

Generalized MPLS (GMPLS)

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Generalized Multi-Protocol Label Switching (GMPLS)

- GMPLS is an extension of MPLS.
- MPLS was designed originally to introduce label-switched paths into the packet-switched network
- GMPLS was designed with a view to applying label-switching techniques to time-division multiplexing (TDM) networks and wavelength routing networks in addition to packet-switching networks.

- GMPLS, like MPLS, can be used to setup an LSP through an IP network and other packet-switched networks.
- It can also be used to:
 - setup a circuit-switched connection in a SONET/SDH network.
 - setup a lightpath in a wavelength routing optical network.

- In GMPLS
 - IP routers, ATM switches, Frame Relay switches, Ethernet switches, DCSs and OXCs are all treated as a single IP network from the control point of view.
- There are no UNIs and NNIs, since GMPLS is a peer-to-peer protocol.

GMPLS interfaces

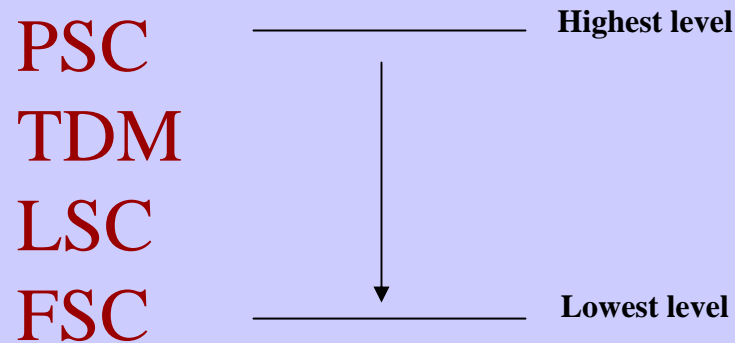
- A GMPLS-capable LSR may support the following interfaces:
 - *Packet-switch capable (PSC) interfaces*
 - *Time-division multiplex capable (TDM) interfaces*
 - *Lambda switch capable (LSC) interfaces*
 - *Fiber-switch capable (FSC) interfaces*

- *Packet-switch capable (PSC) interfaces:*
 - These are the different interfaces used to receive and transmit packets, such as IP packets, ATM cells, Frame Relay frames, and Ethernet frames. Forwarding of these packets is based on an encapsulated label, VPI/VCI field, DLCI field.
- *Time-division multiplex capable (TDM) interfaces:*
 - They forward data based on the data's slot(s) within a frame. This interface is used in a SONET/SDH DCS.

- *Lambda Switch Capable (LSC) interfaces*
 - They forward data from an incoming wavelength to an outgoing wavelength. This interface is used in OXCs.
- *Fiber-switch capable (FSC) interfaces*
 - They forward data from one (or more) incoming fibers to one (or more) outgoing fibers. They are used in an OXC that can operate at the level of one (or more) fibers.

A hierarchy of interfaces

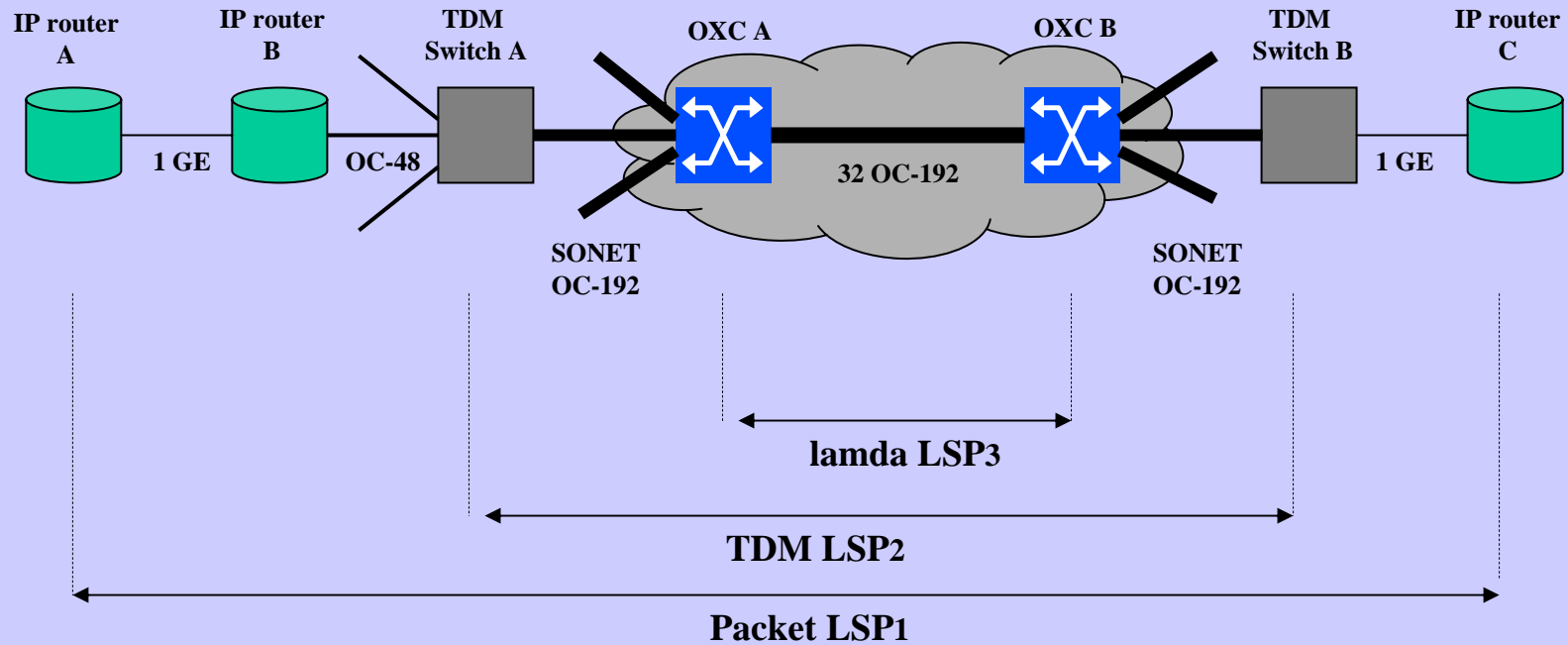
- These four interfaces form a hierarchy used to support hierarchical LSPs



Hierarchical LSPs

- An LSP may start and end at a packet-switched interface (PSC) .
- It can be then nested together with other LSPs within an LSP that starts and ends on a TDM interface, which in turn is nested (together with other) within an LSP that starts and ends on a lamda switched interface (LSC).

An example of a hierarchical LSP



Challenges..

- GMPLS has been typically implemented to setup lightpaths only (i.e. no TDM or packet-based connections).
- It exists in hardware for one vendor.
- Lightpaths are still setup manually.
- Limited open source implementations.
- No implementations of hierarchical LSPs across multi-domain networks.