Applicability of Generalized Multiprotocol Label Switching (GMPLS) User-Network Interface (UNI)

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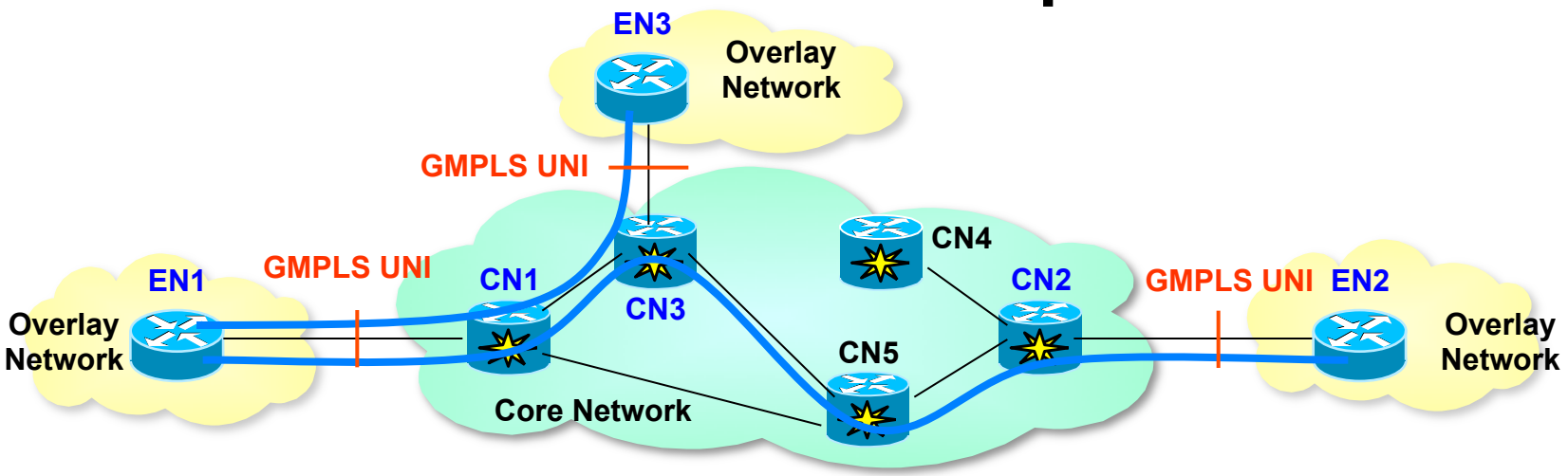
Overview of this Draft

  - UNI Deployment in different addressing space scenarios
  - UNI TE link discovery
  - UNI path computation
  - UNI connection provisioning models
  - UNI path recovery
  - UNI Call
- UNI multicast

• Shows how GMPLS protocol and PCE can be used to automate or enable critical processes for these applications

• Points out some existing unresolved issues of GMPLS UNI and suggests simple extensions to existing technologies to resolve the

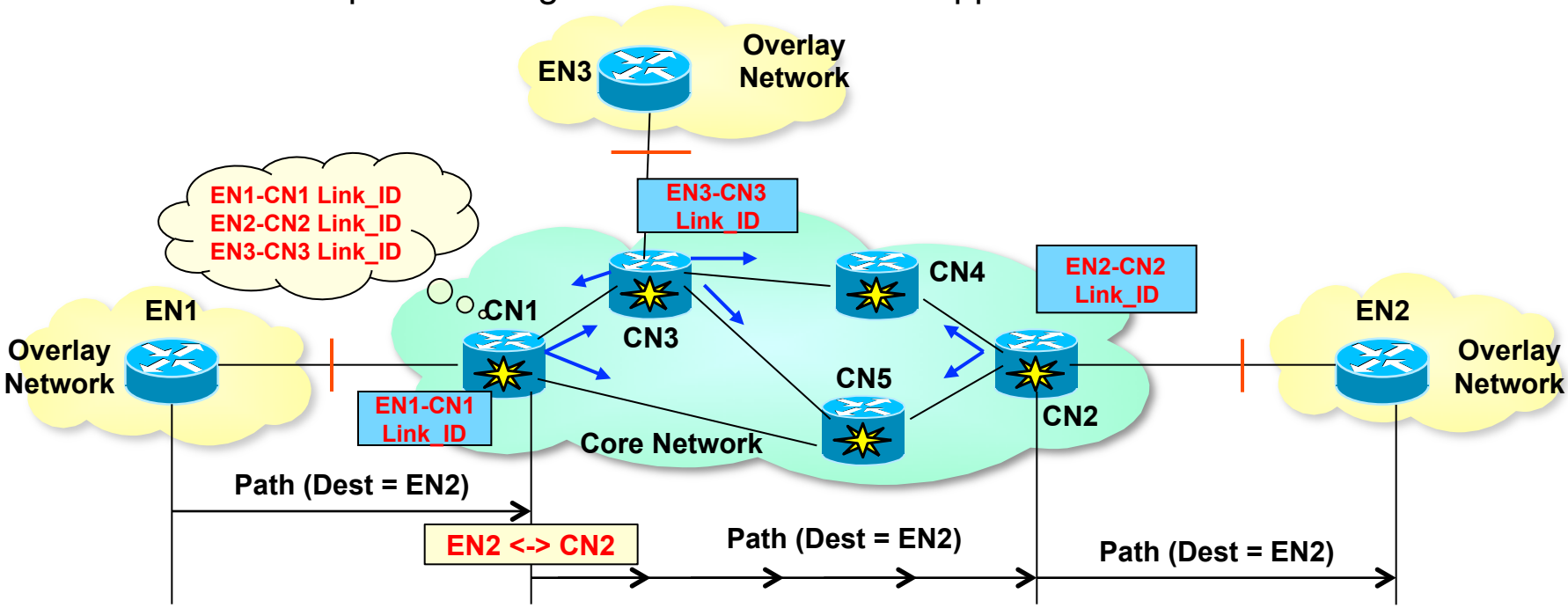
UNI Address Space



- Existing GMPLS UNI: ENs and their attached CNs MUST share the same address space
  - <EN1, CN1>, <EN2, CN2>, <EN3, CN3> MUST share the same address space
- Practical deployment
  and may NOT share the same address space
  - E.g., ENs use IPv4 while CNs use IPv6, or, CNs and ENs use overlapping address
- It may need to lift-up this address space restriction and introduce some process or mechanisms
  - e.g., reuse the session shuffling model defined in L1VPN (see the later slide…)

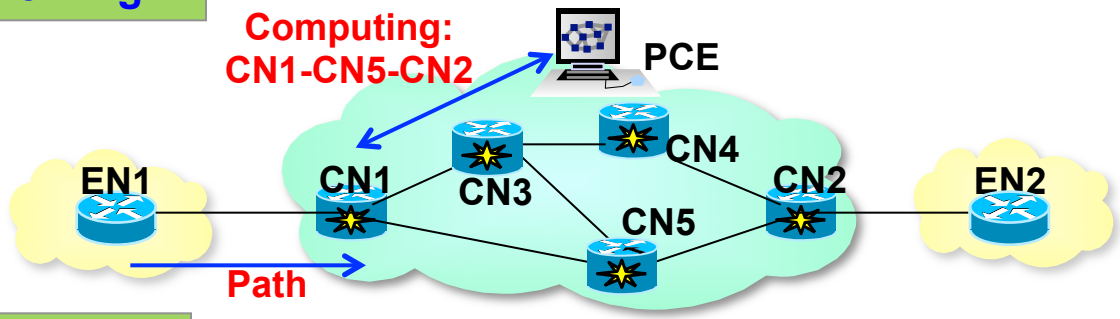
UNI TE Link Discovery

- When creating UNI connection, ingress CN is responsible to resolve who is the egress CN that the destination EN is attached
  - i.e., CNs should learn the information of all EN-CN relationship(e.g., by discovery or manual configuation)
- IGP needs to advertise the EN-CN relationship inside the core network
- L1VPN scenario: using L1VPN LSA *[RFC5252]* to advertise the CE-PE link
  - It could be possible to generalize this LSA to support other UNI scenarios



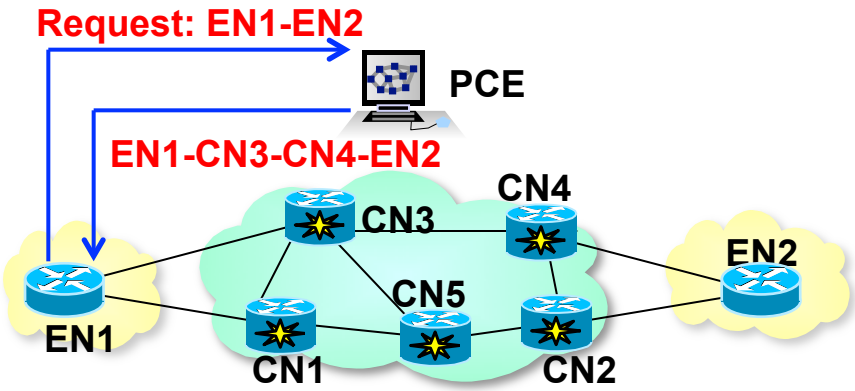
UNI Path Computation

Single-homing:

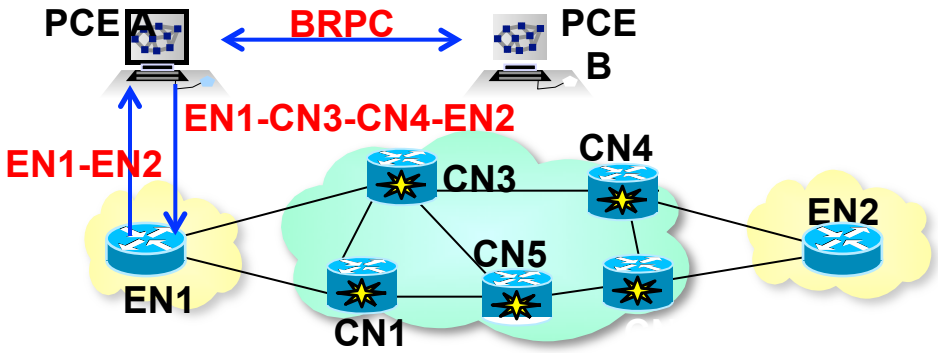


- CN1 or PCE computes the path segment inside the core network
- No need to select source UNI link because of single-homing

Multi-homing:



- PCE is aware of ENs and is visible to ENs
- PCE computes the E2E optimal path (by selecting the source UNI TE link)

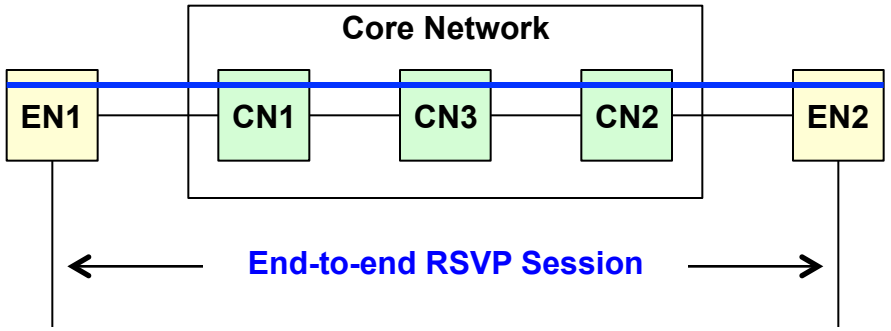


[redacted]

Note: No PCEP extensions are needed, just need some descriptions on how to deploy PCE in the UNI scenarios.

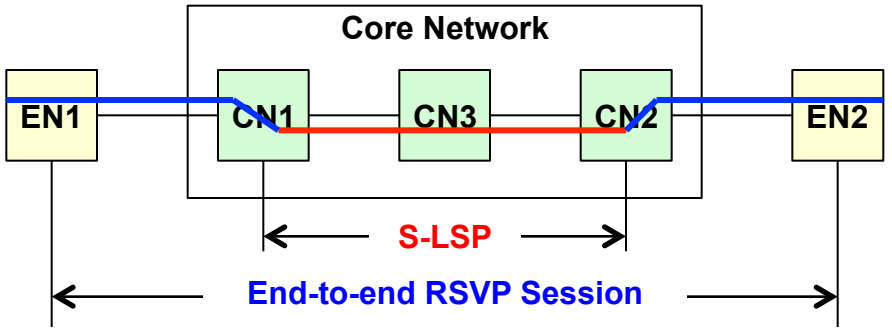
UNI Conn Provisioning Models

Flat model *[RFC3473]*



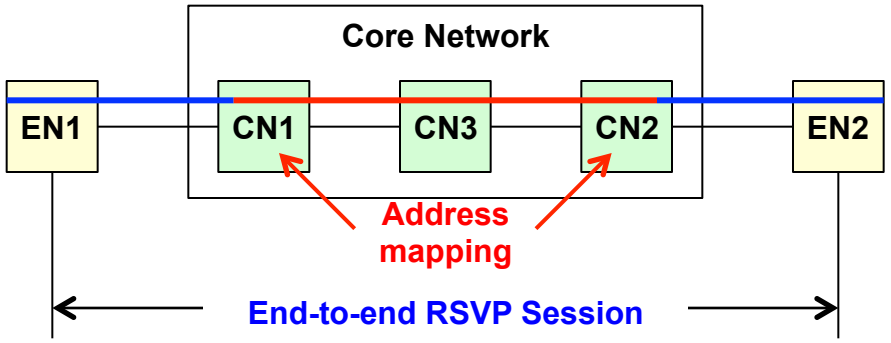
- Single end-to-end session through ENs and CNs
- Similar to intra domain path provisioning

Stitching model *[RFC5150]*



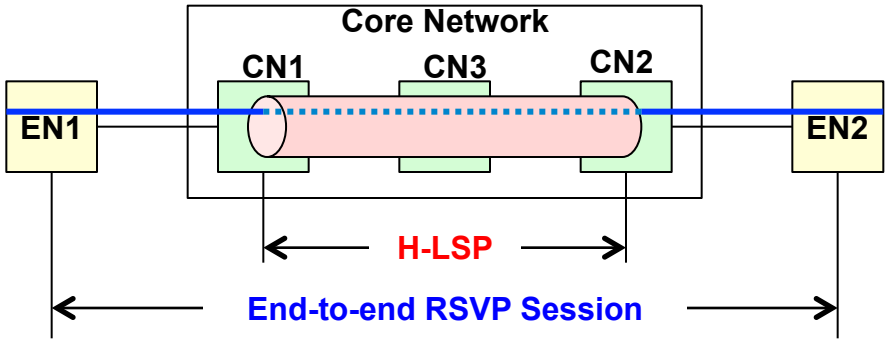
- S-LSP is pre-provisioned
- Stitch the UNI connection to the created S-LSP

Session Shuffling model *[RFC5251]*



- Address mapping at ingress/egress CNs, which changes the session identifiers
  - End-to-end session: source / dest = EN1 / EN2
  - Core session: source / dest = CN1 / CN2

Hierarchical model *[RFC6107][4206]*

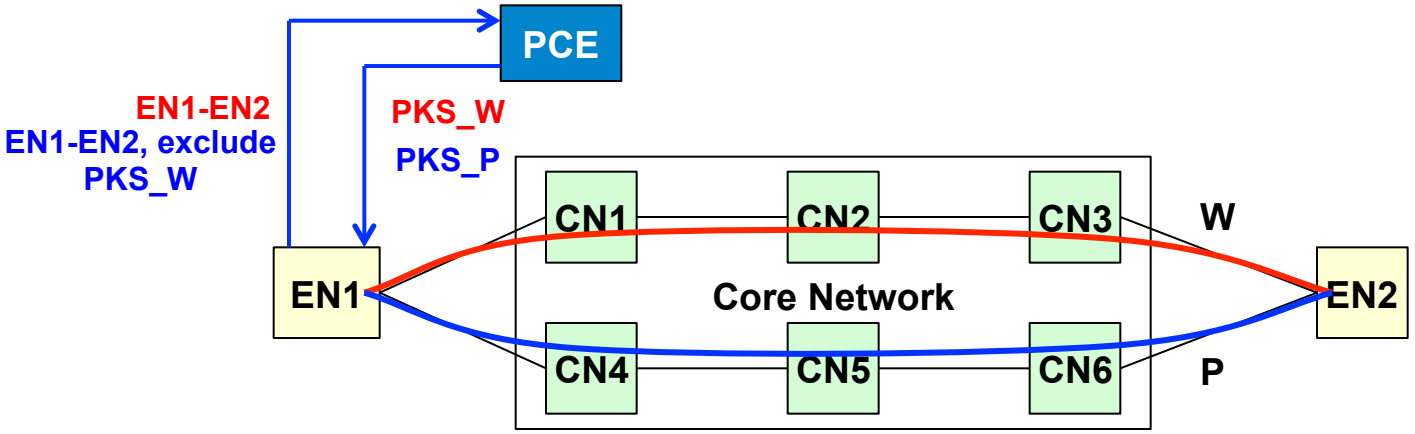


- The end-to-end UNI connection is nested into the H-LSP (tunnel)
- H-LSP can pre-provisioned or be triggered by the UNI signaling

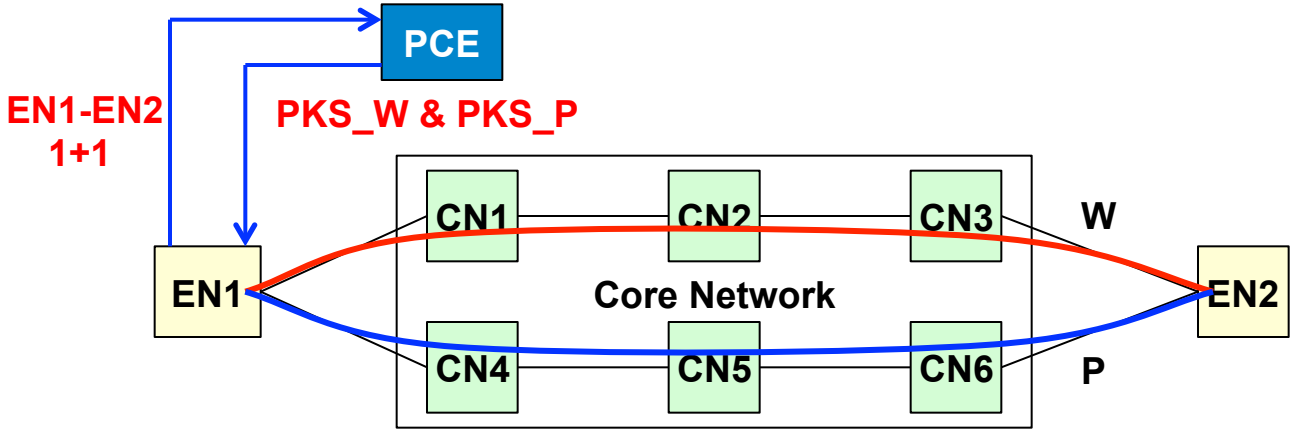
End-to-end UNI Path Recovery

- **In the case that PCE is involved:**
  - **Path Key can be used for confidentiality consideration**

Serial Path Computation



Concurrent Path Computation

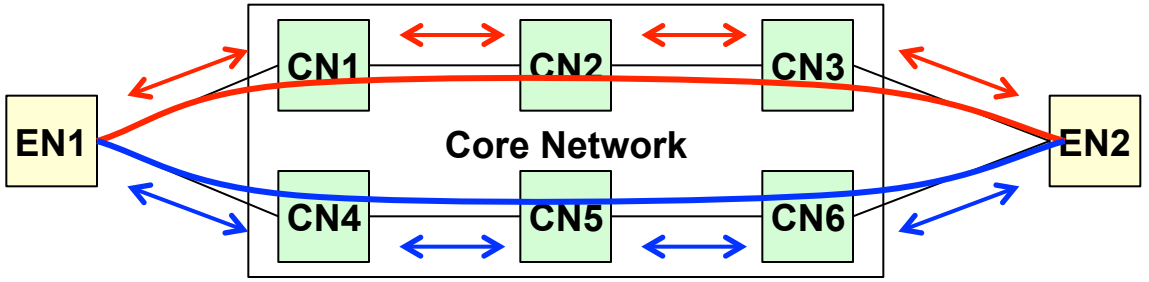


End-to-end UNI Path Recovery

Key point: diversity between working and protection path

General method

(1) Using RRO to collect the working path information



(2) Using XRO to exclude the working path when creating the protection path

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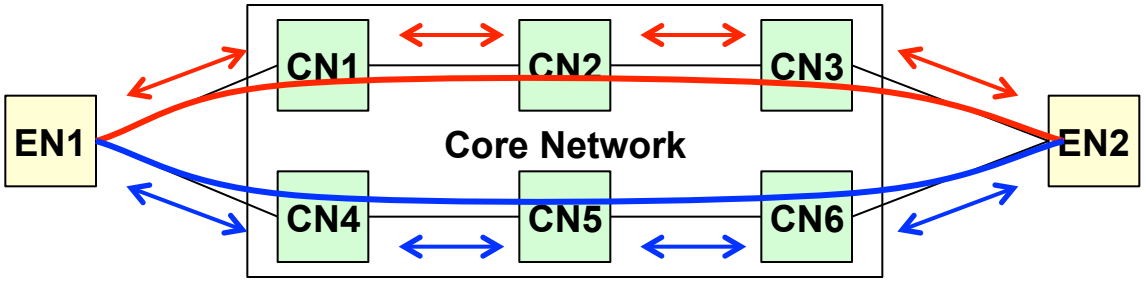
Topology hidden (confidentiality consideration)

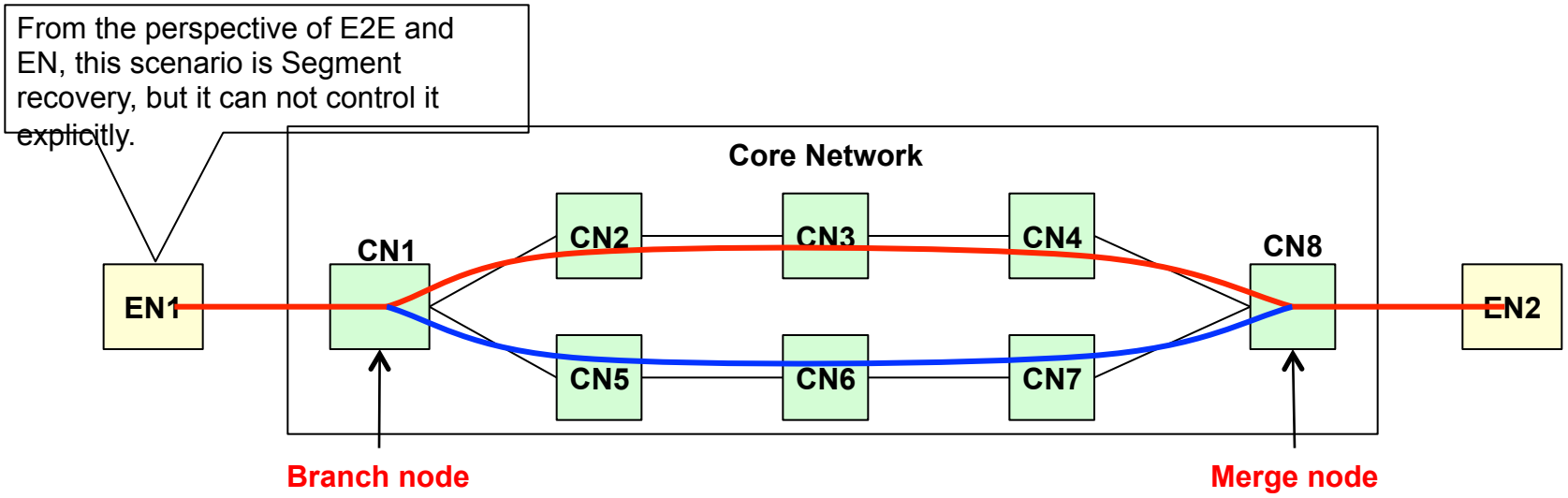
(1) Collect the working path SRLG



(2) Exclude the SRLG when creating the protection path

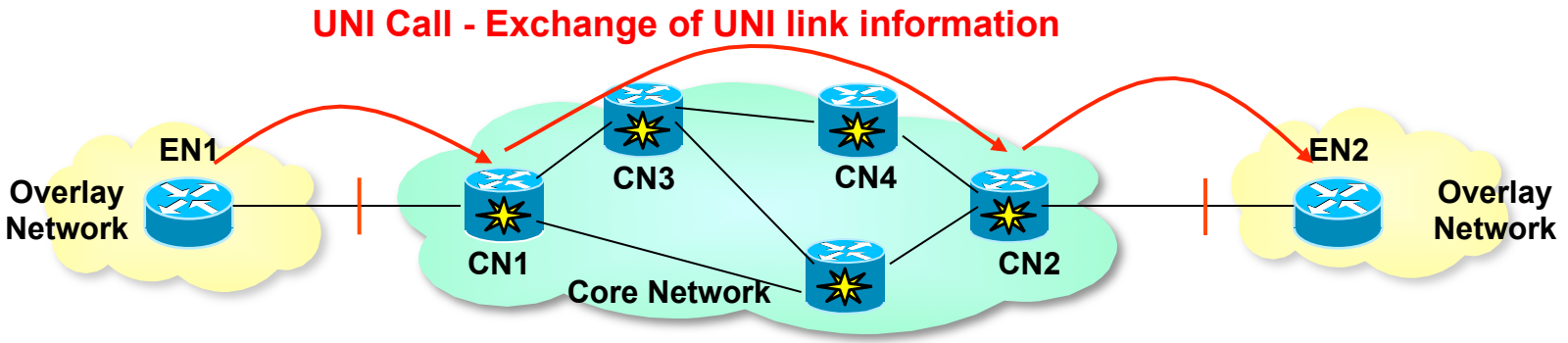
UNI Segment Recovery

- *[RFC4873]* provides the segment recovery
  - Use SERO to indicate the recovery segment between the branch node and the merge node
- But in UNI cases, the source EN may not know which CN the destination EN is attached to
  - Therefore, source EN cannot control the segment recovery explicitly (i.e., it can not fill the address of merge node into the SERO)
  - This issue may need to be address

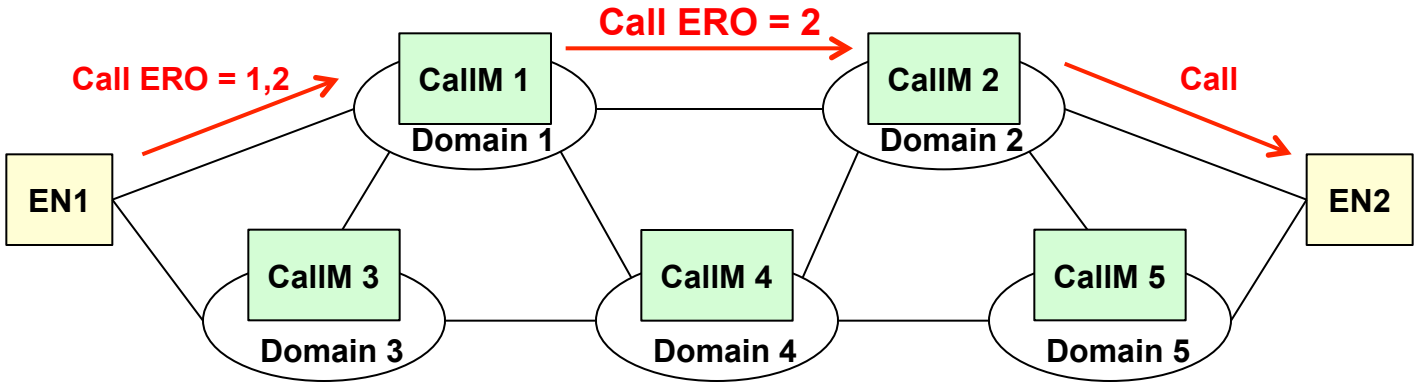


UNI Call

- **Exchanging of UNI link information [RFC4974]:**
  - **Information of destination UNI link is not advertised to the source EN. Therefore, Call is needed**



- **Multi-domain Scenarios:**
  - **Commercial and policy motivations play an important role in selecting Call route**
  - **Explicit of Call control is required (i.e., it may need some extensions)**

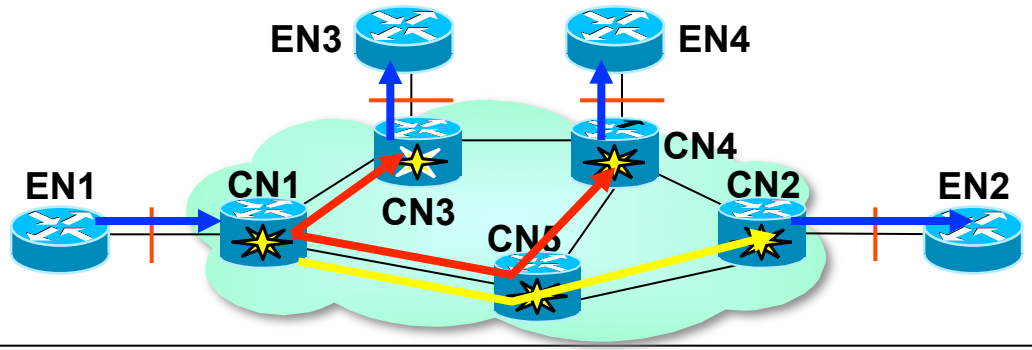


CallM: Call Manager

UNI Multicast

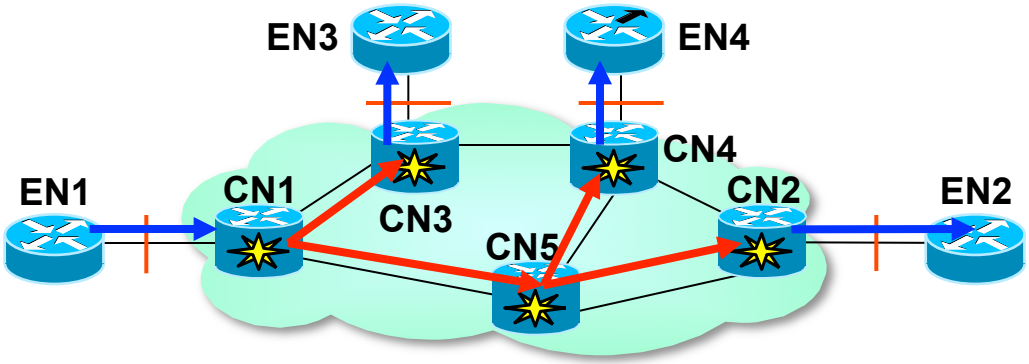
- There is a requirement to transport signals from one EN to multiple ENs
- If UNI P2MP connection is supported, bandwidth resource is saved
- Requirements:

Case 1: client layer multicast (saving UNI resource)



E.g., packet over TDM network, and CN1 has the packet multicast capability

Case 2: server layer multicast (saving UNI & core network resource)



E.g., all the nodes involved can support multicast capability

Conclusions

- The existing tools including GMPLS, PCE and GMPLS UNI [RFC4208] can support most of the scenarios
- There still are some restrictions or gaps to be resolved
  - E.g., address space restriction, UNI link discovery, UNI path provisioning, UNI recovery, UNI Call…
- Enhancement to the GMPLS UNI is required
  - Some extensions to the existing tools (e.g., GMPLS, UNI, PCE)

Next Steps

- Request the comments from operators
  - Any other scenarios should be included?
- Any comments are always appreciated