GMPLS UNI
Best Current Practices

draft-beeram-ccamp-gmpls-uni-bcp-00.txt

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Introduction

- GMPLS
  - Provides tools to create and manage end-to-end services in various transport technologies
- GMPLS_UNI
  - RFC 4208 discusses how GMPLS can be applied to the overlay model.
- [GMPLS_UNI_BCP]
  - Attempts to pool together the best current practices that are being used to apply the GMPLS Overlay model at the UNI reference point.
  - Based on experiences drawn from interoperating GMPLS-enabled IP routers with Optical Transport elements
  - Could be generalized for any client-server layer combinations

Hierarchical Network
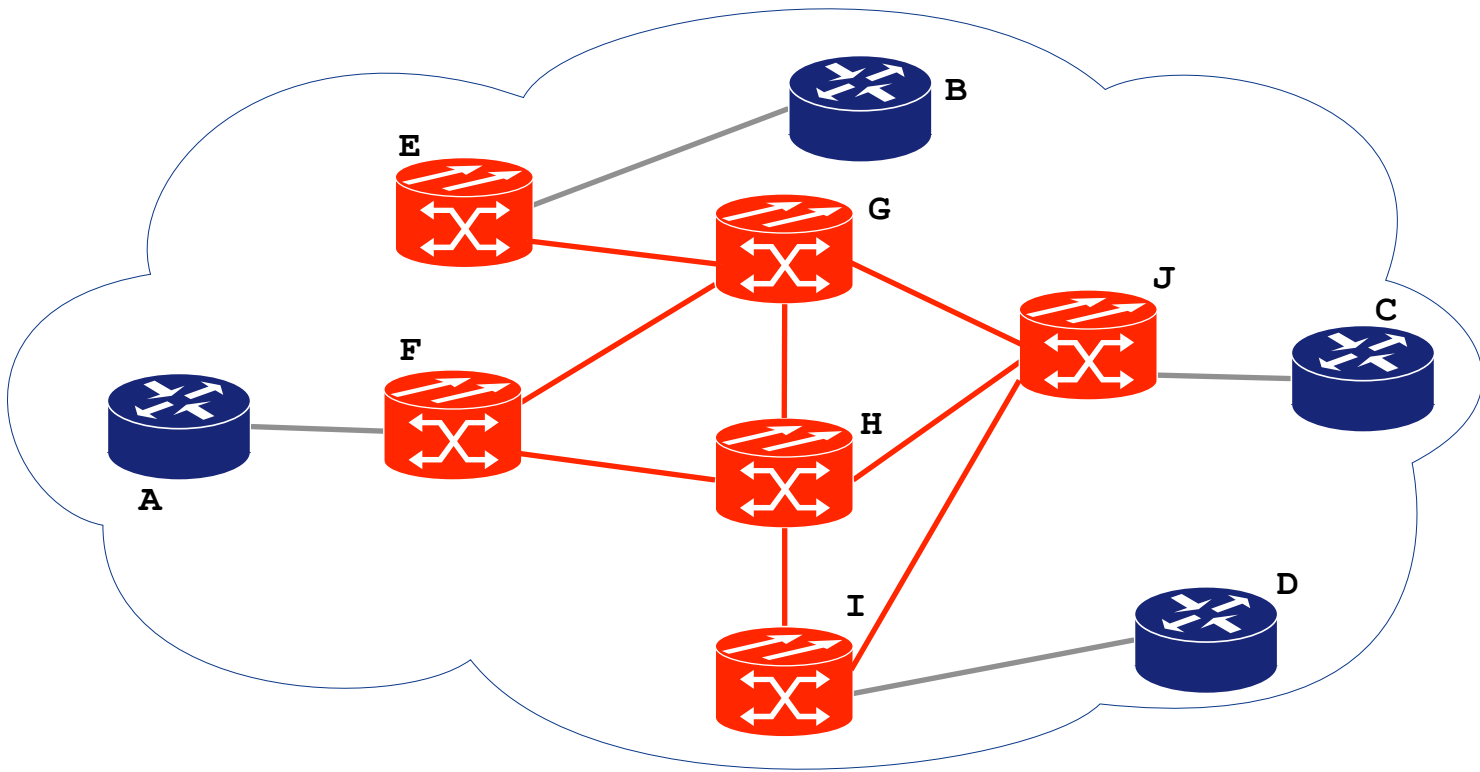
Traffic Engineering

- Topology and resource availability information required by elements of the client-layer network is distinct from that required by elements of the server-layer network
- One way to setup an end-to-end client-layer path in a hybrid network is to use an ERO with a "loose hop" across the server-layer domain.
- This would cause the server-layer to create the necessary segment of the client-layer topology on the fly.
- Drawbacks:
  - necessity for operator to specify ERO with "loose" hop
  - potential sub-optimal usage of resources
  - unpredictability WRT fate-sharing of the new segment created on the fly with other links of the client-layer topology.
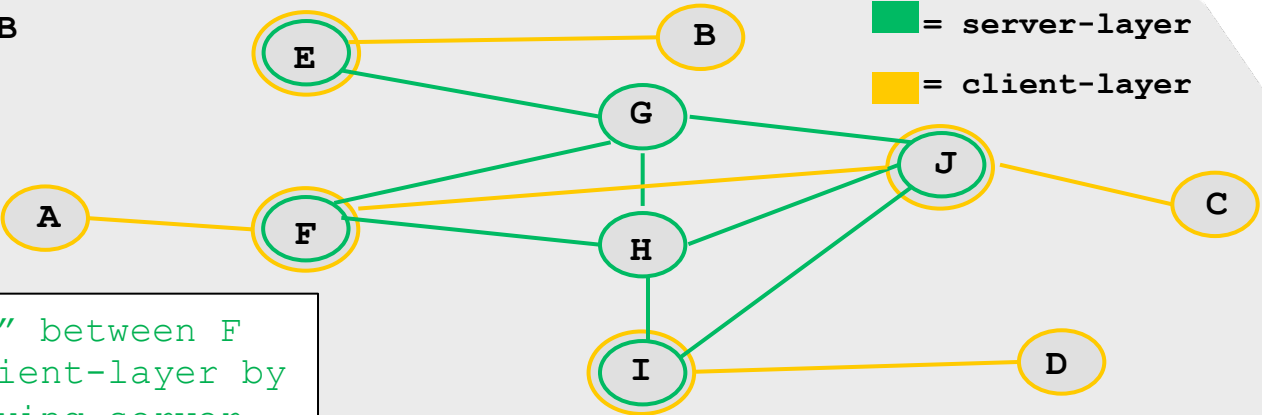
Augmenting client-layer topology

- To enable computing paths between pairs of client-layer endpoints the client-layer topology must be

available (in terms of TE-links and nodes that exist in the client layer) to all the clients
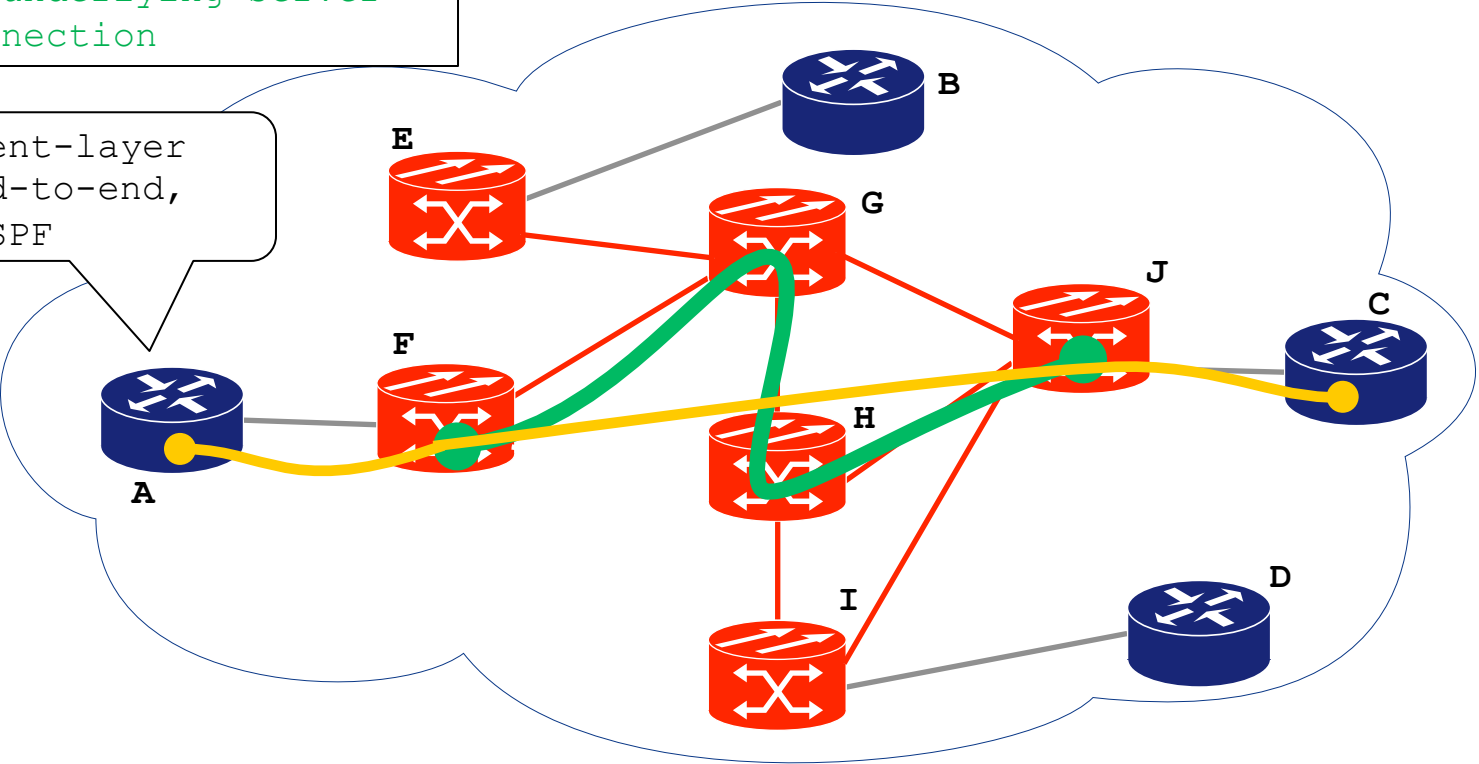
Augmenting client-layer topology

Client TEDB

■ = server-layer
■ = client-layer

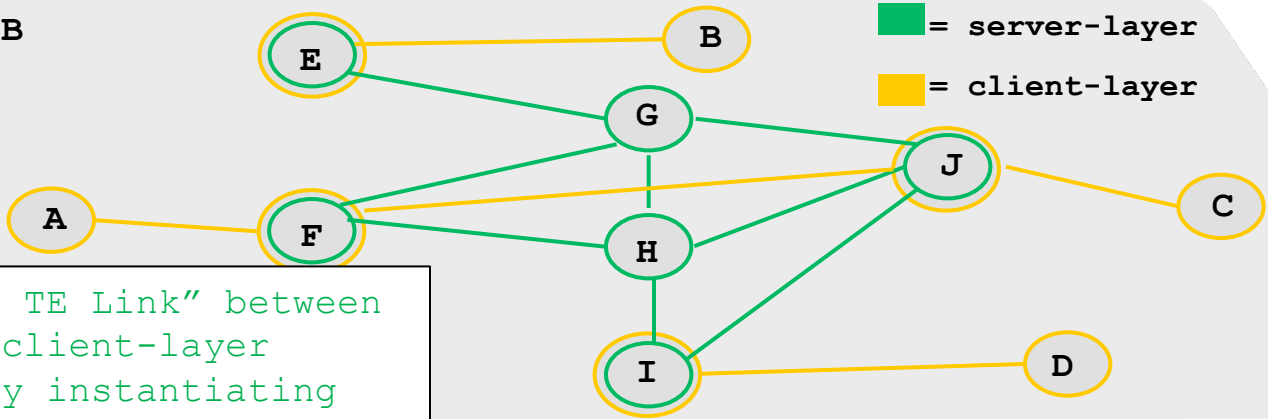Create "TE Link" between F and J in the client-layer by creating underlying server-layer connection

Have client-layer links end-to-end, can do CSPF

- Virtual TE Link is a TE link that is advertised into the client-layer with no active server layer trail set up to support the TE link

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      – It is advertised just like a real/regular TE link (client-layer elements see no difference between virtual and real links)

  – It can share server-layer resources with other virtual TE links

    - When a virtual TE link is signaled in the ERO of a client-layer connection, it ceases to be "Virtual" and transforms into a regular TE link
      – When this transformation takes place, the clients notice the change in the advertised available bandwidth of this TE link
      – All other virtual TE links that share server layer resources with the link in question start advertising "zero" available bandwidth

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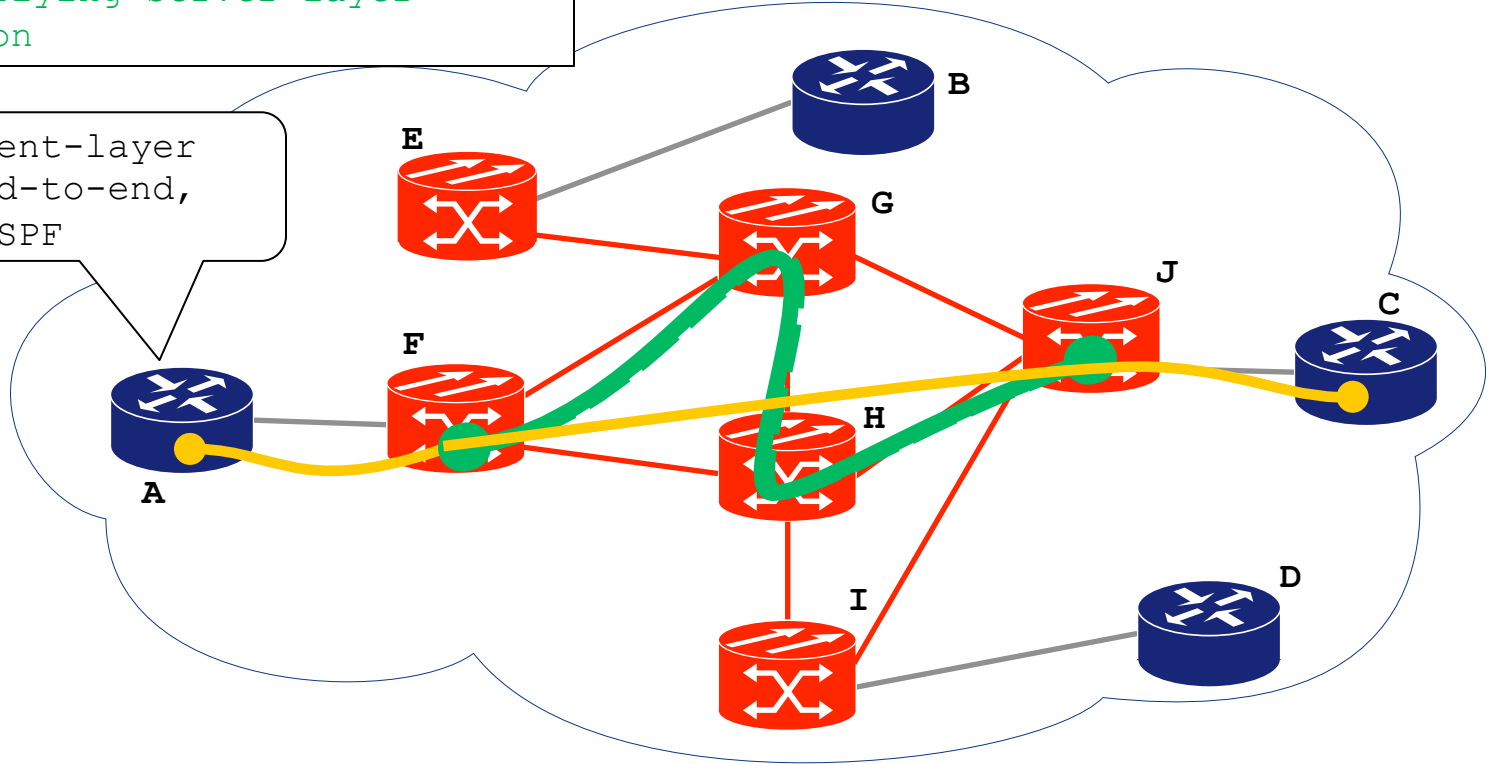# Hierarchical Service Activation

Client TEDB

= server-layer

= client-layer

Create "Virtual TE Link" between F and J in the client-layer without actually instantiating the underlying server-layer connection

Have client-layer links end-to-end, can do CSPF

Macro SRLGs

- TE links that are added to the client-layer topology may not be totally independent
  - If diverse end-to-end client-layer connections are to be computed, fate-sharing information of the TE links needs to be accounted for.
- Traditional SRLGs
  - Traditional SRLG represents a shared physical network resource upon which normal function of a link depends
  - Scalability issues exist with using physical SRLGs in multi-layer environments
  - SRLG IDs may collide in the client layer advertisements
- Macro SRLGs
  - Address scalability and uniqueness of IDs
  - Same protocol format as that of traditional SRLGs
  - Assigned automatically for each TE link that is advertised into the client-layer
  - Each Macro SRLG represents a path segment that is traversed by 2 or more of the underlying server-layer connections.

Macro SRLGs

Client TEDB

■ = server-layer
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SRLG 25

SRLG 25
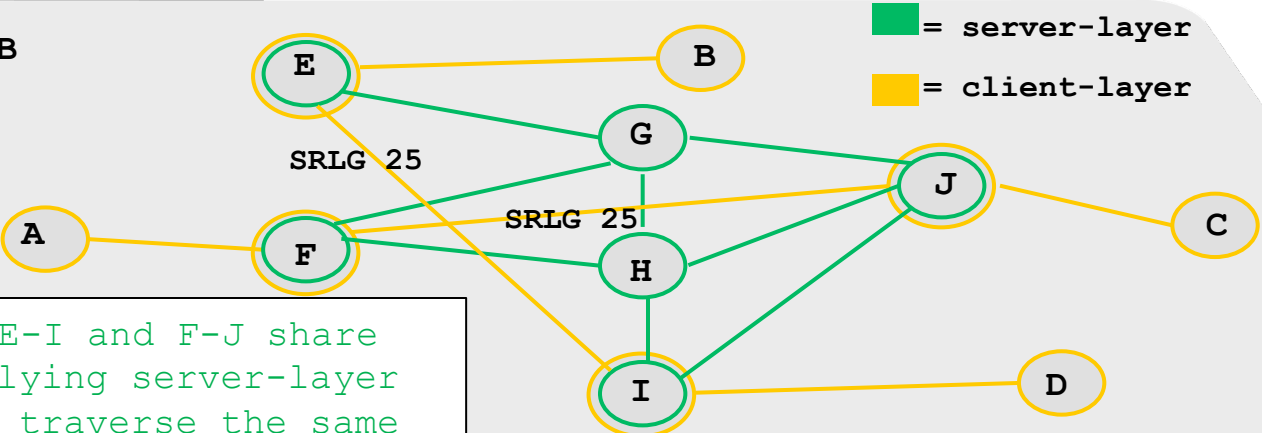
- "TE Links" E-I and F-J share fate (Underlying server-layer connections traverse the same path segment – [G-H][H-I])

- Macro SRLG-ID "25" assigned to both the "TE-Links"
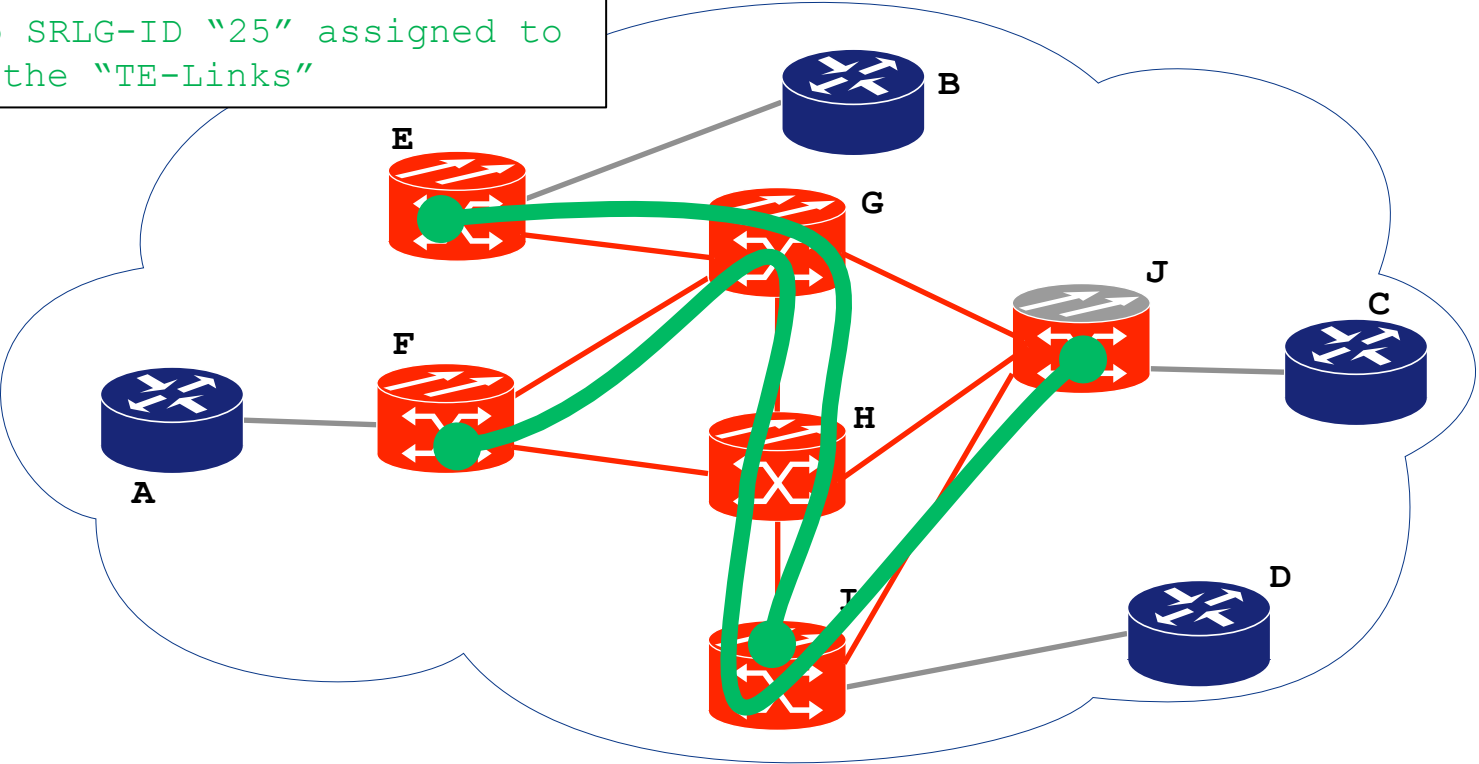
Switching Constraints

- Optical network configurations often necessitate specification of connectivity constraints in the TE advertisements.

- If constraints associated with the binding between a TE link served by the server domain and its associated access TE link are not advertised, there is a risk of an invalid path being picked.

- Extensions specified in [draft-ietf-ccamp-general-constraint-encode] address this

Switching Constraints

A   **B**   **C**   **D**

A1   B1   B3   C1   C3   D1
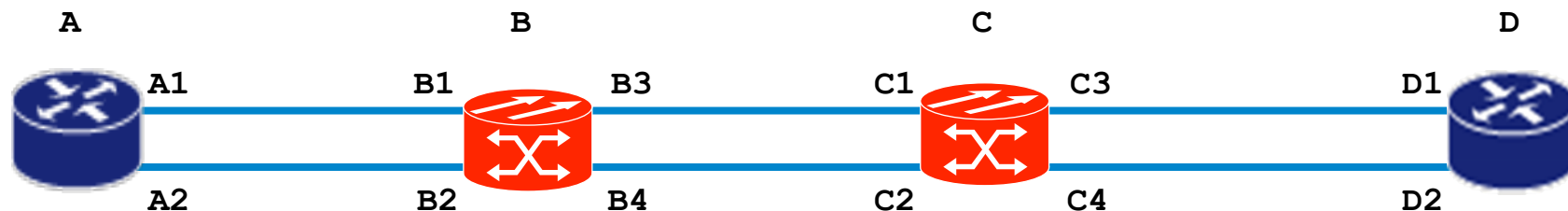
A2   B2   B4   C2   C4   D2

TE Links served by the server domain

B3-C1

B4-C2

Access TE Links

A1-B1   C3-D1

A2-B2   C4-D2

Valid Paths

[A1-B1][B3-C1][C3-D1]

[A2-B2][B4-C2][C4-D2]

Switching Constraints

B1 ⇔ B3

B2 ⇔ B4

C1 ⇔ C3

C2 ⇔C4

Invalid Paths

[A1-B1][B4-C2][…]

[A2-B2][B3-C1][…]

[A1-B1][B3-C1][C4-D2]

[A2][B4-C2][C3-D1]

Thank you