

Next Generation Optical Services and L1VPNs: Business Scenarios, Technical Challenges and Current Effort

NTT

Tomonori Takeda

takeda.tomonori@lab.ntt.co.jp

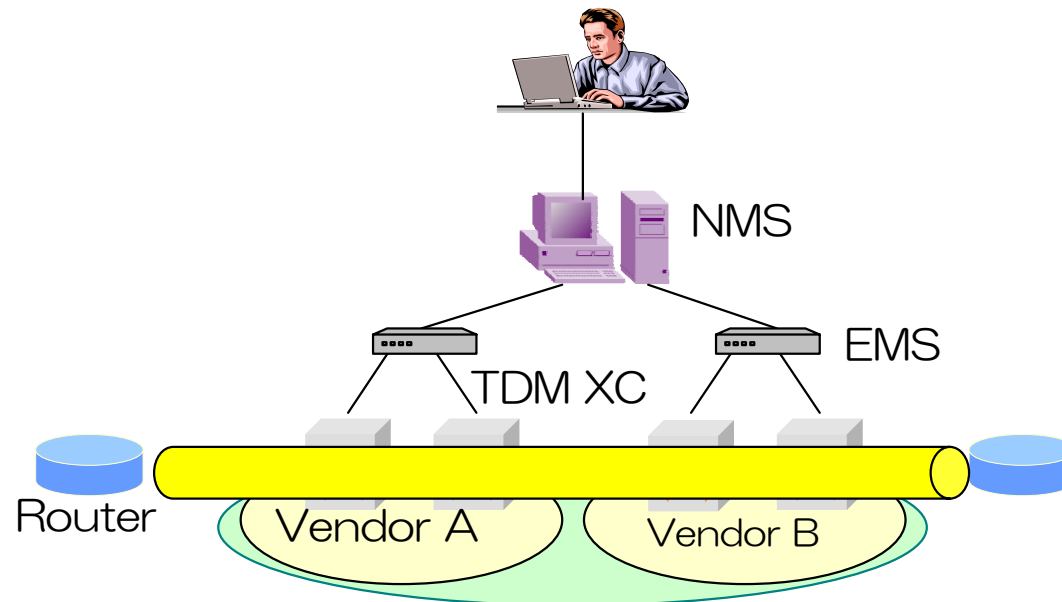


Outline

- Background
- Next Generation Optical Services Business Scenarios
- Key Requirements and Migration
- Current Effort

Background – Traditional Private Line Service

- Service aspects
 - Not data optimized – rigid SONET/SDH hierarchy
 - Limited service class – unprotected or protected
 - Static service in principle (fixed bandwidth/topology)
- Operation aspects
 - Proprietary management interface – expensive development cost, equipment cost and operation cost



Background – Technical Progress

- Data Plane Technology Progress
 - GE/10GE: becoming a “de facto” interface for data
 - Next Generation SONET/SDH (VCAT/LCAS/GFP): offers data optimized transport
 - WDM: massive bandwidth with low cost
 - ROADM/OXC: switching capability at lambda
- Control and Management Plane Technology Progress
 - GMPLS:
 - “Standard” mechanisms: possibility to lower development cost, equipment cost and operation cost
 - “Distributed” mechanisms: possibility to increase robustness, multiple recovery classes
 - “Data integration”: Easy integration with data (packet) technologies

D-Plane Progress

GE/10GE, NG-
SONET/SDH, WDM,
ROADM/OXC

C/M-Plane Progress

GMPLS



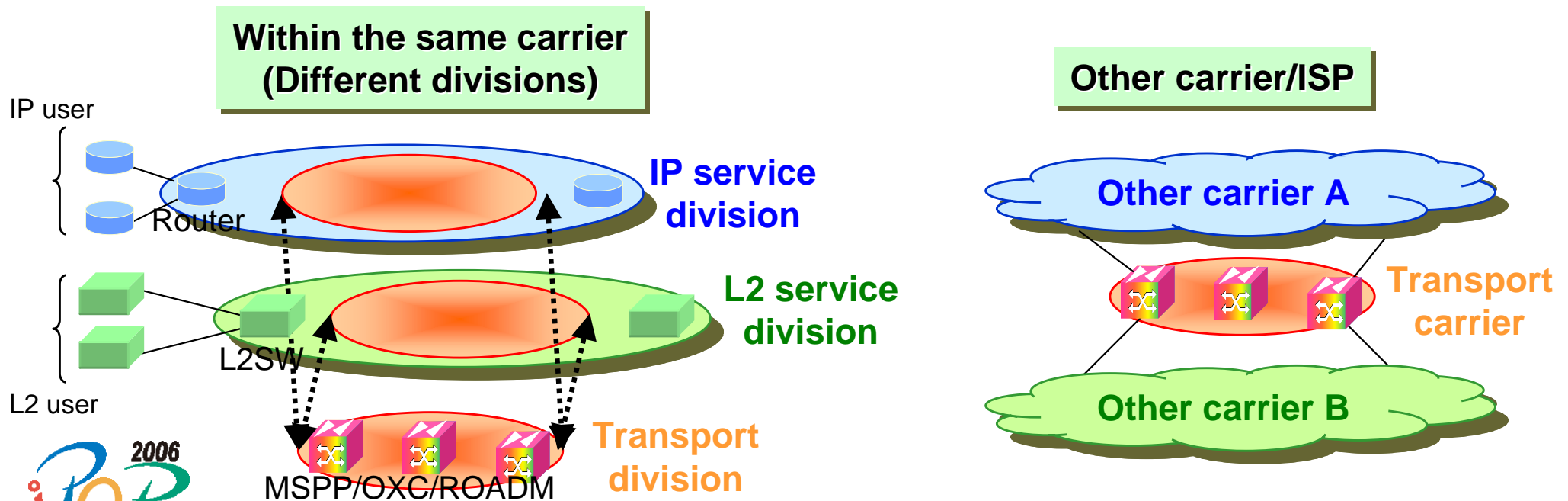
Time for next generation optical services?

Business Scenarios

- Carrier's carrier
 - Within the same carrier (different divisions)
 - Different carriers/ISPs
- Customer service (e.g., enterprise)
 - Video transport service
 - Data backup service
 - Grid

Carrier's Carrier

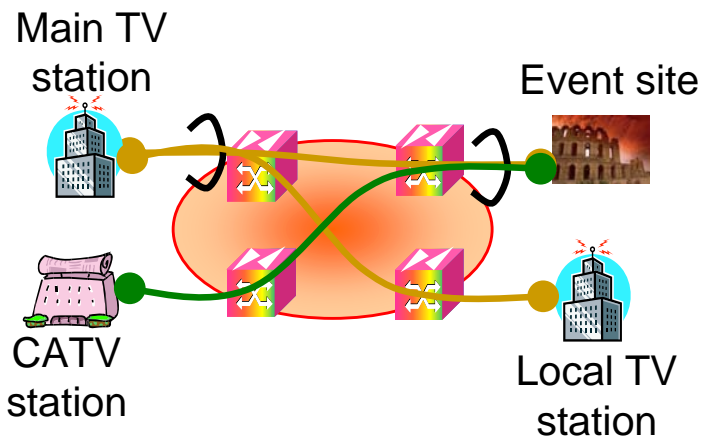
- Already in use in today's networks
- Opportunities
 - Ethernet transport, flexible bandwidth
 - Multiple recovery class
 - Fast service delivery
 - A closer control/management integration (esp. within the same carrier)
 - Recovery operation, monitoring/reporting, etc.



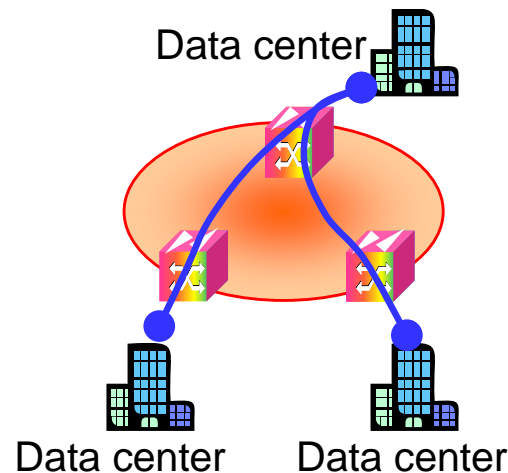
Customer Service

- Some services already in use (with proprietary mechanisms)
- Opportunities
 - Standard mechanisms
 - Switching service (topology change)
 - Scheduling

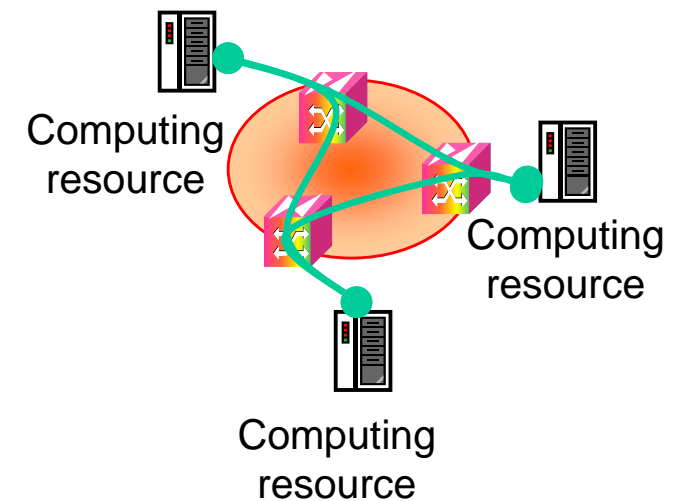
Video transport service



Data backup service



Grid

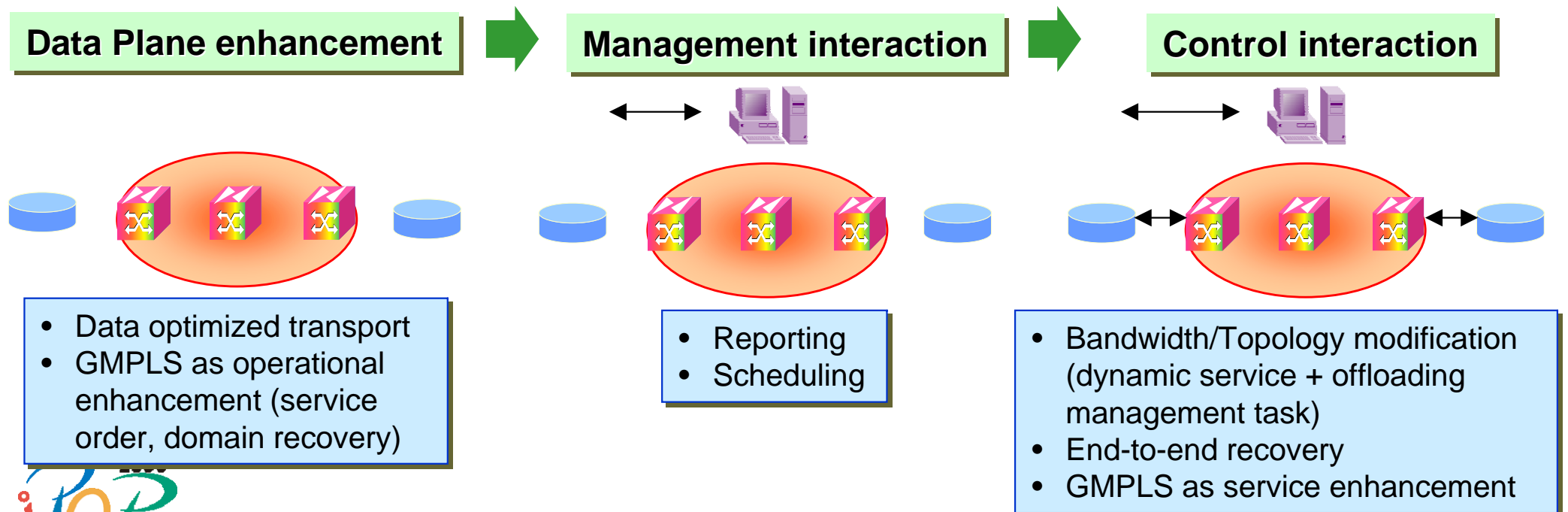


Key Requirements

- Data Plane
 - Ethernet transport, flexible bandwidth
 - Recovery
- Control and Management Plane
 - Bandwidth modification
 - Topology modification (switching service)
 - Closed User Group
 - Security
 - Usage recording
 - Fast service delivery
 - Scheduling
 - Monitoring/Reporting

Service Migration

- 1st phase: Data plane enhancement
- 2nd phase: Management interaction
- 3rd phase: Control interaction



Current Effort

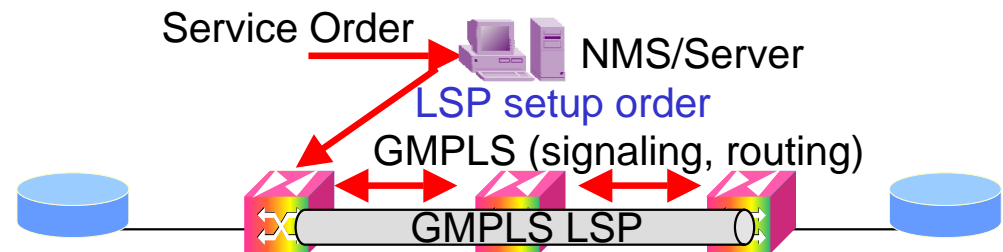
- Standardization
- Interoperability

L1VPN Framework

- IETF CCAMP WG: Focus on GMPLS protocols (in general)
- IETF L1VPN WG: Focus on GMPLS extensions for optical (VPN) services

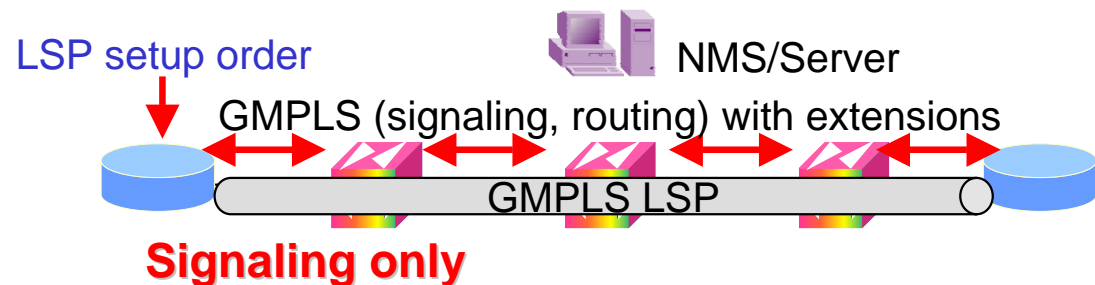
Management Model

NMS/Server initiated connection setup
(Soft Permanent Connection)



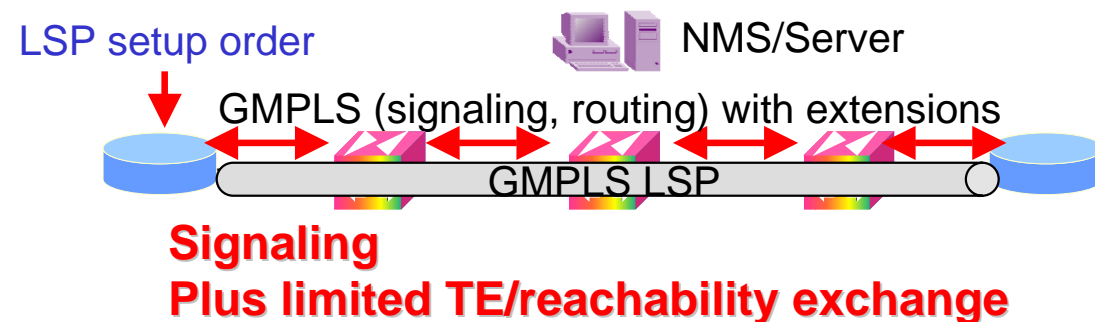
Basic Mode

Signaling initiated connection setup
(Switched Connection)



Enhanced Mode

Signaling initiated connection setup
(Switched Connection)
Plus limited TE/reachability exchange



Basic Mode Solution Work

- IETF L1VPN WG current focus: Basic mode
- Signaling
 - Connection setup/deletion/modification from CEs
 - Options: Nesting, stitching, shuffling
- Discovery
 - Client reachability + membership exchange within the transport network
 - Options: BGP, IGP, (manual configuration)

Signaling options

Nesting



- Hierarchy in the data plane
- Hierarchy in the control plane

Stitching



- No hierarchy in the data plane
- Hierarchy in the control plane

Shuffling



- No hierarchy in the data plane
- No hierarchy in the control plane

Discovery options

BGP



- Add BGP to IGP-TE

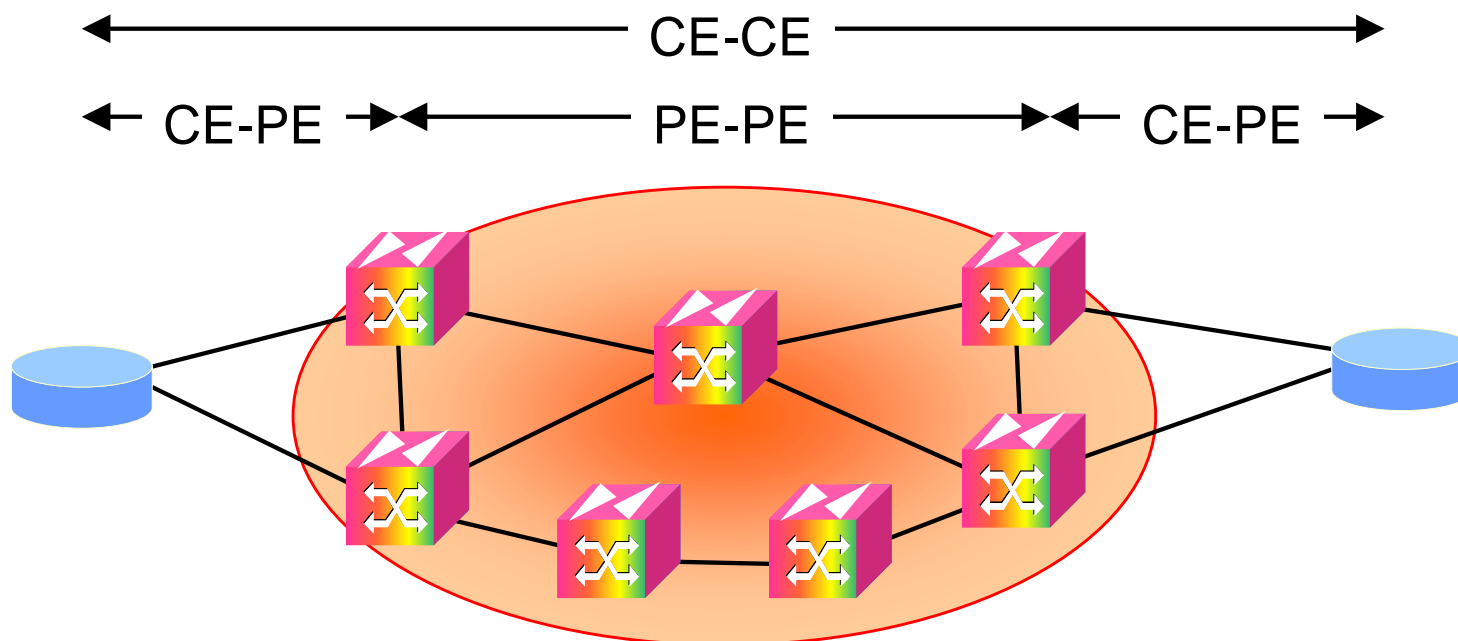
IGP



- Add new LSA to IGP-TE

Advanced Features

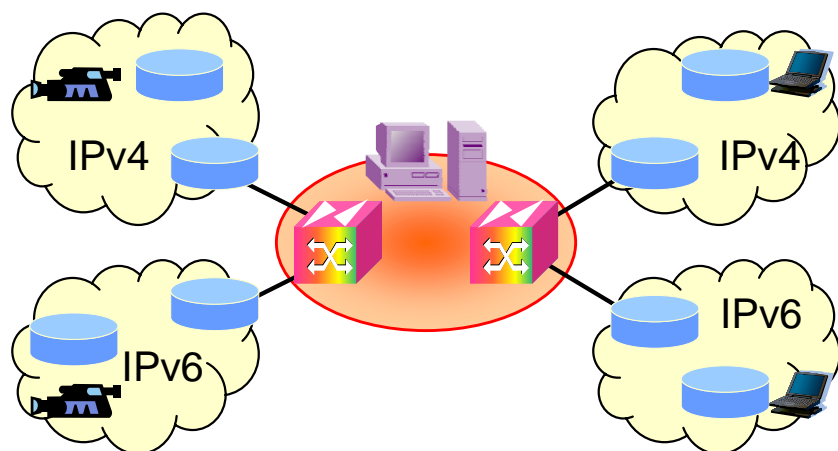
- Recovery
 - PE-PE (domain recovery)
 - CE-PE (link recovery)
 - CE-CE (end-to-end recovery)
- CE-CE recovery requires mechanisms to ensure disjointness
 - Not completely addressed yet in IETF
 - Analysis needed



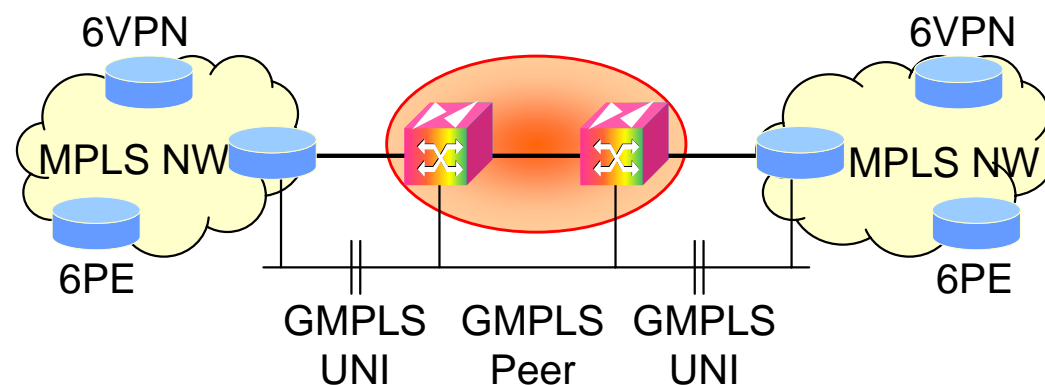
Interoperability Status

- Management model
 - Interoperability testing in UNH (2004)
<http://www.iol.unh.edu/consortiums/osrm/>
- Basic mode
 - Interoperability testing on several key functions in MPLS2005 public demo (2005)
<http://www.isocore.com/mpls2005/program.htm#interop>

Management model testing



Basic mode testing



Conclusion

- New technologies are opening up opportunities for next generation optical services
 - Ethernet, NG-SONET/SDH, WDM, OXC/ROADM
 - GMPLS
- Several key service requirements and migration scenarios
 - Control plane capabilities added as technology and operational tools become mature
- Standardization and interoperability are on-going
 - IETF L1VPN WG, CCAMP WG
 - Interoperability events