



10GbE Implementation Architectures

A View of Where and How
10GbE Will Be Used
And the Fiber Facilities Support Needed

Roy Bynum

Optical and Data Network Technology Development

MCI WorldCom, Richardson, Texas

roy.bynum@wcom.com

802.3 10GbE Initial Markets

Storage Area Networks (Local and Remote WAN/MAN)
Disaster Recovery Facilities Networks (WAN/MAN)

Enterprise Network Server Farms (Local)
Enterprise Network Aggregation Facilities (Local)
Enterprise Network Campus Facilities (Extended)
Enterprise Network Backbone Facilities (WAN/MAN)

Internet Service Providers (Local)
Internet Regional Aggregation Facilities (WAN/MAN)
Internet Backbone Facilities (WAN)

Why 10GbE In WAN/MAN Implementations

Reduced Cost Of Implementation:

- Reduced Cost Of Common Equipment and Interfaces

 - No Time Domain Multiplexing

 - No Segmentation And Re-assembly

 - No Modification Native Data Frame

 - L3 Only At Routing Domain Boundaries

 - Commodity Market Pricing

- Reduced Cost Of Installation

 - Link State Auto-configuration

 - “Over Engineering” Reduces Pre-testing Requirements

Reduced Cost Of Ownership:

- Reduced Support Costs

 - Lower Support Technical Expertise Required

 - No Transport Disparity Between LAN And WAN

- Reduced Maintenance Costs

 - Total Visibility Of All Points In Network

 - Single Vendor Common Spares For LAN And WAN

- Reduced Re-occurring Costs

 - Leased Facilities Costs Less Than Leased Services

 - Service Levels Can Be Directly Controlled

10GbE Implementation Span Requirements

Storage Area Networks: Local - 100m;

Remote WAN/MAN - 300m/2km/40km

Disaster Recovery Facilities Networks;

WAN/MAN - 300m/2km/40km

Enterprise Network Server Farms: Local - 100m

Enterprise Network Aggregation Facilities: Local - 550m

Enterprise Network Campus Facilities: Extended - 10km

Enterprise Network Backbone Facilities:

WAN/MAN - 300m/2km/40km

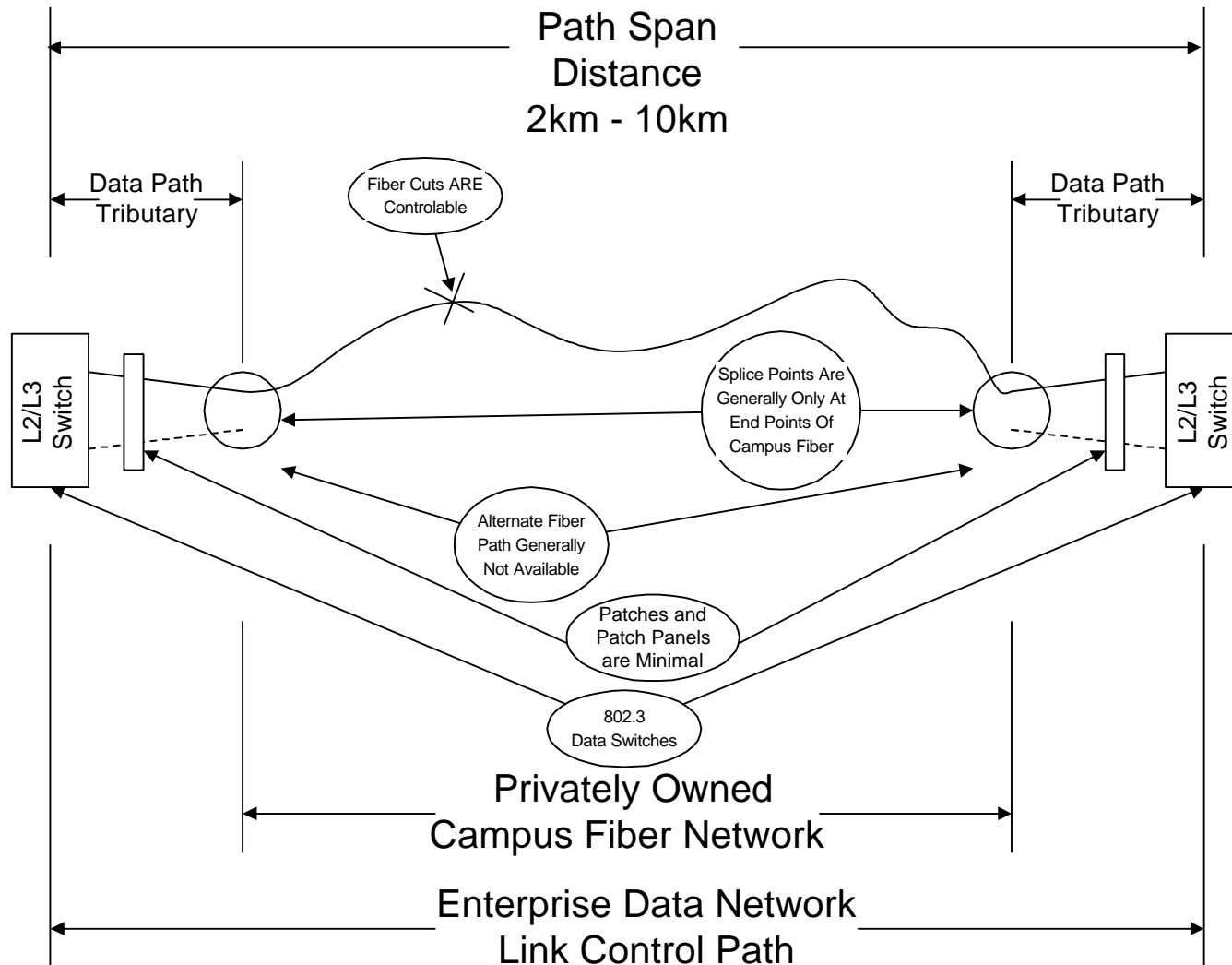
Internet Service Providers: Local - 100m

Internet Regional Aggregation Facilities:

WAN/MAN - 300m/2km/40km

Internet Backbone Facilities: WAN - 300m/2km

Extended Operations Support Functionality Is Generally Not Needed In Privately Owned Campus Fiber Networks



10GbE Extended Interface Needs Only Minimal Path/Link Level Operations Support Functionality

Privately Owned Campus Fiber Facilities

Distances between fiber end points are generally within easy travel/walking distance.

Fiber route right of way

is generally on property owned by the owner of the campus network.

Access to fiber splice points and end point facilities

are controlled by the campus network owner.

Provisioning and use of individual fibers are controlled by the campus network owner.

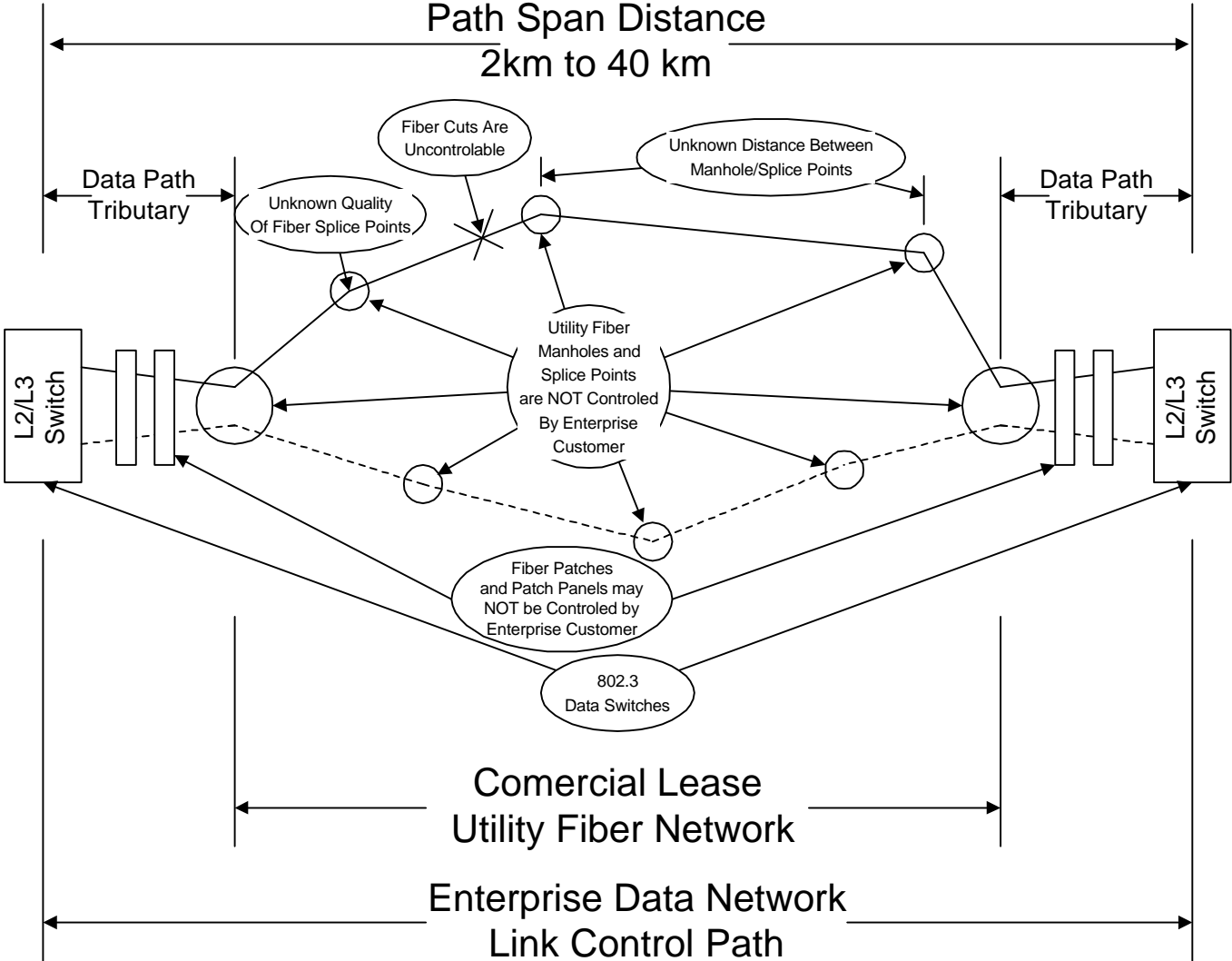
Changes to physical fiber facilities are controlled by the campus network owner.

Minimal link state indication and framing error monitoring

is adequate to monitor the long term and end of life condition of the fiber facilities.

Minimal staffing is needed to support the entire campus network, including the fiber.

Extended Operations Support Functionality Can Be Needed For 802.3 Metro Networks Using Leased Utility Fiber Facilities



10GbE MAN/WAN Interface Should Have Support for End to End Path Level Operations Support Functionality

802.3 Metro Networks Using Leased Commercial Fiber

Distances between fiber end points are generally

NOT within easy travel/walking distance.

Fiber route right of way is

NOT on property owned by the owner of the 802.3 enterprise network.

Access to fiber splice points and end point facilities are controlled

by the commercial fiber service provider.

Provisioning and use of individual fibers are controlled

by the commercial fiber service provider.

Changes to physical fiber facilities are controlled

by the commercial fiber service provider.

802.3 networks using leased commercial fiber facilities need the ability to monitor

the quality of the data link over the fiber, separate from data switch frame errors.

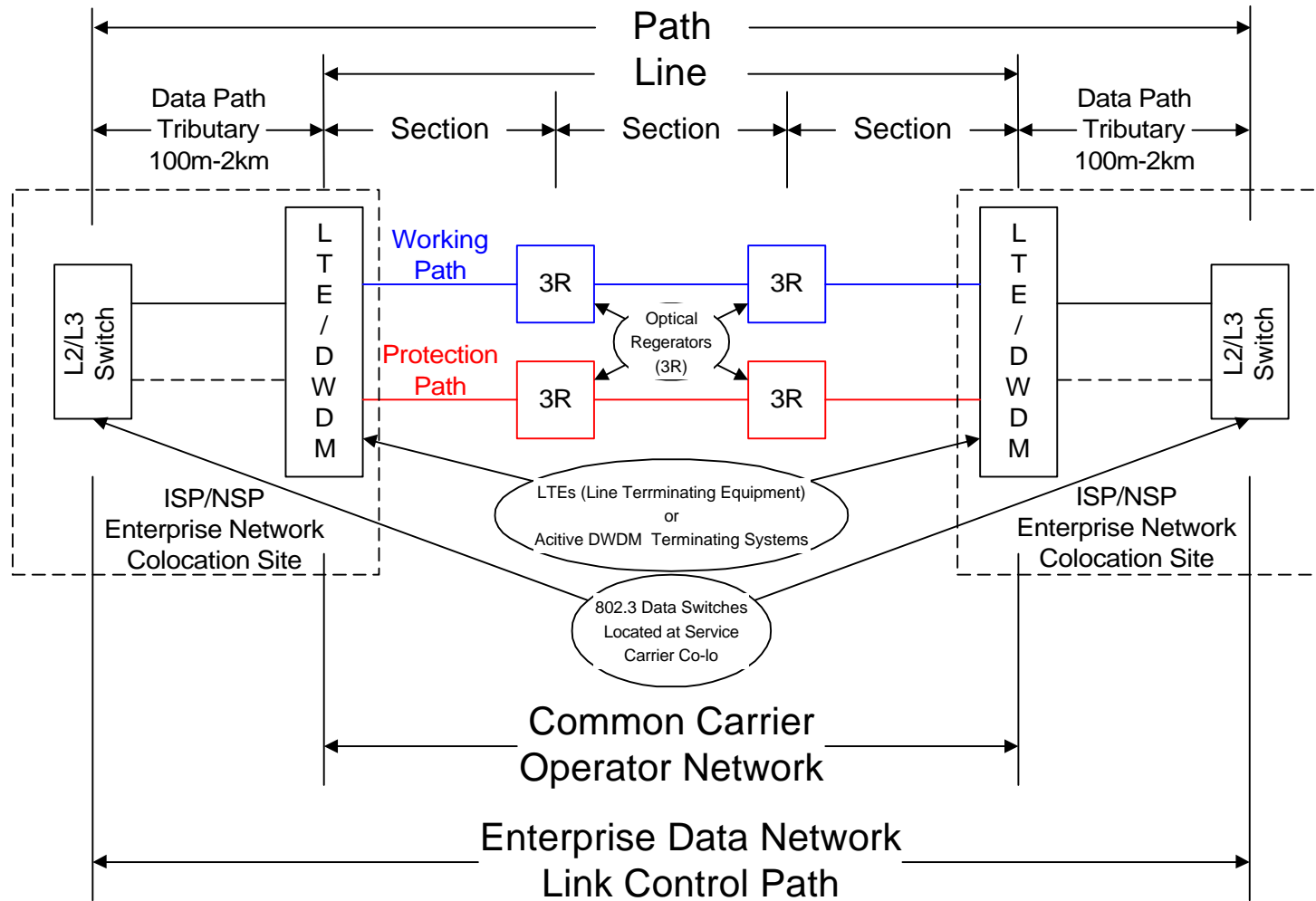
802.3 networks using leased commercial fiber facilities needs to monitor

link quality at remote systems, even when the upper layer protocols are down, to isolate problems between the fiber facility and the data switches at each end.

With adequate fiber system operational support, minimal staffing is needed

to support the entire campus network, including the fiber.

SONET Operations, Administration, Maintenance & Provisioning With Automatic Protection Switching Is Only Required Inside the Carrier Network at The SONET Line Level



802.3 10GbE WAN Minimum Interface Only Requires Support For Path Level Performance Overhead

802.3 Long Haul Networks

Using Carrier SONET/SDH Networks

10GbE Path transport services are leased from the SONET/SDH/Optical Commercial Network carrier services providers.

SONET/SDH LTEs (Line Terminating Equipment), Amplifiers, Regenerators, Active DWDM Transducers, Optical Add/Drop Multiplex/Transducers, Optical Cross Connects, and other transmission equipment that is used in long haul networks would be owned and controlled by the carrier service providers.

Fault and maintenance, line and section, protection switching is provided by the SONET/SDH/ADWDM systems owned by the carrier service provider

SONET/SDH network element Line and Section OAM&P support is provided the carriers out of band network management system.

10GbE Path operational support is provided by the enterprise network management system.

802.3 WAN Compatible PHY

Only Needs Active Path Level Support

Common interoperable interface only needs minimum operations support:

802.3 Full Duplex service is a path to SONET/SDH/DWDM systems

(OIF uses the term “trail”)

Most of cost of SONET/SDH, other than the optics, is the processing required for line and section operations support. Keeping operations support requirements to minimum should make a major reduction to that cost.

Optical “path/trail” level local interface receiver bit error detection (B3) and remote performance (local transmitter bit error detection) (G1) provides support for leased fiber implementations; provides monitoring distinction between enterprise data switch problems and problems with leased fiber facilities.

Optical “path/trail” trace (J1) provides identification of the enterprise path service within and by carrier provisioning, support, and network management systems.

Optical “path/trail” label (C2) identifies the path payload as 10GbE.

STS/STM payload pointers (H1,H2,H4) inform the transmission network elements that the path/trail payload is concatenated.

Any additional processing can be added by a vendor for its specific market.