

10 Gigabit Ethernet

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Paul A. Bottorff
Director, Switching Architecture
Bay Architecture Lab
Nortel Networks

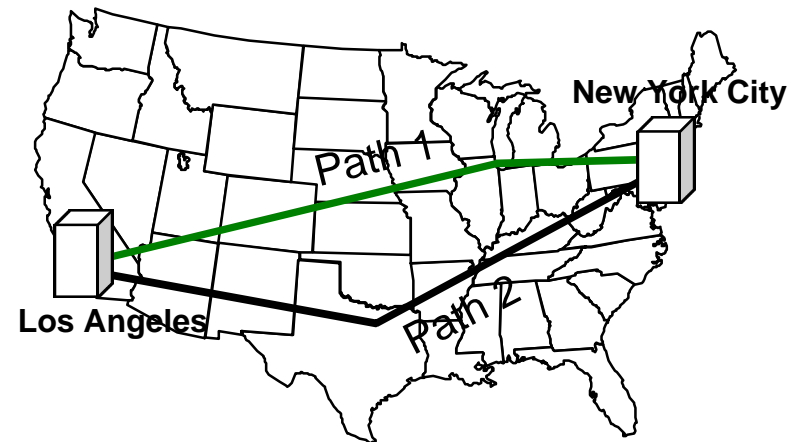
10 Gigabit Ethernet Backbones

Campus Backbones

Access Networks

Metropolitan Networks

Wide Area Networks

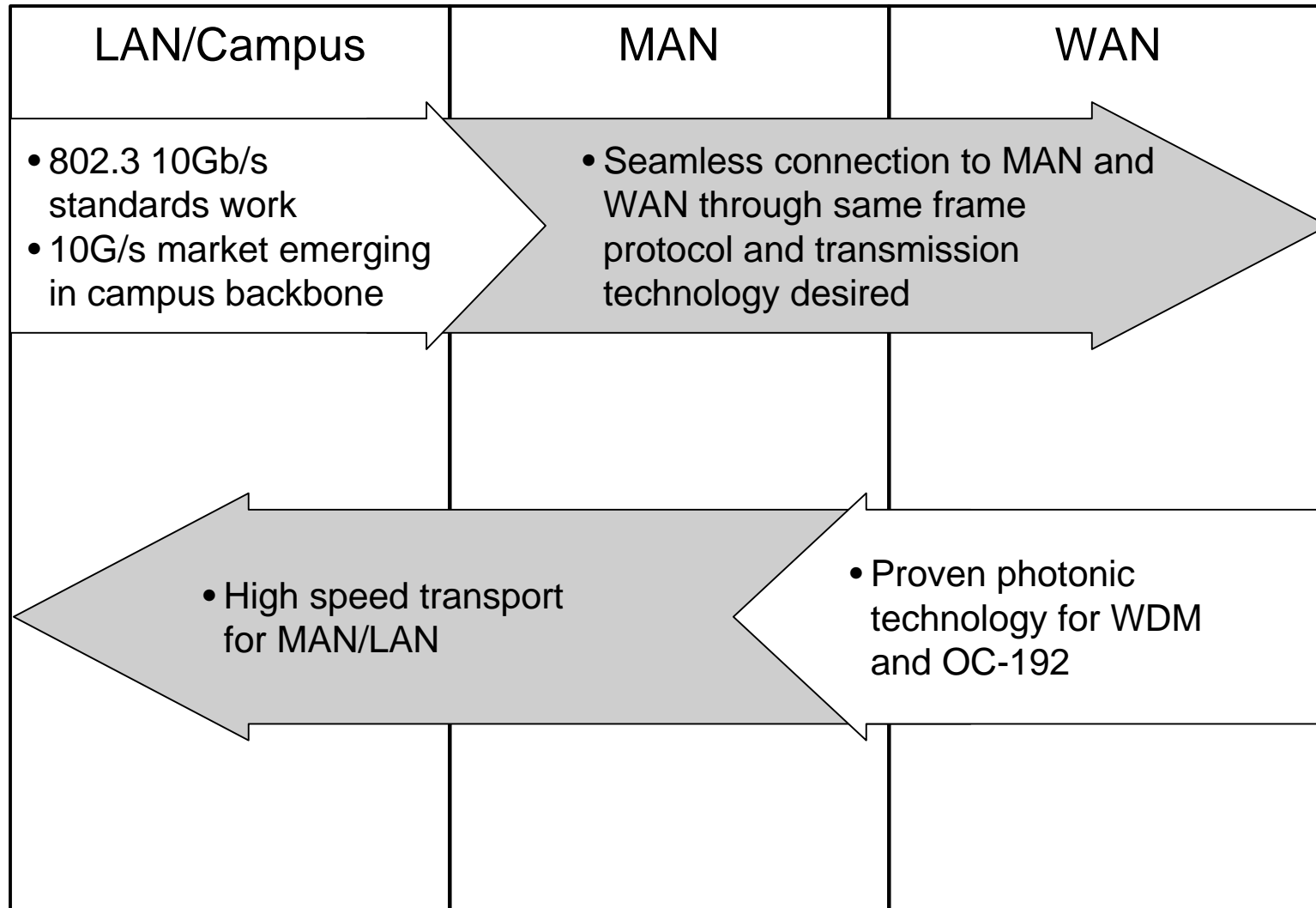


-Using Ethernet as the universal link layer for wide area networks provides a consistent end-to-end infrastructure

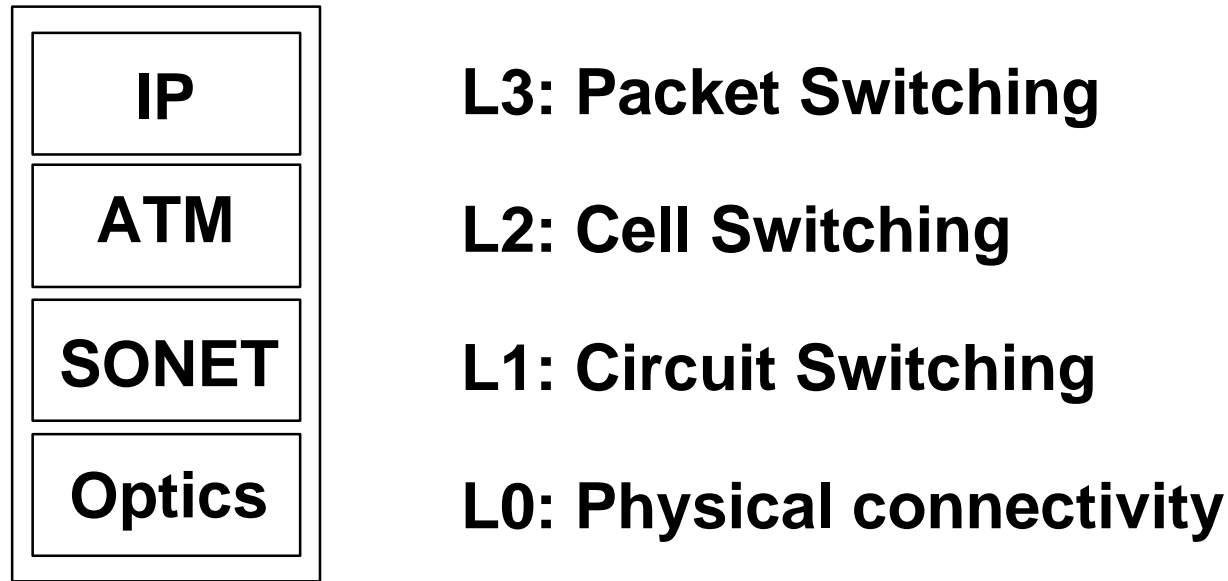
-10 GigE fills wavelengths of WDM photonic systems

-10 GigE needs to be defined with wide area applications in mind

Optical and LAN Convergence



Today's Backbone



Each Extra Layer Adds Overhead and Cost

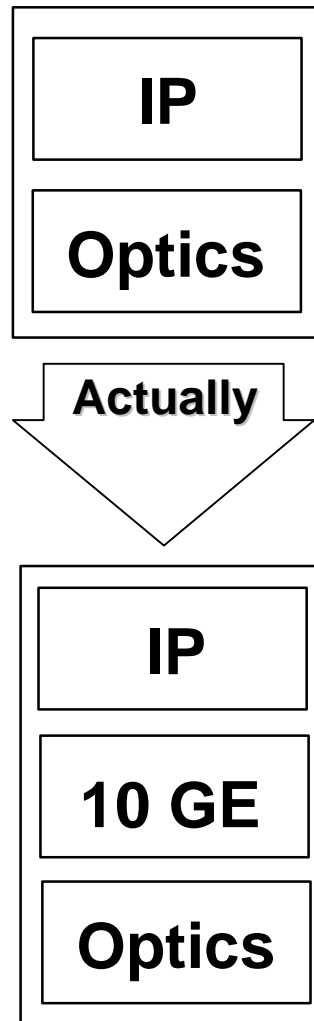
ATM adds “Cell Tax” of 9.4%

IP Packets don't fit exactly into ATM cells

SONET Add/Drop performs no bandwidth sharing

SONET framing adds 3.7% overhead

Packets on Photons Architecture



Seems obvious

Simpler, cheaper (assuming the vendor actually cares about your cost)

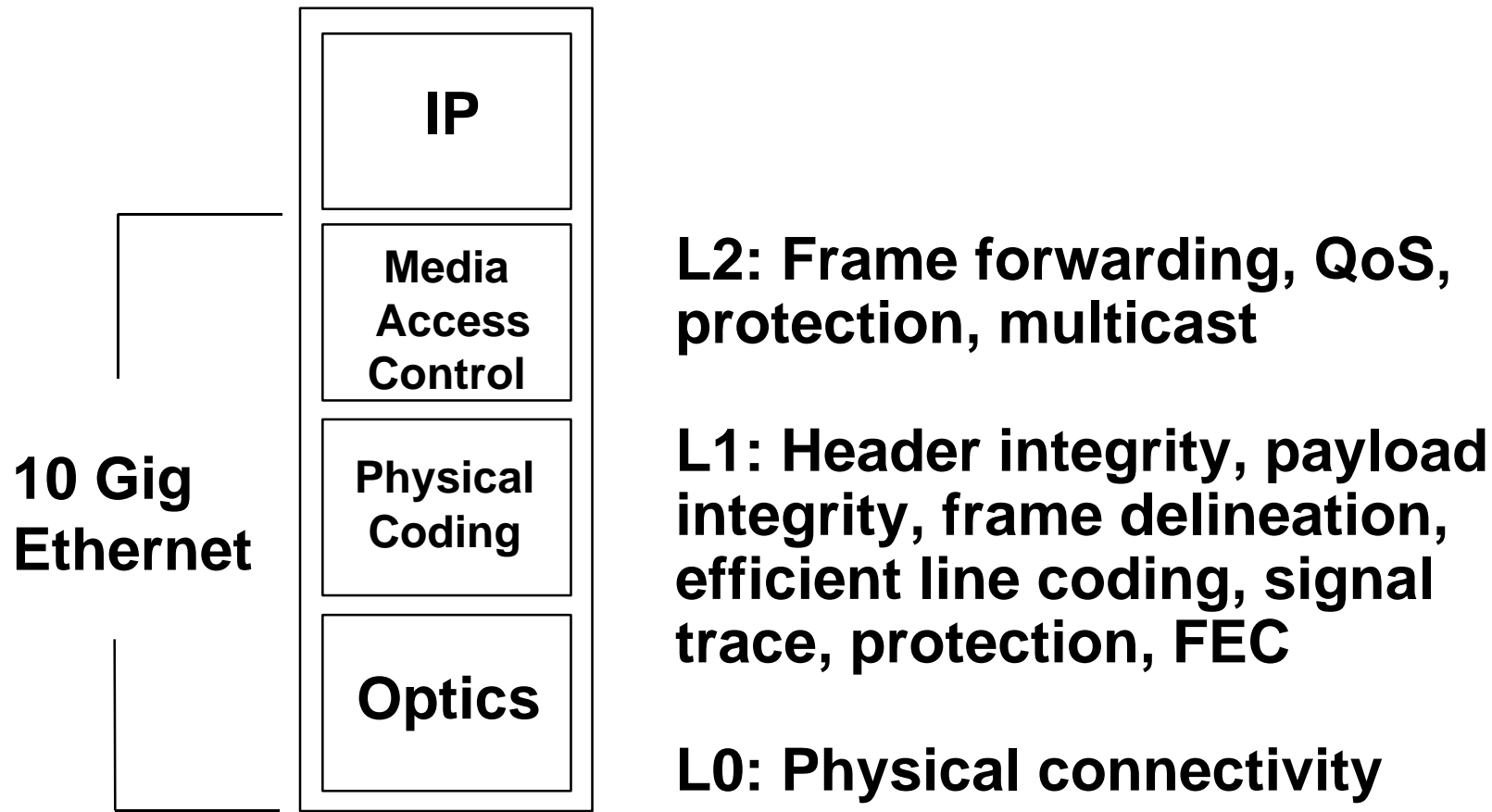
When you don't have the intervening pieces it's easier to say they aren't necessary than to build the expertise

But it's not quite bolt-on

Some functions might actually be necessary!

Layers 0 & 3 need to know a lot more about each other

10 GigE Provides a Universal Link



Coding Efficiency

- **SONET** **3.7%**
 - Major loss from unshared circuit switch channels
- **POS** **3.7% + Byte Stuffing + PPP Headers**
 - Major loss from unshared circuit switch channels
- **ATM** **3.7% + 9.43% + Cell Packing Loss**
 - Allows bandwidth sharing reclaiming loss from circuit switch
- **1G Ethernet** **25% + Preamble + IFG + Headers**
 - Major loss from 8/10 encode and gaps
 - Allows bandwidth sharing

Need Fast Failure Detection

Layer 3

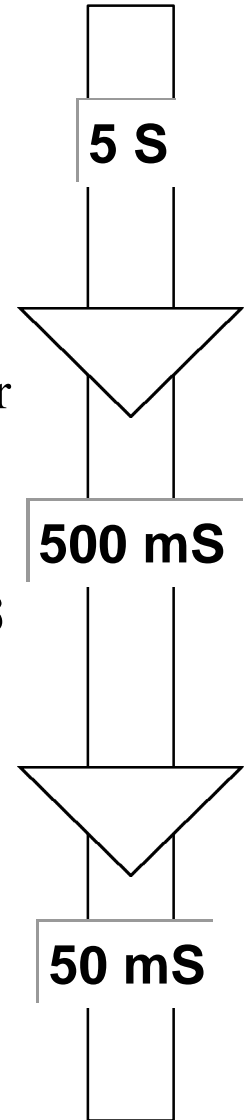
IP Routing: self-healing but slow
Need to be able to choose next-best path

Layer 2

Protects against nodal failures, and link failures not handled at layer 1
Recovery is slower than layer 1 to avoid interference
L2 protection tries to retain the logical network topology seen at L3 after a failure

Layer 1

Protects the transmission links
Fast switchover minimizes higher layer impact
service disruption is “imperceptible”
higher layer network topology is unaffected



Recommendations

- **Phased project**
 - First phase for campus backbone networks
 - Later phases for access and metropolitan
- **Designed from the start considering wide area**
 - Infrastructure is not free
 - Failure detection time around 10 msec
 - Support duplex operation only
 - High Encoding Efficiency
 - » Better than ATM's "cell tax" and packing overhead