Multi layer implications in GMPLS controlled networks

draft-bcg-ccamp-gmpls-ml-implications-05

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Update since v04.txt

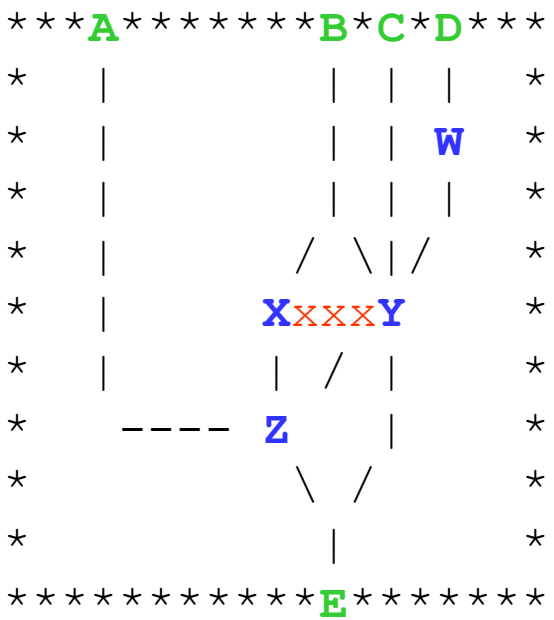
- Need for a problem statement
  - Routing
  - Signaling
- Applicable to any SC supporting mux'ing:
  - ETH: C-VID, S-VID, B-VID
  - SDH: LOVC, HOVC
  - OTN:
- Use cases

Problem Statement

- MRN architectural framework [RFC6001] models the internal properties of the nodes by its internal switching capabilities (referred to as resource pools) and their interconnection, i.e. single and multiple pool models
- Assumptions
  - Internals properties of (logical) resource pools left uncovered to external nodes: technology-specific details composing resource pools not part of the IACD advertisement
  - Spatial structure defined by the interconnection of resource pools does not induce any cycle (even if resource pools relationship do not have to follow the SC value hierarchy defined in RFC 4206)

Routing

- Main aspects
  - Exchange (of information) following GMPLS RFCs
  - Representation (of information) : how to represent relations between resource pools and their capabilities (beyond un/used capacity e.g. multiplexing structure)
- Example



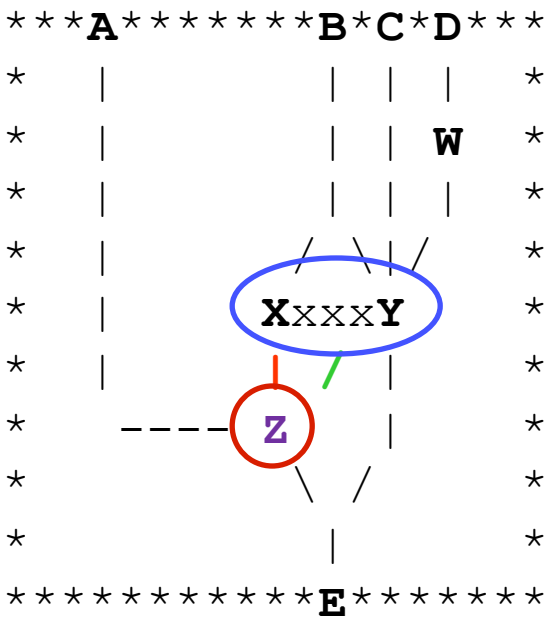
A,B,C,D and E : external interfaces of the node
W,X,Y and Z : internal switching capacities

If internal SCs are associated to same SC value (SC W = SC X = SC Y = SC Z), they could either be represented as

1. Single (logical) resource pool **or**
2. Kept separated into different resource pools at the condition that their ingress and egress relations does not lead to any loop, i.e., no "X-Y" direct relationship

Routing

- Same example



Assumption: X and Y part of same logical resource pool (SC X = SC Y) but different from the two others (W and Z)
-> Properties of relationships between resource pool (associated to SC Z) and resource pool (SC X = SC Y) may be different

Example (properties): encoding associated to each relationship can be different (note: only one encoding field per IACD sub-TLV)

In practice: L2SC (for SC Z) with two different encapsulation method GFP-F or GFP-T towards common resource pool TDM (SC X = SC Y)

Signaling

Recap

- GMPLS signaling relies on (external) link property inference for label allocation
- Technique progressively complemented by technology specific information encoded as part of the label request

MRN

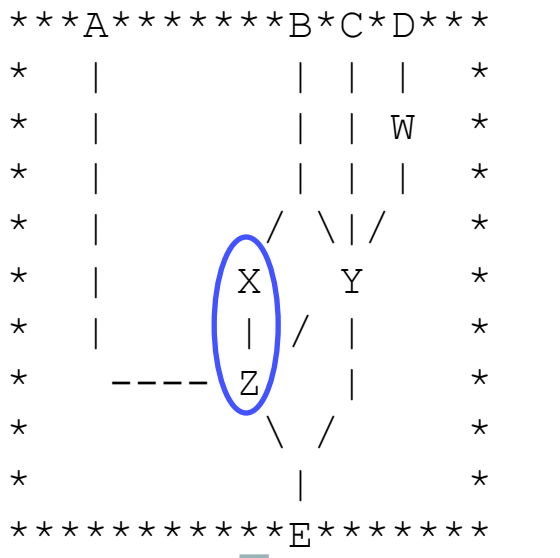
- Multiplexing hierarchies are "inter-related" but no (TE) link describing them

=> Need for signaling mechanism by which they have to be locally inter-connected at provisioning time

Signaling

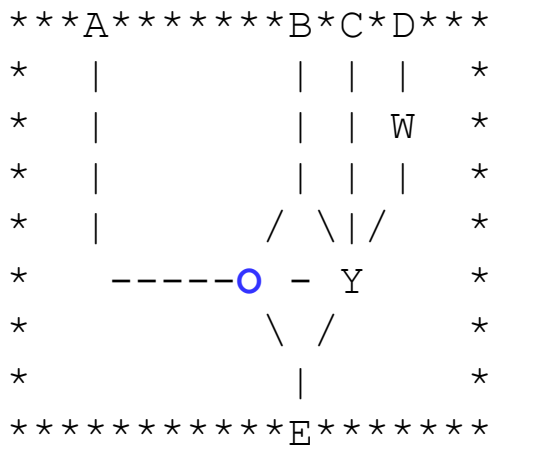
- Example

Local view



Routing info

Remote view



X, Y, and Z : internal switching capabilities (underlying technology supporting hierarchical multiplexing)

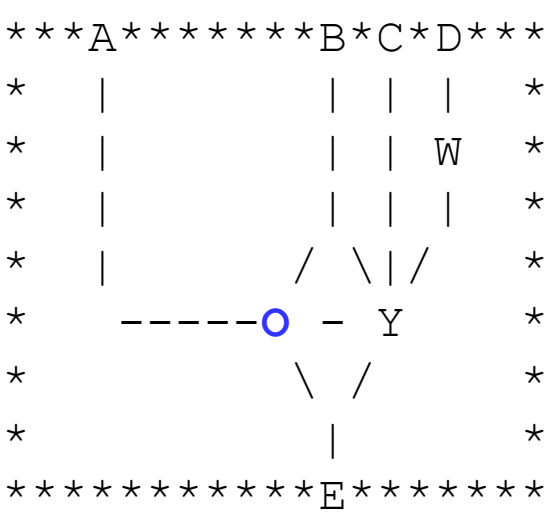
X and Z are part of the same logical resource pool (SC X = SC Z)
Example: multistage multiplexing

An external node receives the routing information from which it can derive the relations between

i) resource pools O, W, Y
ii) resource pools O, W, Y and external interfaces A, B, C, D, E

Signaling

- Example



Four ways to reach interface (I/F) B from I/F E:

1. E->O->Y->B
2. E->Y->O->B
3. E->O->B
4. E->Y->B

=> Each time there is possible choice to pass from one SC to another SC (which is not associated to an external interface), there should be a mean by which the requester can indicate which SC it would like to make use of or equivalently exclude

Example: mean to indicate if the incoming-outgoing signal shall go through O or Y

Note: MRN signaling (Section 4.1 of RFC 6001) enables such choice but only if SC O =/= SC Y

Other additions in v05

- Practical use cases
  - Multiple internal matrices with different inter-link types
  - Multiple internal matrices with different inter-link types and shared server layer capacity
  - Multistage multiplexing at different levels

Next steps

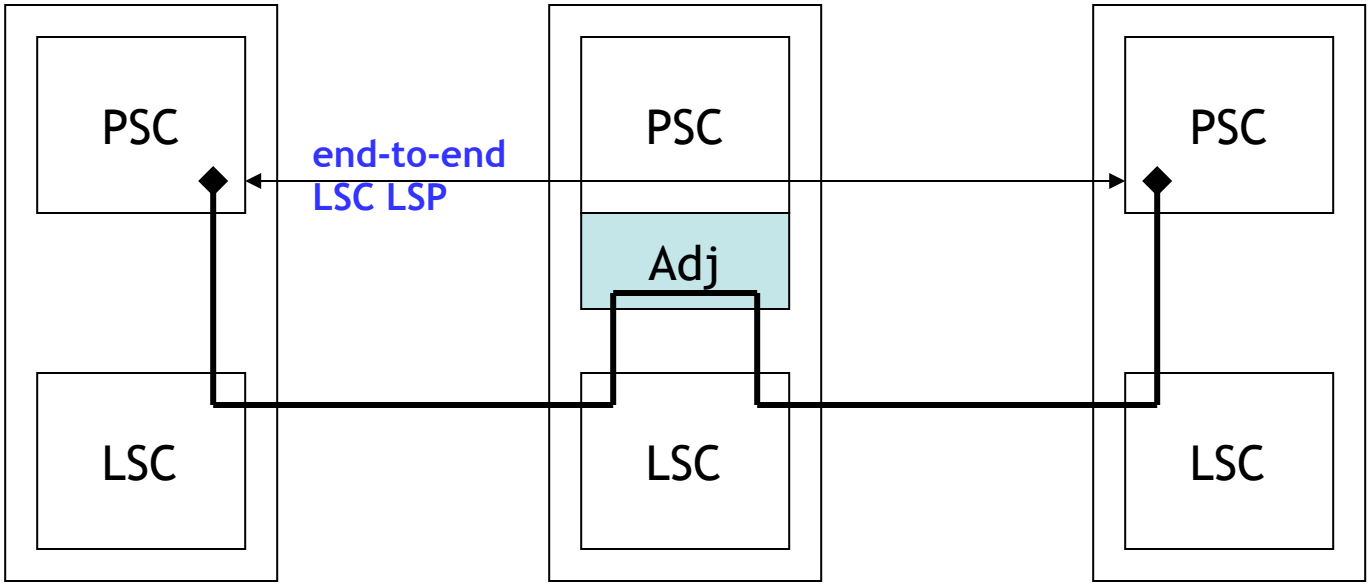
- Sent for feedback
- Once agreement reached => query for WG status

Backup slide

Motivation (1)

- Nodes equipped with PSC + LSC capability to regenerate the photonic signal without "interrupting" the LSC LSP

=> setup e2e LSC LSP even if certain intermediate nodes are being used to regenerate the signal at PSC level

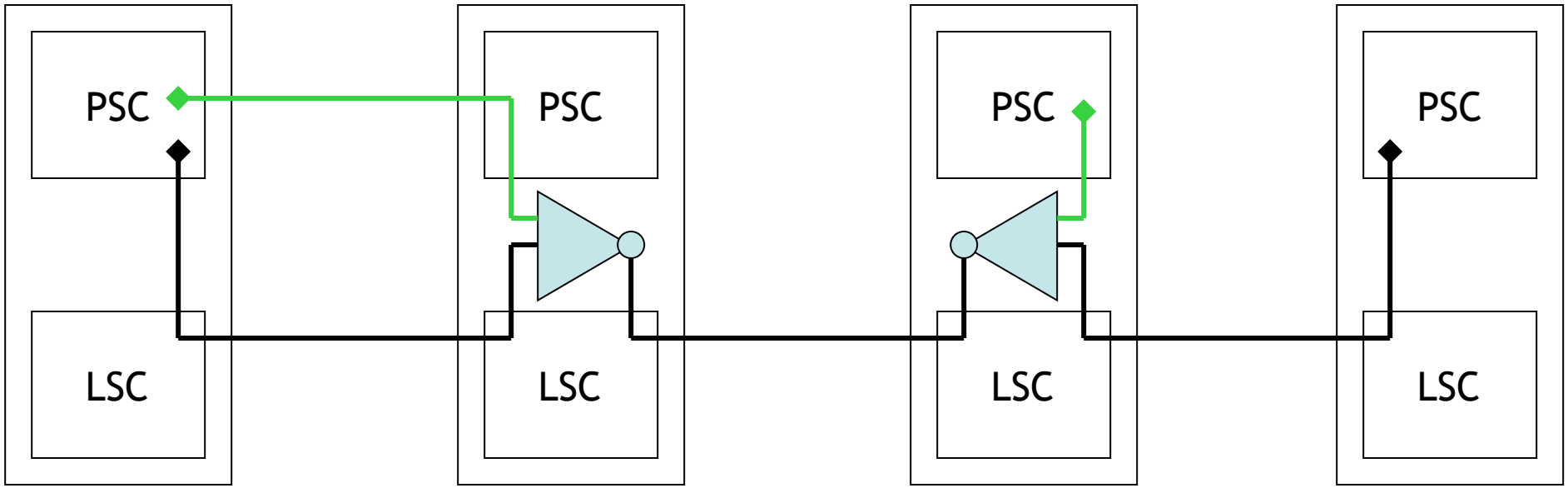


Motivation (2)

- GMPLS doesn't enable insertion of traffic at an intermediate point along an established LSP, i.e., the control plane limits the flexibility of nesting LSP only at the head-end of the underlying LSP

=> multiplex and demultiplex e.g. PSC LSP into LSC LSP even if the LSC LSP does not originate/end at the nodes where PSC LSPs are multiplexed or demultiplexed

Gain: re-use of existing LSP + avoids one-hop FA LSP



Adjustment capability

- Adjustment capability assumes the availability of adjustment capacity or adjustment resource pool at given SC (say SC Z, in the following).
- Adjustment capability: mean by which LSPs can be
  - adapted/mapped from one SC X to SC Y via Z
  - translated from one SC X to SC Y via Z
  - inserted (e.g., multiplexed or demultiplexed) from SC X to SC Y via Z. Note that SC X value MAY be identical to SC Y value and that SC Z value MAY be identical to SC X or Y value
- Examples
  - Transparent regeneration: SC X = LSC = SC Y and SC Z = PSC
  - Traffic grooming: SC X = PSC and SC Y = LSC and SC Z ≡ adj. resource pool enabling the insertion of packet LSP into a lambda LSP

Check list

- Multiple mapping information from a client to a server layer.

  E.g. an Ethernet signal could be mapped over and OTN hierarchy using GFP-F or GFP-T adaptation.

  IACD sub-TLV includes "single" LSP encoding (like ISCD sub-TLV)

- Connectivity constraints
  - STM-16 -> ODU2 -> ODU3

    not STM-16 -> ODU1 -> ODU3
  - **Note: IACD sub-TLV bandwidth represent "resource pool"**

- Multistage inter-switching capability
  - **IACD already allows advertising single and multi-stage multiplexing capability**