Next Generation Connectivity for the Data Center

Chris Putman – 7 November 2013
Outline

Bandwidth and Data Center Trends

Current Standards and Technologies

Looking Ahead
Today’s Data Center and Emerging Trends and Technologies

Cabling Infrastructure impacts the success of implementation
**Infrastructure Standards for the Data Center**

<table>
<thead>
<tr>
<th>Standard</th>
<th>TIA/EIA-942-A</th>
<th>EN 50173-5</th>
<th>ISO 24764</th>
</tr>
</thead>
<tbody>
<tr>
<td>Published</td>
<td>2012</td>
<td>2010</td>
<td>2010</td>
</tr>
<tr>
<td>Copper</td>
<td>Category 6A</td>
<td>Class E_A</td>
<td>Class E_A</td>
</tr>
<tr>
<td>Fiber</td>
<td>OM4 OS1</td>
<td>OM3 OS1</td>
<td>OM3 OS1</td>
</tr>
<tr>
<td>Connector</td>
<td>LC (1-2 fibers) MPO (&gt; 2 fibers)</td>
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</tr>
</tbody>
</table>
Consistent migration towards higher performance cabling

Source: BSRIA Annual Report, April 2013
Data Center Ethernet Market Trend

Source: Dell'Oro 2013
Data Center Cabling and Planning

- Cabling containment planned for Growth, not Replacement
- Future-proofing is critical
10G Serial to 40/100G Parallel Upgrade

Preserve Your Investment

- Reuses trunks
- Reuses panels
- Reuses racks
- No re-termination
- Reversible

360DM-4X4P-LS
InstaPATCH® 360 4x4 Parallel Module
40/100G Today: Multimode or Singlemode?

<table>
<thead>
<tr>
<th></th>
<th>Multimode module (40GBASE-SR4)</th>
<th>Singlemode module (40GBASE-LR4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Density</strong></td>
<td>16 ports/card</td>
<td>3-4 ports/card</td>
</tr>
<tr>
<td><strong>Power (40G)</strong></td>
<td>~1.5W/port</td>
<td>~8W/port</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>~$500</td>
<td>$7,000</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>150m* (OM4)</td>
<td>&gt; 10km</td>
</tr>
</tbody>
</table>

*40GBASE-eSR4 extends distance to 400m on OM4
Multimode Fiber QSFP+
Extended Reach 40GBASEeSR-4

- Complies to 40GE and 10GE specs – 300m (OM3) / 400m (OM4)
  - Delivers 1 x 40GbE

OR

- Delivers 4 x 10GbE

- Alternative to SM 40GBASE-LR4
  - Lower CAPEX: <1/4 price

- Lower OPEX: <1/2 power dissipation

- 2.5X panel density increase on switches for 10GBASE-S

16 SFPs = 16 × 10G = 160G

10 QSFPs = 40 × 10G = 400G or 10 QSFPs = 10 × 40G = 400G
# IEEE 802.3ba and 100GbE: Current Fiber PMDs and their Applications

## Multimode

<table>
<thead>
<tr>
<th>PHY</th>
<th>Support</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>100GBASE-SR10</td>
<td>20 Lanes @ 850 nm ≤ 100 m with OM3 ≤ 150 m with OM4</td>
<td>Switch Uplink</td>
</tr>
</tbody>
</table>

## Singlemode

<table>
<thead>
<tr>
<th>PHY</th>
<th>Support</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>100GBASE-LR4</td>
<td>4(\lambda) CWDM @ ~1310 nm ≤ 10 km with OS1/OS2</td>
<td>Backbone/Carrier</td>
</tr>
<tr>
<td>100GBASE-ER4</td>
<td>100G @ ~1550 nm ≤ 40 km with OS1/OS2</td>
<td>Backbone/Carrier</td>
</tr>
</tbody>
</table>
Future Happenings in 400G Ethernet (IEEE 400G Study Group)

400G Ethernet Call For Interest in March

- Successfully formed a Study Group to investigate
  - technical feasibility, economic feasibility, broad market potential
  - possibly develop objectives for new project
- Single-mode fiber and multimode fiber solutions in consideration
  - A current theme to reuse / repackage existing 100GE via parallel optics
    - 4 x 100G-LR4 (8 SM fibers)
    - 4 x 100G-SR4 (32 MM fibers)
  - Parallel fiber transmission likely on single-mode fiber
Category 8 and the RJ-45

• RJ-45 has been a huge success story
• Long the industry favourite for datacom cabling
• Prevalent in other industries
  – Facilities (access control, building automation)
  – Consumer electronics
• Where Ethernet goes, so goes the RJ-45
• Alternate design connectors have met with very limited success to date

• Category 8 objective is to use the RJ-45
40GBASE-T Application
DC Application for End/Middle of Row

- Alternative to CR-4 “Direct Attach” and 40GBASE-SR4 for Server Access
  - CR-4’s 7m reach restricts to ToR architecture
  - Fiber alternative is available but remains comparatively expensive

- Standards development has begun
  - 30 meter maximum length - 2-connector channel
  - RJ45 Connectivity for backwards compatibility
  - Bandwidth 2 GHz (ISO/IEC - 1600 MHz, w/ 2GHz F.F.S.)
Summary

• The physical layer can have significant impact on the success of implementing new technologies in the DC
  – Bandwidth, scalability and performance are key
  – Virtualization, Cloud and SDN layers need high bandwidth, low latency infrastructure

• Data Center cabling deployments moving rapidly to higher bandwidth platforms

• Standards work underway to develop next phase
  – 40G over twisted pair
  – Cost-effective 100G over parallel multimode fibre
  – 400G call for interest in IEEE; 1Tb roadmap for Fibre Channel
Thank you!