and reach specifications

<table>
<thead>
<tr>
<th>Cisco QSFP+</th>
<th>Wavelength (nm)</th>
<th>Cable Type</th>
<th>Core Size (microns)</th>
<th>Modal Bandwidth (MHz km)</th>
<th>Cable Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco QSFP-40G-SR4</td>
<td>850</td>
<td>MMF</td>
<td>50.0 (OM3)</td>
<td>2000</td>
<td>100m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0 (OM4)</td>
<td>4700</td>
<td>150m**</td>
</tr>
</tbody>
</table>

* Minimum cabling distance for -SR4 modules is 0.5m, according to the IEEE 802.3ba.
** Considered an engineered link with maximum 1dB allocated to connectors and splice loss.
*** Specified at transmission wavelength.

### Optical transmit and receive power specifications

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Transmit Power (dBm)</th>
<th>Receive Power (dBm)</th>
<th>Transmit and Receive Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco QSFP-40G-SR4</td>
<td>40GBASE-SR4, 4 lanes, 850 nm MMF</td>
<td>1, per lane **</td>
<td>-7.6, per lane</td>
<td>840 to 860</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4, per lane</td>
<td>-9.5, per lane</td>
<td></td>
</tr>
</tbody>
</table>

* Transmitter and receiver power is in average, unless specified.
** Second generation of devices will have a max transmit power of -1dBm per lane for full interoperability with 4 10GBASE-SR interfaces through the ribbon to duplex breakout cables.
QSFP-40G-SR4 typical connectivity

Connecting 2 QSFP+ ports directly with ribbon cables

Connecting 2 QSFP+ ports with breakout cables through duplex patch panels

Connecting a 40G QSFP+ SR4 module to 4 10G SR SFP+ modules
QSFP+ copper cables

- Passive 40GBASE-CR4 copper cables
- Connects to QSFP+ ports at both ends
- Direct-attach cables in lengths of 1, 3 and 5 meters

QSFP-H40G-CU1M
QSFP-H40G-CU3M
QSFP-H40G-CU5M

- Host cards are required to have an electronic dispersion compensation chip
QSFP+ copper breakout cables

- Passive 40GBASE-CR4 to 4x 10GBASE-CU (Twinax) copper breakout cables
- Connects to a QSFP+ port at one end and to 4 SFP+ ports at the other end
- Direct-attach cables in lengths of 1, 3 and 5 meters

QSFP-4SFP10G-CU1M
QSFP-4SFP10G-CU3M
QSFP-4SFP10G-CU5M

- Host cards are required to have an electronic dispersion compensation chip
Changing the way we are using the Internet

- Communication
- Internet Data
- Cable TV
- Wireless Backhaul
Road to 100G

- Large datacenters are already transitioning from 10G to 40G and 100G for connectivity to the SP network
- Small businesses and offices are transitioning from T1/T3 leased lines to Fast/Gigabit Ethernet services
- Residential users are transitioning from DSL to Fast/Gigabit Ethernet FTTH services
- Blooming of muni WiFi, introduction of 4G wireless services, and LTE connect even more new users to the Internet traffic
- Video and mobility are the main drivers behind this shift
At-a-Glance

- First hot-pluggable 100G Ethernet fiber interface module
- First IEEE-compliant CFP module in Cisco portfolio
- IEEE 802.3ba standard was ratified in June 2010
- Enables reaches up to 10km over standard pair of G.652 single-mode fiber
- Enables connectivity for Service Provider Core and large Data Center access
Typical CFP-100G-LR4 deployment cases

- Core
  - CRS
  - CRS

- Metro
  - ASR 9000
    - ASR 9000
  - Cisco Nexus 7000 Series

- Data Center
  - Data Center

Typical links with CFP-100G-LR4, up to 10km
Features

- Supports 100GBASE-LR4 Ethernet
- Hot-swappable input/output fiber interface device
- Plugs into a 100G CFP port of a Cisco switch or router to link the port with the network
- Supports the Cisco quality identification (ID) feature
- Supports digital optical monitoring (DOM) capability
- Power consumption per 100G CFP port is up to 24W
CFP-100G-LR4 Block Diagram

10x10G CAUI lanes to the host card

Gearbox

4 Lasers at 4 different wavelengths

4x25G lanes

4 Receivers

Optical Mux

Optical Demux

Alarm/Control/Monitor Block
Optical and Fiber Specifications

CFP-100G-LR4 transmits and receives 4 wavelengths at 25G each, enabling 10km reaches over single-mode fiber. Fiber interface supports SC duplex connectors. Only flat-polished connectors are supported (SC/PC or SC/UPC). Angled connectors (SC/APC) shall not be used.

<table>
<thead>
<tr>
<th>Transmit Power (dBm)</th>
<th>Receive Power (dBm)</th>
<th>Transmit and Receive Wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>4.5 per lane</td>
<td>-4.3 per lane</td>
<td>4.5 per lane</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Four lanes,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L0 (1295.56 ±1.03)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L1 (1300.055 ±1.035)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L2 (1304.585 ±1.045)</td>
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<tr>
<td></td>
<td></td>
<td>L3 (1309.14 ±1.05)</td>
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</tbody>
</table>
A’s

- Currently being deployed globally
- 12 sites this year, 18 in total
- That’s a great suggestion – I’ll forward it to the Transceiver Business Unit
- Yankees > Reds @ 7:10 pm
- Probably Not