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

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10 GbE First Principles

- **It's too expensive***
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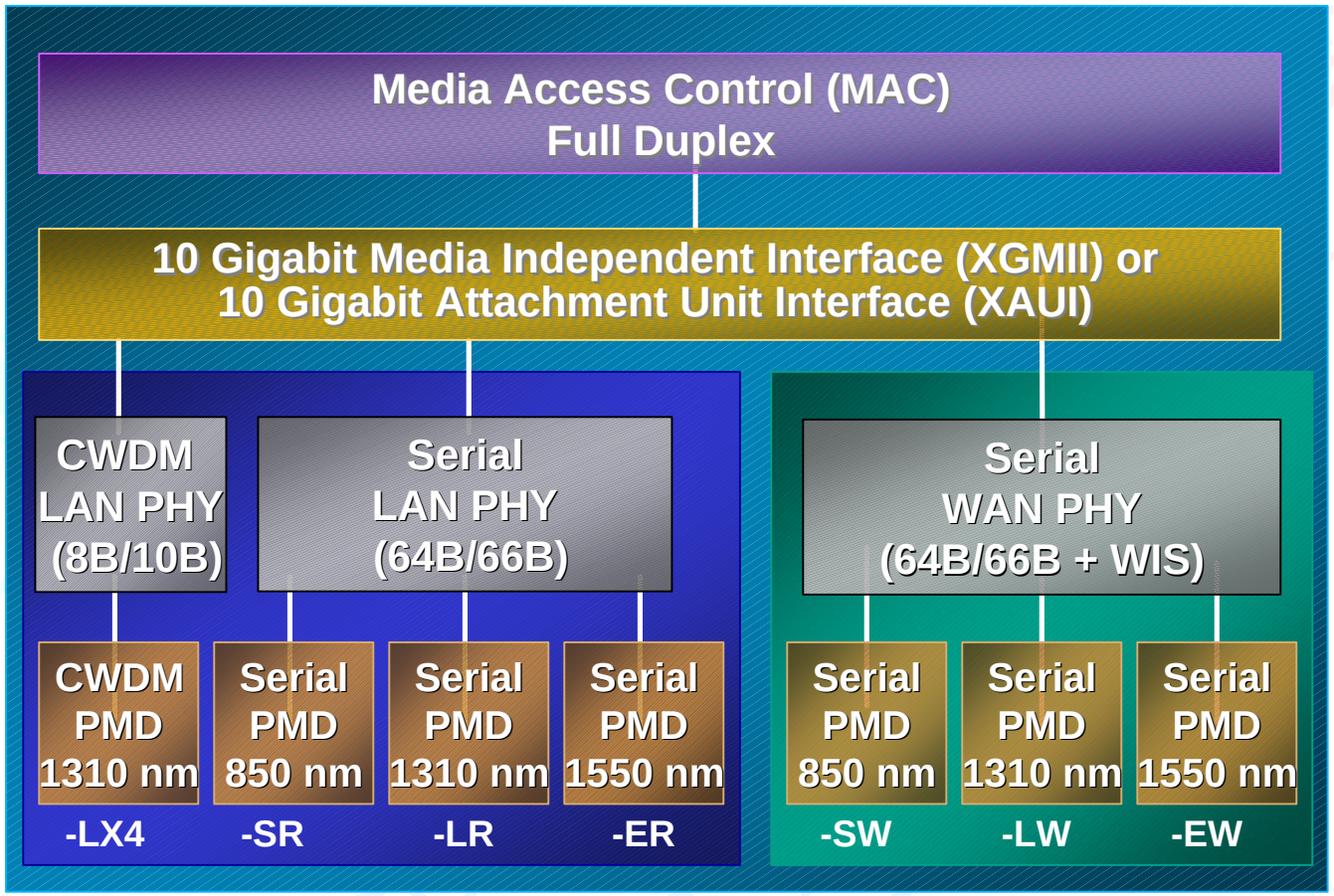
- **We need –LX4 to support installed FDDI grade MM fiber**
- **It does not support installed Cat 5 copper**

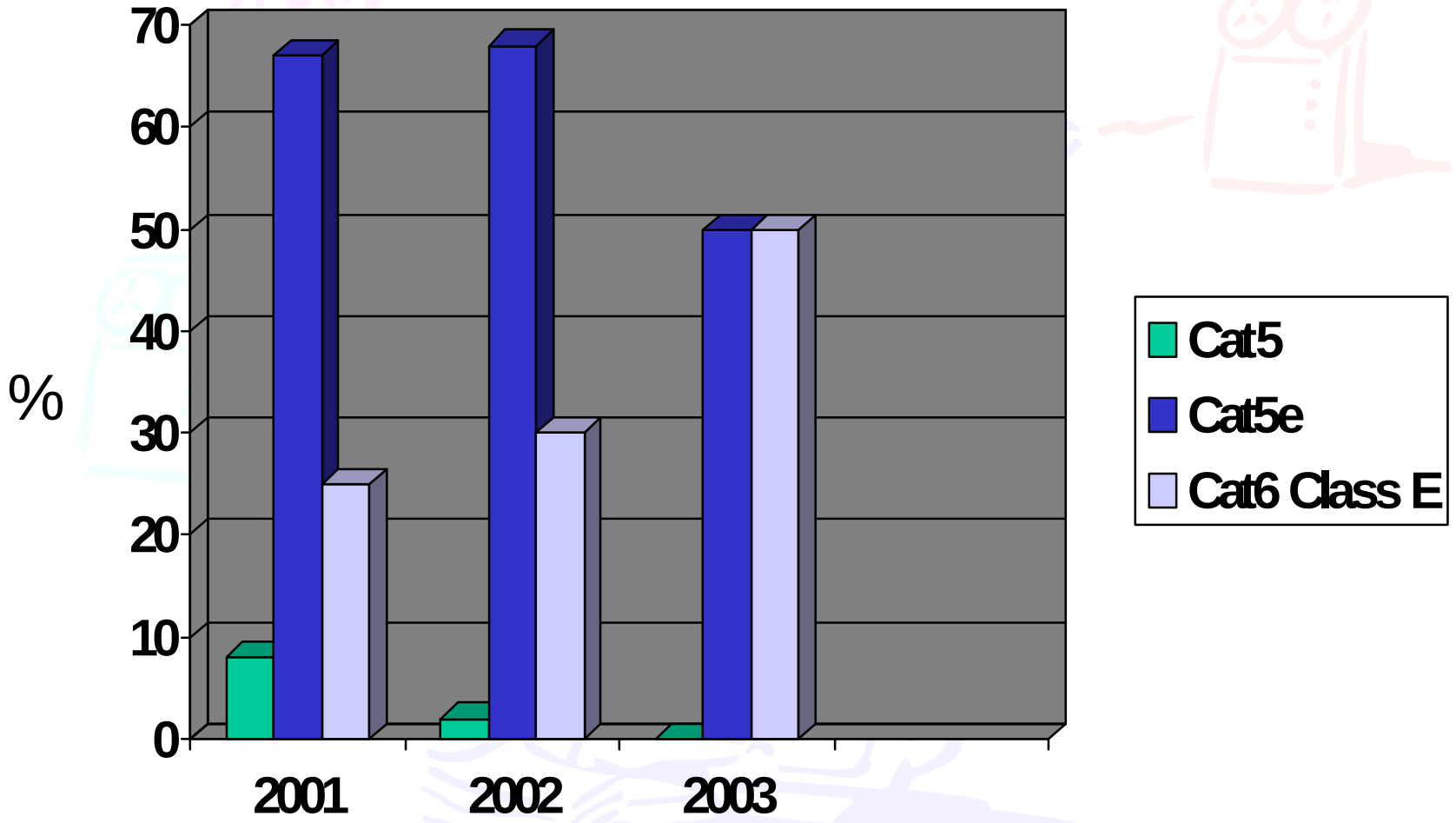
Total cost= transceiver + media + system

10 GbE Layer Diagram



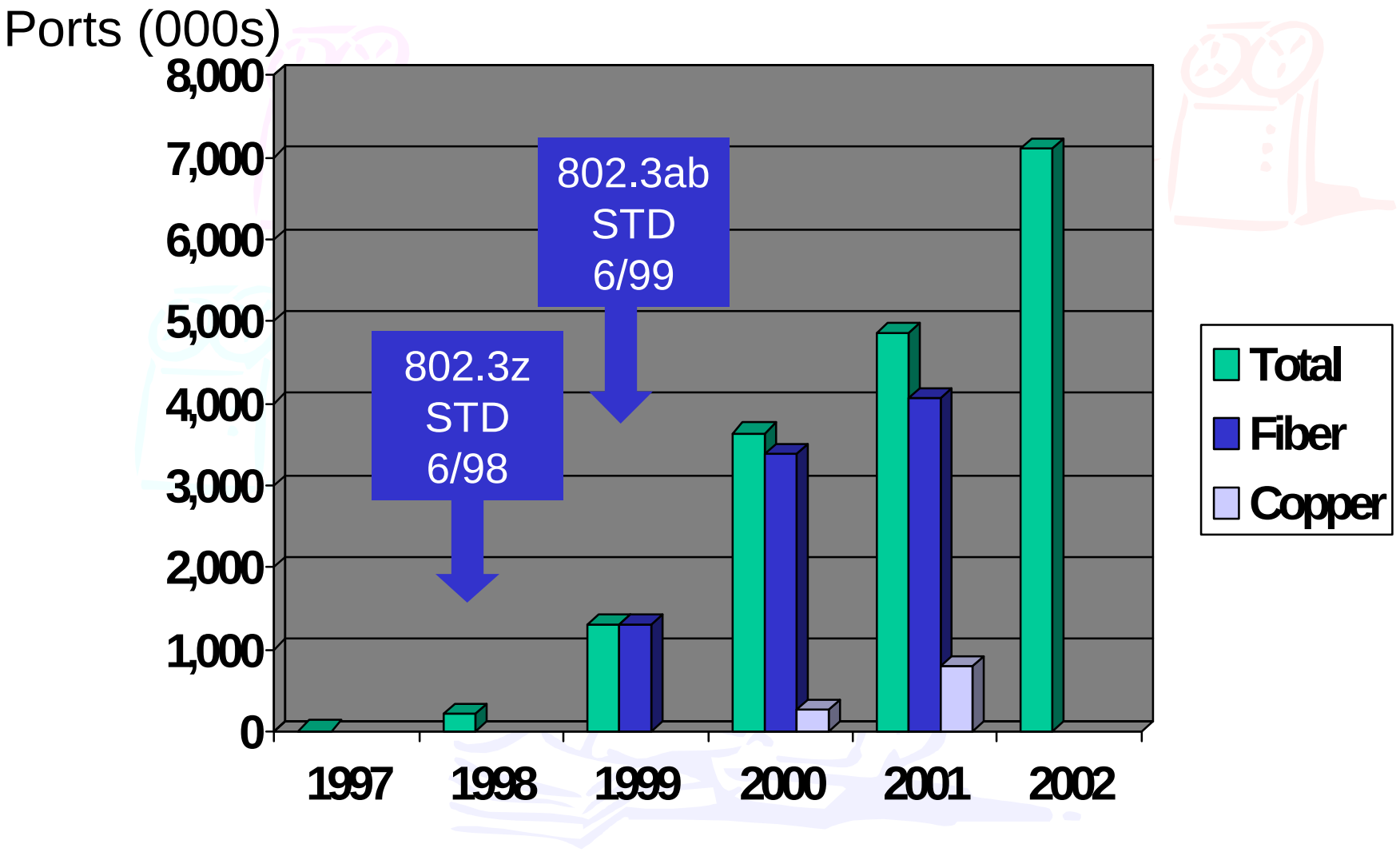
Source: Cisco Systems

Projected % Copper Shipments by Category



Source: BSRIA Report 16383/02 Dec 2001

GbE Fiber vs Copper



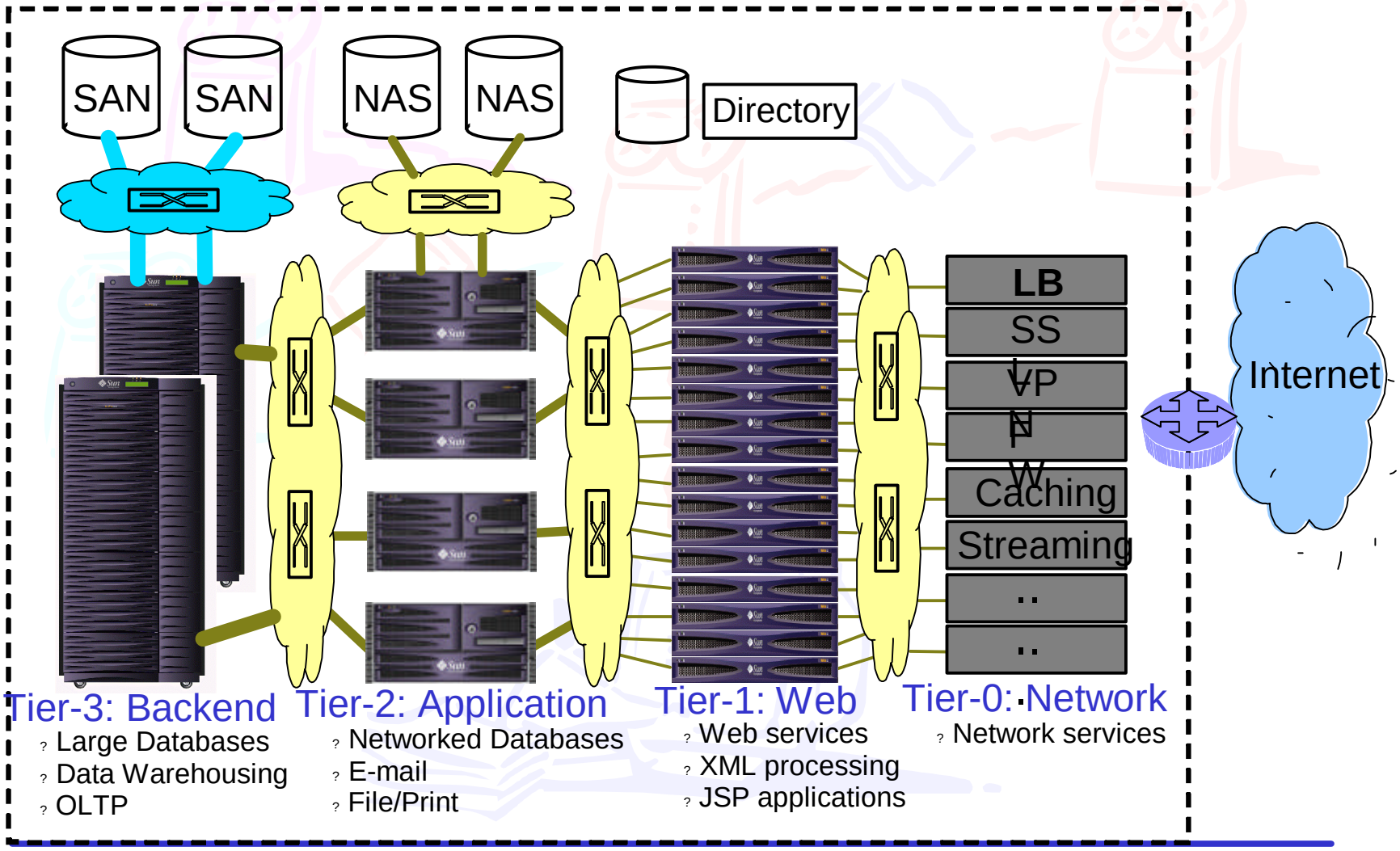
Source: Dell'Oro 2002

10 GbE Applications

- **Large majority of 10 GbE 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, less constrained by installed base and less constrained by structured cabling standards**
  - **–Includes switch to server, switch to switch in rack or same room**
  - **–Includes switch to DWDM in same room**
- **Material portion will be enterprise, building-to- building and service provider/metro ports (outside the building)**
- **Low-cost 1000BASE-T to the desk is key market driver**

In other words: Majority of the market is enterprise/data center

Data Centers: Service Point Architecture



Source: S. Muller, Sun

End-Node and Data Center Performance

- Factors driving the need for increased performance
  - Scaling Tiers 1 and 2
  - Collapsing Tiers 0 and 1
  - Storage, iSCSI
- Mechanisms to increase performance
  - Hardware-assisted CPU load balancing
  - TCP/IP off load engines
  - Protocol acceleration/termination
  - Remote direct memory access protocol RDMA

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:
Between buildings, metro	Yes	No	No

10GBASE-T vs 10GBASE-CX4

CX4

- Differentiated in time: NOW
- Differentiated in application: will not be used in structured cabling, will not be used by “late majority” technology adopters
- Will be used within and between racks (up to 15 meters)

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 1000BASE-T, either autonegotiate or configure**
  - **–Support for XAUI (the installed base of GbE switches *will* have XAUI slots)**
- **Priority 3**
  - **–More than one PHY to support more than one application**

Conclusions

We need 10GBASE-T

- **To grow the 10 GbE market**
- **To lower the cost of 10 GbE solutions**
- **To support the installed base of Cat 5 or better copper cabling**

We should form a study group