



>THIS IS **THE WAY**

IEEE 802.1ah Update

Paul Bottorff, Editor 802.1ah
July 18, 2005

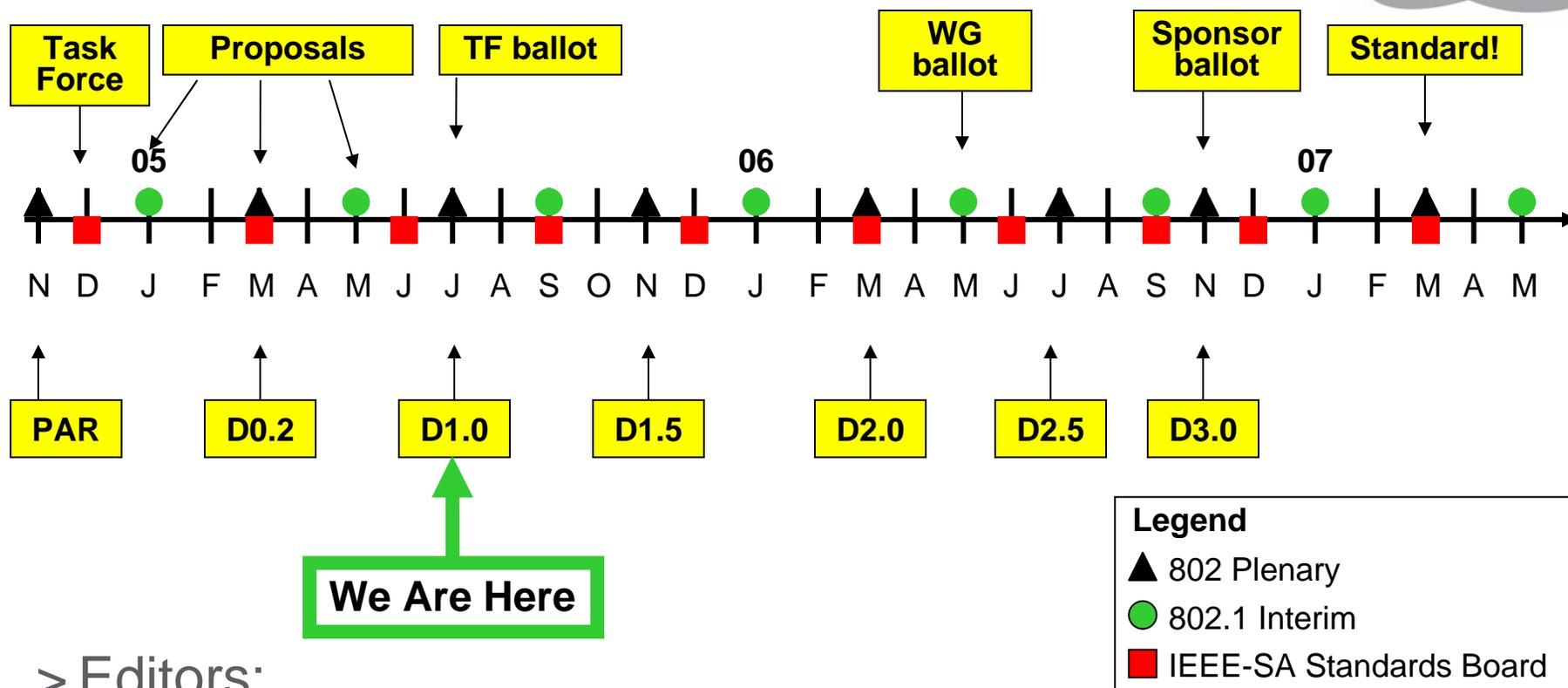
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Agenda

- > Introduction
- > Review
 - Terminology
 - Basic Operation
- > Service interface considerations
- > Reference Model Alternative
 - I-Comp/B-Comp reference model (Draft 1)
 - M-Comp reference model alternative
 - Revised I-Comp/B-Comp reference model
- > Frame Format Alternative
 - Formats types
 - Format identifier field proposal

P802.1ah - Provider Backbone Bridges – Targeted Timeline

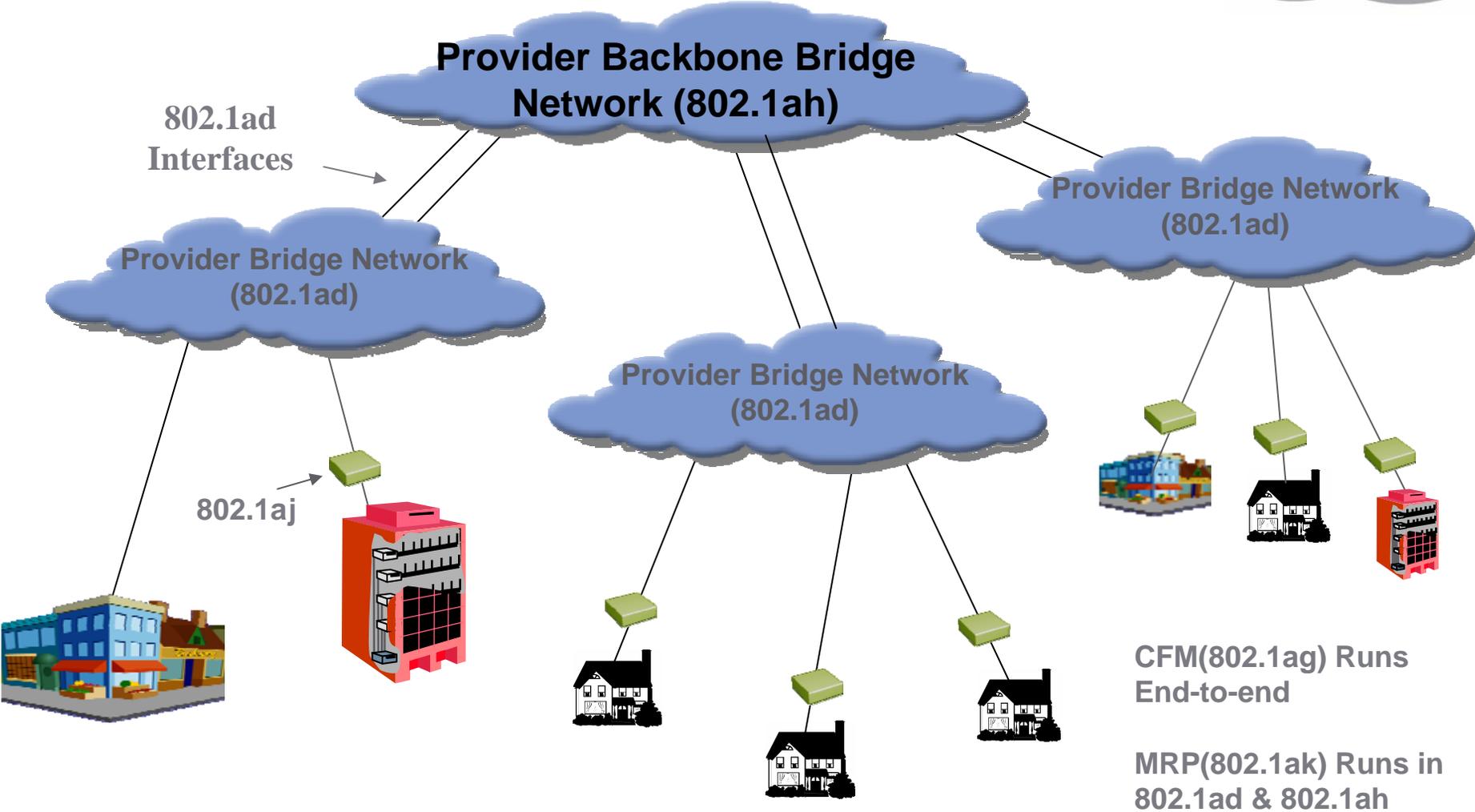


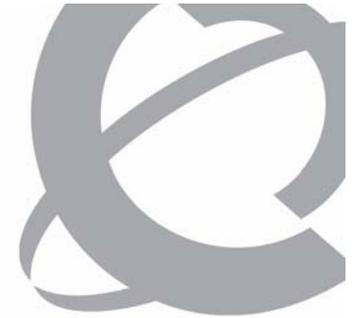
> Editors:

- Paul Botorff, Chief Editor, pbottorf@nortel.com
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IEEE 802.1ah (Provider Backbone Bridge) Context





Draft 1.0 Content

- > Draft 1.0 available at: <http://www.ieee802.org/1/files/private/ah-drafts/>
- > Removes most P802.1ad material
- > **Clause 23: Support of the MAC Service by Provider Backbone Bridged Networks**
 - Added transparent service interface
 - Added I-tagged service interface
 - Added access protection overview and subsections headers
- > **Clause 24: Principles of Provider Backbone Bridged network operation**
 - Aligned terminology with clause 23
- > **Clause 25: Principles of Provider Backbone Bridge operation**
 - Placed model under editor's notes pending decisions from July
 - Moved frame formats to appendix Z
 - Aligned terminology with clause 23
- > **Clause 1 contains some suggestions on scope**
- > **Clause 3/4 contains new Provider Backbone Bridge definitions and acronyms**
- > **Clause 9 contains I-TAG VCI format**



Open items in Draft 1.0

- > Clause 5: Conformance statement
- > Clause 12: Management for PBB bridges
- > Clause 23:
 - Access protection description for Class I-V
 - Service protection considerations
- > Clause 24:
 - Operation of Provider Backbone Bridge spanning trees
- > Clause 25:
 - Reference model decision
 - Details of I Component and B Component operation
 - Operation of address correlation data base
- > Informative annex on an integrated C-VLAN aware component



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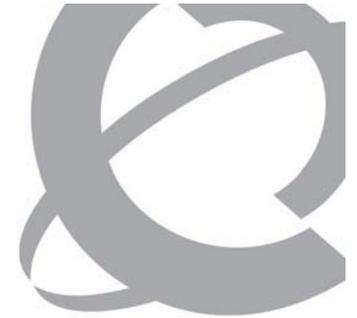
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Agreed Terminology

> IEEE 802.1ad Terminology

- C-TAG Customer VLAN TAG
- C-VLAN Customer VLAN
- C-VID Customer VLAN ID
- S-TAG Service VLAN TAG
- S-VLAN Service VLAN
- S-VID Service VLAN ID

> Additional Provider Backbone Bridge Terminology

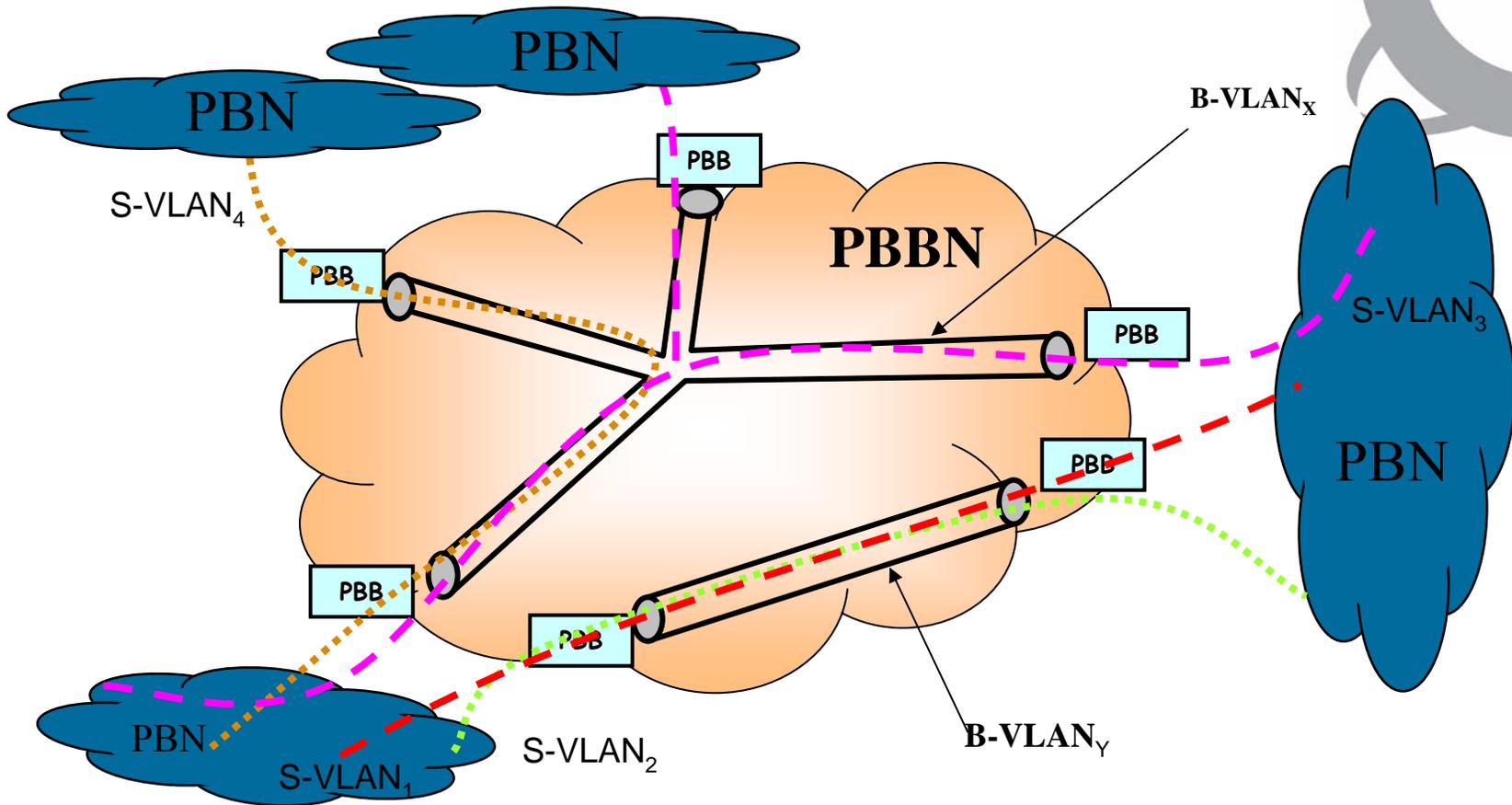
- I-TAG Extended Service TAG
- I-SID Extended Service ID
- B-TAG Backbone TAG Field
- B-VLAN Backbone VLAN (tunnel)
- B-VID Backbone VLAN ID (tunnel)
- C-MAC Customer MAC Address
- B-MAC Backbone MAC Address



More Terminology

- > CBN Customer Bridge Network
- > CB Customer Bridge
- > PBN Provider Bridge Network
- > PB Provider Bridge
- > PBBN Provider Backbone Bridge Network
- > PBB Provider Backbone Bridge

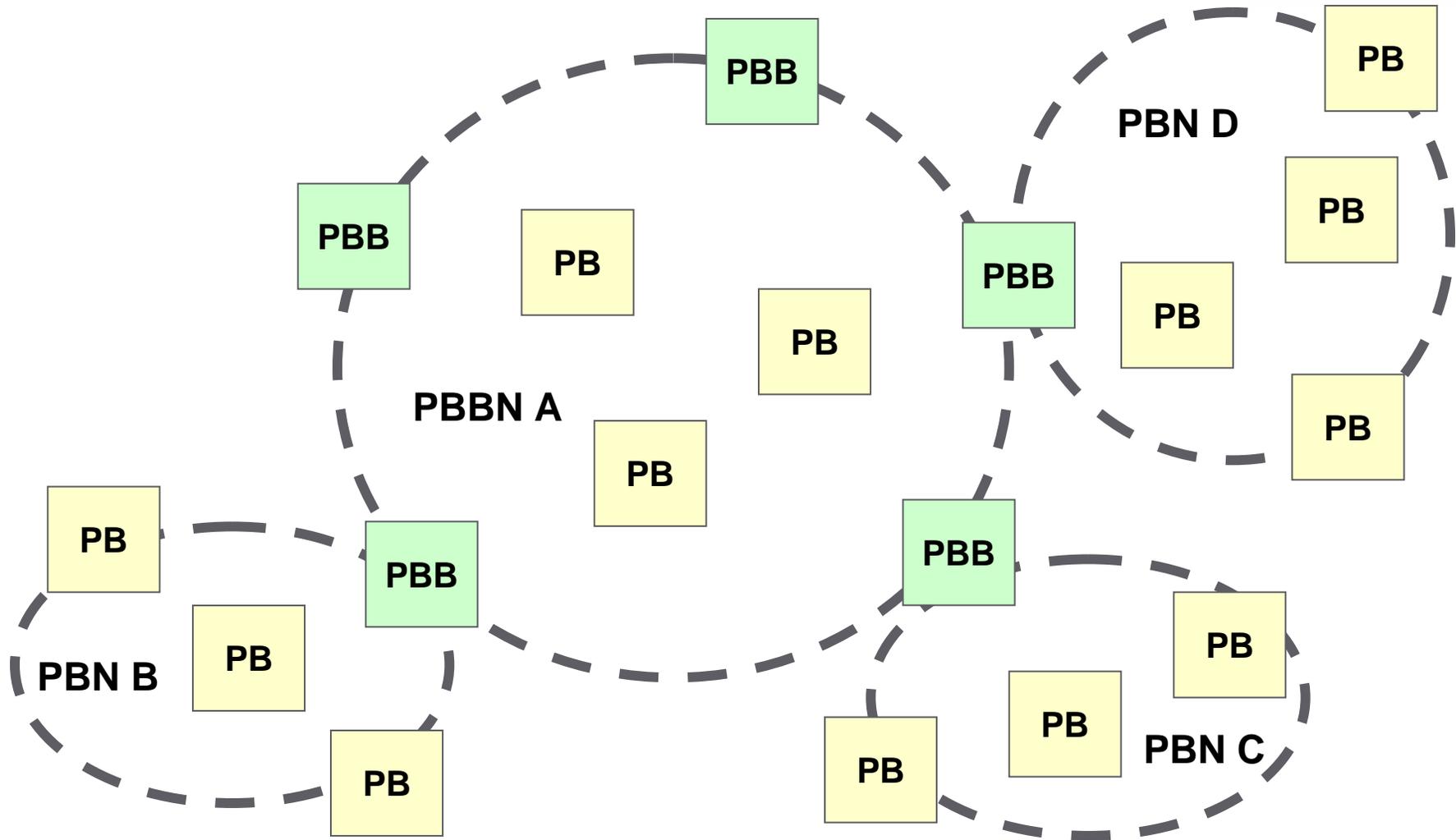
PBBN Provides Multi-Point tunnels between PBNs



• **PBB**: Provider Backbone Bridge Edge

- Each B-VLAN carries many S-VLANs
- S-VLANs may be carried on a subset of a B-VLAN (i.e. all P-P S-VLANs could be carried on a single MP B-VLAN providing connection to all end points).

Combined 802.1ad and 802.1ah Network





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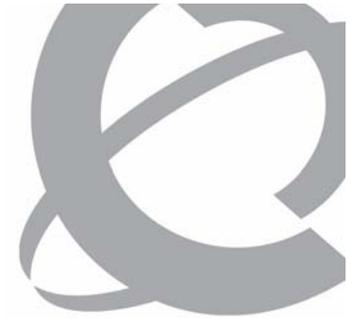
> **Service interface considerations**

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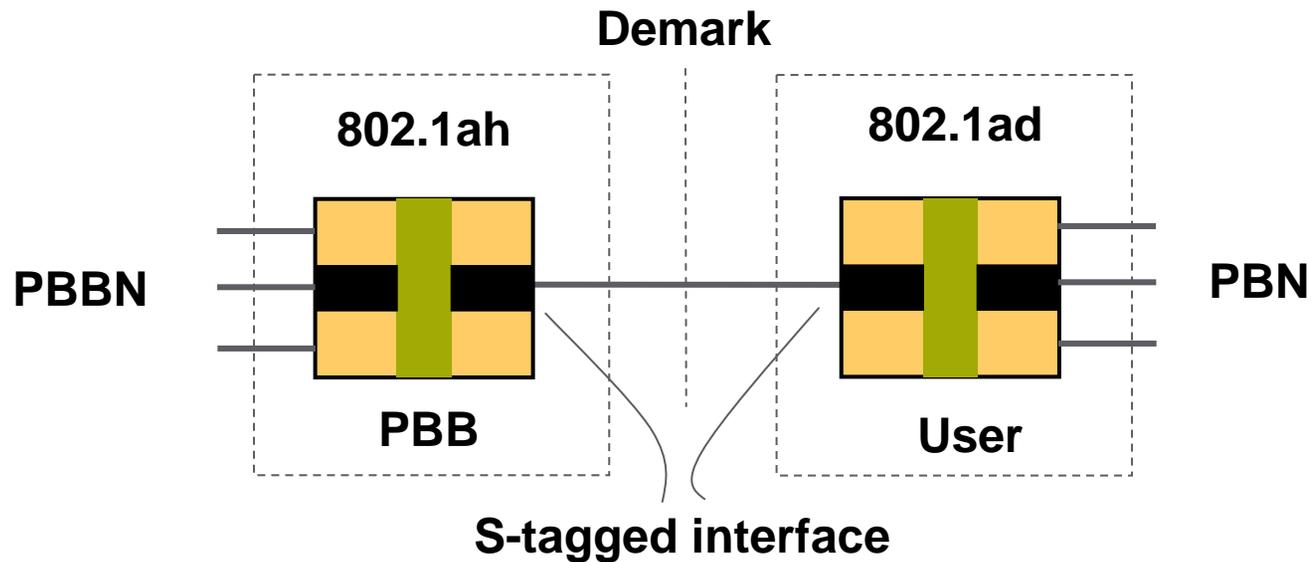
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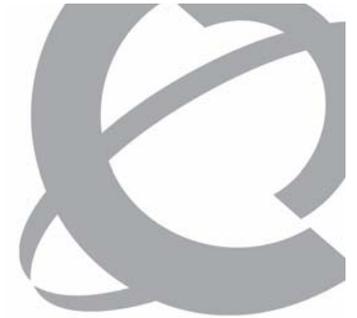
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S-TAG Service Interface

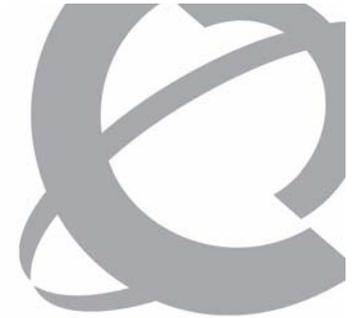


- > PB provides S-tagged interface
- > PBB recognizes S-TAGs and ignores C-TAGs
- > PBB translates S-VID to(from) I-SID for transport over PBBN

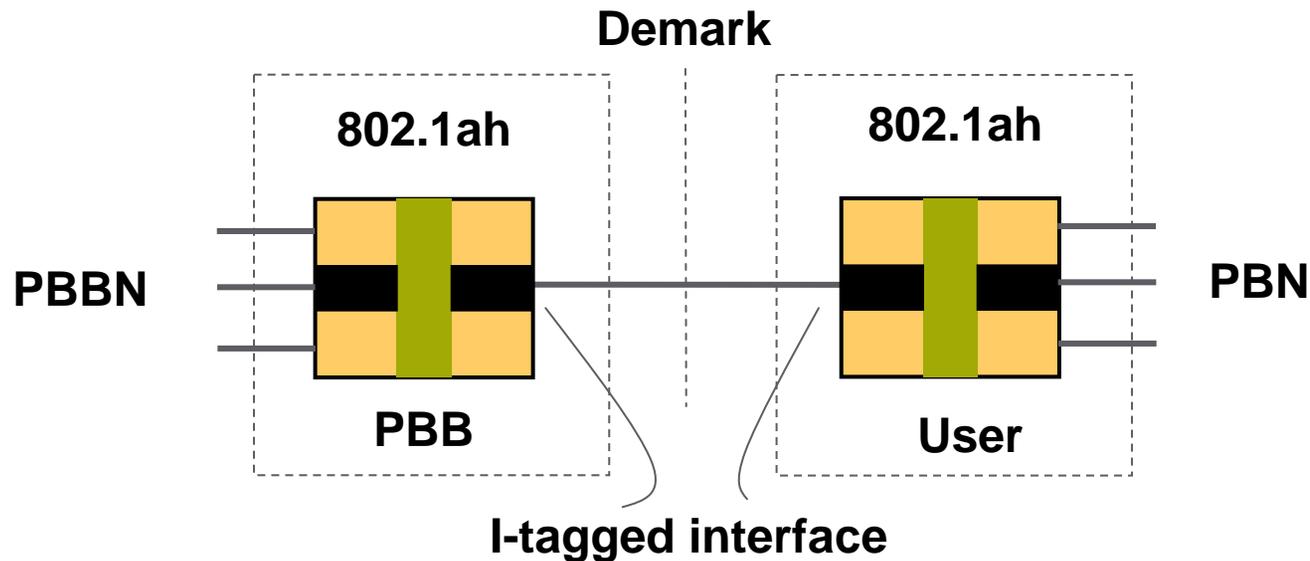


Uses for S-TAG interface

- > Connect multiple PBNs while increasing the total number of S-VLANs up to the I-SID address limit.
- > Appears as a single large PBN to attached customers
- > All PBN attached to the PBBN may be connected
- > The S-VID address space is unique to each PBN and translated over the PBBN



I-TAG Service Interface



- > User provides I-tagged interface
- > PBB recognizes I-TAG and ignores S-TAG and C-TAG
- > PBB maps the user I-SID from(to) the a PBBN I-SID



I-TAG Service Interface Use

- > I-TAG interface may be used to connect a PBBN to an MPLS/VPLS/VPWS network
- > I-TAG interface may couple PBBNs to servers
- > B-MAC hiding is desirable over I-TAG interface

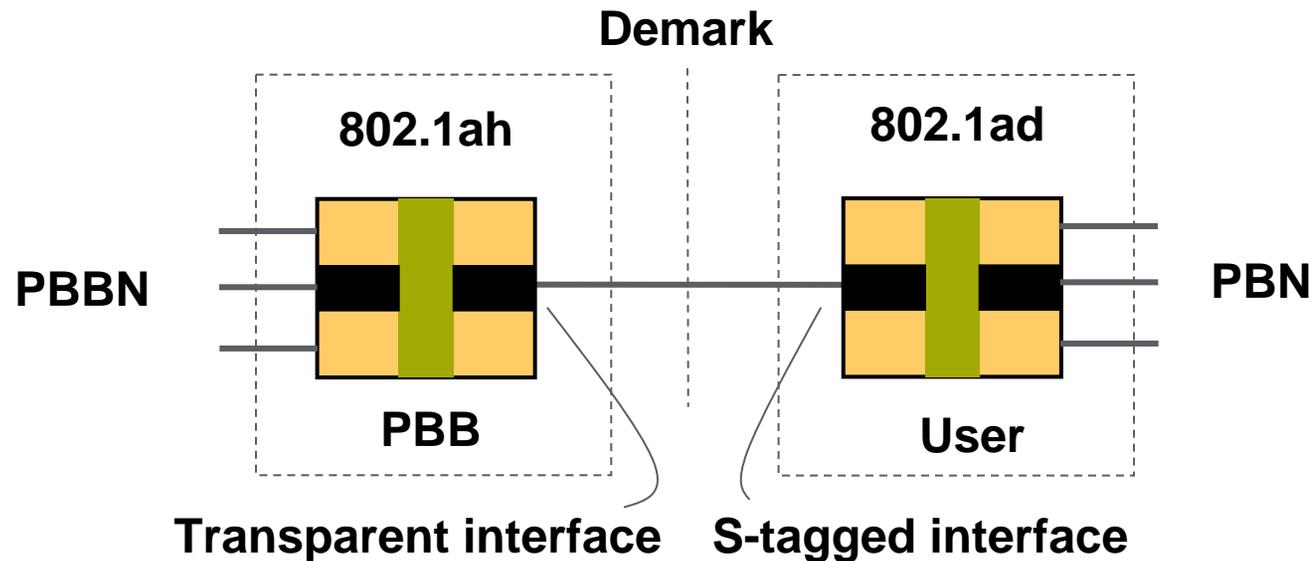


I-TAG Interface Motivates Dual Relay Model

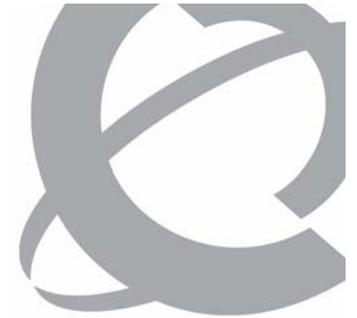
- > Includes a native interface within the architecture which can be demarked by the B-Comp
- > Allows description of access protection splitting over I-B interface



Transparent Service Interface



- > PB provides S-tagged interface
- > PBB ignores S-tag and C-tags
- > All frames are transport over PBBN on a provisioned I-SID



Use of the transparent interface

- > Connect multiple PBN into single PBN group sharing the S-VID address space.
- > Total S-VLANs is limited to 2^{12} for each connected set of PBNs
- > Multiple sets of PBNs may be coupled over a single PBBN

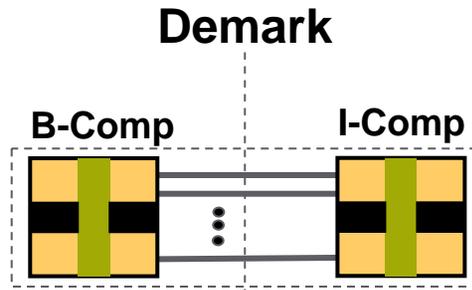


Transparent Interface – Dual Relay

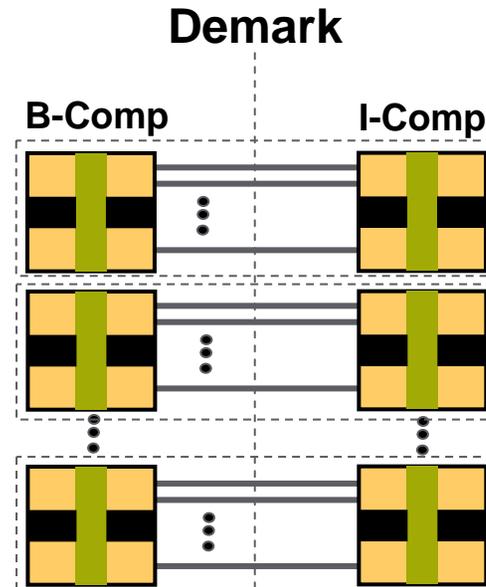
- > Requires options in I-Shim for transparent operation
- > I-Shim maps all use frames on single I-SID
- > I-Shim retains S-TAG inside encapsulated frame
- > I-B interface may use encapsulation format with B-SA and B-DA local addresses
- > Removes transformation from B-Shim



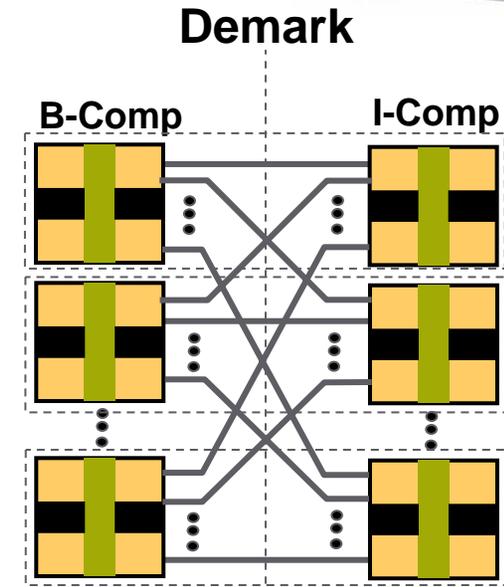
Redundant Interconnect types:



- > Class 1:
- > Redundant Links and Non-redundant Switch



- > Class 2:
- > Redundant Links and Redundant Switches



- > Class 3:
- > Redundant Links and Mesh Connected Redundant Switches



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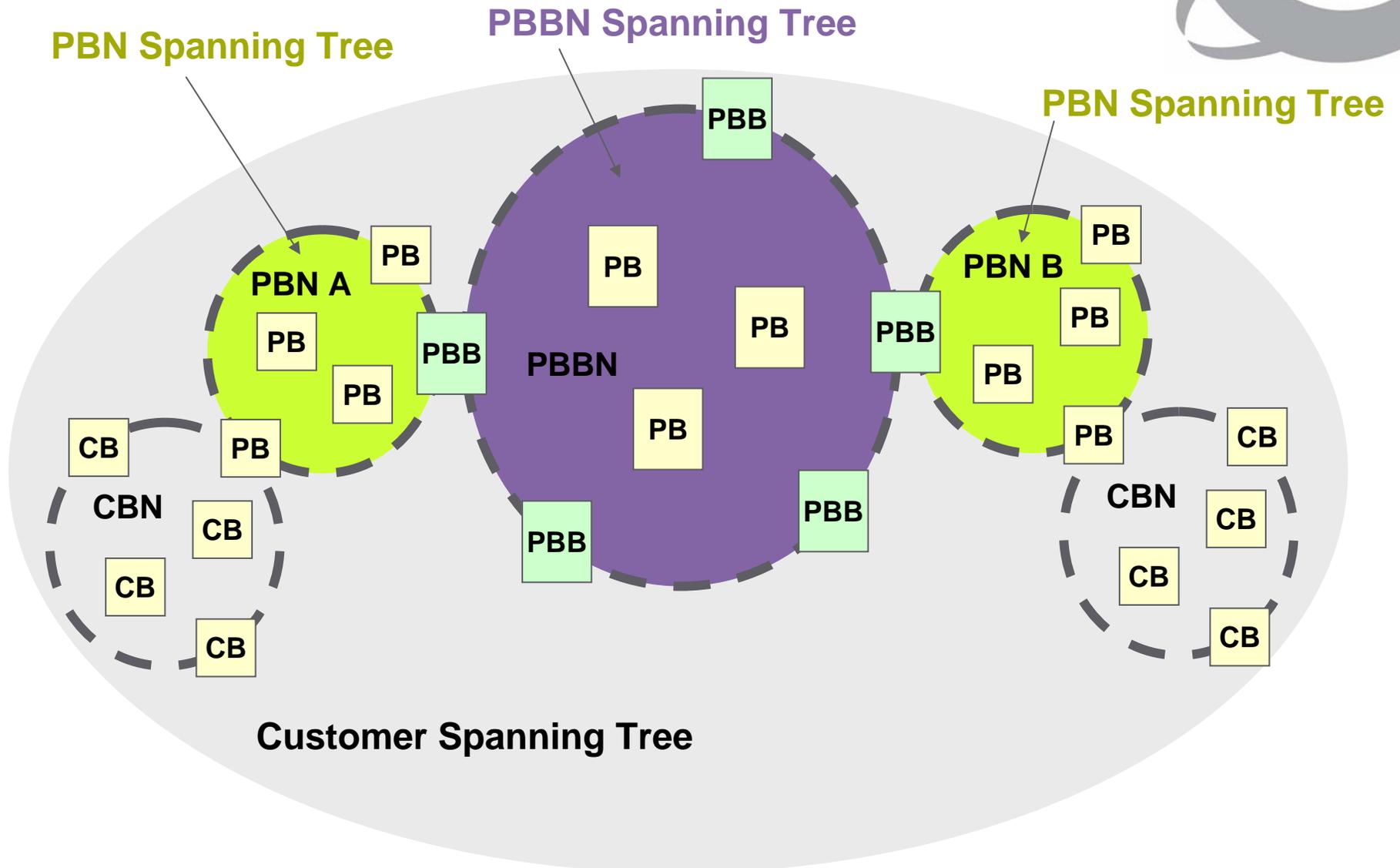
> **Reference Model Alternative**

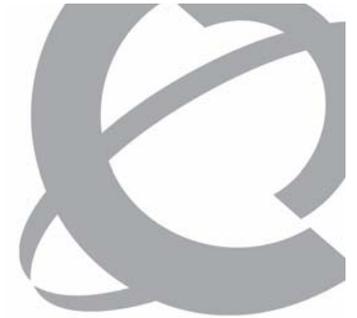
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> Frame Format Alternative

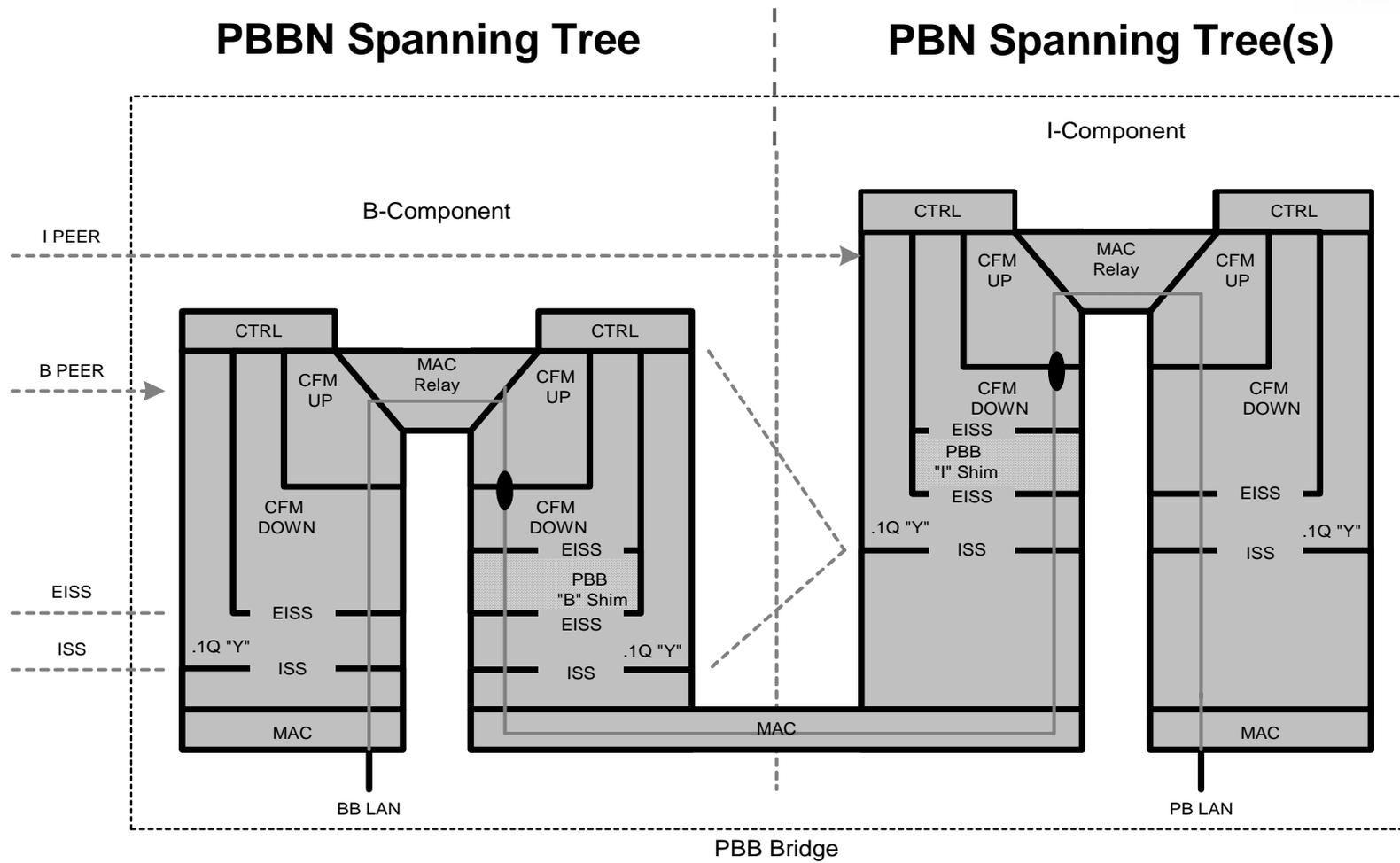
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Combined 802.1ad and 802.1ah Network

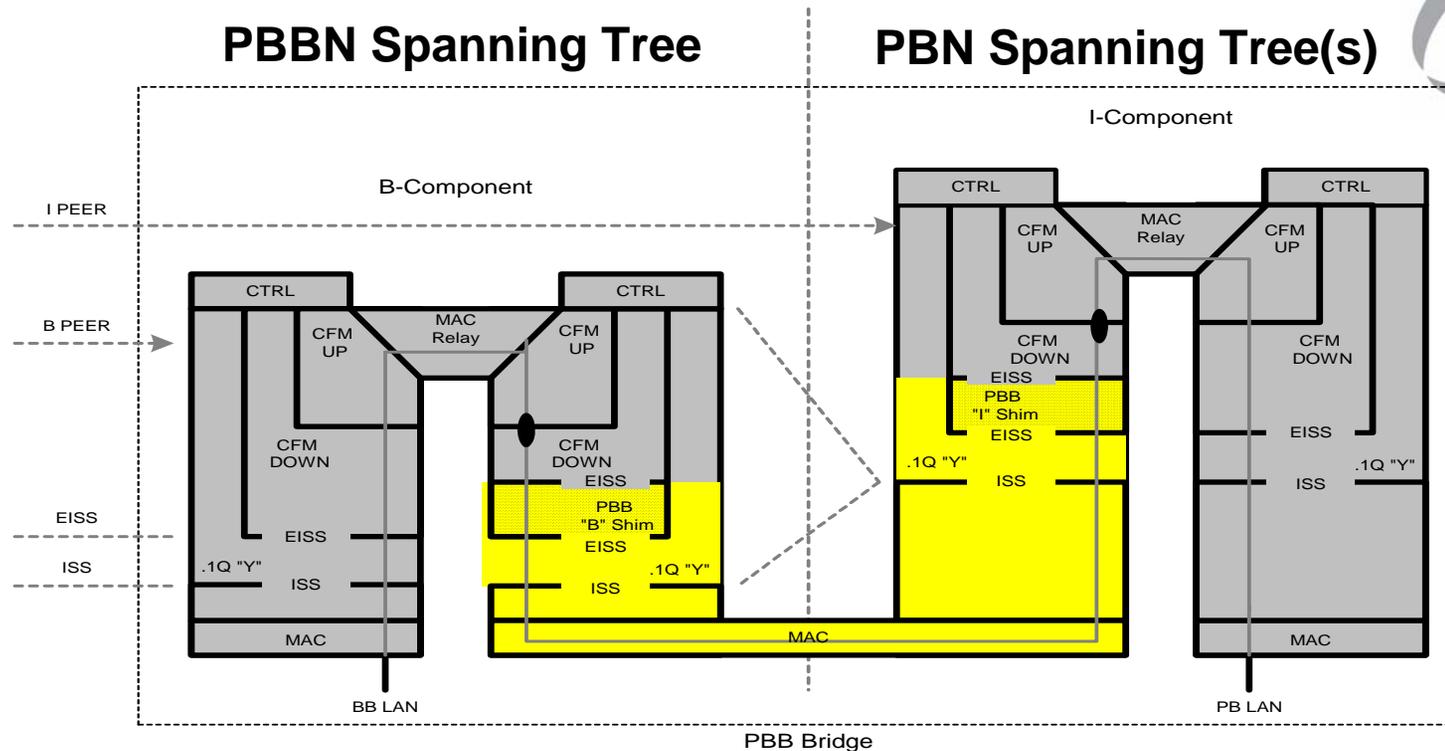
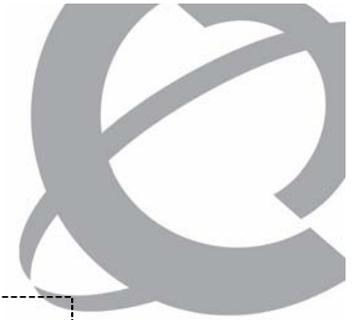




Dual Relay PBB Model

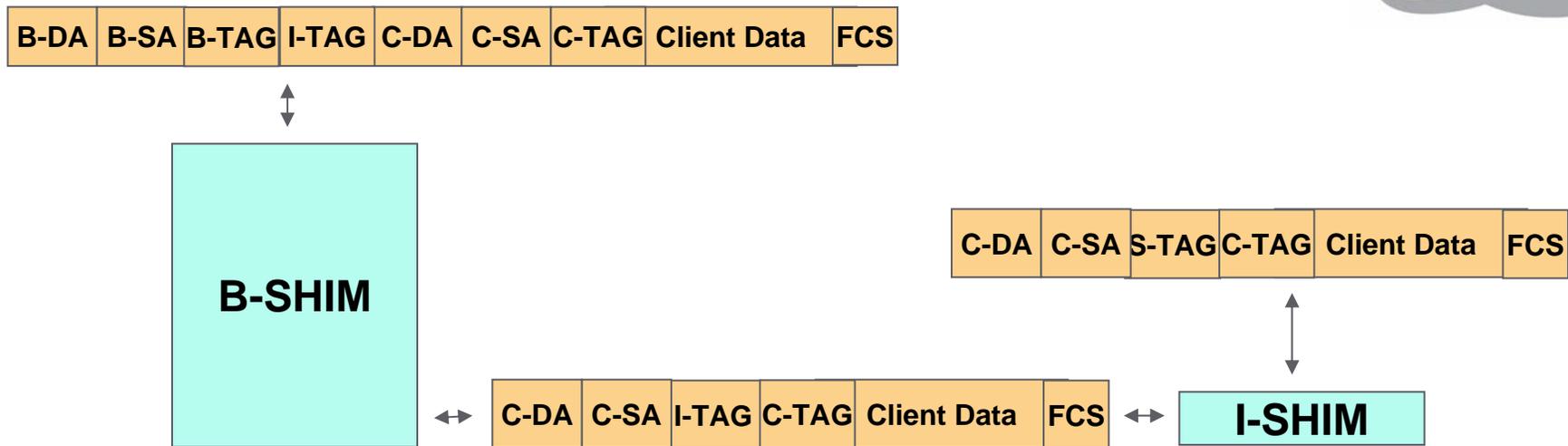
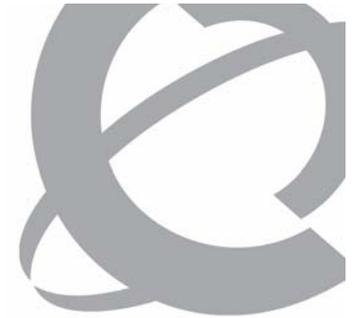


Shims May Split Functions Anywhere



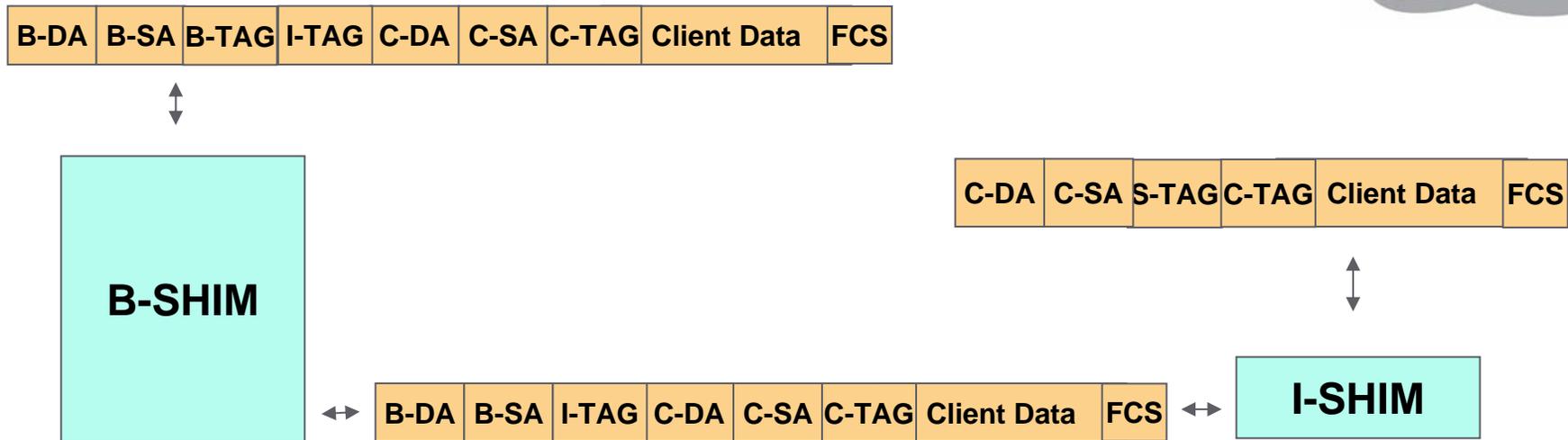
- > Entire yellow region may be considered a single shim with functions divided to either side of the interconnect
- > Splits moving functions toward the I-Comp move knowledge of the backbone topology into the PBN region
- > Current split moves most functions toward B-Comp maximizing information hiding

Current Reference Model: Alternative 1



- > I to B Shim format “naked I-TAG” in I-Format
 - Minimum frame information between I-Shim and B-Shim
 - B-Shim transform is irregular since I-TAG is moved in frame
 - B-Shim upside down since frame grows moving upward
- > I to B Shims are 1-1
- > I-Shim function is very thin while B-Shim does most of work

Alternative 2



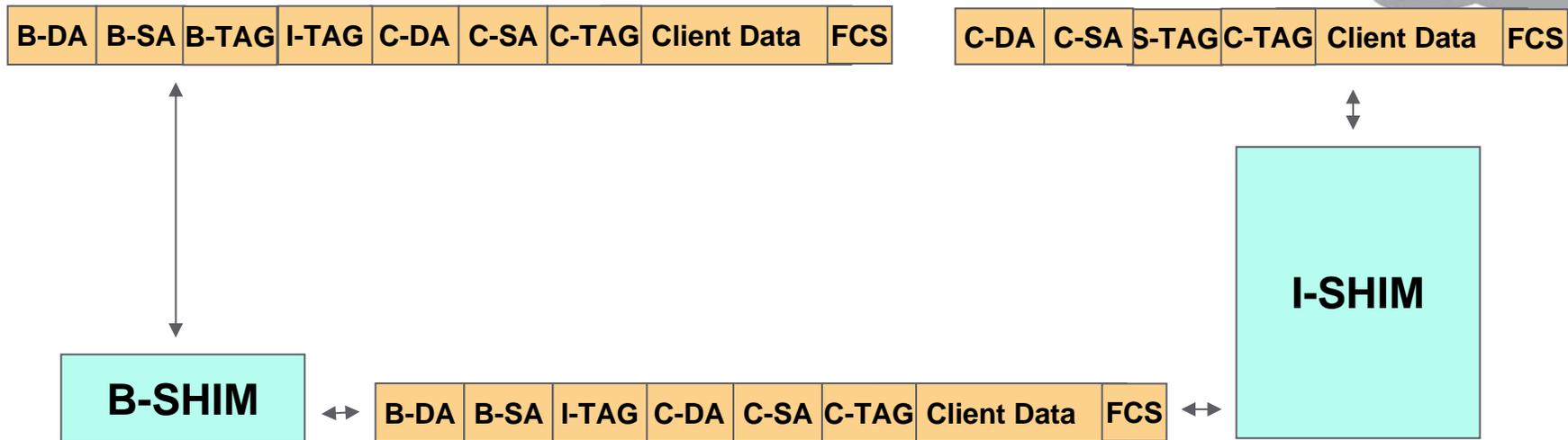
> I to B Shim format “naked I-TAG” in B-Format

- B-DA is dummy field
- B-Shim transform is regular
- B-Shim right side up

> I to B Shims are 1-1

> I-Shim function is thin while B-Shim does most of work

Alternative 3



> I to B Shim format “naked I-TAG” in B-Format

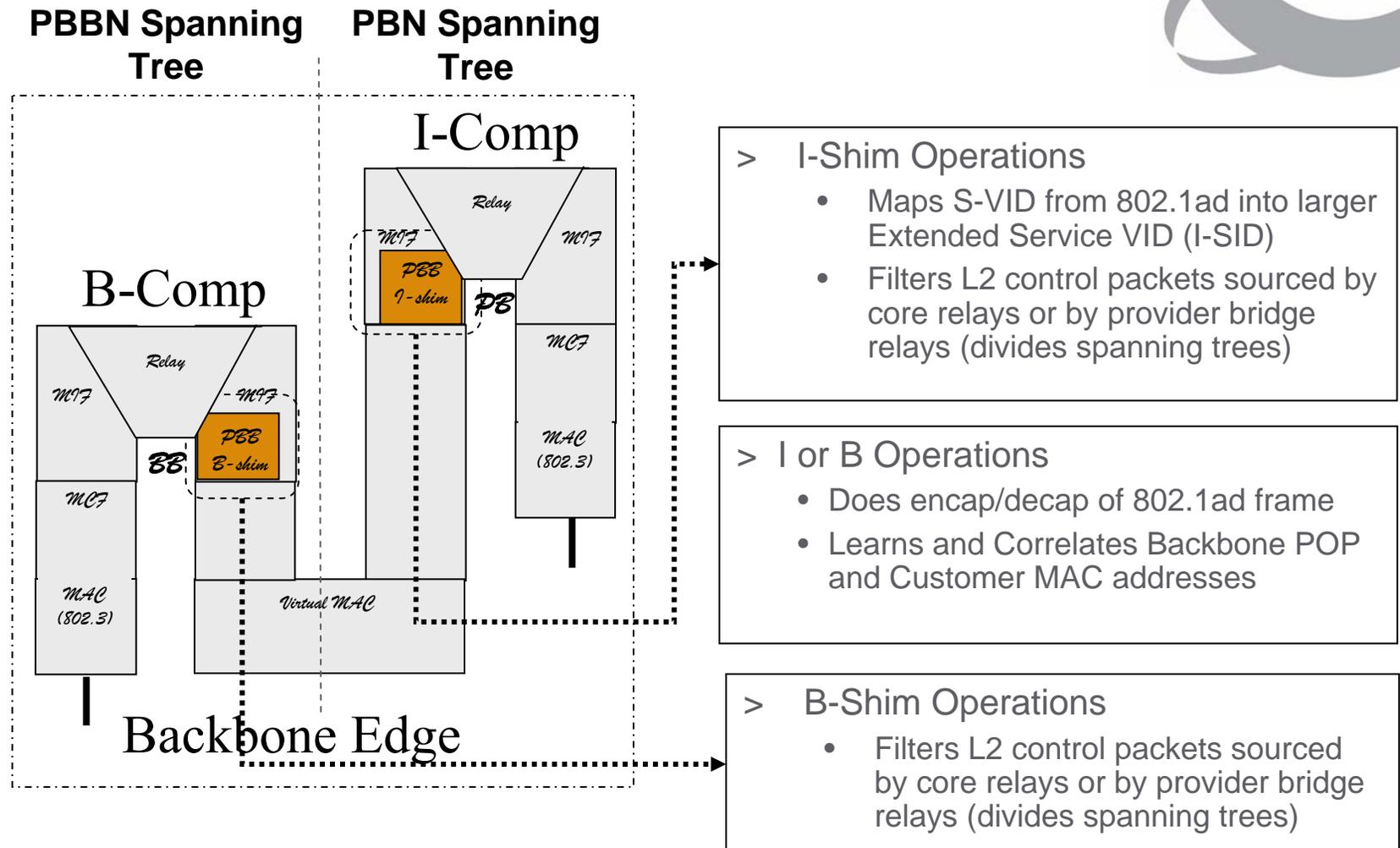
- B-DA functions handled by I-Shim
- B-Shim transform is regular
- B-Shim right side up

> I to B Shims are 1-1

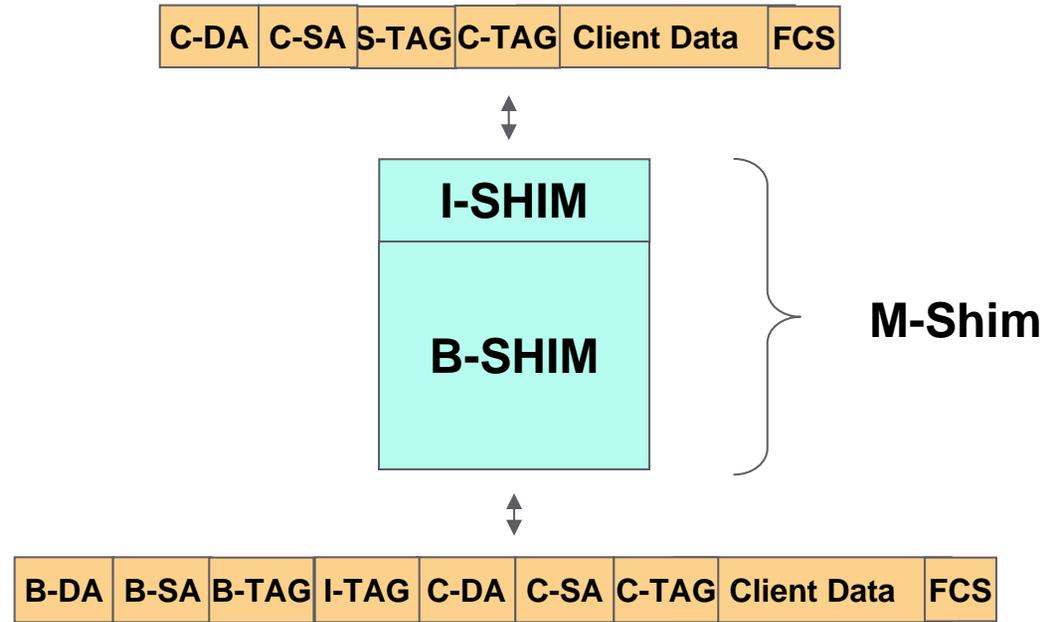
> I-Shim function is thick while B-Shim only handles B-TAG



PBB I & B Shim Alternatives 1-3



Alternative 4



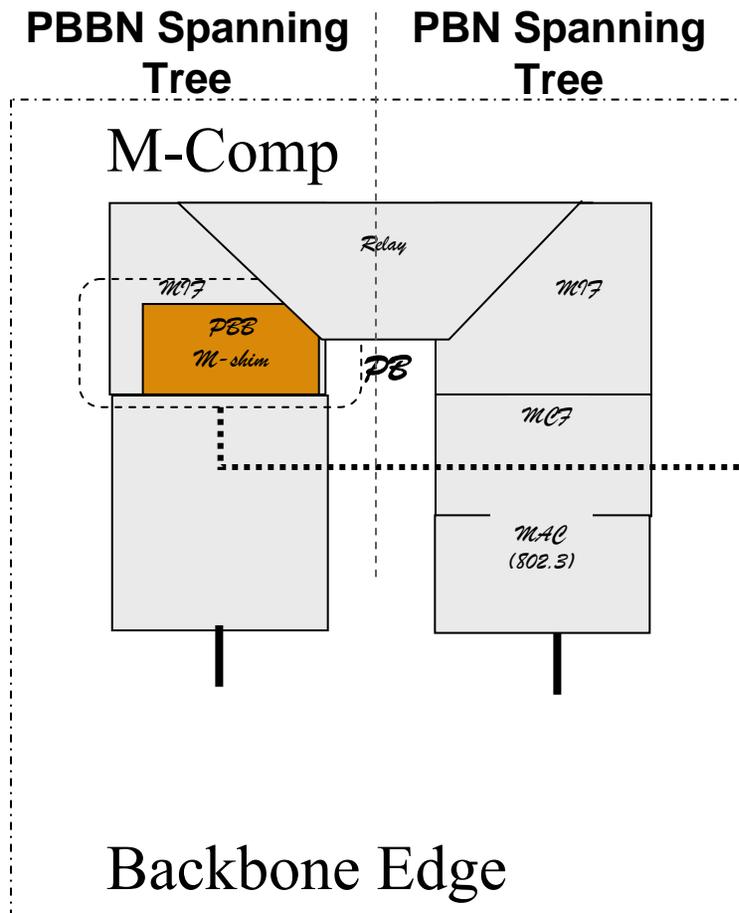
> I and B Shim combined into an M-Shim

- All functions contained in single shim
- Model becomes a single relay model
- Functions are right side up
- Spanning tree splits in the middle of the relay

> No middle level interface exposed by architecture



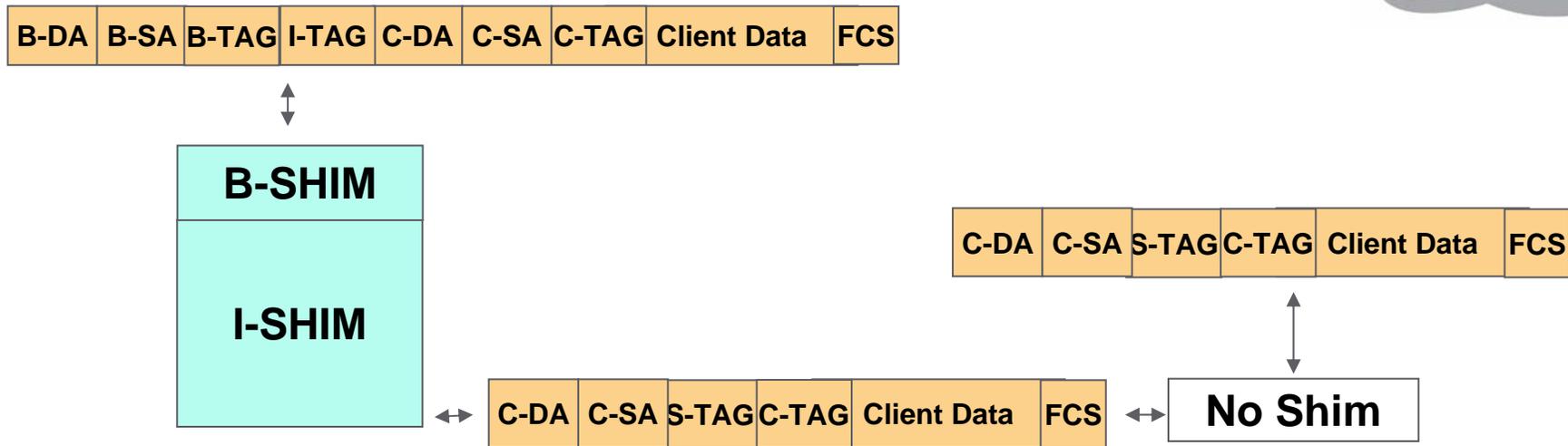
PBB I & B Shim Alternatives 4



> M-Shim Operations

- Maps S-VID from 802.1ad into larger Extended Service VID (I-SID)
- Filters L2 control packets sourced by core relays or by provider bridge relays (divides spanning trees)
- Does encap/decap of 802.1ad frame
- Learns and Correlates Backbone POP and Customer MAC addresses
- Filters L2 control packets sourced by core relays or by provider bridge relays (divides spanning trees)

Alternative 5



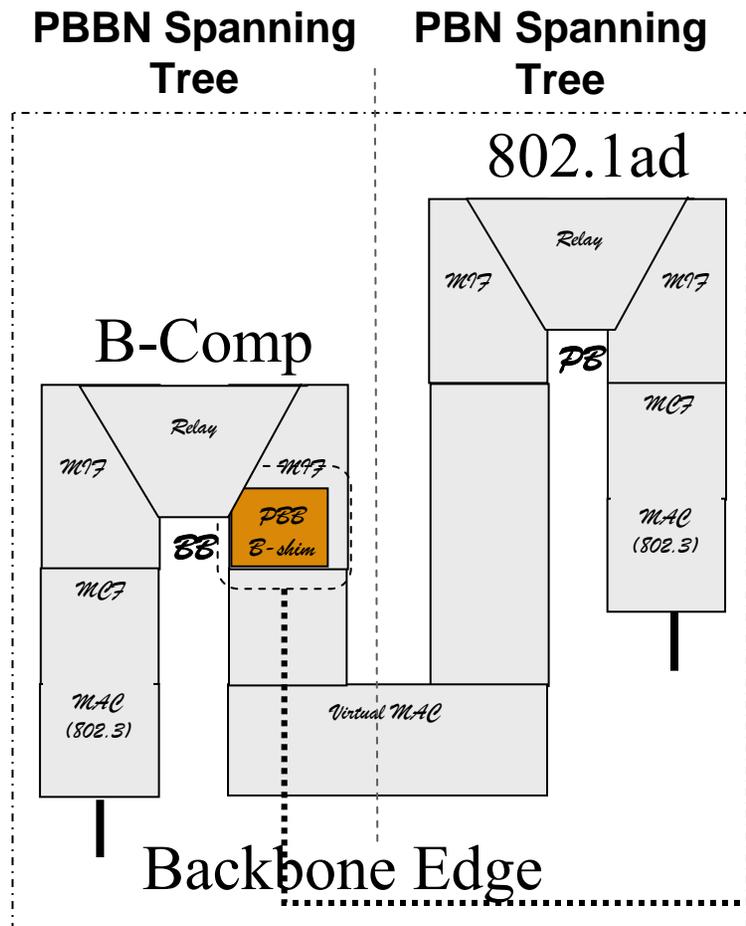
> I and B Shim combined into an M-Shim

- All functions contained in single shim
- Model becomes a single relay model
- Functions are right side up
- Spanning tree splits on link

> No middle level interface exposed by architecture



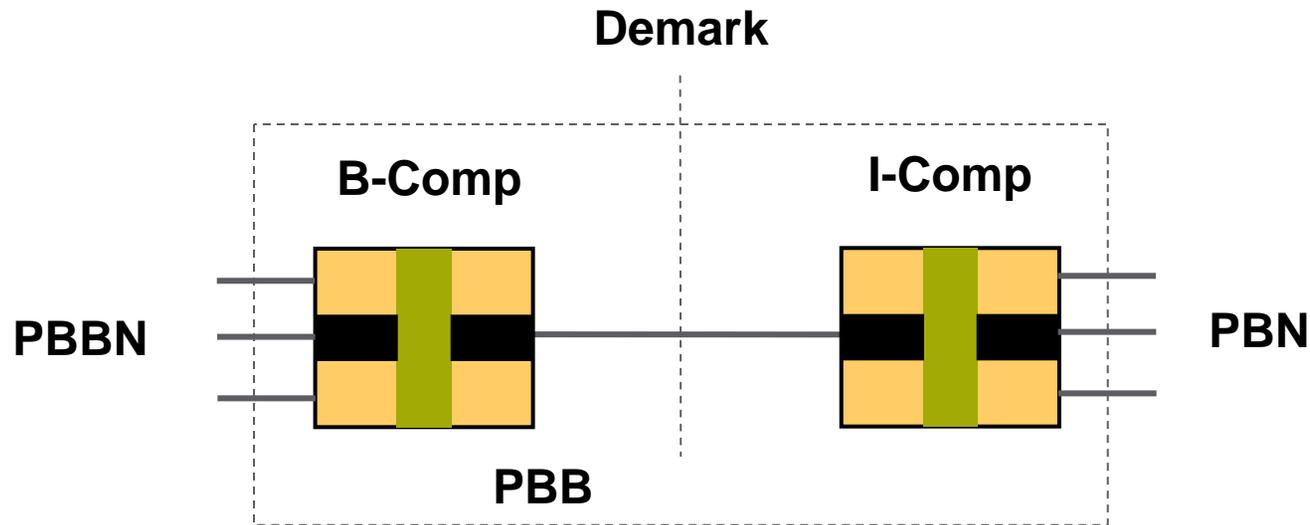
PBB I & B Shim Alternatives 5



- > I & B -Shim Operations
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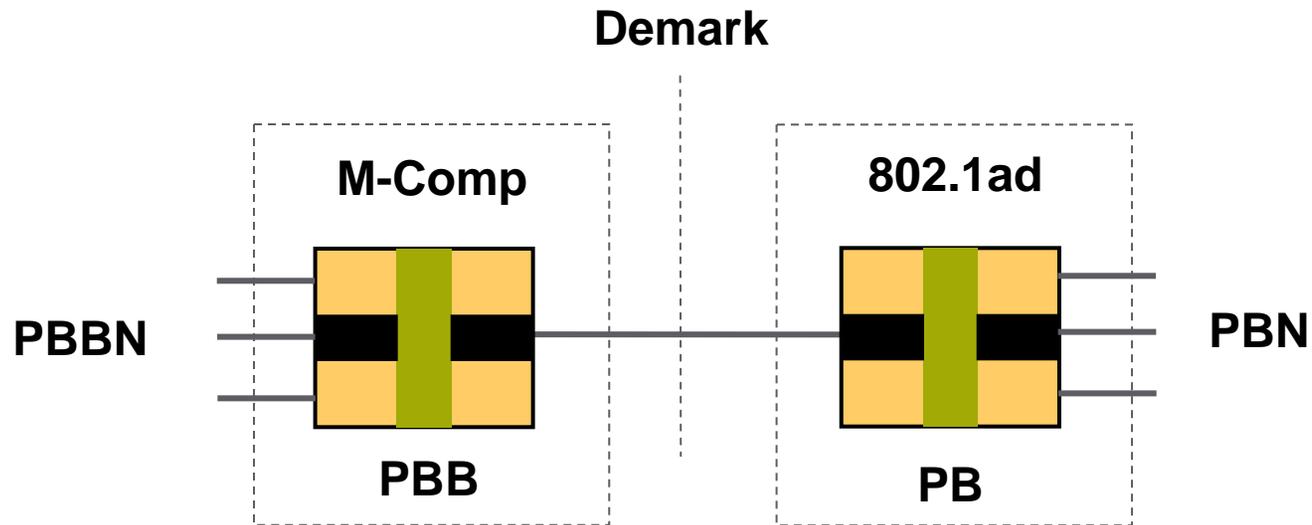
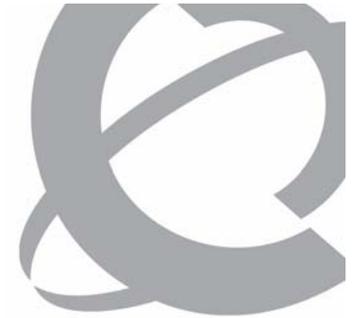


Alternatives 1-3: PBN to PBBN Demark



- > I-Shim and B-Shim 1-1 connected
- > Single I-B Shim pair forms interconnect of PBN and PBBN
- > Spanning trees split between B-Comp to I-Comp
- > Implementation may be a single box or two boxes

Alternatives 4 & 5: PBN to PBBN Demark



- > Interconnect of PBN and PBBN is between a PBB and a PB
- > Spanning trees split between in middle of M relay

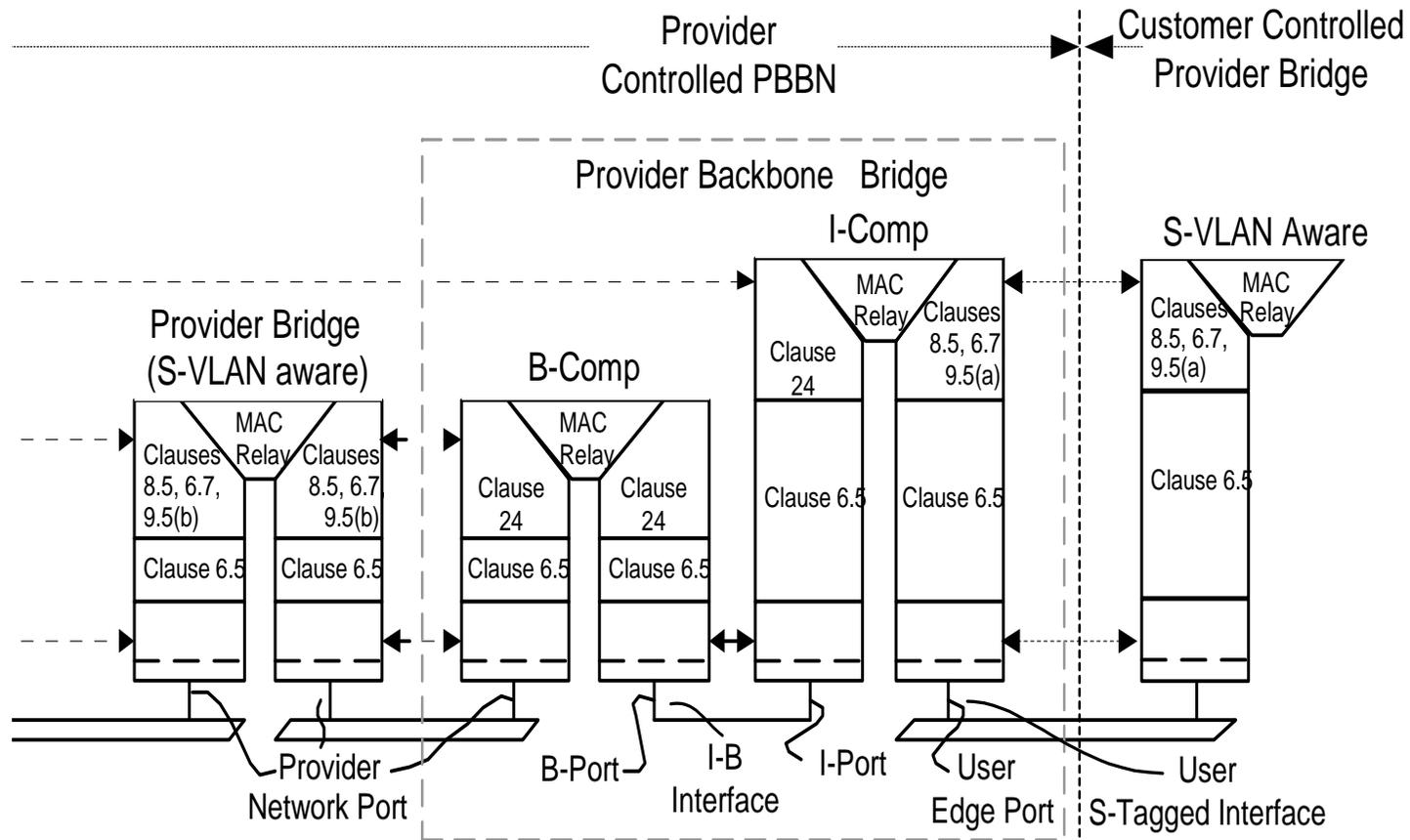


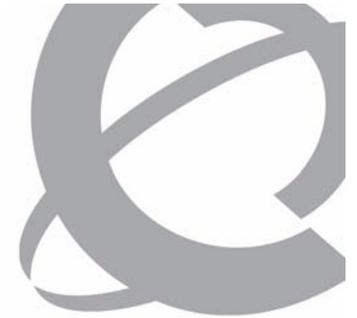
Summary

- > The dual relays create native I-TAG formats
- > Dual relays allow control of both sides for protected access interfaces
- > Alternative 1 dual relay
 - Irregular transforms and upside down operation
 - All 3 service types including native I-tagged interface hiding B-MACs
 - Access protection for S-TAG and I-TAG service
- > Alternative 2 dual relay
 - Regular transformations and right-side up operation
 - All 3 service types including native I-tagged interface hiding B-MACs
 - Access protection model for all three service types
- > Alternative 3 dual relay
 - Regular transformations and right-side up operation
 - All 3 service types including native I-tagged interface exposing B-MACs
 - Access protection model for all three service types
- > Alternative 4 is probably the simplest
 - Regular transformation and right side up operation
 - No native I-tagged interface, 2 services hiding B-MACs
 - Access protection coupled to .1ad relay
- > Alternative 5 similar to alternative 3
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 - Access protection coupled to .1ad relay

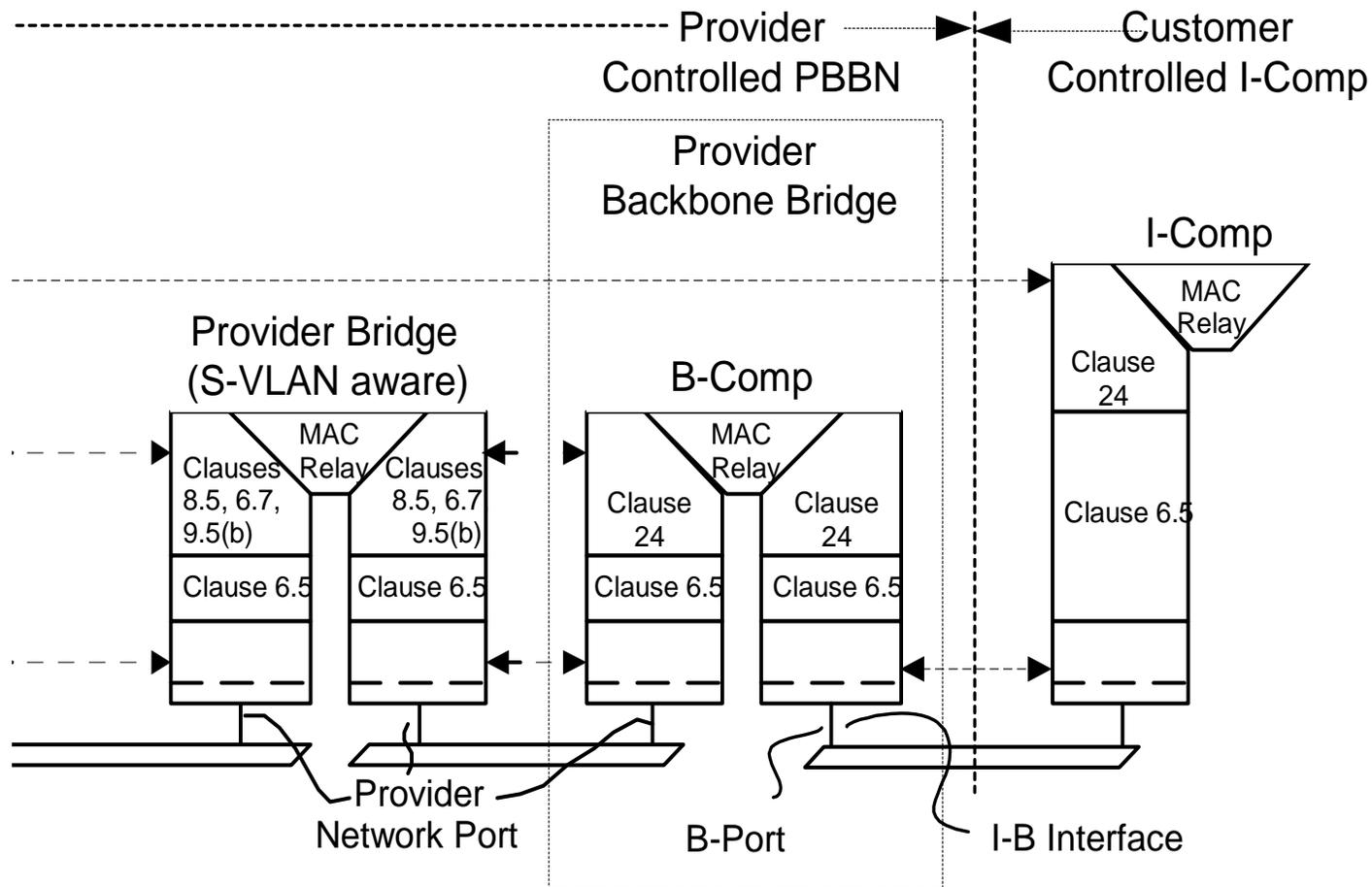


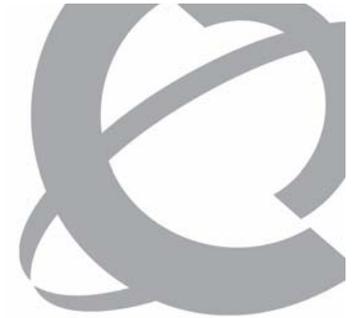
S-TAG Interface - Dual Relay Model



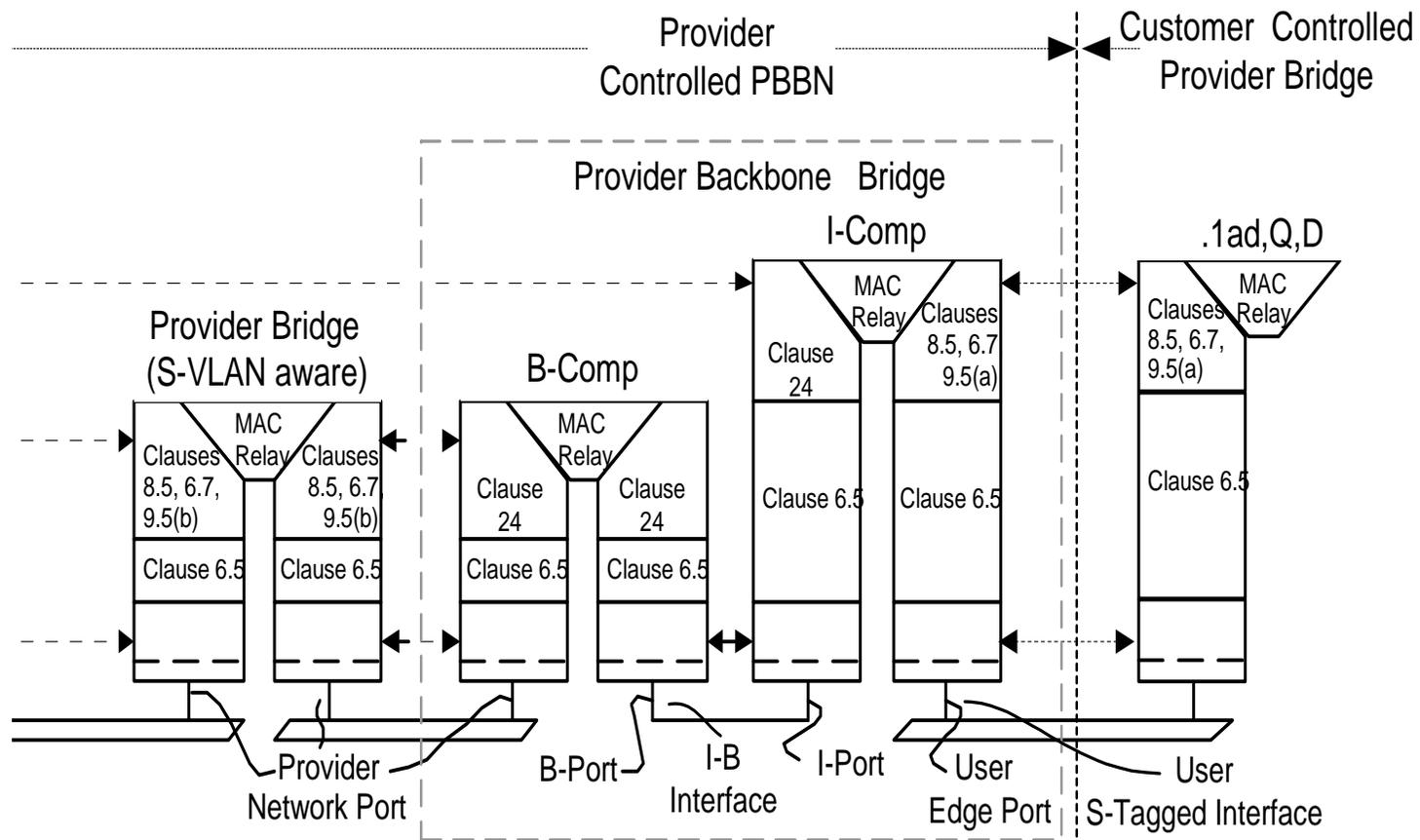


I-TAG Service Interface – Dual Relay Model





Transparent Interface – Dual Relay





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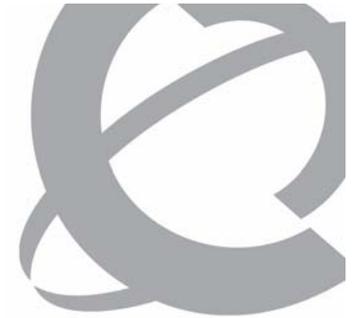
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- **Format identifier field proposal**

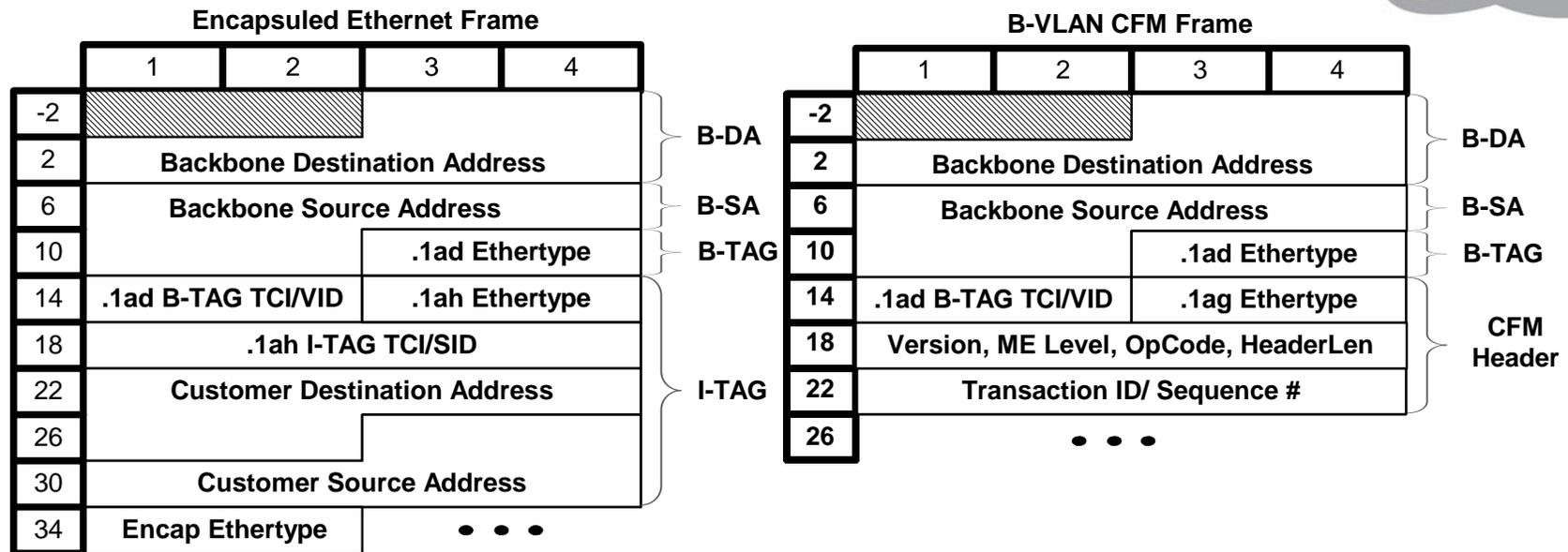


802.1ah Encapsulation Format

- 802.1ah Bridges encapsulate frames with a BBN header
- 802.1ah header contains
 - a) Extended Service identifier (I-SID)
 - Identifies the Provider Bridge S-VLAN within the BBN
 - Is carried within an I-TAG which is 32 bits long and identified by an 802.1ah Ethertype
 - Requires at least 2^{20} bits to identify 1M services
 - **Proposals for 2^{20} , 2^{24} , and 2^{28} bits**
 - b) Site Connectivity identifier (B-VID)
 - Identifies a B-VLAN (or tunnel) that is used to transport the BBN S-VLANs
 - Site connectivity (i.e., tunnel) can be point-to-point or multi-point in nature
 - B-VLAN is carried in a B-TAG with the 802.1ad Ethertype and S-TAG format
 - c) Backbone POP Address (B-MAC)

MAC Address for POPs within Site Connectivity
- 802.1ad Service VLAN IDs (S-VIDs) map to 802.1ah Extended Service IDs (I-SIDs)
 - PBN S-VIDs are local to the PBN
 - PBBN I-SIDs are local to the PBBN

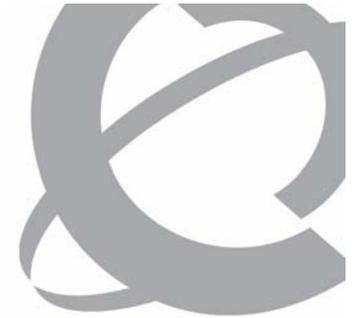
Formats On PBBN Wires



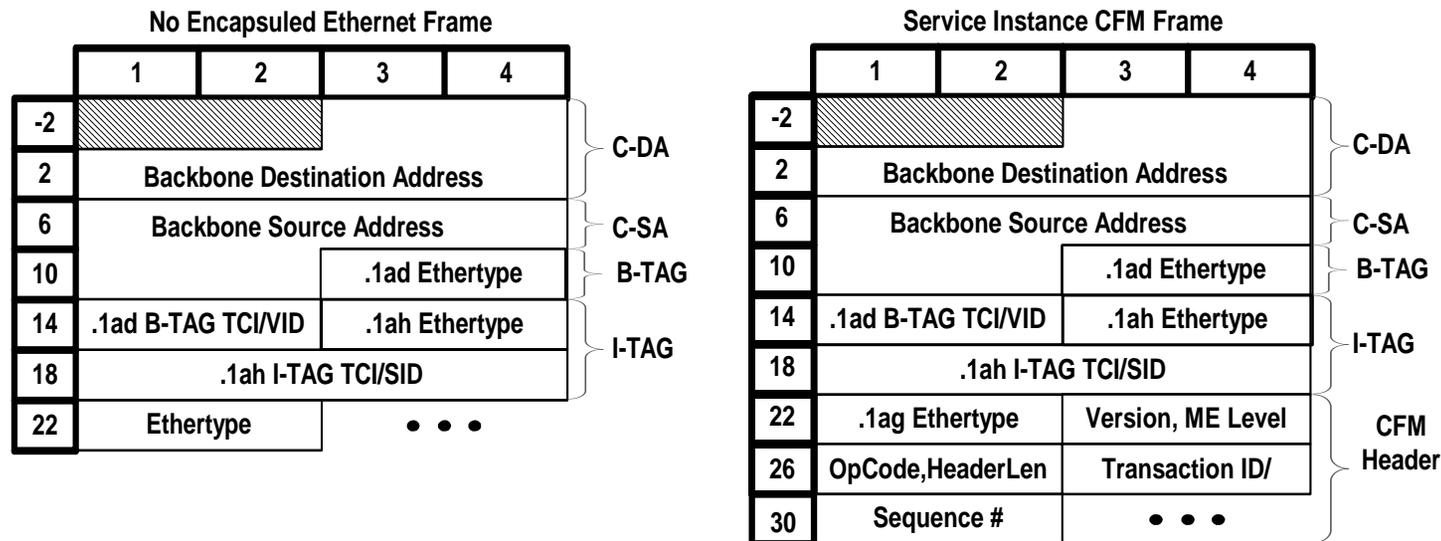
B-TAG is identical to S-TAG and optional in the frame

I-TAG is optional in frame

CFM format is for management of a B-VLAN



Unencapsulated Formats On PBBN Wires



B-TAG is identical to S-TAG and optional in the frame

I-TAG is optional in frame

CFM format is for management of a S-VLAN

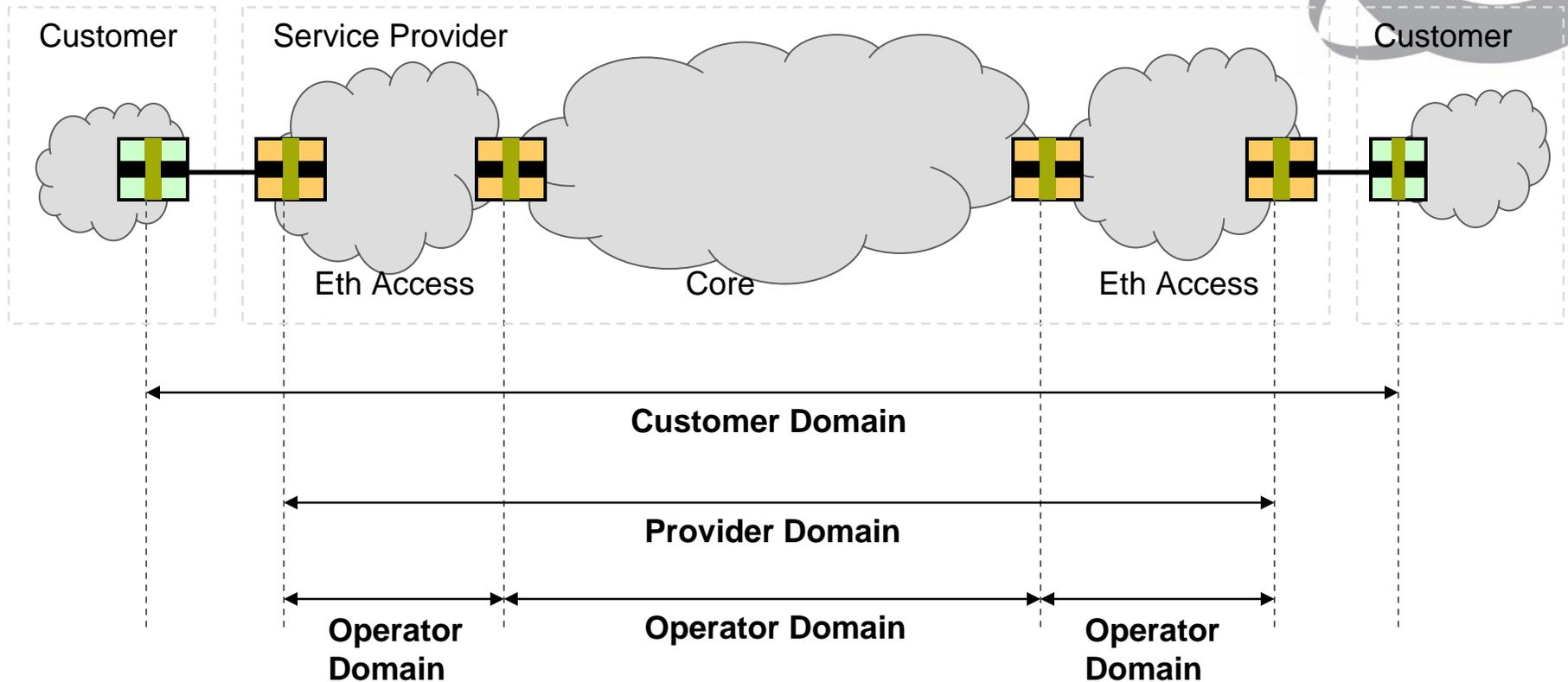
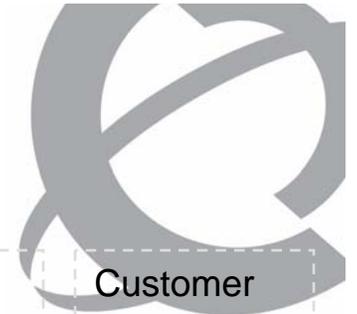


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Backup Slides

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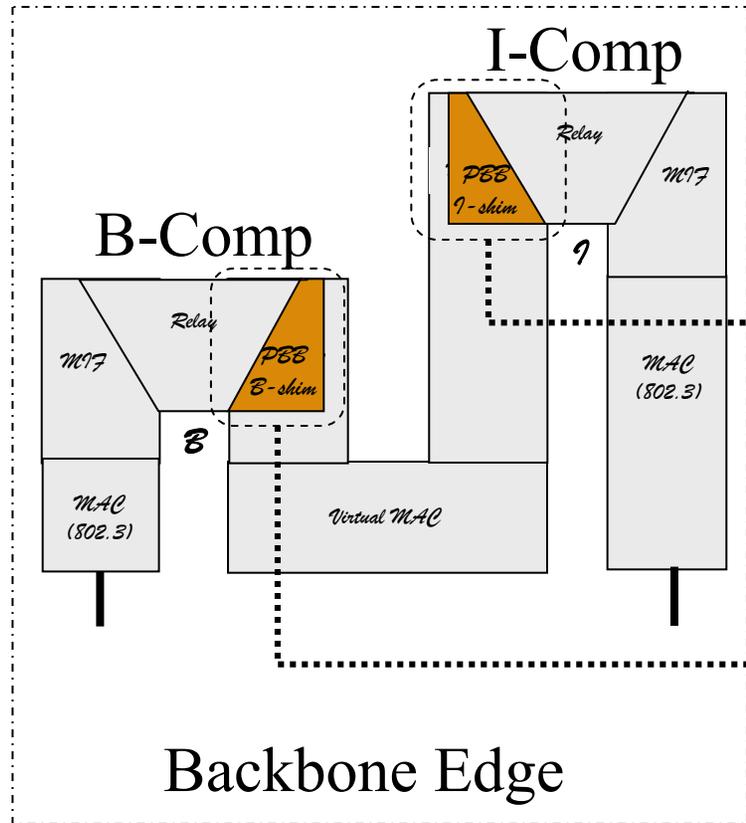
Multiple Domain Management



- > Ongoing work at IEEE 802.1ag, ITU SG13 Y.17ethoam, MEF
- > IEEE P802.1ag Service OAM flows at multiple levels.
- > Ethernet Service OAM allows multiple autonomous networks.



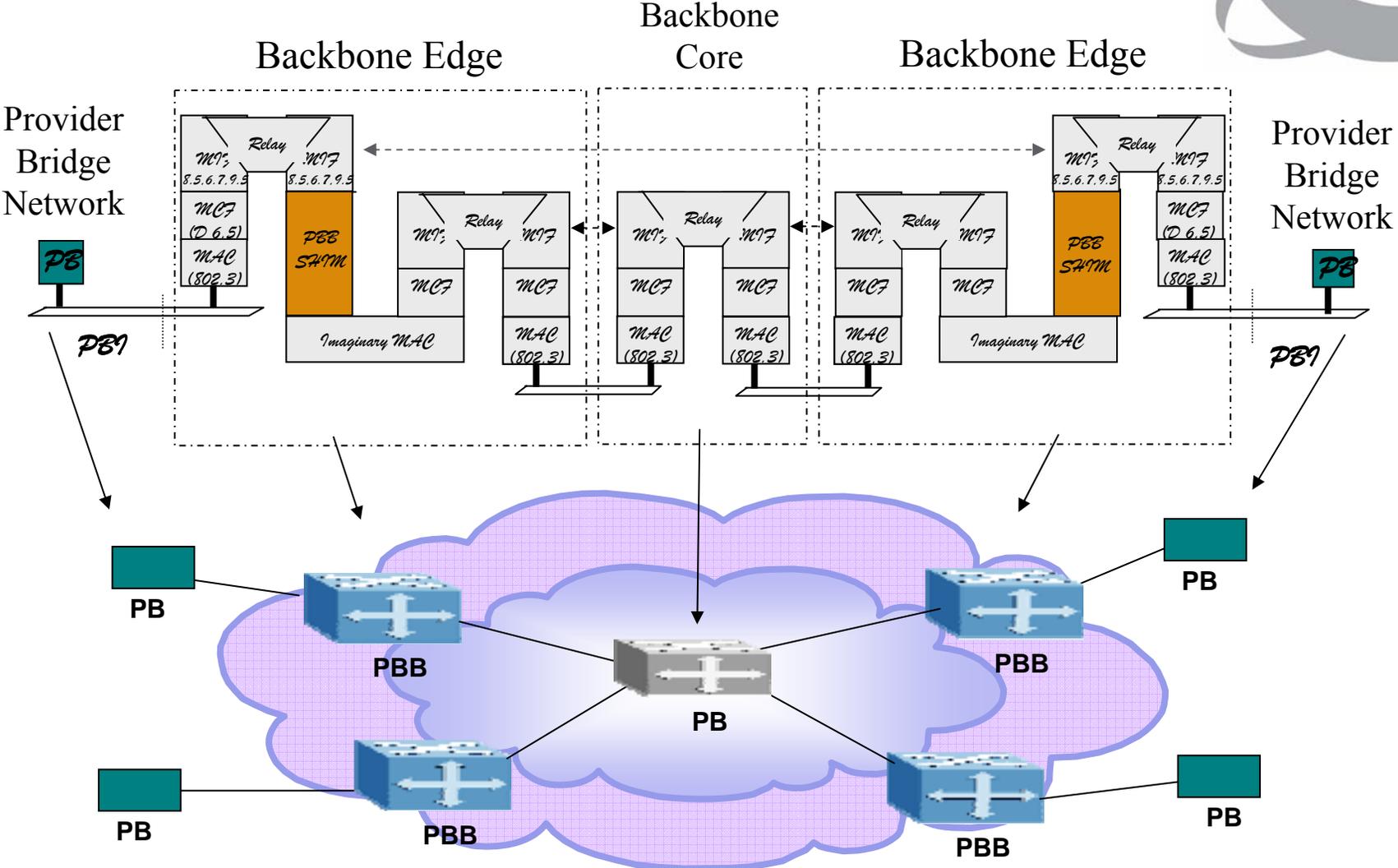
PBB Shim Functions

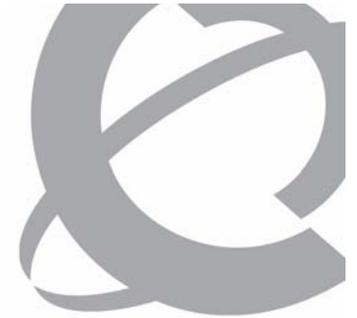


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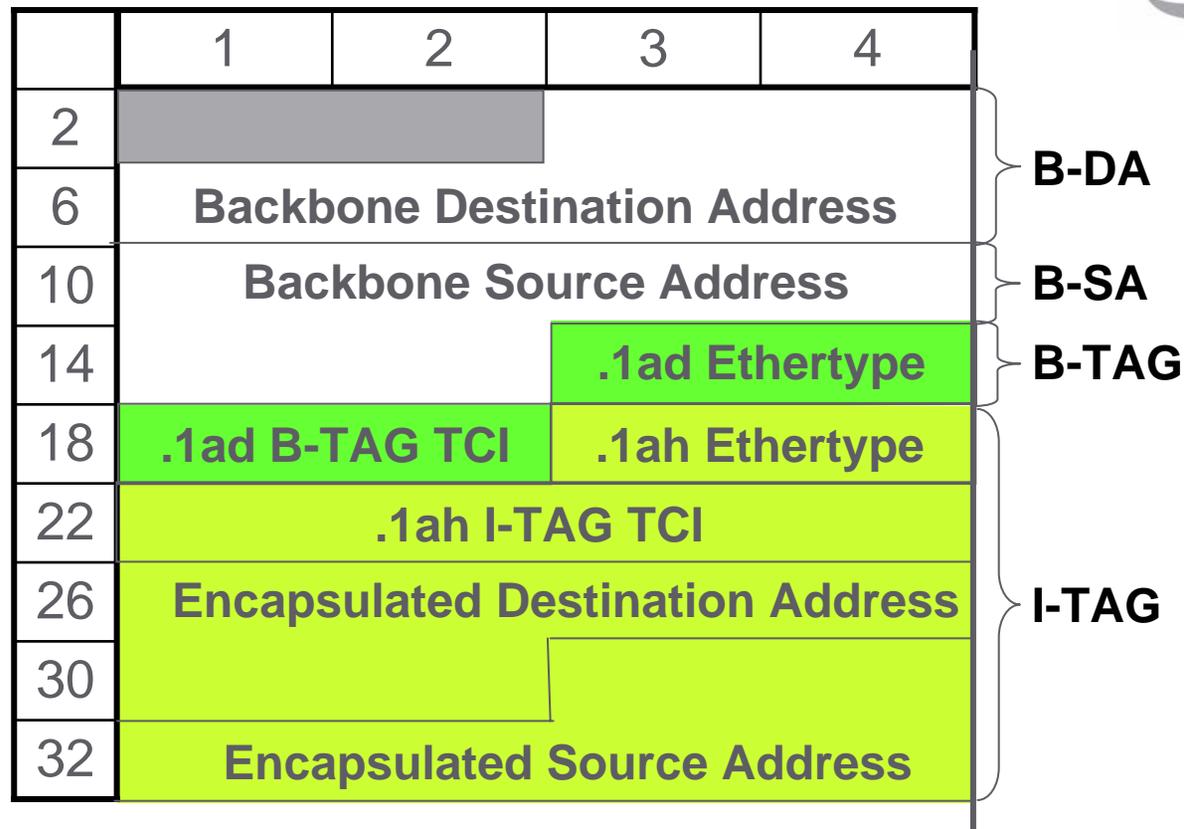
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PBB Peer Model



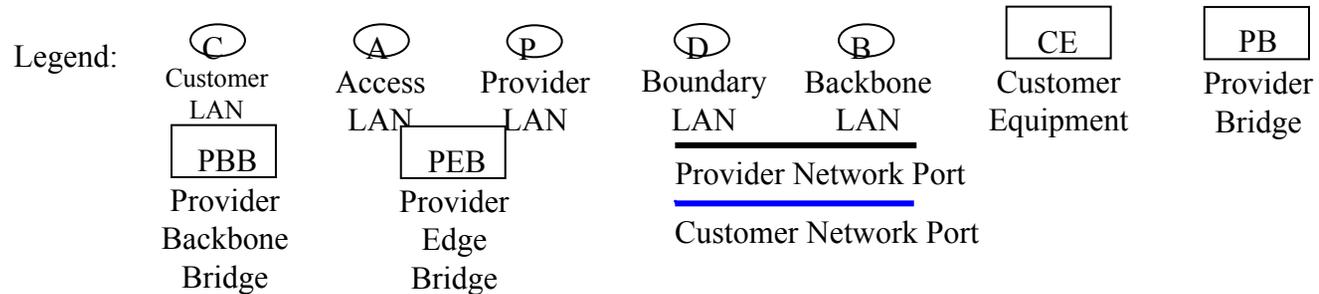
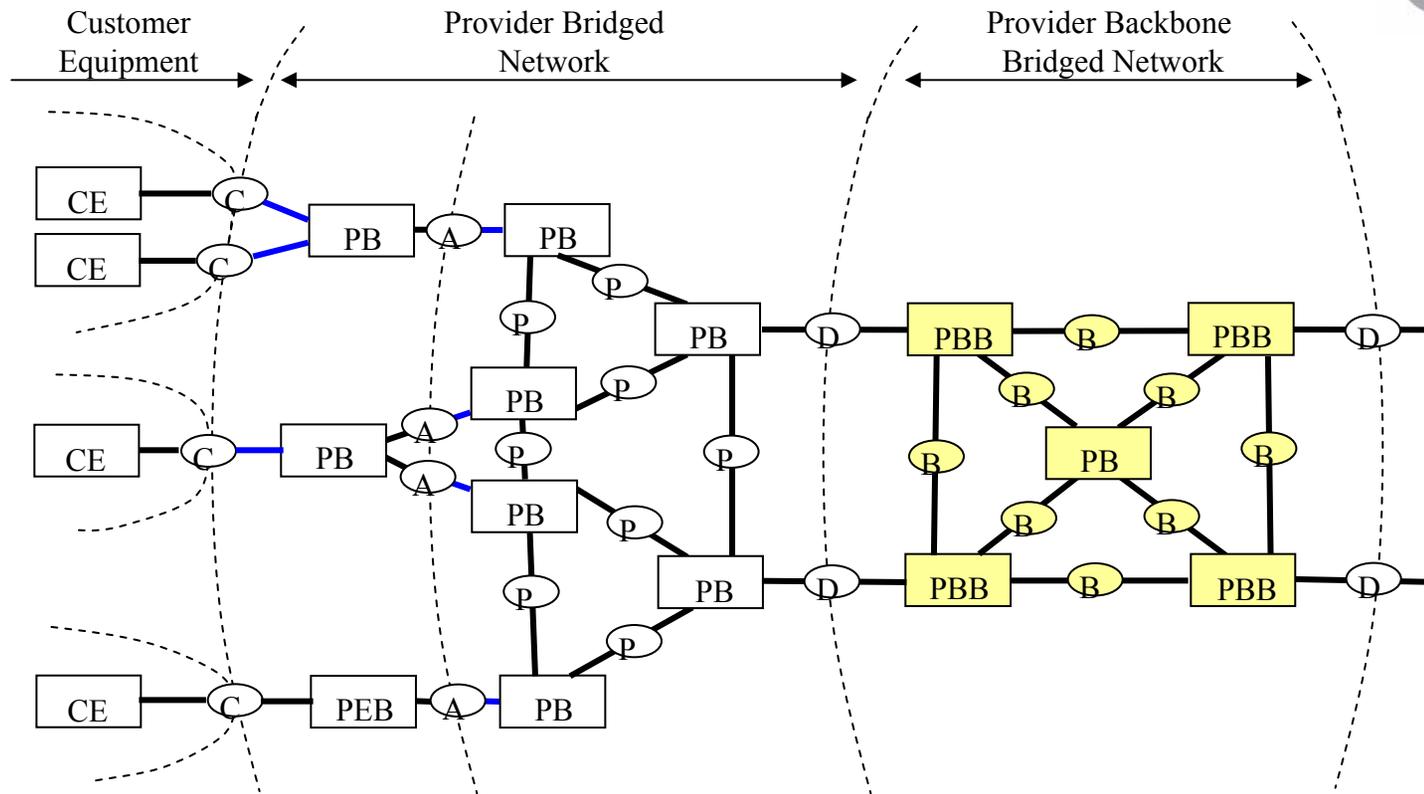


Encapsulation Frame Header

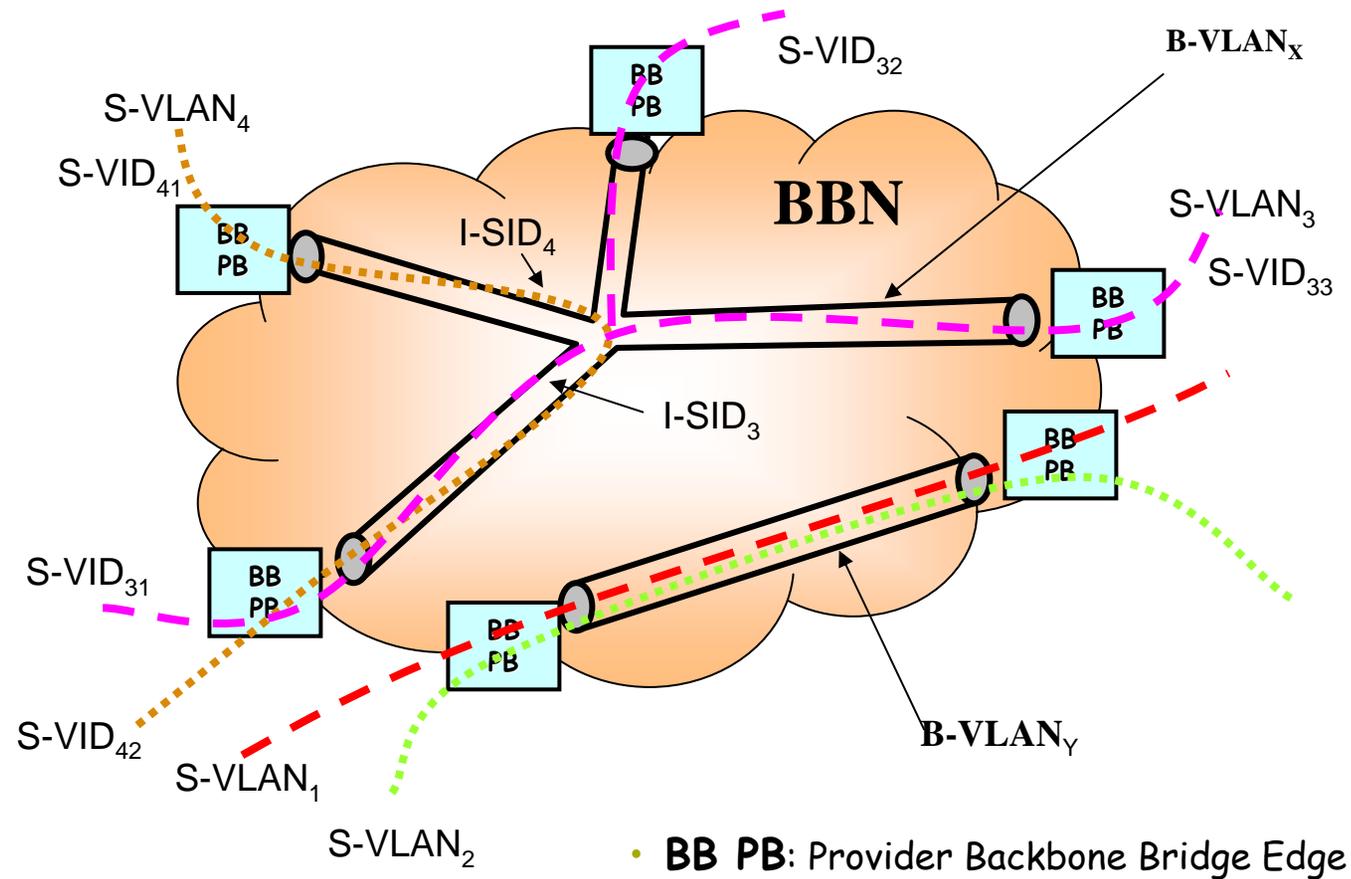
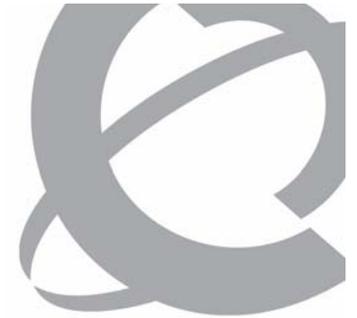


- The B-TAG is identical to S-TAG and optional in the frame

Provider Network Example



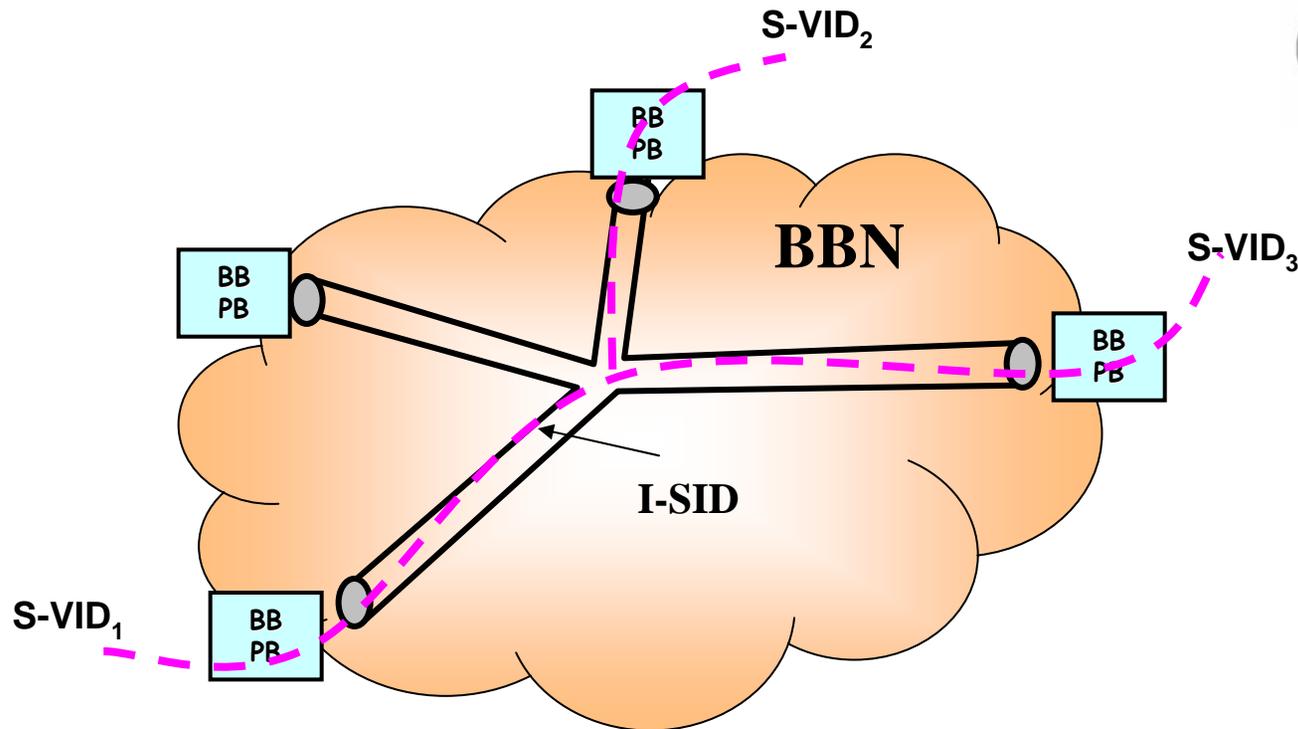
Extended Service VLAN IDs In Backbone



- An I-SID uniquely identifies a S-VLAN within the Backbone
- The MAP Shim translates between S-VID and I-SID
- The I-SID to(from) S-VID mapping is provisioned when a new service instance is created

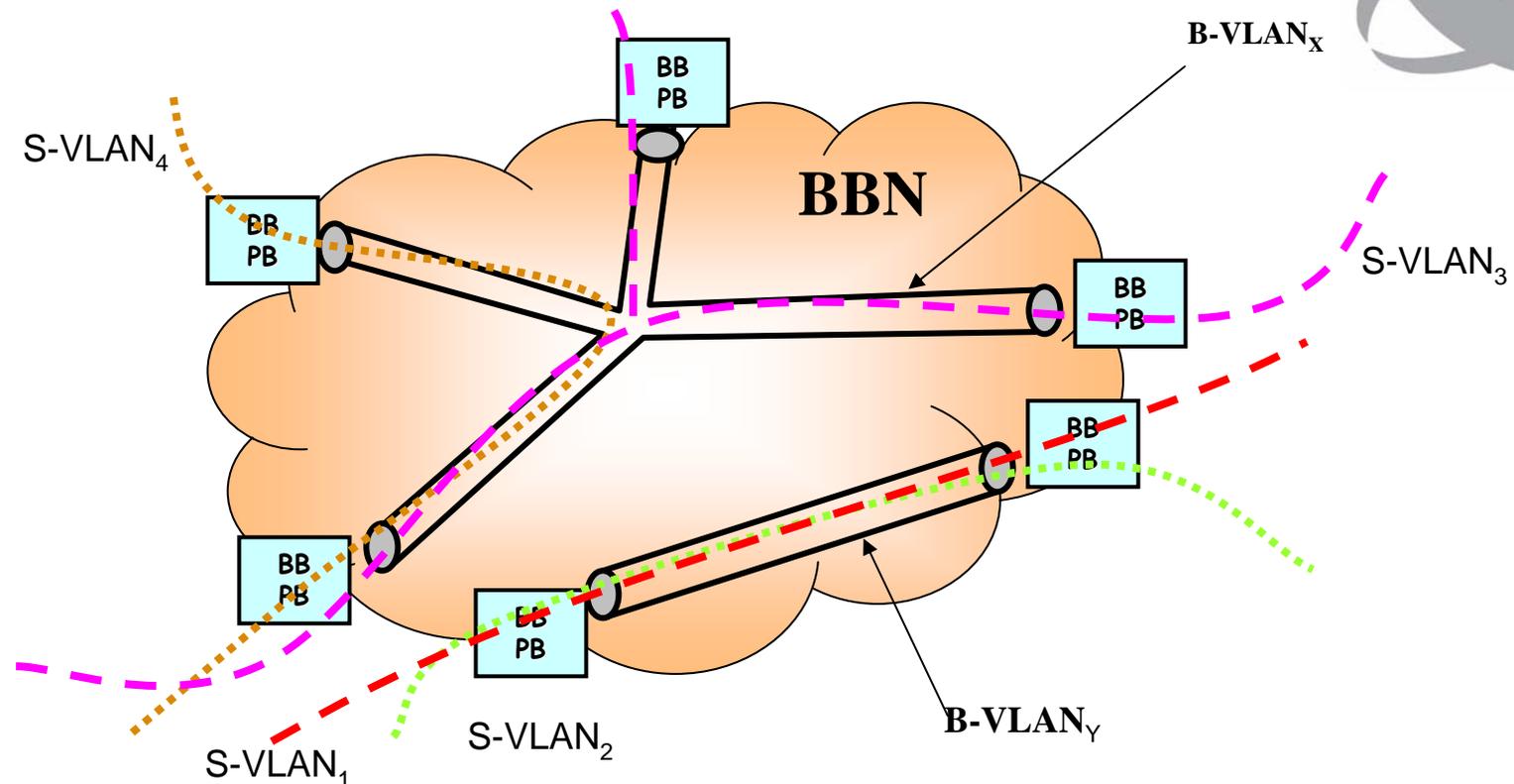


Single I-SID per S-VLAN



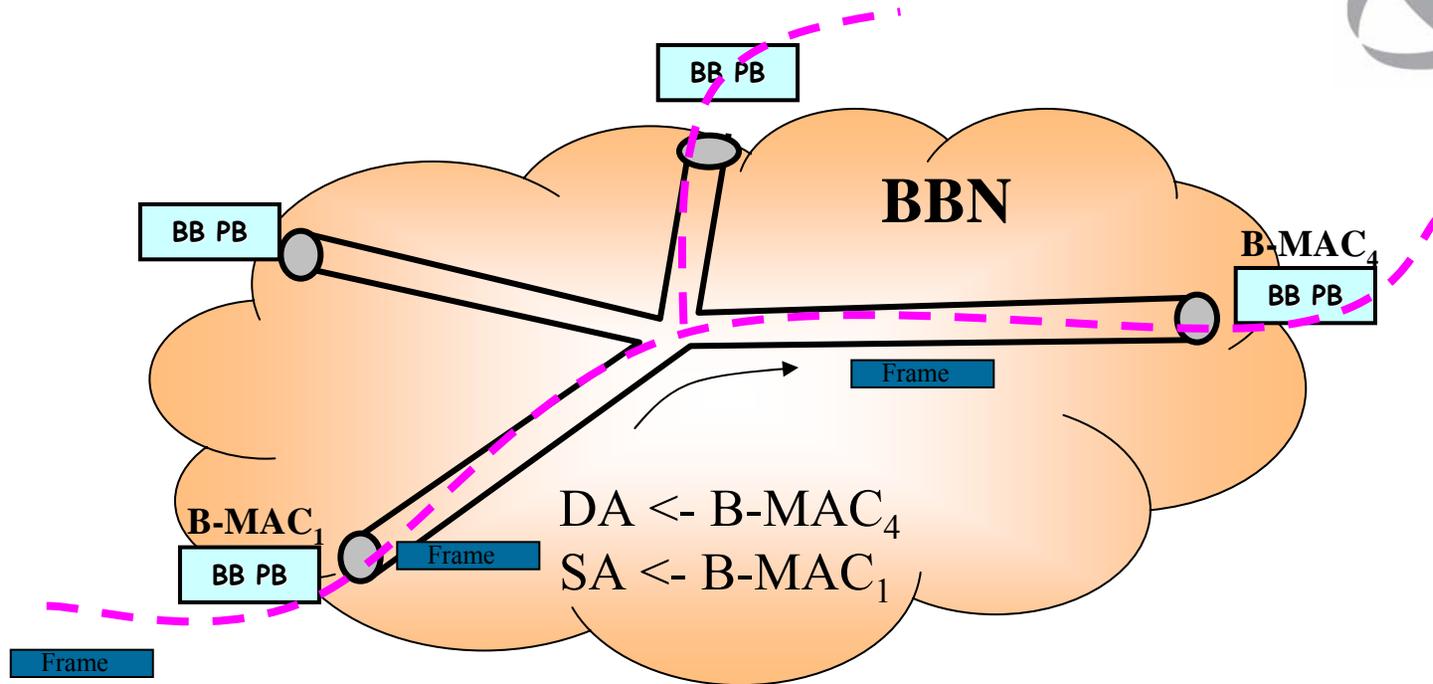
- > Regardless of the I-SID address size the map tables only have 4096 entries since only one I-SID exists per S-VLAN and only 4096 S-VLANs exist per Provider Bridge.
- > A different S-VID in each PBN maps to the I-SID

Site Connectivity B-VLAN ID

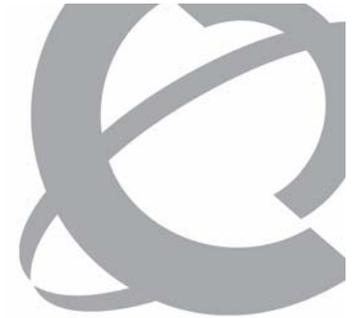


- > B-VLANs are addressed like regular VLANs with a 12 bit B-VID
- > B-VID and I-SID need to be separate ID spaces to allow many S-VLANs to be carried in a single B-VLAN

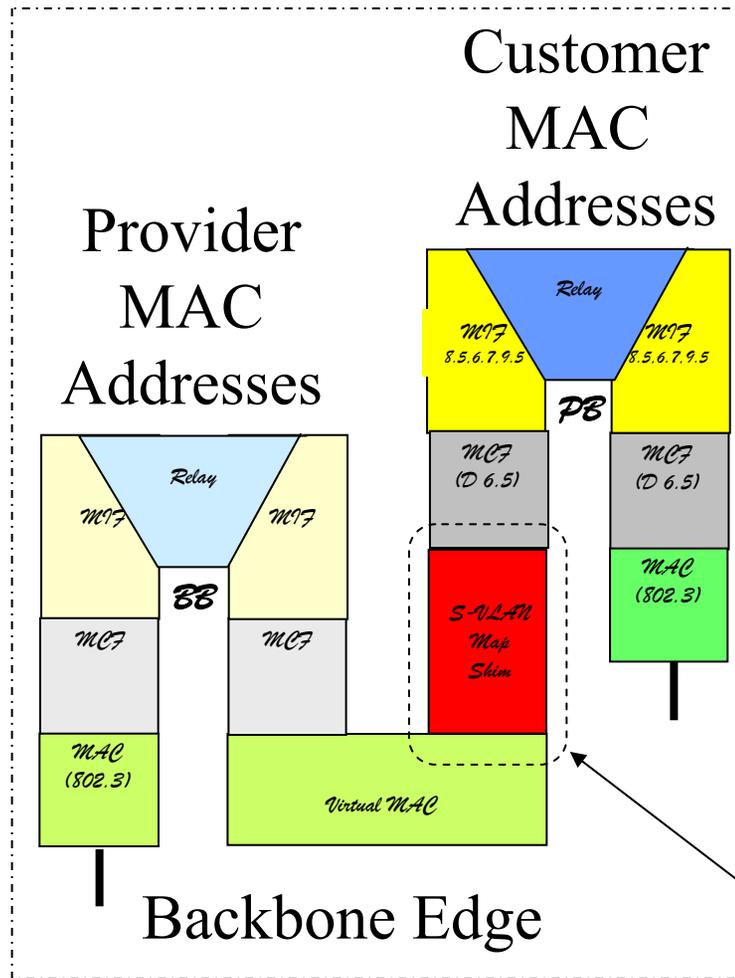
Backbone POP MAC Address



- > B-MAC Addresses identify the Edge Provider Backbone Bridges (BB PB)
- > B-MAC Addresses are learned by other Edge Backbone Edge Bridges
- > The backbone edge MAC address determines which edge on the B-VLAN will receive the frame.
- > Frames may be flooded by sending with broadcast or multicasts DA B-MACs to the B-VLAN.
- > Map shims filter based on the I-SID removing any misaddressed frames

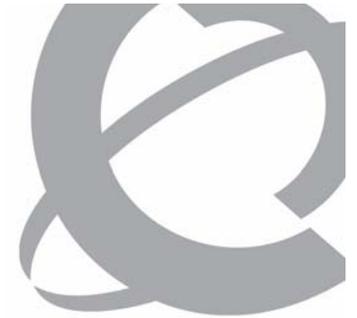


Customer/Provider Addresses

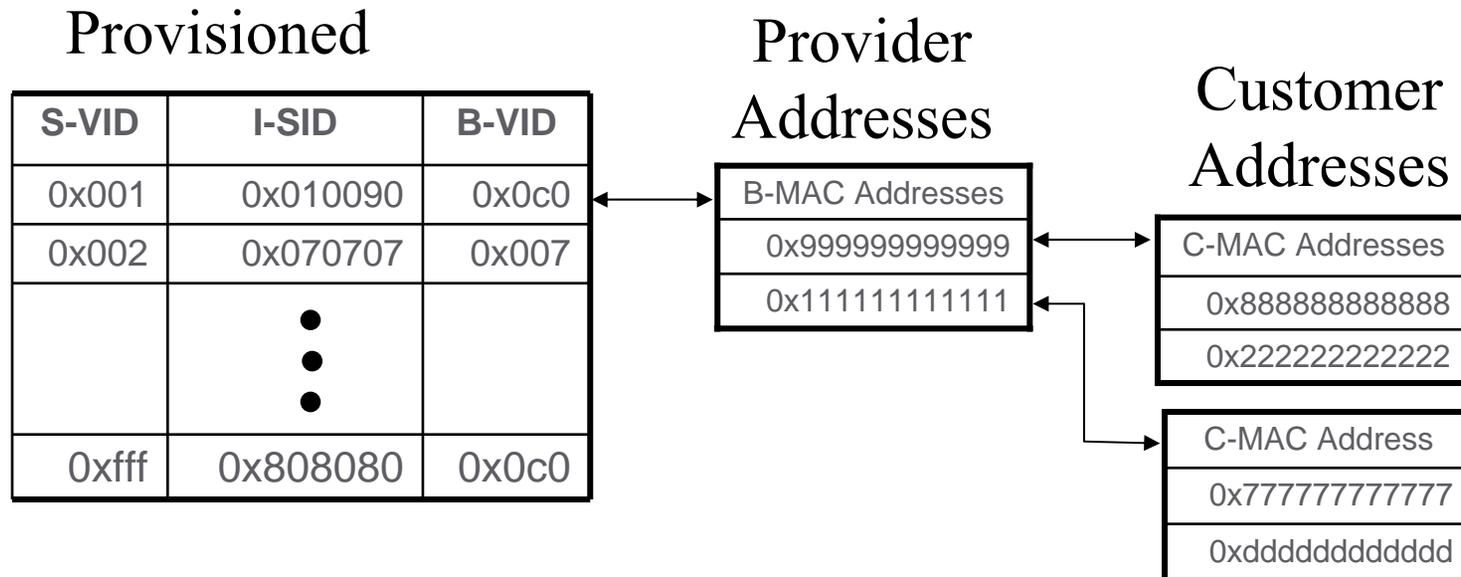


- > PB Relay Learns Customer Address Per S-VLAN
- > BB Relay Learns Provider Addresses Per B-VLAN
- > MAP Shims Learns Correlated Customer and Provider MAC Addresses per S-VLAN

Customer/Provider
MAC Address
Correlation

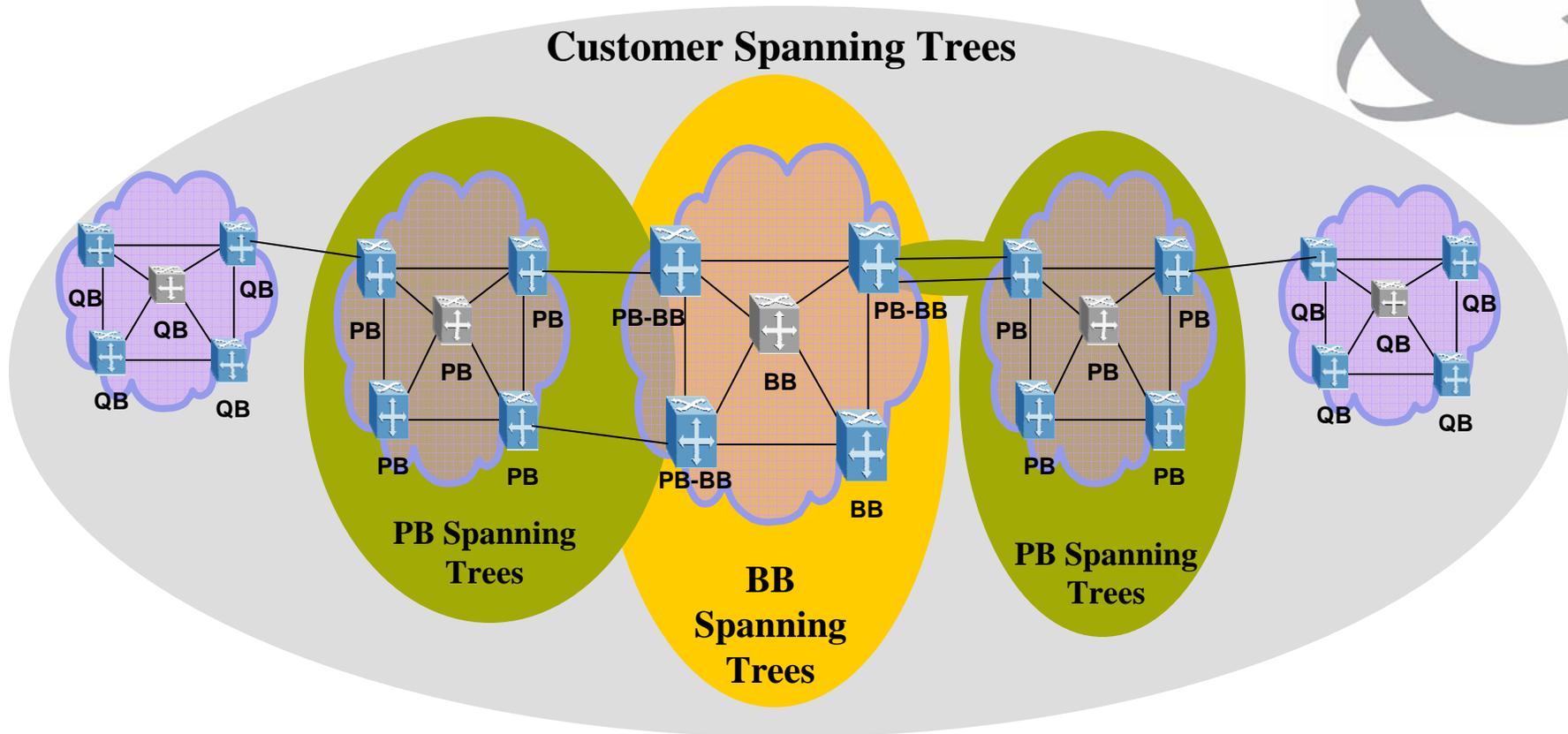


MAP Shim Correlation Table



- > In the beginning the MAP Shim is provisioned with the correlation between the S-VID, I-SID, and B-VID
- > During operation the MAP Shim learns both B-MAC addresses and C-MAC addresses
- > The MAP Shim keeps track of which C-MAC addresses are behind which B-MAC
- > The correlation data is used to encapsulate frames from the PBNs

Customer, PB, BB Spanning Trees



- > Customer spanning trees may extend over Provider Network
- > PB Network and BB Network spanning trees must be decoupled to scale the provider network
- > Provider Backbone Bridge may conform to the requirements for an Interconnect Medium

