Market drivers for 100 Gigabit Ethernet

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Agenda

• 100 GbE early adopters
• (1G → 10G) vs. (10G → 100G) transitions
• 100 GbE PMD considerations
Typical Data Center Architecture: media types, span lengths and data rates

- SMF MMF 100+m
- MMF 100+m
- Copper ~ 30m

DC Core
DC Aggregation
DC Access

100 GbE
10 GbE

Data rates 2006
10 GbE EtherChannel
100 GbE Early adopters
10 GbE/10 GbE EtherChannel

Data rates 2010+ (?)
100 GbE

GbE
GbE/10GbE

Cisco Public 3
Typical Enterprise Campus Architecture: media types, span lengths and data rates

**Desksops**
- **Cat5 copper**: 100m
- **MMF (FDDI/ OM1)**: 220m to 550m
- **MMF/ SMF**: 550m/ 10km
- **SMF**: 10km-Metro

**Data rates 2006**
- **FE/GE**

**Data rates 2010+ (?)**
- **GbE EtherChannel**: 10 GbE
- **10GbE EtherChannel**: 100 GbE

**Core**
- ~2:1

**Distibution**
- ~6:1
- 100G

**Access**
- ~10:1

**In building backbones: wiring closet uplinks**

**Campus backbones: distribution uplinks**

- **UkFIA 1996**
- **Nouri 1996**
- **Diminico 1996**
- **Flatman 1999**

Graphs showing spans and data rates.
## Transition comparisons: (1G → 10G) vs. (10G → 100G)

<table>
<thead>
<tr>
<th>Differences</th>
<th>1G→10G</th>
<th>10G→100G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Campus access</td>
<td>Fueled by 10/100/1000 copper to the desktop</td>
<td>10G copper to the desktop unlikely anytime soon</td>
</tr>
<tr>
<td>Data Center access</td>
<td>Gig NICs in servers (data center access) accelerate transition to 10G in DC</td>
<td>10G adoption pace on servers TBD</td>
</tr>
<tr>
<td>Access technologies</td>
<td>Copper GigE established low cost technology for access</td>
<td>Copper 10G technology challenges may slow down 10G server adoption</td>
</tr>
<tr>
<td>Data Center densities</td>
<td>48-ports 1G cards are available → 10G much needed to aggregate</td>
<td>When will true high density 32+ ports be available on 10 line cards? SFP+ may play a role in accelerating the need for 100G aggregation.</td>
</tr>
<tr>
<td>SP metro transport</td>
<td>10G transport was well understood and based on mature technologies</td>
<td>The technical/economical case for 100G metro transport is a question mark → traction in SP?</td>
</tr>
</tbody>
</table>
PMD Mix: 1 GbE (mature) vs. 10 GbE (growth)

GbE

~75% multimode < 550m
~20% single mode up to 10 km

10GbE - 2005

~50% multimode < 550m
~45% single mode up to 10km

10GbE - 2007

- Slow Growth
  - 35% CX4
  - 25% SR
  - 25% LX4/LRM
  - 3% LR
  - 3% Others

- Fast Growth
  - 45% CX4
  - 25% SR
  - 25% LX4/LRM
  - 3% LR
  - 3% Others
### 1 Gigabit -> 10 Gigabit PMD Migration Rates

(= Transceiver units at 10G/Transceiver units at 1G)

#### 2005

<table>
<thead>
<tr>
<th>Core</th>
<th>SP PMDs</th>
<th>Enterprise PMDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>15%</td>
<td>1%</td>
</tr>
<tr>
<td>2006</td>
<td>25%</td>
<td>3%</td>
</tr>
</tbody>
</table>

#### 2H/2006 Forecast

<table>
<thead>
<tr>
<th>Core</th>
<th>SP PMDs</th>
<th>Enterprise PMDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>25%</td>
<td>5%</td>
</tr>
</tbody>
</table>

- **Single Mode**
  - WDM
  - ZR
  - ER
  - LR

- **Multi Mode**
  - SX
  - LX4
  - SR

- **T**
  - CX4

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**Legend**

- **WDM**
- **ZR**
- **ER**
- **LR**
- **LX4**
- **SX**
- **SR**
- **CX4**

**Note:**

- **“Edge”**
  - # of 1 GbE copper transceiver/
  - # of 10GBASE-CX4 transceiver/

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Source: Cisco Public

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PMD considerations

• ~99% of the 1 GbE fiber market is covered by PMDs reaching below 10km.

• ~95% of the 10 GbE market is served by interfaces below 10km

• It makes sense to limit the numbers of PMDs to reduce transceiver market fragmentation.

• An interface operating on both multimode and single mode fibers up to 10 km (ala 10GBASE-LX4) seems the best candidate to ensure the widest possible market coverage (>95%).
Summary

- 1G → 10 GbE adoption faster for core applications. It is reasonable to expect more of the same for the next transition 10G → 100 GbE. **Service providers will be early adopters.**

- The more 10GbE gets pushed to the edge (10Gbe NICs) the stronger the need for 100 GbE in the aggregation layer and above. **Data centers will be early adopters.**

- In **campus** applications 100 GbE will be adopted mostly for **distribution and core uplinks** (lack of 10 GbE desktop solutions).

- 100 G is the recommended MAC speed for higher speed Ethernet in order to meet the target downlink-uplink oversubscription ratios in data center and enterprise applications.