

# Bridge Port Extension using PBB-TE

**Paul Bottorff**

**Ben Mack-Crane**

**David Martin**

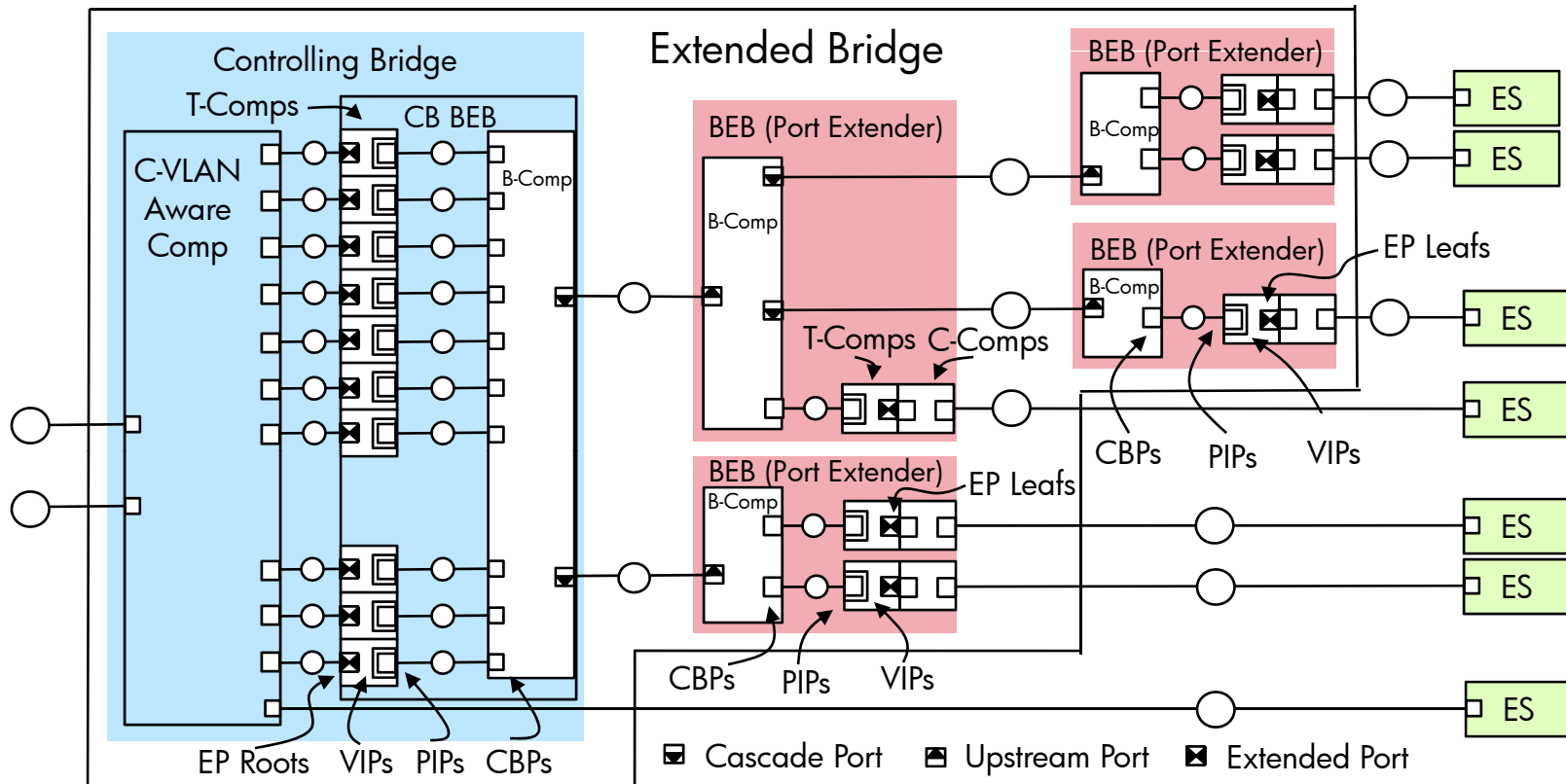
**Panagiotis Saltsidis**

# Comparison between E-TAG and PBB-TE Port Extenders

	E-TAG PEs	PBB-TE PEs
Compatibility with existing 802.1Q Bridge relay		★
No new components		★
No new tags		★
Optional support for CFM, protection and multipathing		★
Optional support for congestion notification	★ <sup>1</sup>	★
Optional support for ETS and PFC	★	★
Optional support for EVB & VEPA	★	★
Lowest overhead octets	★	

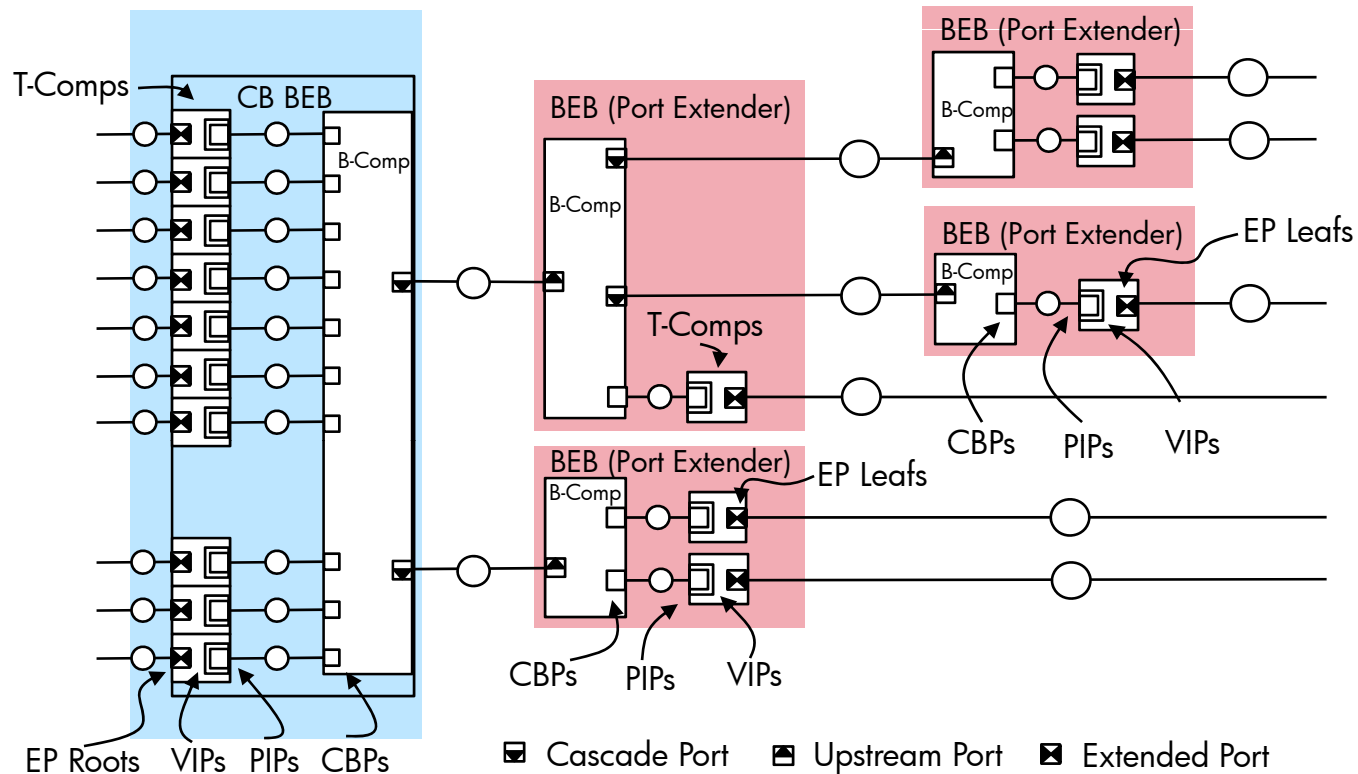
1) Since E-Paths are uni-directional it is not possible to have CN on E-Paths.

# Extended Bridge built from BEBs



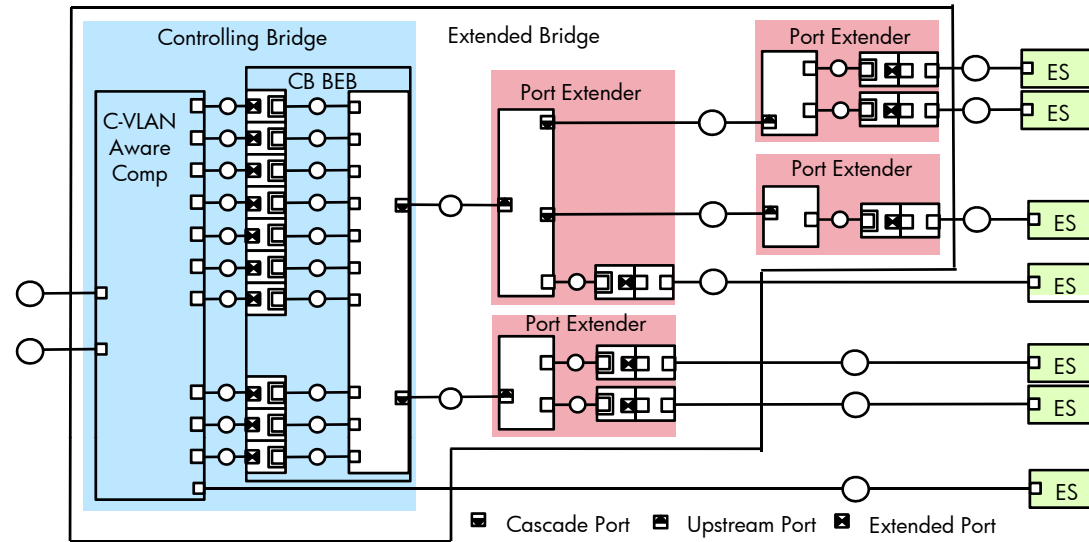
- The EVB Controlling Bridge is composed of a BEB with a B-component and a T-component per VIP coupled to the primary C-VLAN aware component (or S-VLAN aware component)
  - Each Cascade Port is just an exterior facing PNP of the BEB
  - The VIP's of the CB-BEB are modified to form the B-DA and B-SA based on information passed from the C-Component
- A Port Extender is a BEB composed of a primary B-component and a T-component per EP
  - The VIPs of the Port Extender BEBs use standard T-Components
  - An optional 2-Port C-Comp on each leaf Extended Port is used for C-TAG manipulations

# Port Extender PBBN



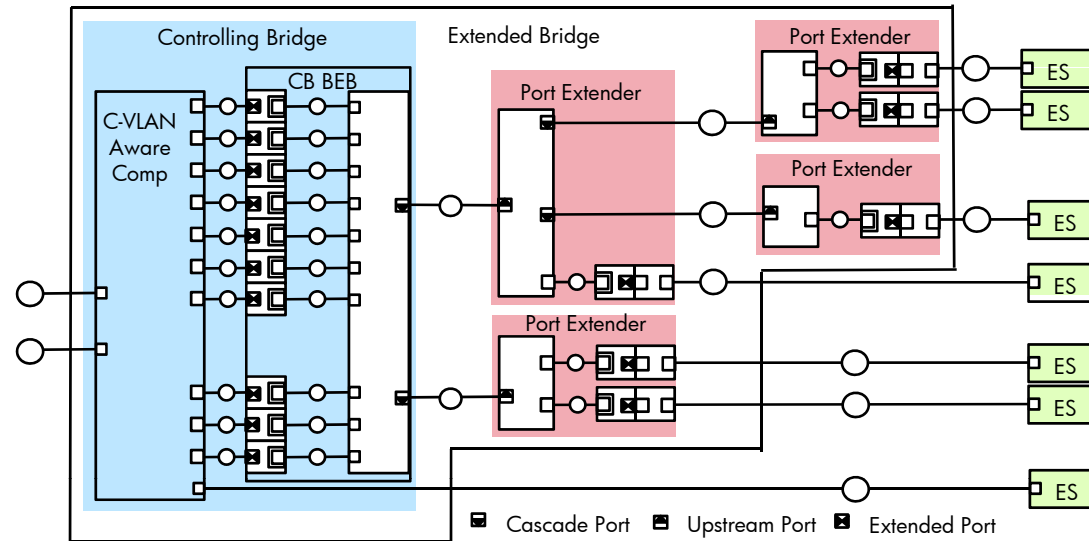
- The Port Extender components of the Controlling Bridge along with the external Port Extenders make a complete PBBN which can support PBB-TE forwarding

# What is the same as PBB/PBB-TE?



- Just an application of PBB-TE with a limited topology and component organization, therefore the Controlling Bridge and Port Extender can be PBB/PBB-TE, with Extended Bridge feature additions.
  - Each leaf EP is connected to a CB-BEB VIP with a point-to-point TESI
  - Each UP is connected to a CB-BEB VIP with a point-to-point TESI
  - Each “replication group” or EP set is connected from a CB-BEB VIP with a point-to-multipoint ESP
- The Controlling Bridge’s primary component is modified as in 802.1Qbh
- The Port Extenders forward along configured TESIs
  - Each EP is attached to single VIP and PIP on a T-Comp
  - The PIP associated with an EP is identified by a unique B-MAC , which may be constructed using the E-PID

# What is different from PBB/PBB-TE?

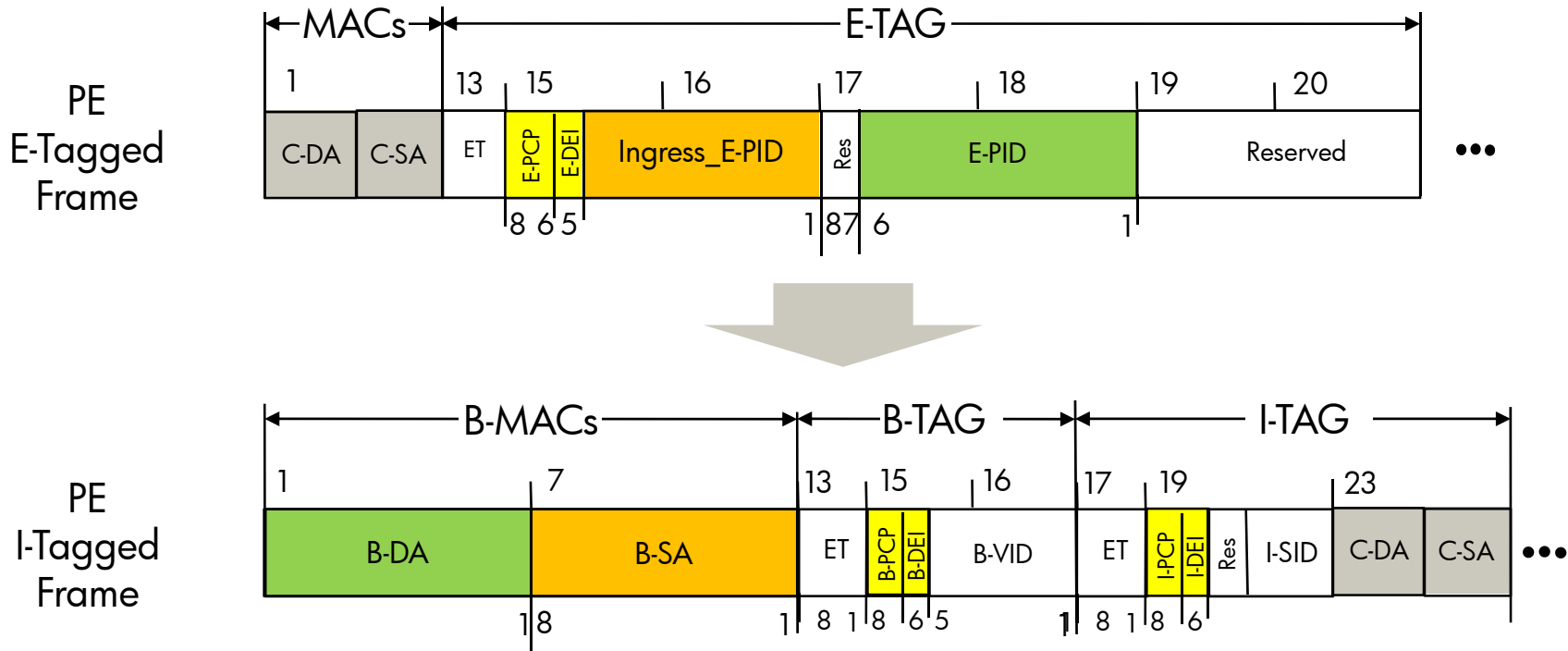


- The forwarding state for the CB-BEB and Port Extenders is configured using the Port Extender Control and Status Protocol
- The C-VLAN component relay issues one request primitive for each frame to be forwarded via the PE
  - The connection\_identifier parameter carries a port map indicating the ports associated with EPs to which the frame should be forwarded
  - If the related indication primitive was received from the PE the request primitive is sent on the port from which the indication was received
  - If the related indication was not received from the PE, the request is sent on one of the ports indicated in the connection\_identifier
- The CB-BEB PIPs assign B-MAC addresses selecting the ESP for each primitive according to modified rules for Port Extension
  - For “remote replication groups” the PIP selects a B-DA (E-PID) identifying a point-to-multipoint TESI (as currently in Qbh)
  - If the PIP’s corresponding EP is not in the connection\_identifier port map, the frame is marked for echo cancellation
- Echo cancellation is performed at the PIP associated with an EP, whenever the B-SA is equal to the corresponding root EP’s CB-BEB echo cancellation B-MAC
  - Subclause paragraph 6.10.1f) is extended to provide a parameter for the B-SA which is cancelled. This parameter is set to the associated root EP

# 802.1Qbh/BR Leverage

- Port Extender Control and Status Protocol from 802.1BR with perhaps some modest changes in the E-PID field definitions
- The managed object extensions for the Controlling Bridge MIB
- The PE LLDP extension TLVs for the Controlling Bridge and Port Extender

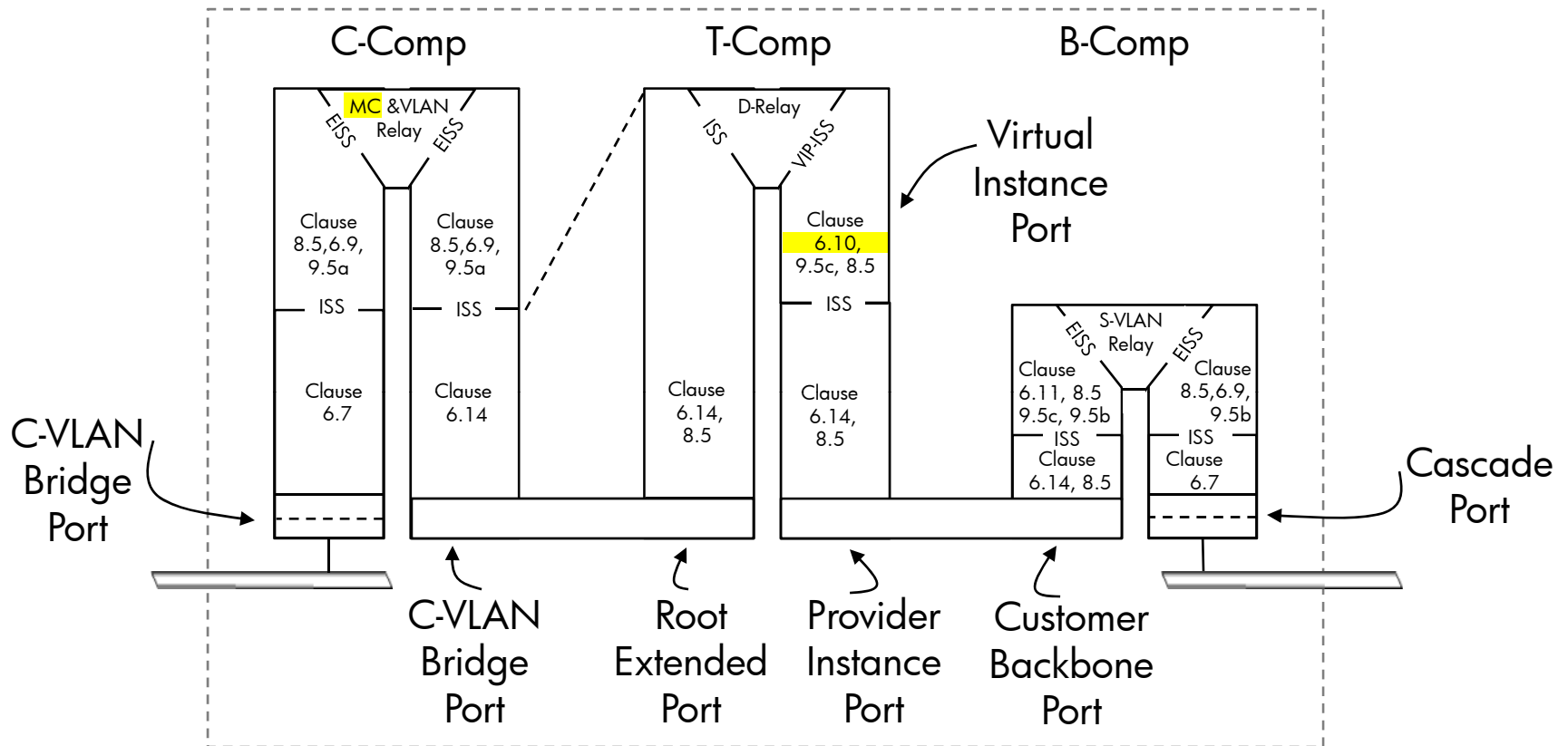
# PBB Encoding Transform from E-TAG



- The Ingress PE Port is identified by the B-SA rather than an Ingress\_E-PID, while the PE Destination (group or unicast) is identified by the B-DA rather than an E-PID.
- The E-PCP and E-DEI are carried in I-PCP, I-DEI.
- The I-SID is not used for a PE application.

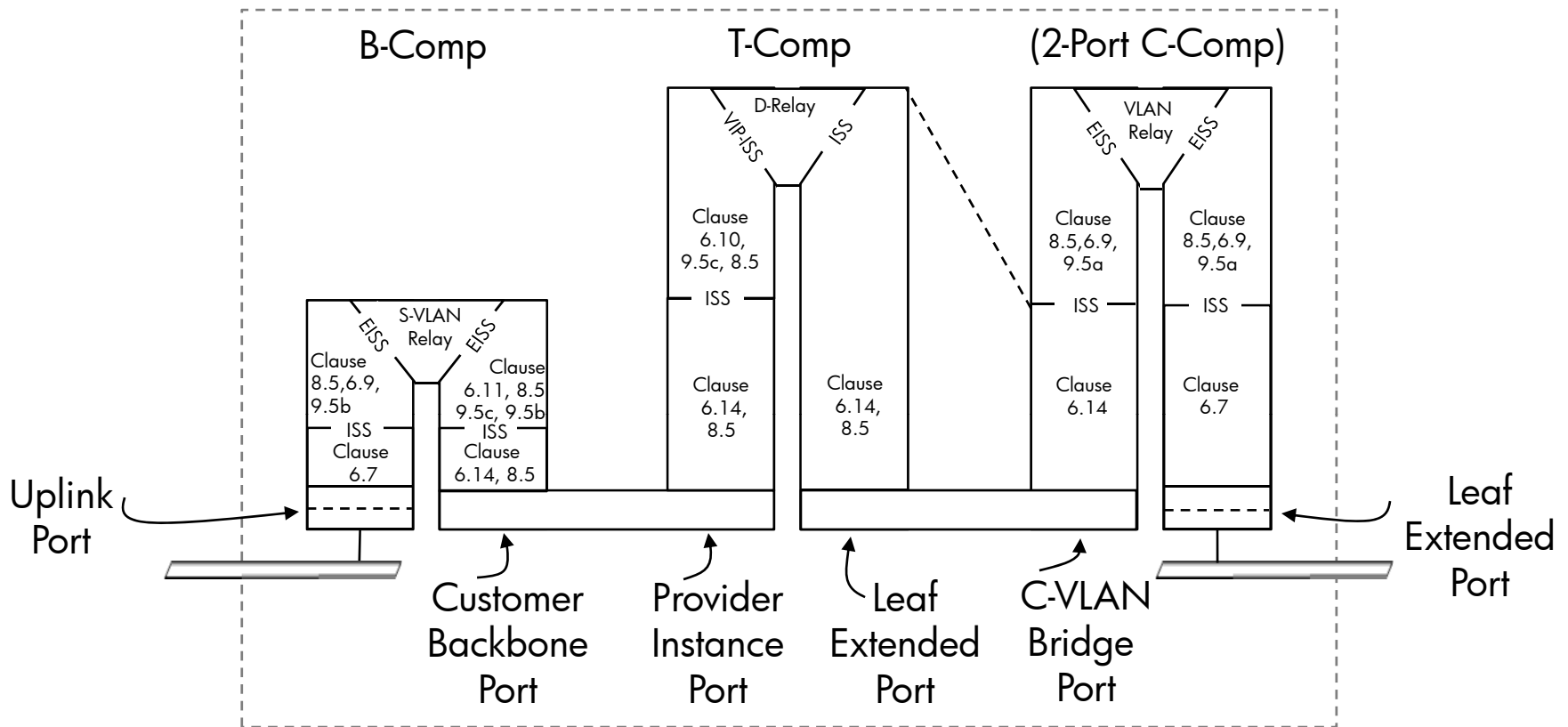


# Controlling Bridge Baggy Pants Diagram



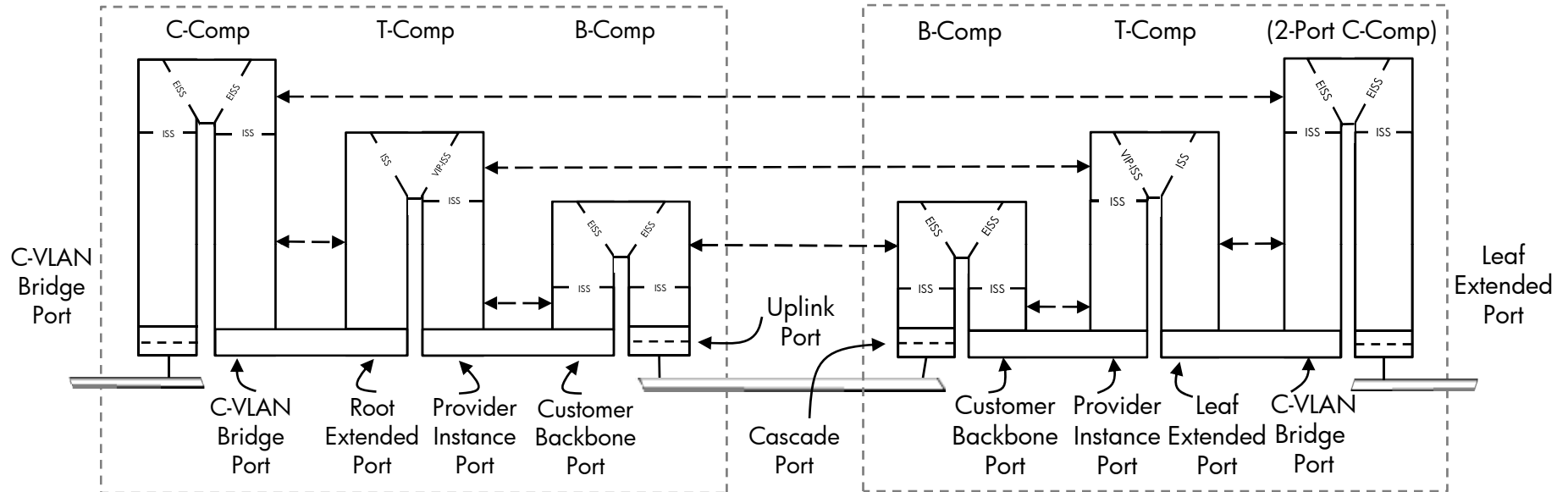
- No new relays, components, ports, or tags
- Yellow indicates subclauses requiring feature additions, other subclauses are unmodified

# Port Extender Baggy Pants Diagram



- Unmodified components form the PE relay
- One “real” filtering database at the B-Comp
- The optional 2-Port C-component allows C-tagging/untagging
- The control plane is replaced with the PE CSP

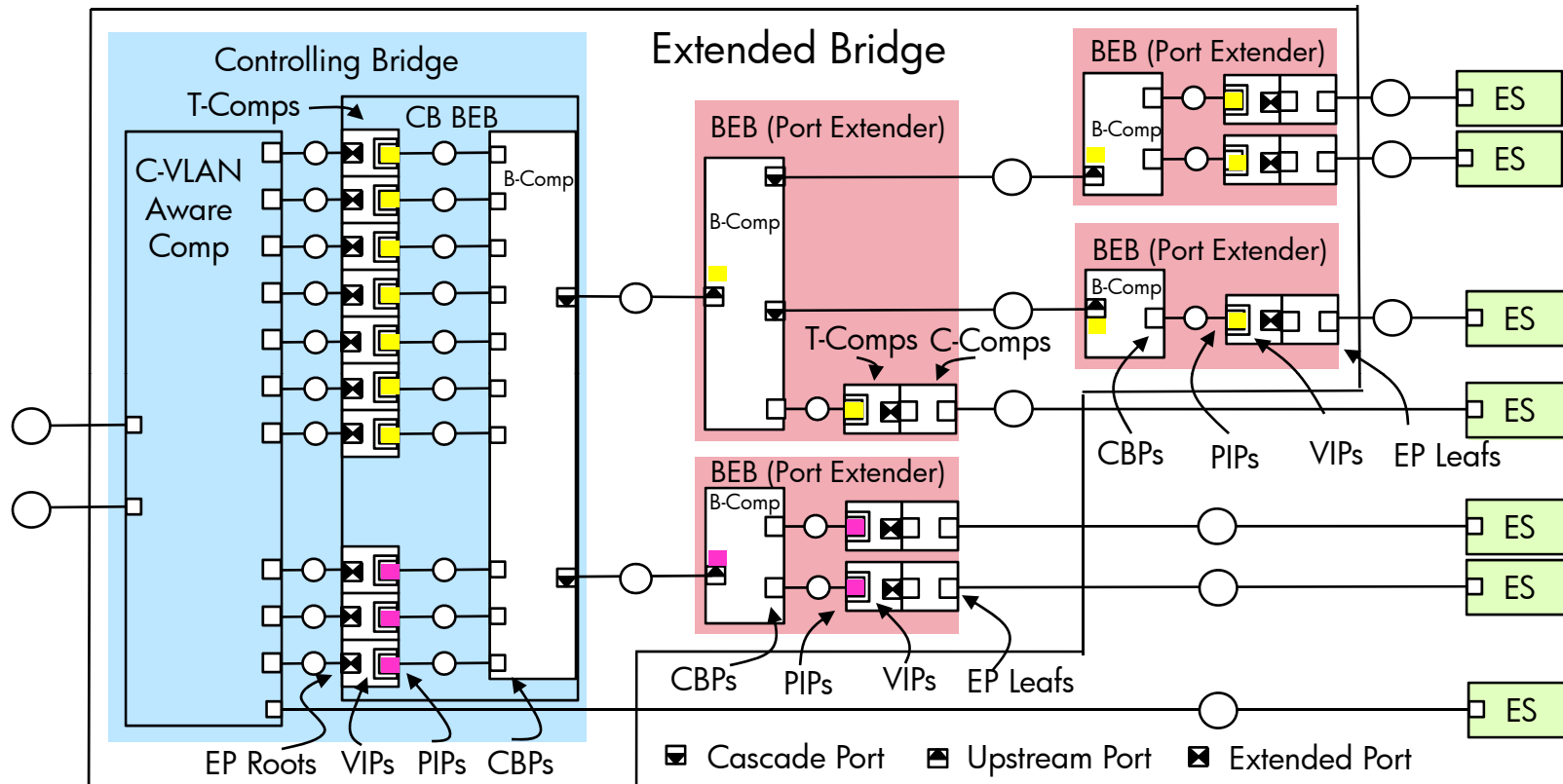
# Extended Bridge component peering



- VIPs in T-Components terminate Backbone Service Instance over Port Extender network
- C-Components in Controlling Bridge and Port Extender terminate port extensions

# Extended Bridge BSIs

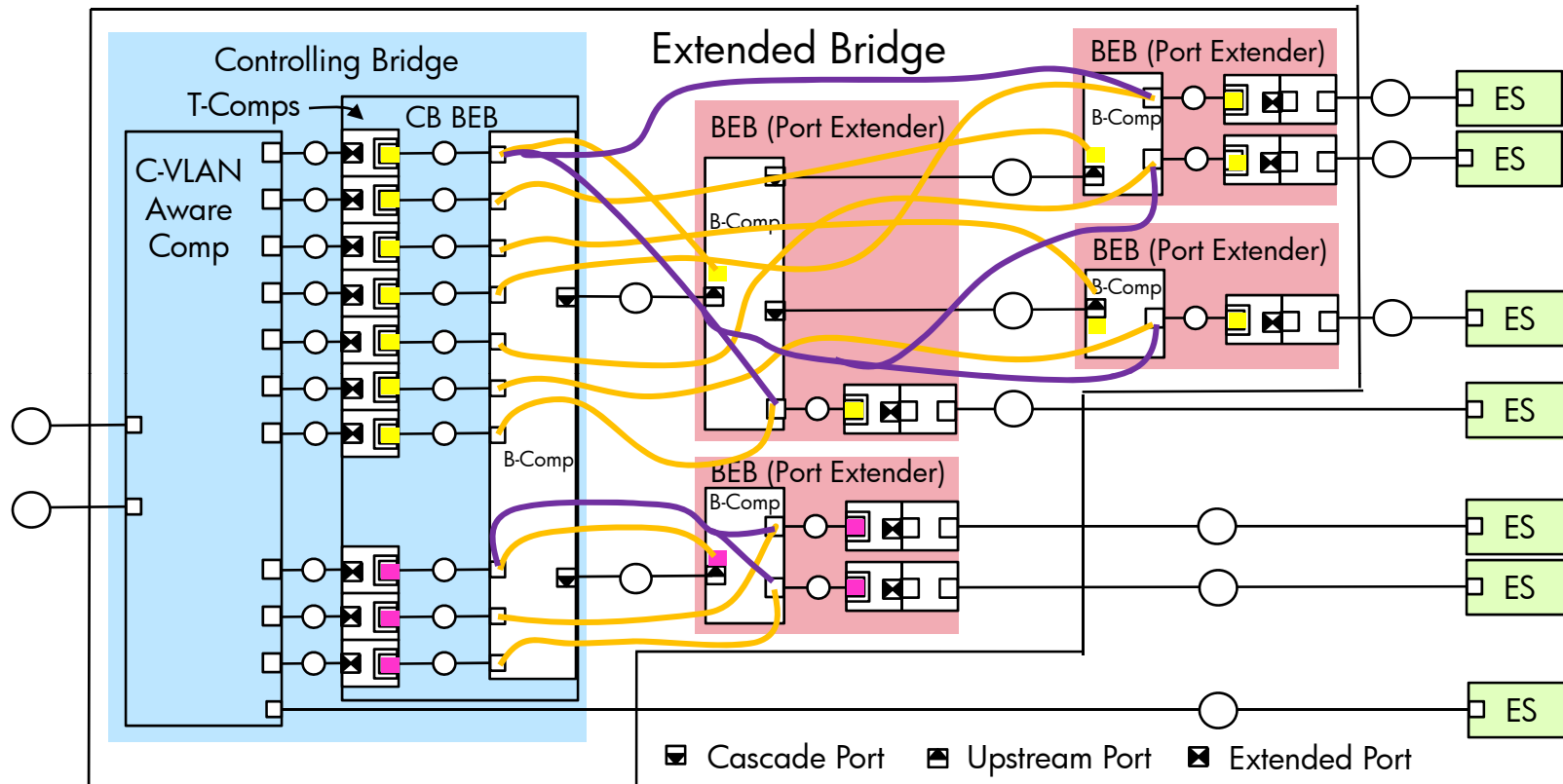
## Backbone Service Instances



- All the VIPs of a connected PE “tree” are members of the same Backbone Service Instance (BSI) and therefore use the same I-SID value.
- In the example above we have two PE “trees” and each with a different I-SID value indicated by the yellow and pink marks
- Note that a VIP for BSI termination exists above the Uplink Port LLC layer

# Extended Bridge TESIs

## Traffic Engineered Service Instances



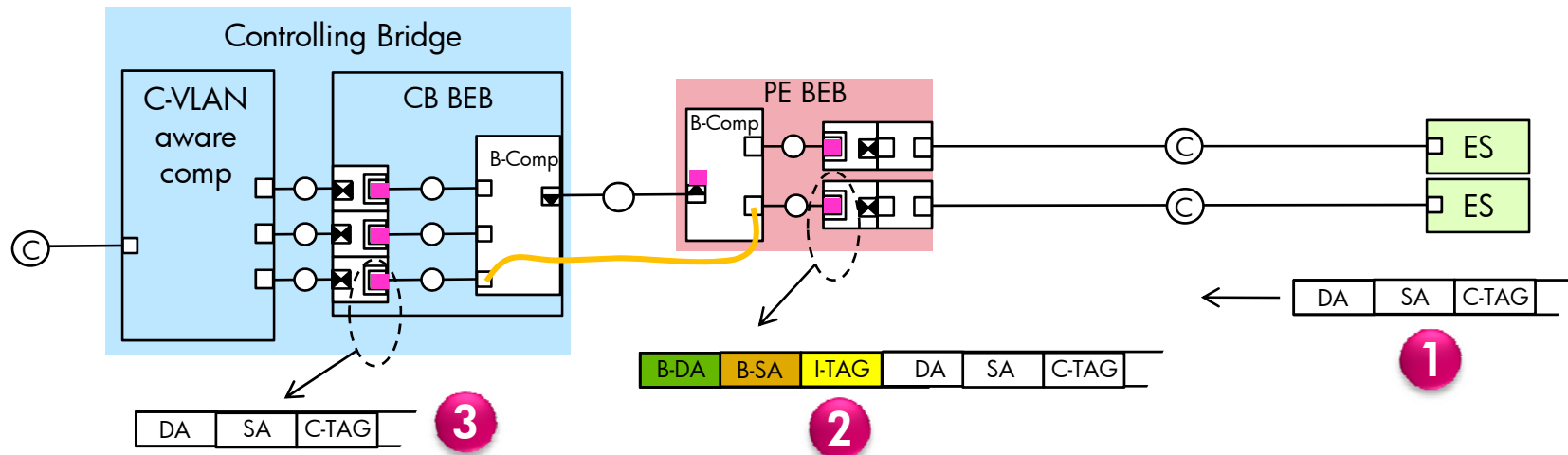
- Tan lines in the diagram show the attachments of point-to-point TESIs
  - One pt-pt TESI couples a Root EP's VIP to the Uplink Port's LLC on each Port Extender
- Purple lines indicate the attachments of pt-mpt TESIs within the Port Extender "trees"
  - Though a single pt-mpt TESI attaching a Root EP's VIP to all Leaf EPs VIPs of the PE "tree" is shown, additional pt-mpt TESIs attaching to limited groups of Leaf EPs are possible

# Port Extension B-VIDs

## Path Selection

- Without redundant links the Port Extender can use a single default B-VID
- By using multiple B-VIDs to engineer alternate ESPs it would be possible to support extended features
  - The B-VID can be used to enhance the Port Extenders with protection support
  - The B-VID can be used to enhance the Port Extenders with multi-pathing support

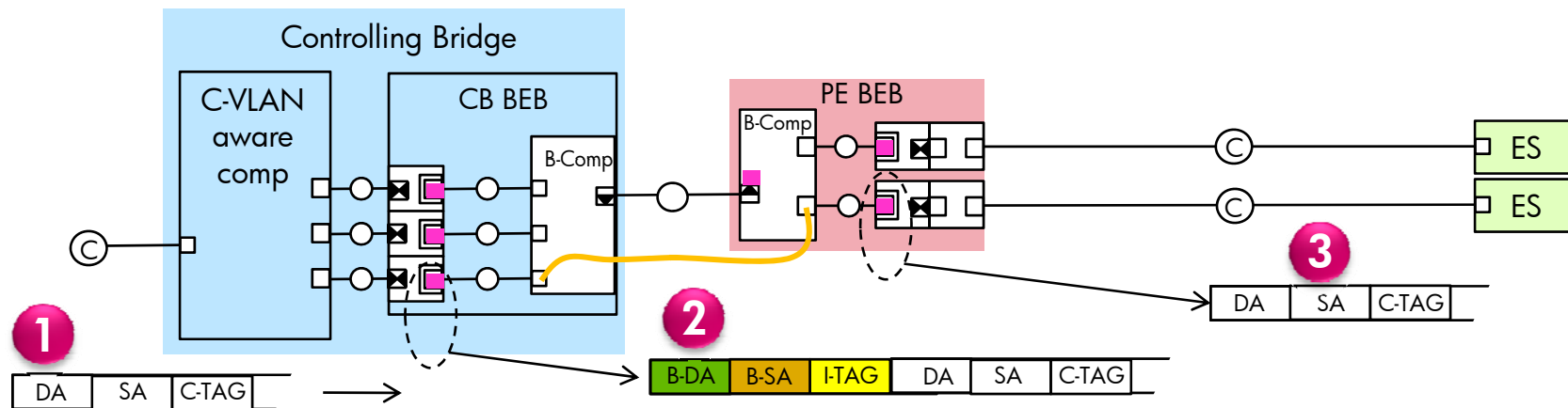
# Frame forwarding from Leaf EP



- Before frame transmission the PIP of the T-component is programmed using PE CSP with:
  - It's SA as a leaf EP address constructed from the E-PID
  - It's Default Backbone Destination parameter set to a root EP address constructed from the E-PID
  - The enableConnectionIdentifier parameter is set to FALSE
  - The I-SID parameter is set to default value

- 1** A frame is transmitted from the ES attached to an Extended Port with DA/SA/C-TAG
- 2** The frame is received at a leaf PE of a T-component within the Port Extender who delivers it over the VIP-ISS to the PIP. The PIP builds a frame with B-DA = root EP and B-SA = leaf EP sending it to the CBP of the B-Comp who forwards it along the TESI
- 3** The frame is de-encapsulated at the PIP of the T-component within the CB-BEB and delivered over the internal LAN to an internal port of the C-VLAN aware component

# Frame forwarding from the root EP Individual B-DAs

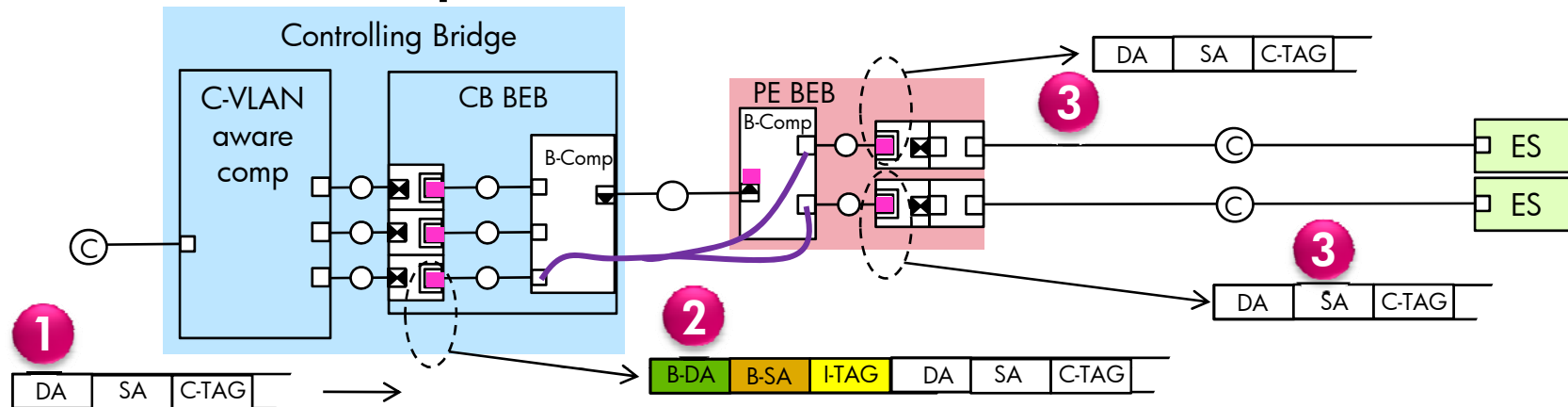


- Before frame transmission the PIP of the CB-BEB T-component is programmed with:
  - It's SA as a root EP address constructed from the E-PID
  - It's Default Backbone Destination parameter set to a leaf EP address constructed from the E-PID
  - The I-SID parameter is set to identify the PE "Tree"

- 1** A frame is sent from a C-Comp Port to a root EP of the CB-BEB with DA/SA/C-TAG
- 2** The frame is received at a root EP of the T-component within the CB-BEB and delivered over the VIP-ISS to the PIP. The PIP builds a frame with B-DA = leaf EP and B-SA = root EP sending it to the CBP of the B-Comp who forwards it along the TESI
- 3** The frame is de-encapsulated at the PIP of a T-component of an EP and delivered to a LAN



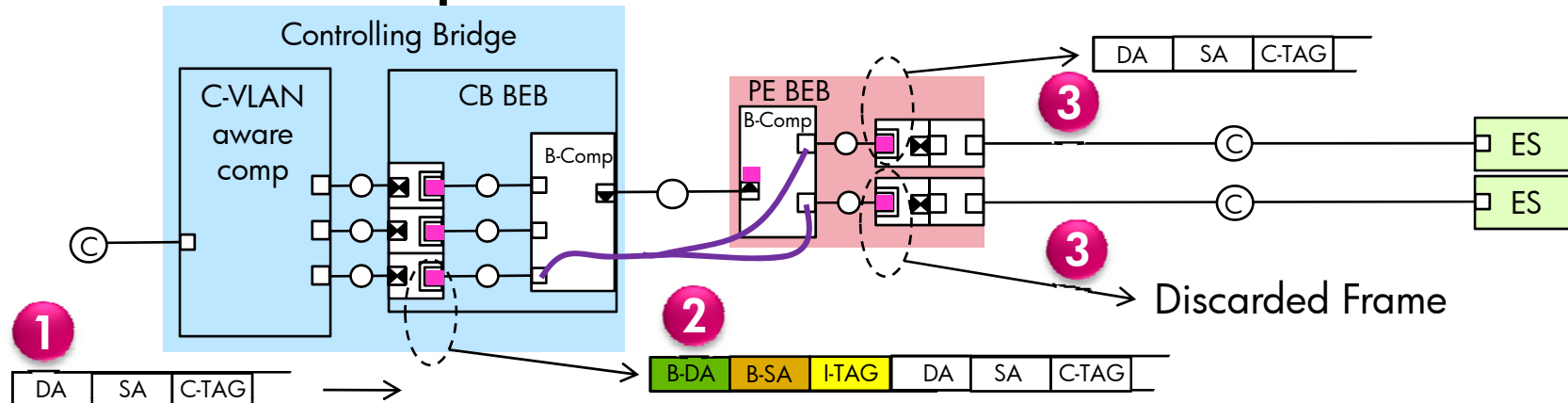
# Frame forwarding from the root EP Group B-DAs no Echo Cancellation



- Before frame transmission the PIP of the CB-BEB T-component is programmed:
  - Is programmed as in the Individual address case
  - The T-component supports passing a connection\_identifier containing a destination port map
  - The PIP is modified to use the connection\_identifier to select a B-DA using the destination port map

- 1** A frame is sent from a C-Comp Port to a root EP of the CB-BEB with DA/SA/C-TAG
  - The frame was sent from outside the “replication group” and so the connection\_identifier contains a destination port map which includes the CB-BEB PIP used to forward the frame (only a single request is sent to the “replication group”).
- 2** The frame is received at a root EP of the T-component within the CB-BEB and delivered to the PIP. The PIP builds a frame and sends it to the CBP of the B-Comp who forwards it along a TESI
  - B-DA is selected based on the connection\_identifier destination port map
  - B-SA = root EP B-MAC without Echo Cancellation (since the source is outside the replication group)
- 3** The frame is replicated over the TESI and de-encapsulated at the PIPs of the T-components, delivered to the leaf EPs and then the attached LANs

# Frame forwarding from the root EP Group B-DAs with Echo Cancellation



- The PIP of the CB-BEB T-component is programmed:
  - Is programmed as in the Individual address case
  - The T-component supports passing a connection\_identifier containing a destination port map
  - The PIP is modified to use the connection\_identifier to select a B-DA using the destination port map
  - The PIP is modified to use the connection\_identifier to select the B-SA using both the destination port map and source port
- The PIP of all Leaf EPs are modified to filter out frames matching a B-SA filter parameter (6.10f)
  - Each root EP has two B-MACs one echo cancelled and one not. The B-SA filter parameter of the each leaf EP PIP is set to the echo cancelled B-MAC of it's root EP

- 1 A frame is sent from a C-Comp Port to a root EP of the CB-BEB with DA/SA/C-TAG
  - The frame was sent from within the "replication group" and so the connection\_identifier contains a destination port map which excludes the CB-BEB PIP used to forward the frame (only a single request is sent to the "replication group").
- 2 The frame is received at a root EP of the T-component within the CB-BEB and delivered to the PIP. The PIP builds a frame and sends it to the CBP of the B-Comp who forwards it along a TES!
  - B-DA is selected based on the connection\_identifier destination port map
  - B-SA = root EP B-MAC with Echo Cancellation of the source port from the connection\_identifier (should be this root EP port)
- 3 The frame is de-encapsulated at the PIPs of the T-components of the PEs and delivered to the LANs which are not echo cancelled.

# What needs to be specified

- Move clause 8, 7.12-7.14 (PE CSP) of 802.1BR into a new 802.1Qbh clause 45 using 7.12-7.14 as part of the protocol introduction.
- Port Extender can be defined by a new conformance subclause specifying a Port Extender as a specific type of BEB and including the PE CSP
- The Controlling Bridge can be defined using the current conformance statement from 802.1Qbh replacing the PE requirements with the requirements defining a CB-BEB

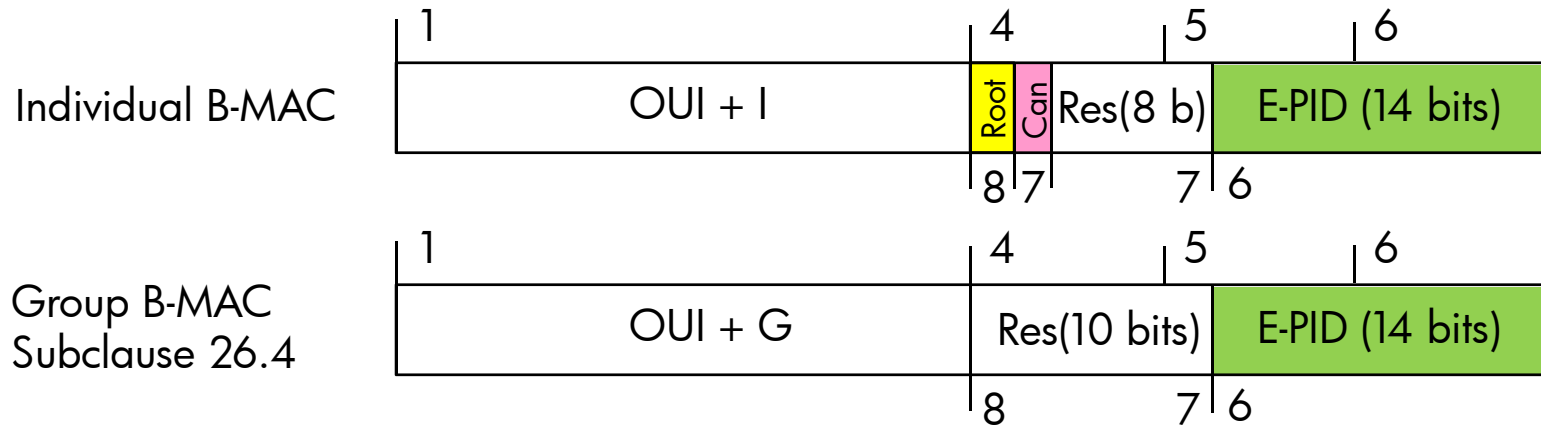
# Comparison between E-TAG and PBB-TE Port Extenders

	E-TAG PEs	PBB-TE PEs
Compatibility with existing 802.1Q Bridge relay		★
No new components		★
No new tags		★
Optional support for CFM, protection and multipathing		★
Optional support for congestion notification	★ <sup>1</sup>	★
Optional support for ETS and PFC	★	★
Optional support for EVB & VEPA	★	★
Lowest overhead octets	★	

1) Since E-Paths are uni-directional it is not possible to have CN on E-Paths.

# **BACKUP SLIDES**

# Constructed B-MACs



- Globally assigned B-MACs also could be used by simply increasing the E-PID size to a full TESI address.
- Constructed individual B-MACs use the Root indicator to differentiate between the CB-PIPs and the PE-PIPs
- Constructed addresses use the Can indicator to differentiate frames which can be echo cancelled and those which can not
- Constructed group B-MACs could use the Backbone Service Instance Group Address OUI
- Since the Controlling Bridge is co-ordinating the selection of E-PIDs the assignments would be locally unique
- Since the B-MACs don't extend beyond a single PE mesh they would never interact with a general purpose system