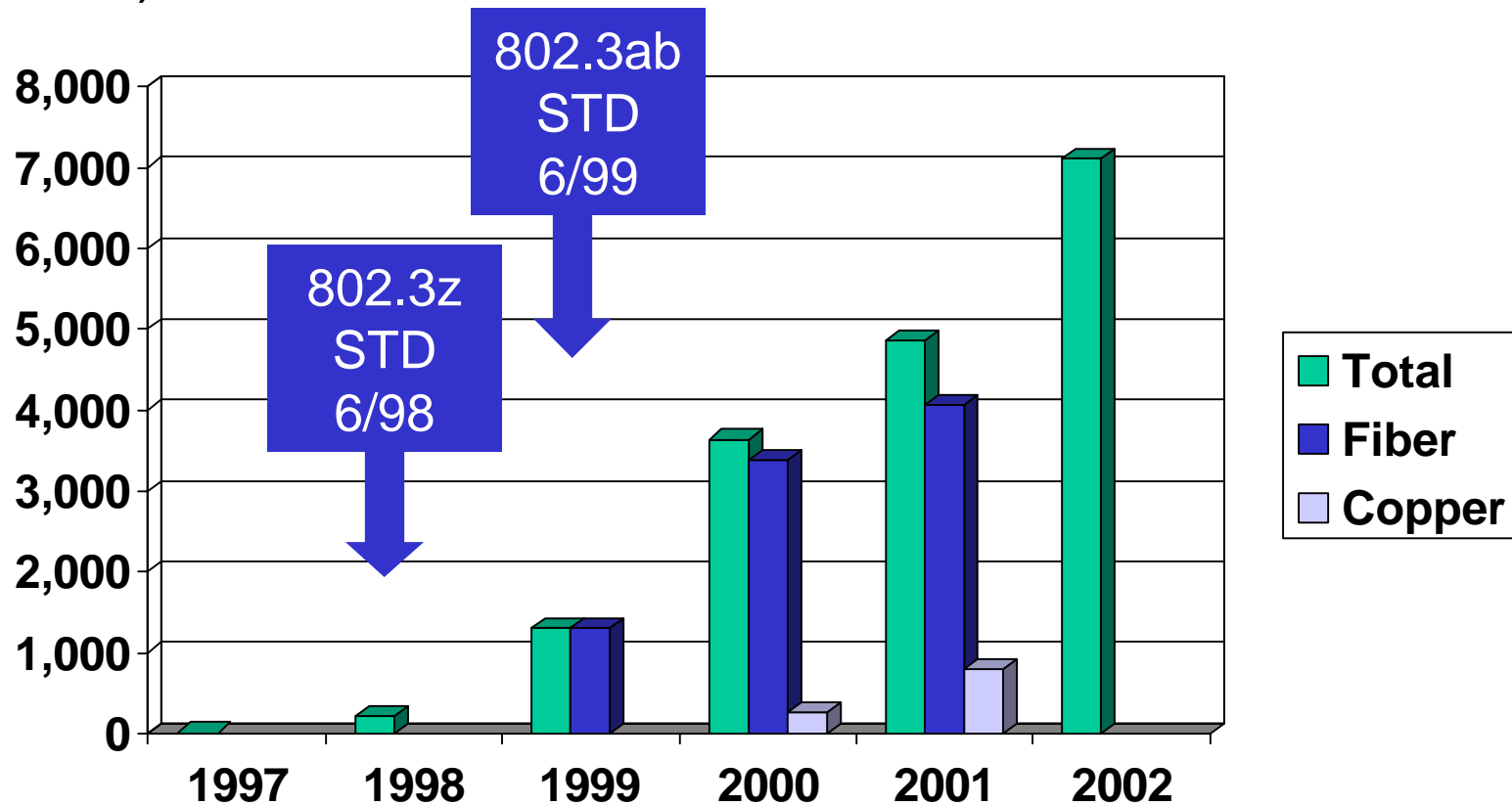# Customer and Market Issues: 10 Gbps Ethernet on Category 5 or Better Cabling

Bruce Tolley

Cisco Systems, Inc

btolley@cisco.com

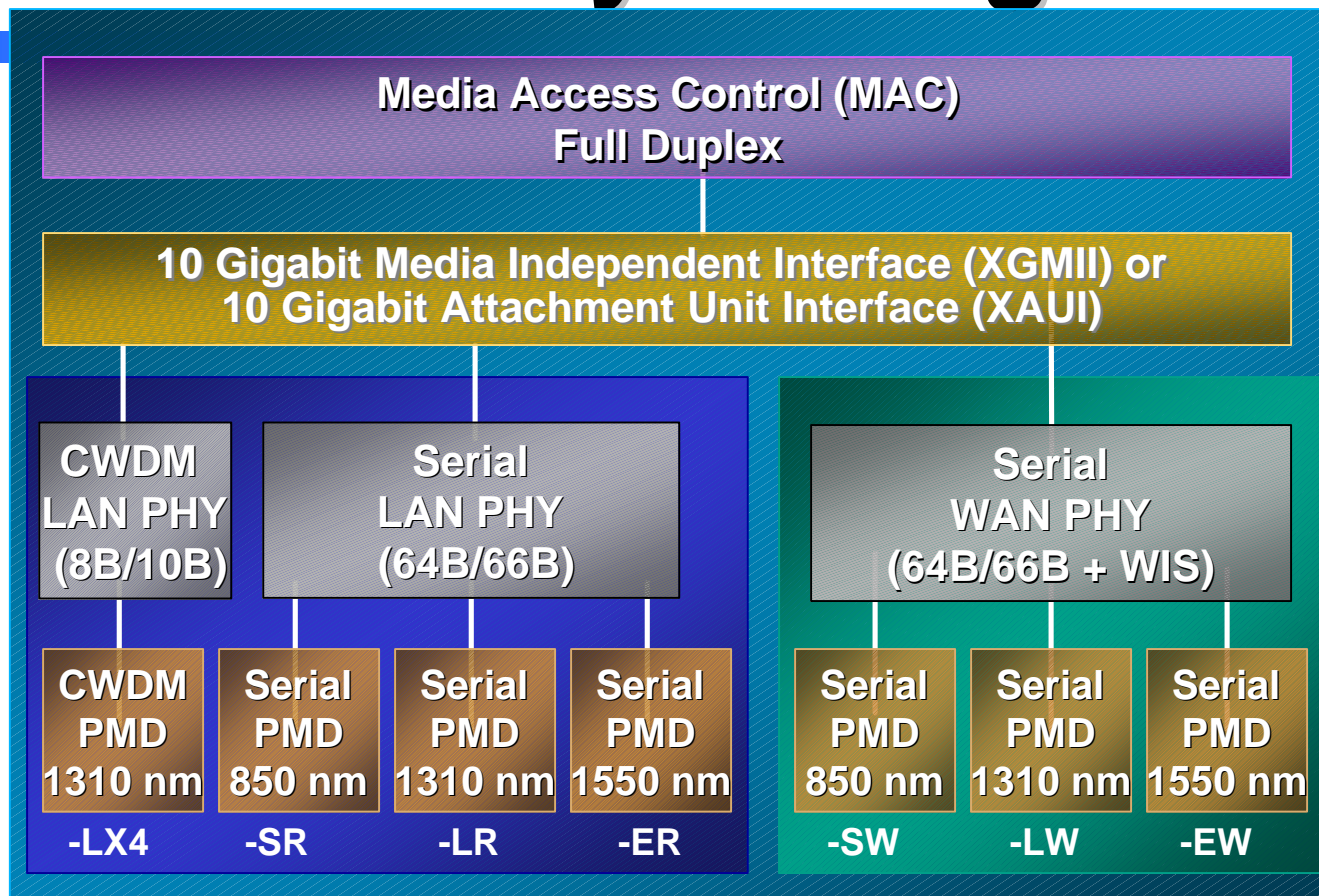# GbE Switch Ports: Fiber vs Copper

Ports (000s)

Source: Dell'Oro 2002   **IEEE 802.3 Interim January 2003**

Success of GbE on Copper

- ## It is 10/100/1000 Mbps
- ## It runs Cat5, 5e and 6
- ## It does not obsolete the installed base
- ## It does not require both ends of the link to be upgraded at the same time
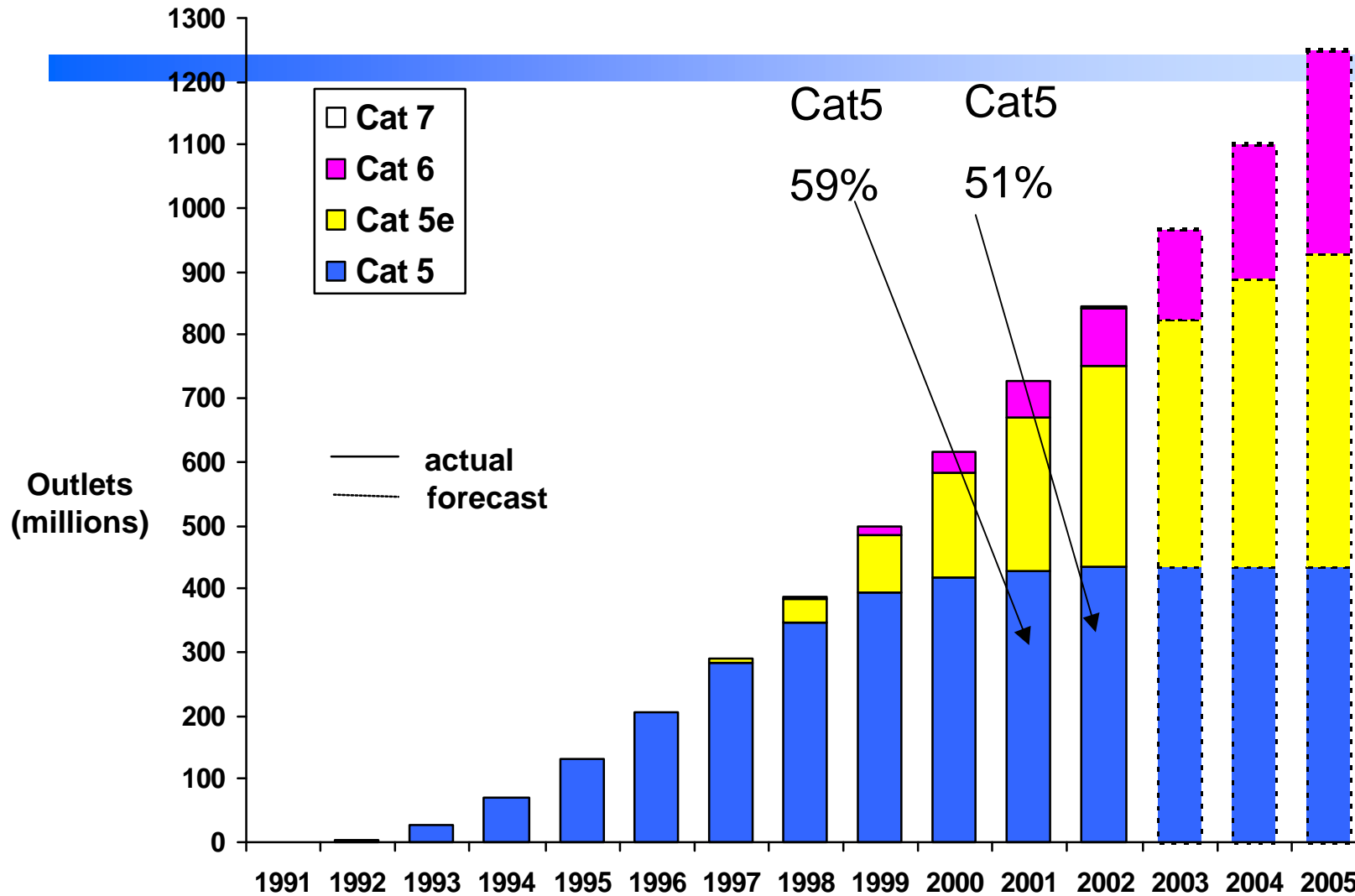
10 GbE Layer Diagram

Media Access Control (MAC)
Full Duplex

10 Gigabit Media Independent Interface (XGMII) or
10 Gigabit Attachment Unit Interface (XAUI)

CWDM
LAN PHY
(8B/10B)

Serial
LAN PHY
(64B/66B)

Serial
WAN PHY
(64B/66B + WIS)

CWDM PMD 1310 nm	Serial PMD 850 nm	Serial PMD 1310 nm	Serial PMD 1550 nm	Serial PMD 850 nm	Serial PMD 1310 nm	Serial PMD 1550 nm
-LX4	-SR	-LR	-ER	-SW	-LW	-EW

Source: Cisco Systems

Pluggable 10 GbE Modules: The Surfeit of SKUs

10GBASE PMDs	XENPAK XAUI	X2/XPAK XAUI	XFP
-SR		X	X
-LR	X	X	X
-ER	X		X
-LX4	X	X	
-CX4	X	X	
-T	X	X	X
CWDM, DWDM	X	X	X

Please: No new pluggable for 10GBASE-T!

Cumulative World-wide Shipments

Estimated World-wide Installed Base End CY 2002

Note: Ignored Cat 3 (~7% installed base) will inflate Cat 5 share

total outlets 680 million

Cat 5e/ new Class D 45%

Cat 5/ old Class D 41%

FTTD 0.4%

Cat 6/Class E 13%

Cat 7/Class F 0.2%
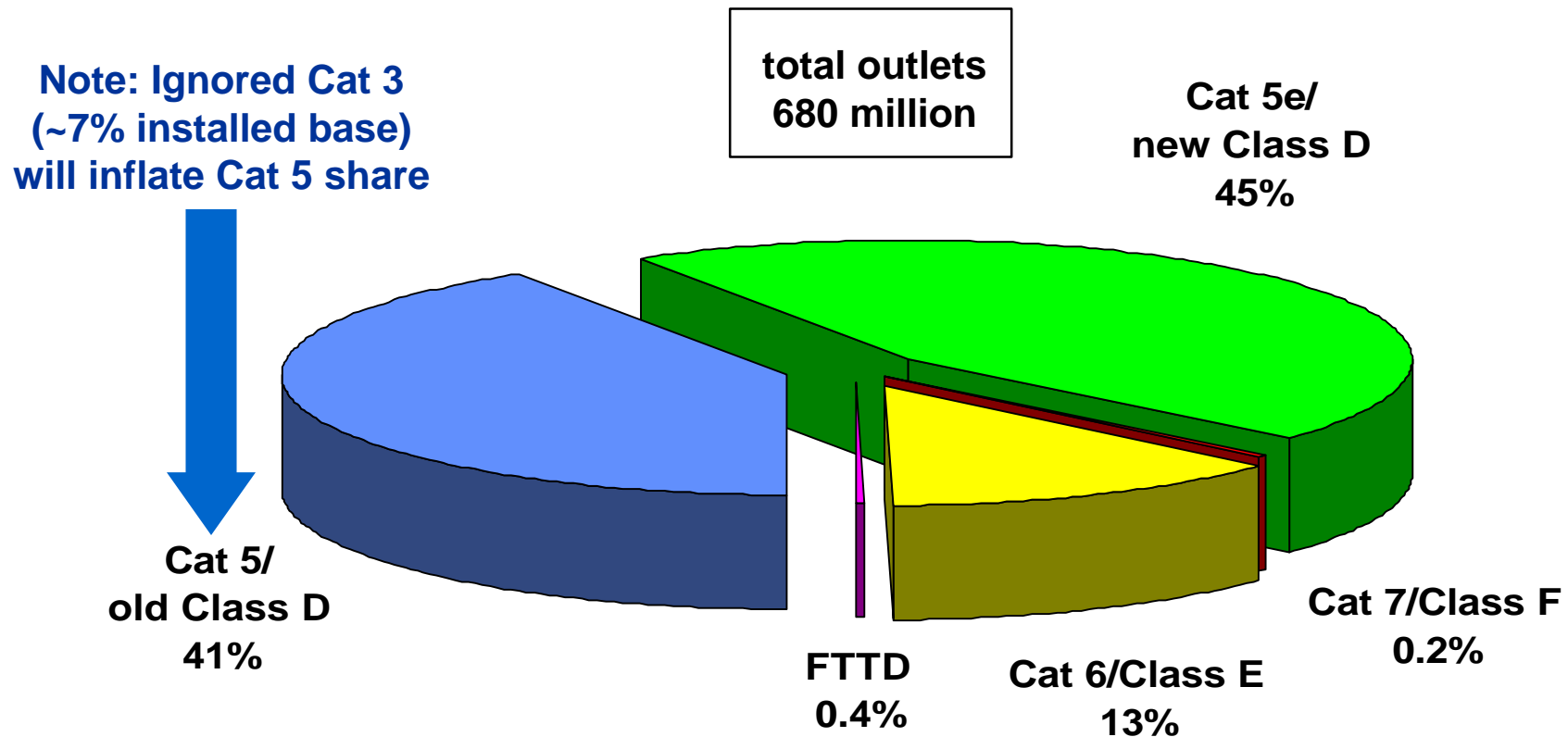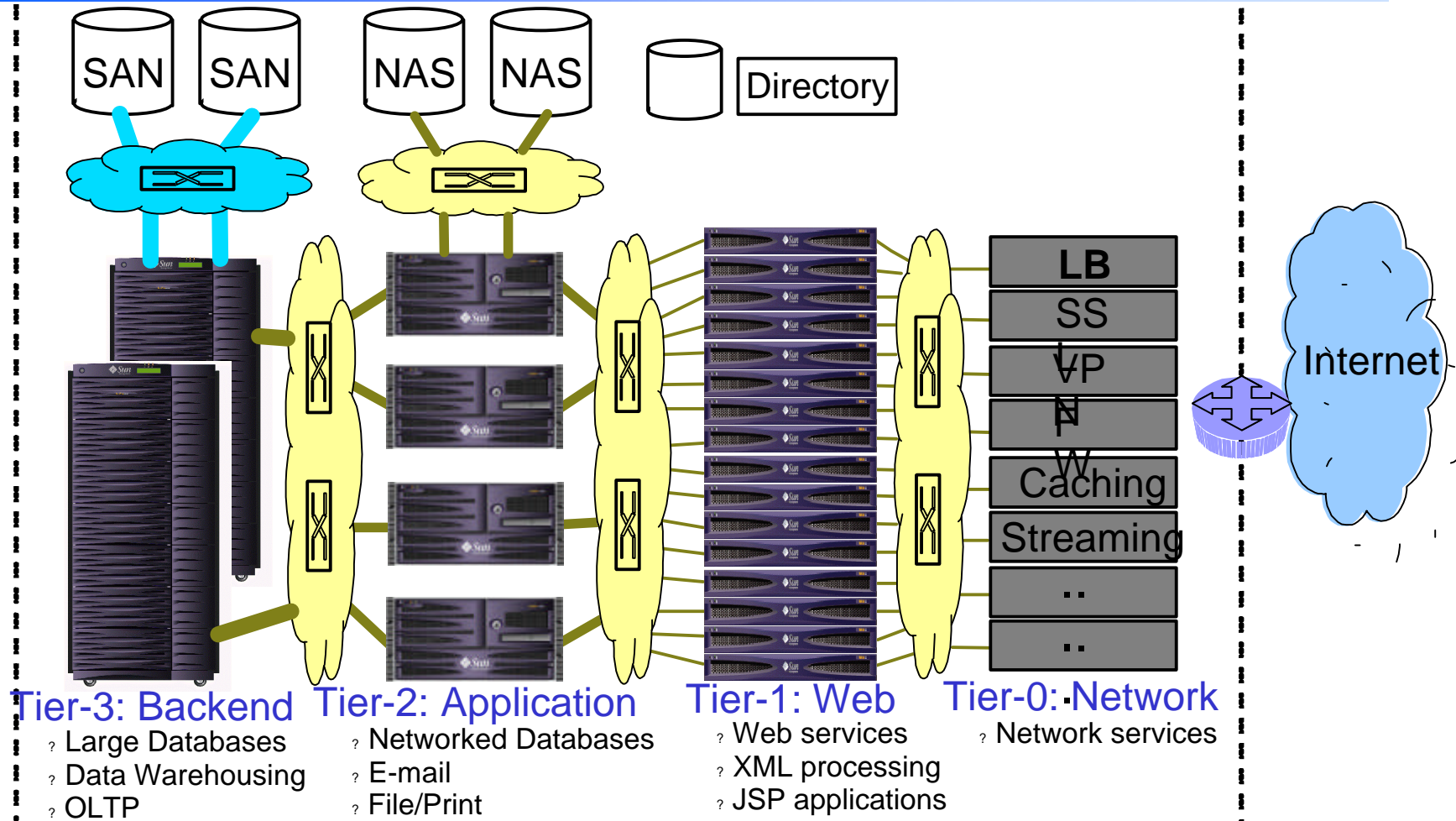
Source: LAN Technologies (2003)

10 GbE Copper Applications

- **Large majority of 10 GbE copper ports will be enterprise for deployment in-building**
  - –**Constrained by installed base and by structured cabling standards**
- **Significant and material portion will be data center deployment**
  - –**Includes switch to server, switch to switch in rack or same room**
  - –**Includes switch to DWDM in same room**
- **Low-cost 1000BASE-T to the desk is key market driver**

10GBASE-T Applications

Application	10GBASE-fiber	10GBASE-T	10GBASE-CX
In-building horiz copper	No	Yes	No
In building vertical	Yes LR on SM Need -LX4 for MM	Most likely No	No
Data center/Server farms	Yes: -SR high end if cheap enough	Yes: But not for 2 or 3 years. 15 m not far enough	YES: XENPAK, X2, XPAK slots
External backplane for stackables	Not likely	Yes in future	Yes
Outside bldg	Yes	No	No

Data Centers: Service Point Architecture

Tier-3: Backend
- ? Large Databases
- ? Data Warehousing
- ? OLTP

Tier-2: Application
- ? Networked Databases
- ? E-mail
- ? File/Print

Tier-1: Web
- ? Web services
- ? XML processing
- ? JSP applications

Tier-0: Network
- ? Network services

SAN SAN NAS NAS Directory

LB
SS
VPN
FW
Caching
Streaming
..
..

Internet

10GBASE-T

- **Priority 1**
  - 100 meters on four pairs of Category 5 or better cabling
  - Preserve existing investments in datacenter and structured cabling
- **Priority 2**
  - 10GBASE-T PHY that can support autonegotiation 1Gbps/10Gbps
  - Support for XAUI (the installed base of 1/10 GbE switches *will* have XAUI slots)
- **Priority 3**
  - Include support for short reach applications (less than 100 meters)

Conclusions

Request SG to study technical feasibility of

1) Support for Category 5

2) Support for Category 5e

3) Support for XAUI electrical interface

4) Support for negotiation between 1 and 10 Gbps