Prototype demonstration of integrating MPLS/GMPLS network management system

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IP+Optical Network

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Next generation network

- Next generation IP+Optical network
  - Complex structure
    - Large network scale
    - Logically and physically multi-layer
      - ✓ Router, L2SW, TDM, Optical and WDM equipments
    - Multi-vendor

The technology is deployed without any consideration…

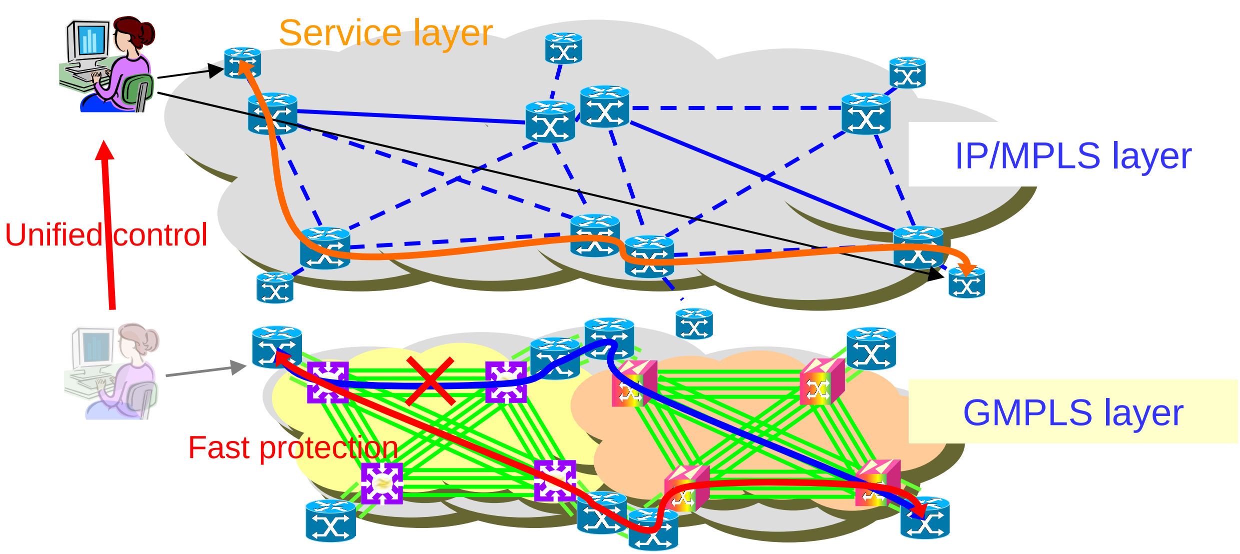
☞ OPEX increases.

☞ Fault analysis becomes difficult.

- ✓ Fault localization
- ✓ identification of the extent of influence

Introduction of control plane

- MPLS and GMPLS technology
  - Unified control plane provides efficient operation, higher resource utilization and resiliency.
  - Interworking between layers(MPLS and GMPLS) can provide more efficient function.
    - End-to-end provisioning
    - Efficient inter-layer resource utilization and resiliency

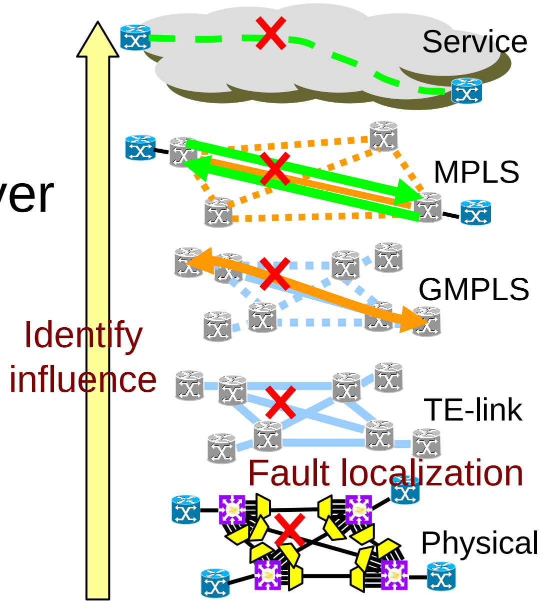


MPLS/GMPLS multi-layer network management

Interworking between MPLS and GMPLS is currently being standardized supported by control plane.

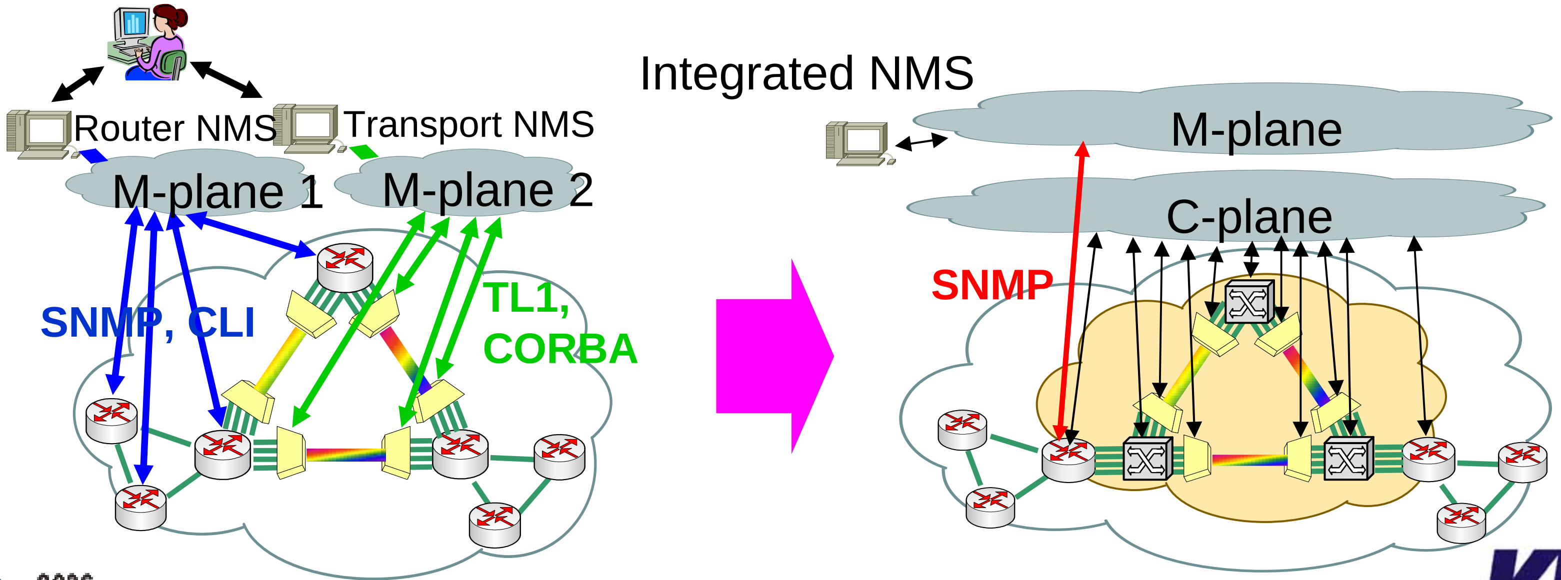
However, each network element as well as layer or vendor still depends on its own EMS…

- Basic requirements for network management
  - Common management plane
    - ✓ Retrieving network topology in real-time
  - Network component management with inter-layer relationship
    - ✓ Fault localization
    - ✓ Identification of the extent of influence
  - Network planning



Common management plane

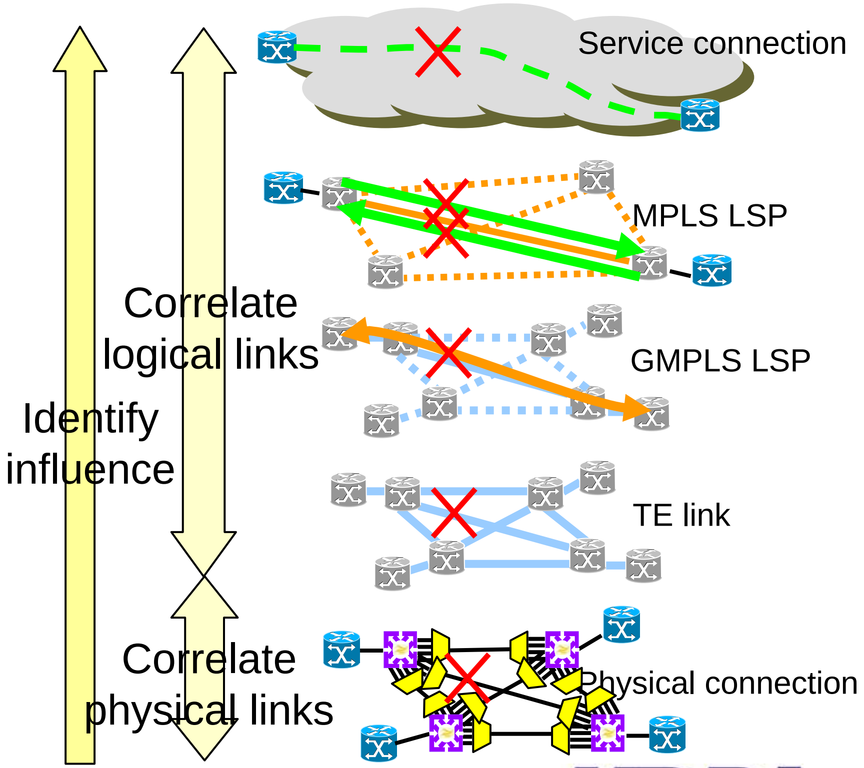
- Conventional Network Management System architecture
  - Element-dependent interface
  - Continuously polling the status from all network nodes
- Integrated NMS architecture
  - Common management interface such as SNMP is standardized.
  - All nodes share some information such as Link State DB supported by control plane.



Viewpoint from resource management

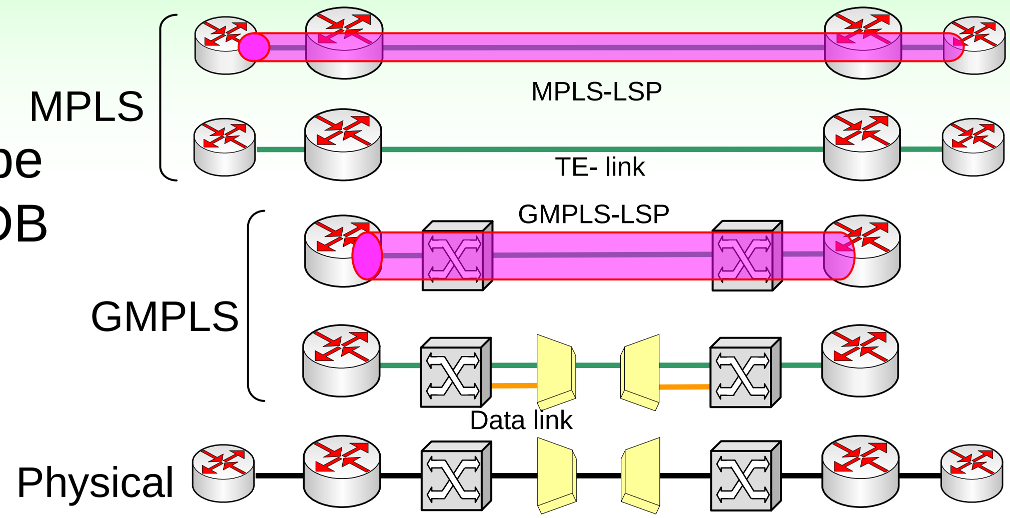
Network component management with inter-layer relationship

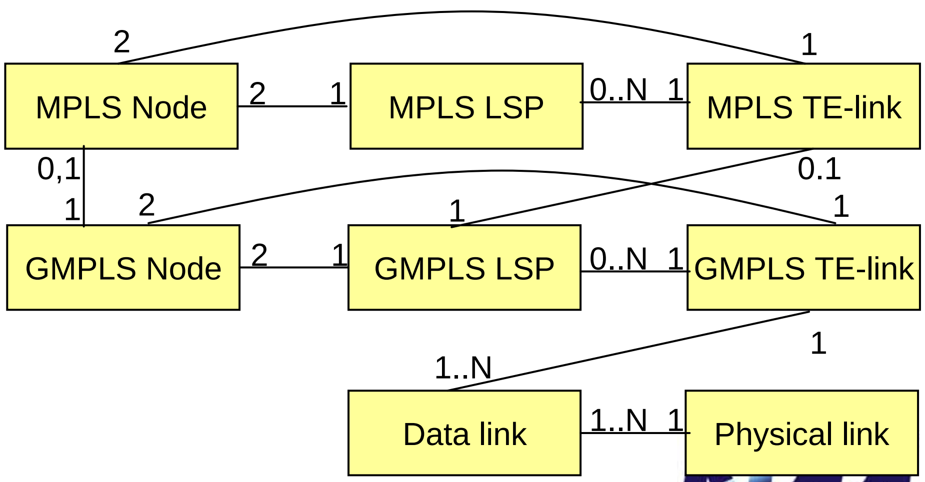
- Each two network components such as node, link or LSP are required to be correlated with relationship of inclusion.
  - LSP is correlated with TE-links which are reserved as the resource
  - MPLS LSP is established over a GMPLS LSP
- The correlation facilitates
  - Root cause localization of a failure
  - Identification of the extent of influence
  - Suppression of multiple alarms by the same root cause



Network component management with inter-layer relationship

- Component relationship
  - Network components can be correlated and registered DB with relationship.
  - MPLS layer
    - LSP
    - TE-link
  - GMPLS layer
    - LSP
    - TE-link
    - Data link
  - Physical connection





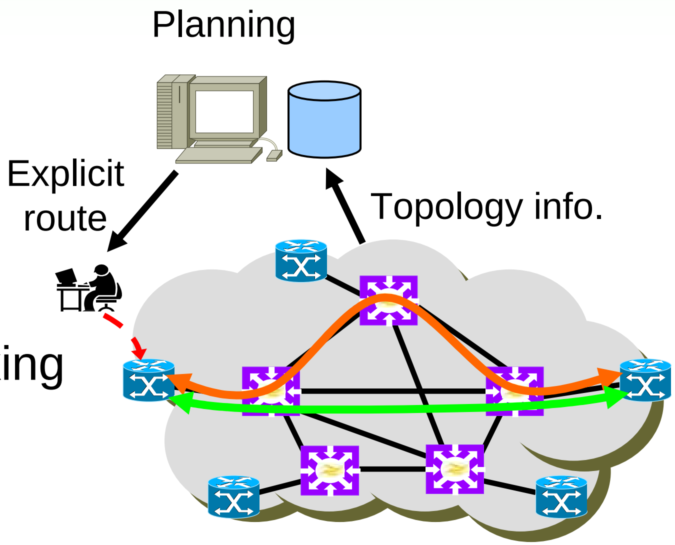
Entity Relation diagram

Network planning

- RSVP-TE provides a CSPF-based automatically calculated path for provisioning, protection and restoration.

  Not always best in any case…

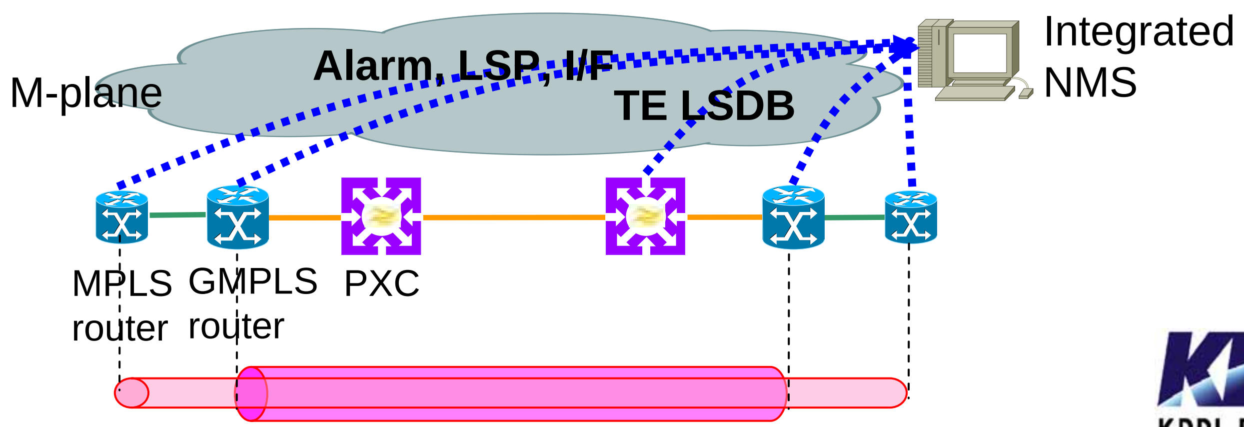
- SP requires
  - Administrative-policy-based route planning
  - Protection and restoration
    - ✓ Disjoint SRLG
    - ✓ No differential delay (RTT) between working and protecting paths
  - Route optimization
    - ✓ Evaluation of route optimality from the resource utilization perspective



Retrieving real-time topology information (link resource, LSP route) and, optimal and administrative route planning

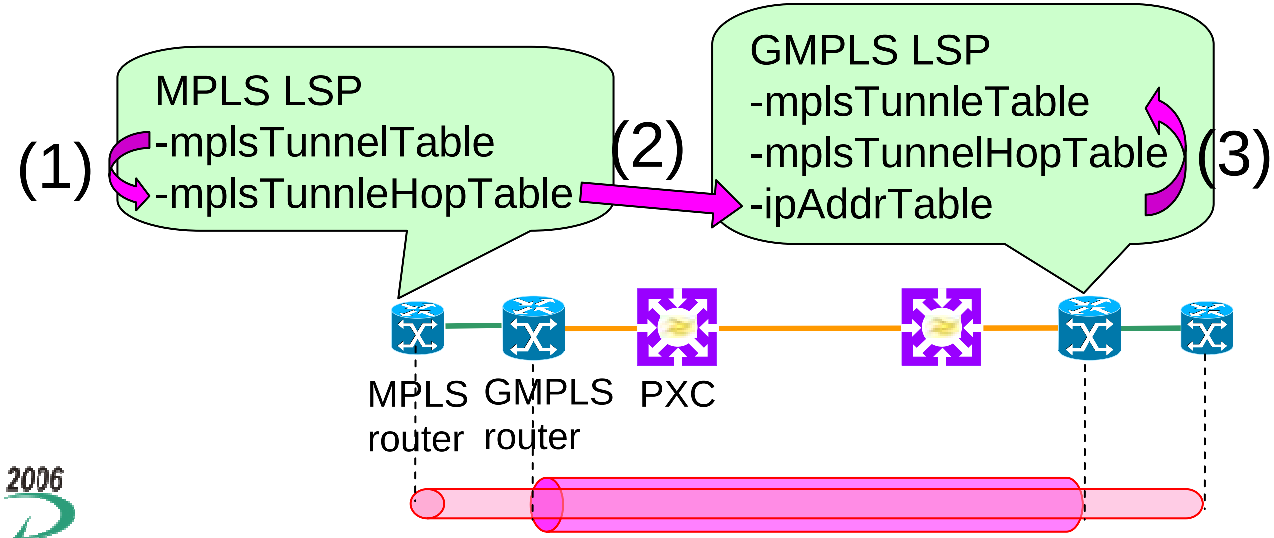
Prototype development of integrated NMS architecture

- Prototype of proposed integrated NMS was developed.
  - Inventory retrieving
    - Interface, address and system information
      - ✓ SNMPPing(mib-2)
    - TE LSDB
      - ✓ XML over HTTP from PXC
    - LSP
      - ✓ SNMP(MPLS-TE-MIB)
  - Fault(Alarm) management
    - SNMP trap



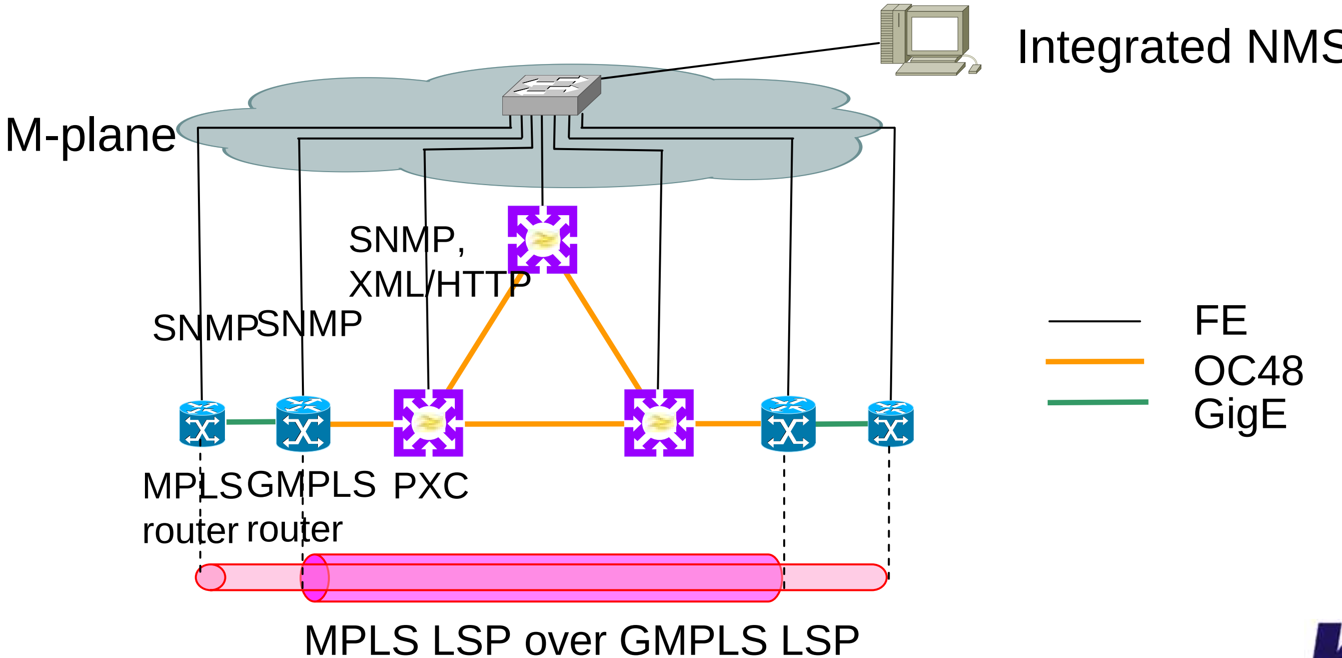
Prototype development of integrated NMS architecture

- Multi-layer correlation
  - Relation of inclusion between MPLS and GMPLS LSPs is solved using retrieved inventory information.
    - LSP information (attributes, route)
      - mplsTunnelTable, mplsTunnelHopTable(MPLS-TE-MIB)
    - I/F Address information
      - ifTable, ipAddrTable and ipRouteTable(mib-2)



Demonstration of prototype NMS

- Test configuration is composed of MPLS and GMPLS routers, and PXC
- Full peer model between MPLS and GMPLS network

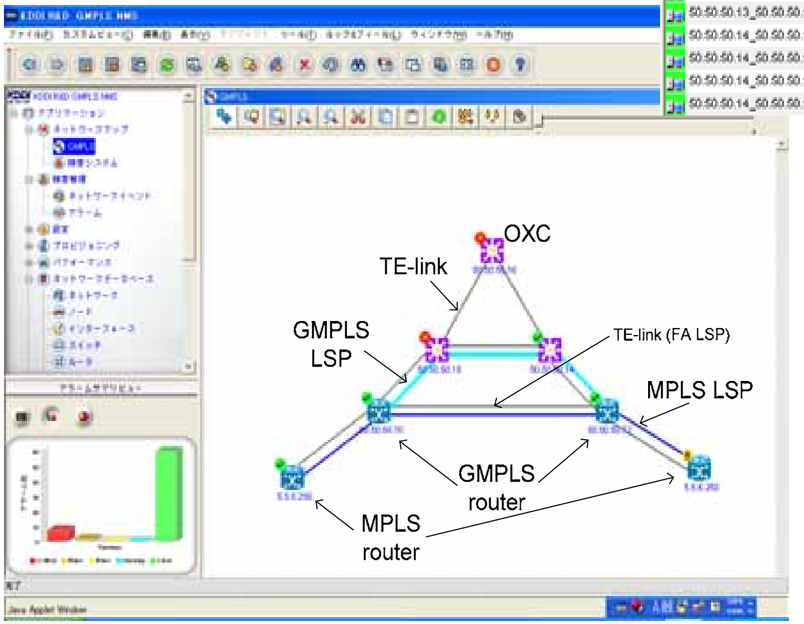


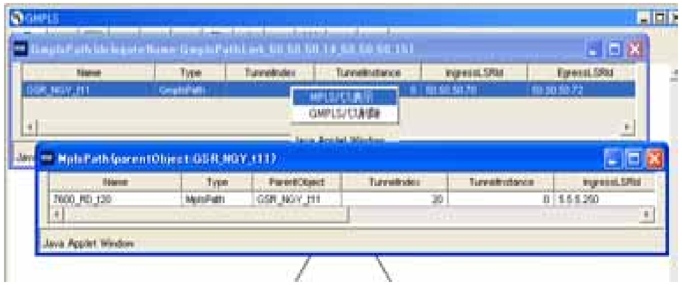
Test configuration

Demonstration of prototype NMS

- Automatic topology discovery and display
  - Node identification (PXC, MPLS and GMPLS routers)
  - TE-link
  - LSP (Attributes, Route)
  - Alarm indication
  - GMPLS LSP provisioning
  - Dynamic network topology update

TE-link list

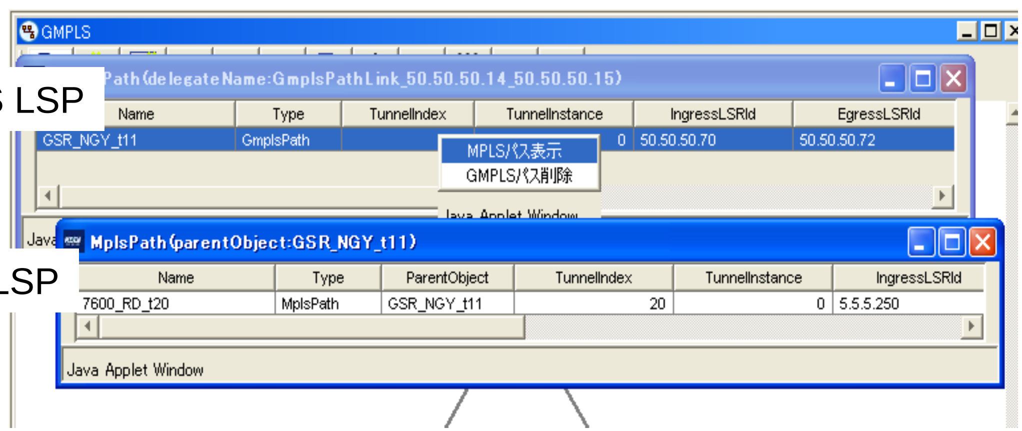




LSP list

Demonstration of prototype NMS

- Correlation between MPLS and GMPLS LSPs
  - MPLS LSPs are included within a GMPLS LSP and displayed in a sub-list of the GMPLS LSP.



Requirement of implementation

- Retrieving TE LSDB
  - Inconsistent method of retrieving TE LSDB from NE per vendor
  - Retrieving some interested parts in TE-LSA attributes is desired.

> *draft-ietf-ccamp-gmpls-ospf-mib*
> *can provides the TE-LSA attributes per subTLV object*

- Retrieving GMPLS LSP attributes
  - GMPLS-TE-MIB provides the attributes of GMPLS LSP.
  - The mib has not supported yet.

> *Implement GMPLS-MIB*

Conclusion

- Integrated NMS architecture for MPLS and GMPLS network is proposed and demonstrated.
- The automatic topology discovery, multilayer correlation and a dynamic status update are successfully demonstrated.
- Some of standardized MIB is required to be supported for effective operation.