Switch Designs for 50GbE and 200GbE

Scott Kipp

kipp_50GE_NGOATH_01_0116.pdf

January 2016
Supporters

• Rob Stone, Broadcom
• Vittal Balasubramanian, Dell
• Mike Dudek, QLogic
• Ali Ghiasi, Ghiasi Quantum
• Scott Sommers, Molex
• Nathan Tracy, TE
• Tom Palkert, Molex
50G Lanes are Part of the Bigger Picture

50G technology has Broad Market Potential

- In addition to going faster, the industry is developing 128+ ports on switch ASICs
- QSFP supports only 144 lanes in 1U
- The industry will move to higher lane density than the QSFP can support in the 50G era

GRAPHIC SOURCE: 2015 ETHERNET ROADMAP
More Ports at Higher Speeds

25Tb/s Switch ASIC

128 Ports of 25Gb/s Lanes
128 Ports of 10Gb/s Lanes
256 Ports of 100Gb/s Lanes = 25.6Tb/s

SOURCE: BROADCOM PRESENTATION FROM ETHERNET ALLIANCE TEF’2014
Modules Types and Lane Counts

- SFP = 1 lane/module
- QSFP, CFP4, microQSFP, CFP2 = 4 lanes/module
- CFP2, QSFP-DD, On Board Optics = 8 lanes/module
- On Board Optics = 12 lanes/module

<table>
<thead>
<tr>
<th>ASIC Port Count</th>
<th>4X</th>
<th>8X</th>
<th>12X</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>16</td>
<td>8</td>
<td>5 + 4</td>
</tr>
<tr>
<td>128</td>
<td>32</td>
<td>16</td>
<td>10 + 8</td>
</tr>
<tr>
<td>192</td>
<td>48</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td>256</td>
<td>64</td>
<td>32</td>
<td>21 + 4</td>
</tr>
</tbody>
</table>
64 Port Switch Designs

640Gb/s of Throughput with 10G Lanes ~2008

48 SFP + 4 QSFP

16 QSFP

QSFP is ~3X the lane density of SFP
128 Port Switch Designs
1.28Tb/s of Throughput at 10G. 3/2 Tb/s at 25G ~2015

32 QSFP

32 microQSFP

microQSFP is ~4X the lane density of SFP

8 SFP + 10 12-lane On Board Optics

10 24-fiber MPO Receptacles
192 Port Switch Designs

4.8 Tb/s at 25G, 9.6 Tb/s at 50G ~2017?

48 microQSFP

16 12-lane On Board Optics

16 24-fiber MPO Receptacles

24 8-lane On Board Optics

24 16-fiber or 24-fiber MPO Receptacles
256 Port Switch Designs
12.8 Tb/s at 50G. 25.6Tb/s at 100G >2020?

64 microQSFP

*All these designs will be very challenged thermally and by board real estate. microQSFP has enhanced thermal properties compared to SFP and QSFP.

24 QSFP + 16 12-lane On Board Optics

32 8-lane On Board Optics

32 16-fiber or 24-fiber MPO Receptacles
Module Tradeoffs

Flexible Solutions are mixing On Board Optics (OBO) and Pluggable Optics

- SFP to QSFP to microQSFP to 8-lane OBO

- SFP to QSFP to microQSFP to 12-lane OBO
Implications of High Port Count Switches

• Switches are going away from SFP (50GbE) modules to QSFP and microQSFP to OBO depending on the port count

• Not all switches will be based on the highest port count ASIC, but most switches are expected to be 128 ports or more for high density
  – Thus not SFP+

• The 50G Study Group needs to consider that switch designs will be based on multi-lane ports that will be broken out
Electrical Interface Implications

- High port count switch ASICs are scaling to meet the needs of hyperscale data centers
- Multi-Lane ports and OBO must support multiple electrical interfaces and FEC scenarios
  - CCAUI-4
  - CAUI-2
  - LAUI
Interoperability Challenges

- We need to define the PMDs (CR, SR, LR, ...) to support interoperability between many module form factors and OBO.
- This presentation shows how 50/100/200/400G technology will be used in a wide variety of products that expands the broad market potential of the technology.
Thank you!