



Carrier Ethernet External Network to Network Interface (E-NNI)

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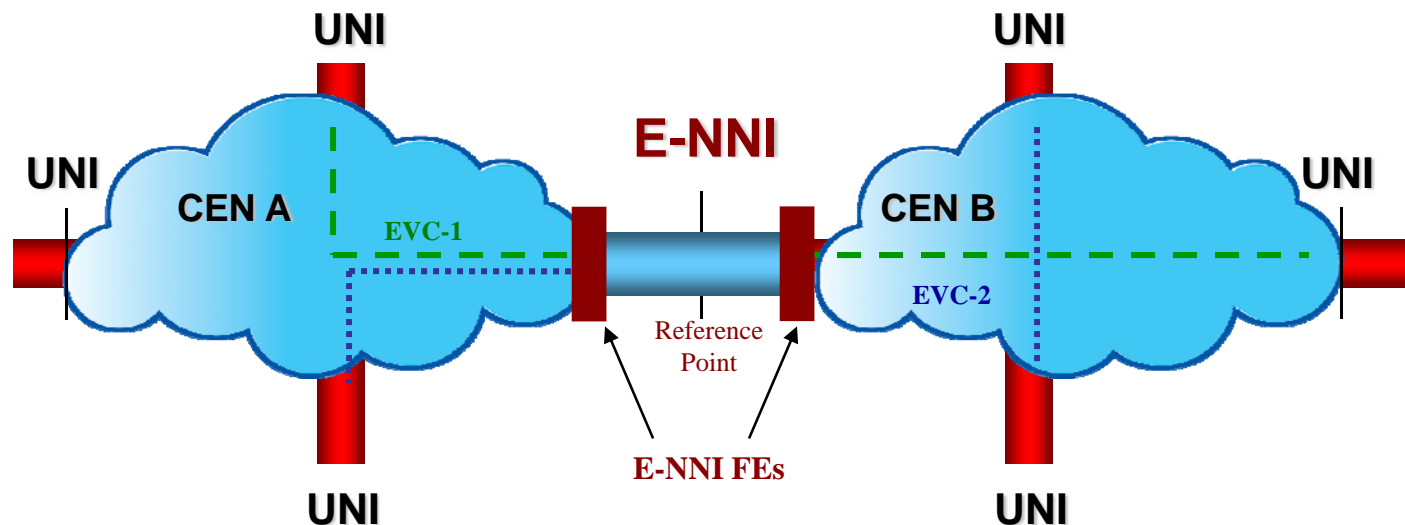


Why an MEF E-NNI Implementation Agreement?

- **Ethernet Service applicability have moved beyond the Metro area space**
- **Increasing need of Ethernet Service Providers to interconnect their Ethernet service offering for**
 - Multi-SP Ethernet service offerings
 - Interconnection of multiple internal CENs within a large Ethernet SP
 - Out-of-franchise Ethernet service offerings

What is the MEF E-NNI?

Simplified Reference Model: 2 CENs



- A reference point where 2 Service Providers meet in support of specified MEF Services
- Technically functionally supported by CEN equipment at the specified reference point in support of MEF Services (*E-NNI Functional Element)

E-NNI Phase I

In Scope:

- **E-LINE and E-LAN services (but not E-TREE)**
 - Inc. hairpinning (e.g., frame may go in/out same PHY)
- **Multiple CENS**
 - Inc. multiple E-NNIs or links between two CENs
- **E-NNI protection (but not End-to-End service protection)**
 - Customers & SP must provide loop-free connectivity
- **End-to-End OAM and QoS**
 - Inc. traffic “coloring” via IEEE PCPs or IETF DSCPs
- **Service Frame delineation via IEEE 802.1**
 - No S-Tag or single S-Tag

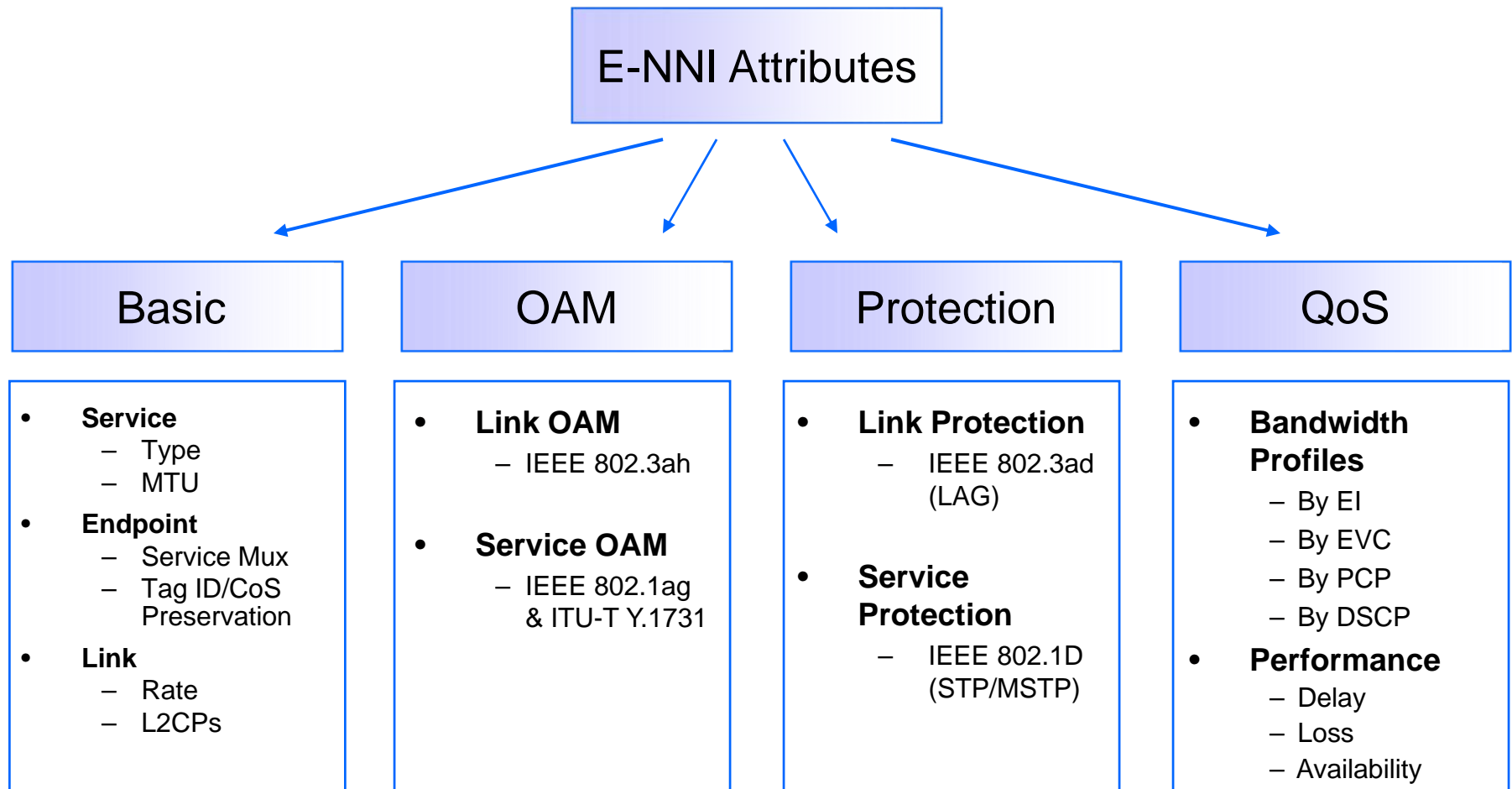
E-NNI Phase I

Out Scope:

- **EVC map across CENs via multiple S-tags, PBB or MPLS at E-NNI**
 - Multiple S-tag solutions unlikely
 - PBB and MPLS proposed for later phases
- **E-Tree**
 - More time required to work out forwarding rules to avoid leaf blackout
 - Proposed Approach: Multiple endpoints types (root, *trunk*, *branch*, leaf) and combination rules for how they connect
- **NIDs (aka MTU types)**
 - Desire for multiple NIDs types
 - Affects Service Attribute visible at External Interfaces and where tunnels terminate
 - Multiple scenarios and configurations to be specified.

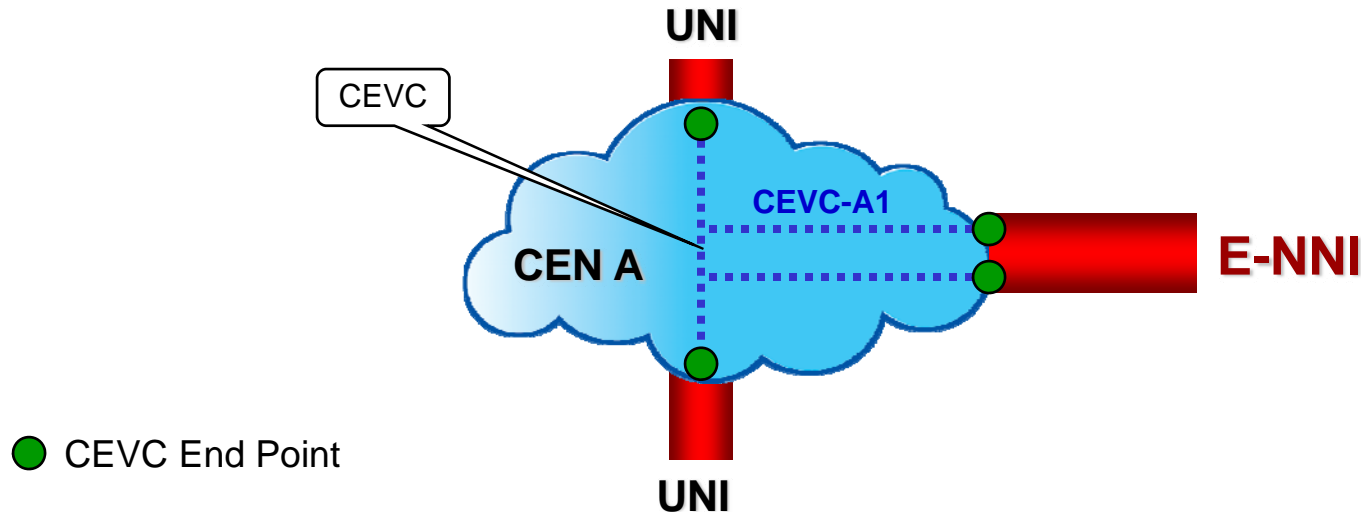
E-NNI Attributes

Similar attribute structure as current MEF specifications



C-EVCs & End Points

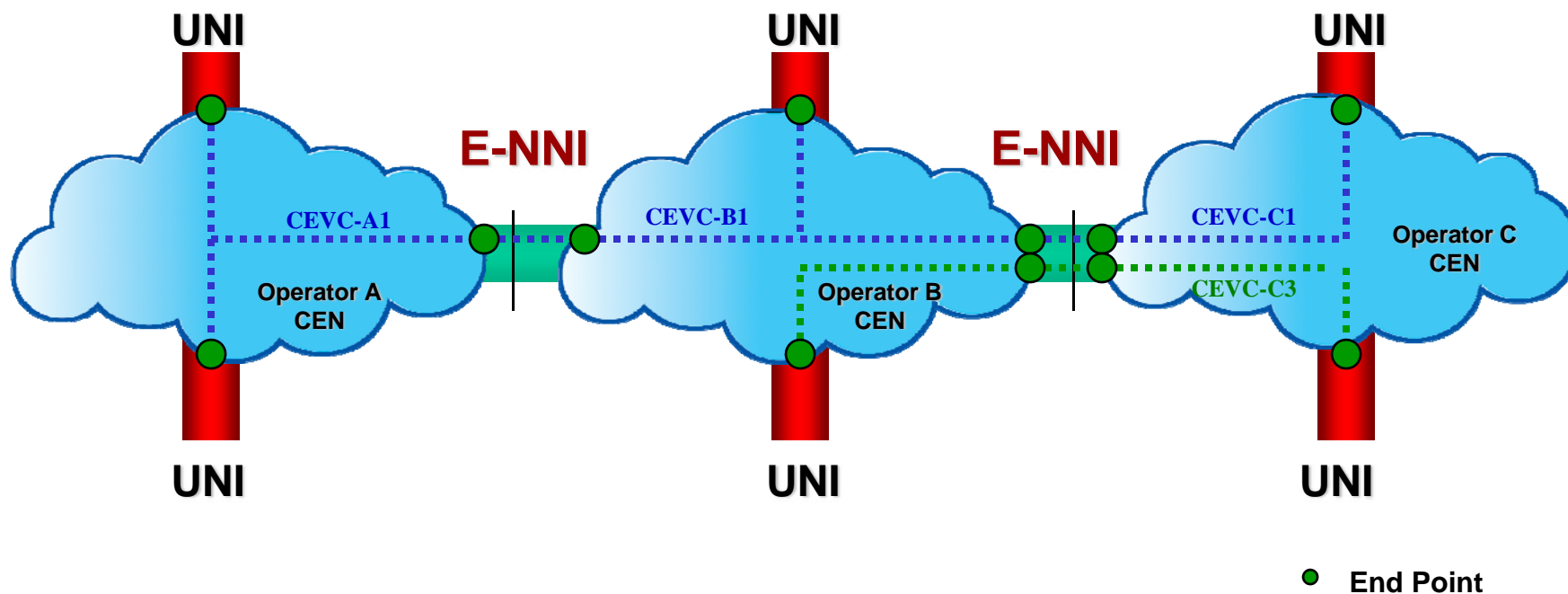
Component Ethernet Virtual Connection (CEVC)



- An CEVC associates End Points at External Interfaces (EI), e.g., UNIs or E-NNIs
 - A frame **MUST NOT** leak into or out of a ESNC
- There **MUST** be at most one CEVC End Point at a UNI
- There **MAY** be multiple CEVC End Points an E-NNI
 - A frame **MUST NOT** egress the End Point that it came in on
 - A frame **MAY** enter a CEN via a given E-NNI and then exit the CEN on via the same E-NNI (but via a different End Point)
- Each data frame **MUST** be mapped to a CEVC End Point at a UNI and at an E-NNI

Realizing EVCs & MEF Services

Single CEVC End Point per E-NNI Example



An EVC crosses multiple Operator CENs by:

- Establishing an appropriate CEVC in each CEN and then
- Mapping the CEVC End Points together at each E-NNI (via CEVC to End Point maps)

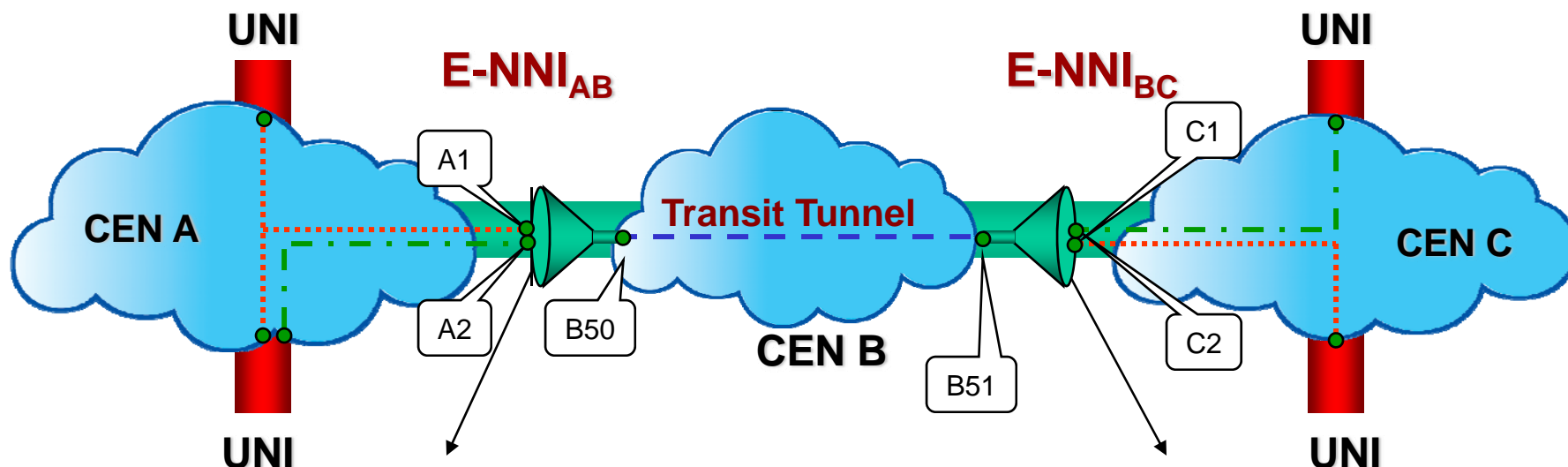
Digging Tunnels

- **Two types of tunnels are envisioned for E-NNI Phase 1**
 - Transit Tunnel
 - Terminating Tunnel
- **These require additional End Point Maps**
- **Terminating Tunnel introduces the Termination End Points (and Virtual UNI, Remote UNI)**
- **Generalization of ESC* may introduce additional types of tunnels**



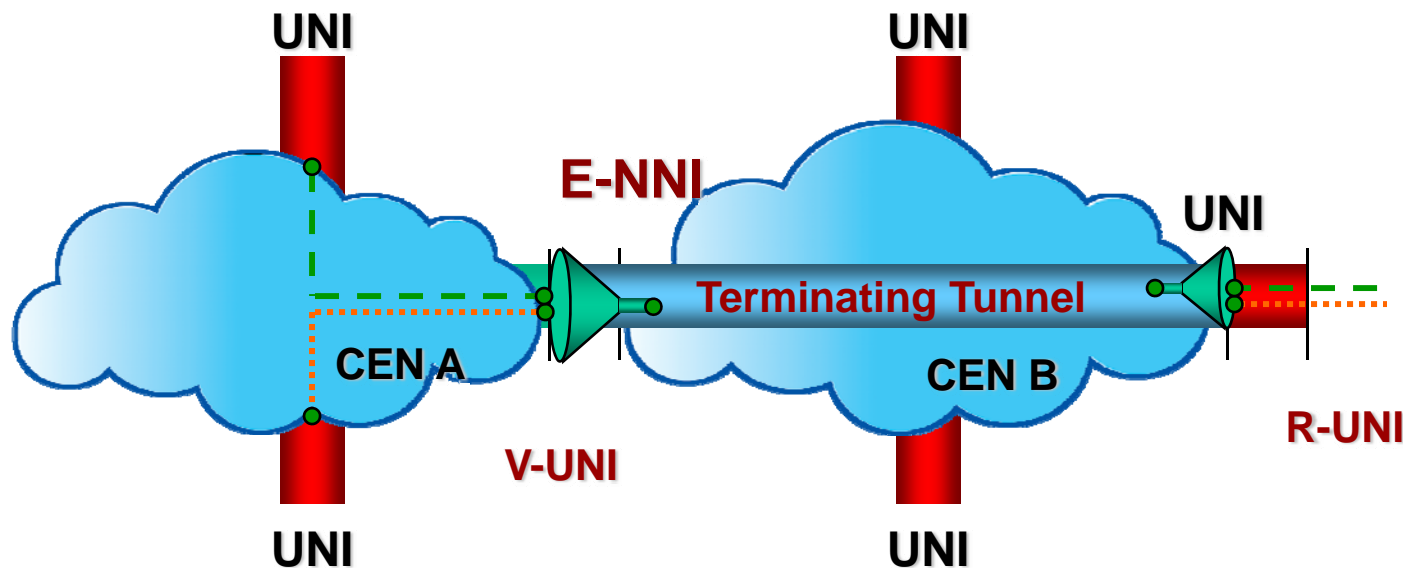
* ESC: Ethernet Services Constructs (New Ongoing Project)

New Services I: Transit Tunnel



- **Multiple S-VLAN IDs map to CEVC End Point in an Operator CEN**
 - Multiple CEVC End points in one Operator CEN bound with a single CEVC End Point in the other Operator CEN
- **Transit Tunnel CEVC must have:**
 - Exactly 2 End Points (eliminates MAC address learning issues)
 - S-VLAN ID Preservation = yes
- **Multiple Transit Tunnels can exist on a given E-NNI**

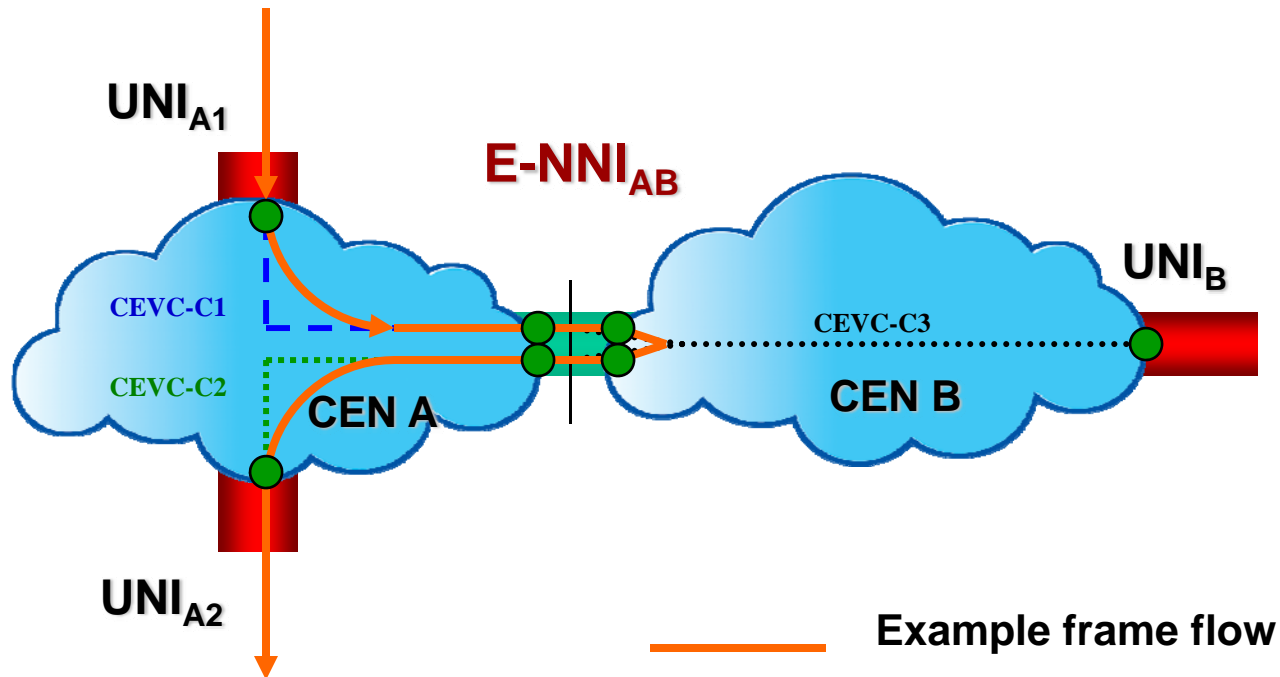
New Services II: Terminating Tunnel



- **CEN Operator B “extends” UNI to E-NNI:**
 - Operator B not aware of the individual EVCs
 - Service Provider, e.g., Operator A, can add and delete EVCs without coordination with Operator B
- **Multiple Terminating Tunnels can exist at an E-NNI:**
 - Operator A sees each Terminating Tunnel as a Virtual UNI (VUNI)

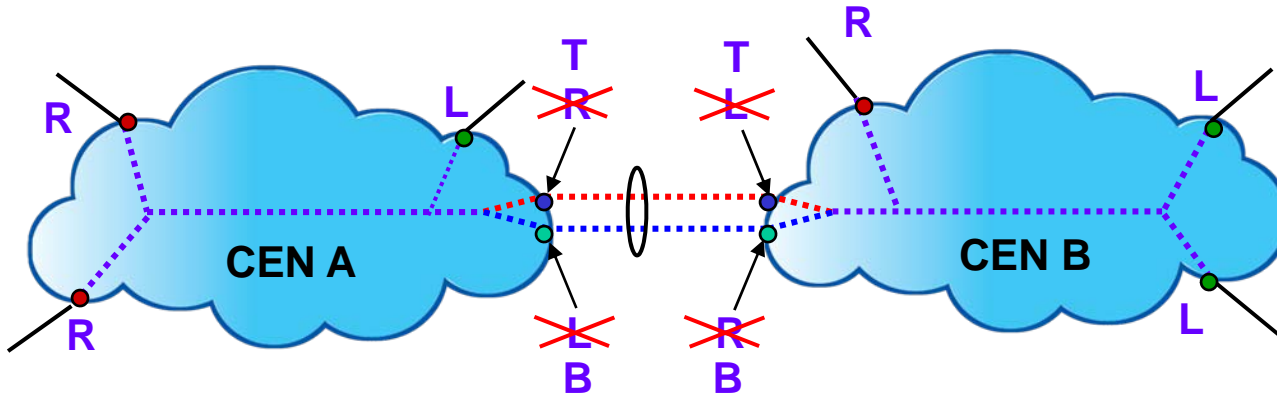
Hairpin Switching

Enabling remote access to MEF Services



- Multiple CEVC End Points at an E-NNI allows hairpin switching
- Beware!!
 - Not to be configured back-to-back on the same EVC!!

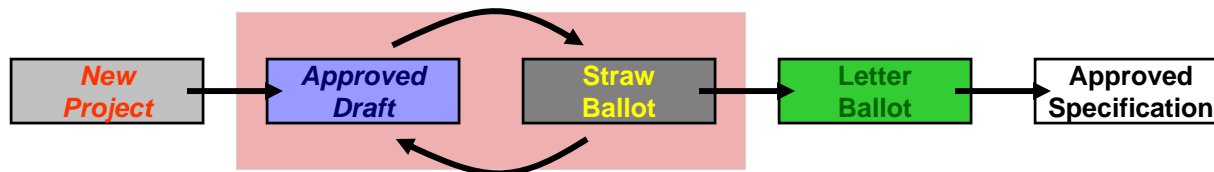
Next: New Improved Rooted Multipoint



- **Define two new endpoint types:**
 - Trunk: Receives from Root and Trunk ; Delivers to Leaf, Root, and Trunk
 - Branch: Receives from Leaf and Branch ; Delivers to Root and Branch
 - Each E-NNI has a pair of Trunk and Branch End Points
- **Why is this better?**
 - Eliminates * restriction not to deliver frames between pair of endpoints at E-NNI.
 - Makes multipoint transit tunnel work.
 - Makes pair of transit multipoint CEVCs work.
 - Makes implementation in 802.1 bridges simpler (more natural implementation).

E-NNI Phase I Project Roadmap

- **First Approved Draft v1.0** - Aug, 2003
- **Project Re-chartered:** - Jul, 2006
Phase 1, AD 1.0
- **Current Approved** - Aug, 2007
Phase 1, AD 3.3
- **Expected IA Approval** - 4Q, 2008





Thanks!

Questions?