802.1ah Architecture Diagrams

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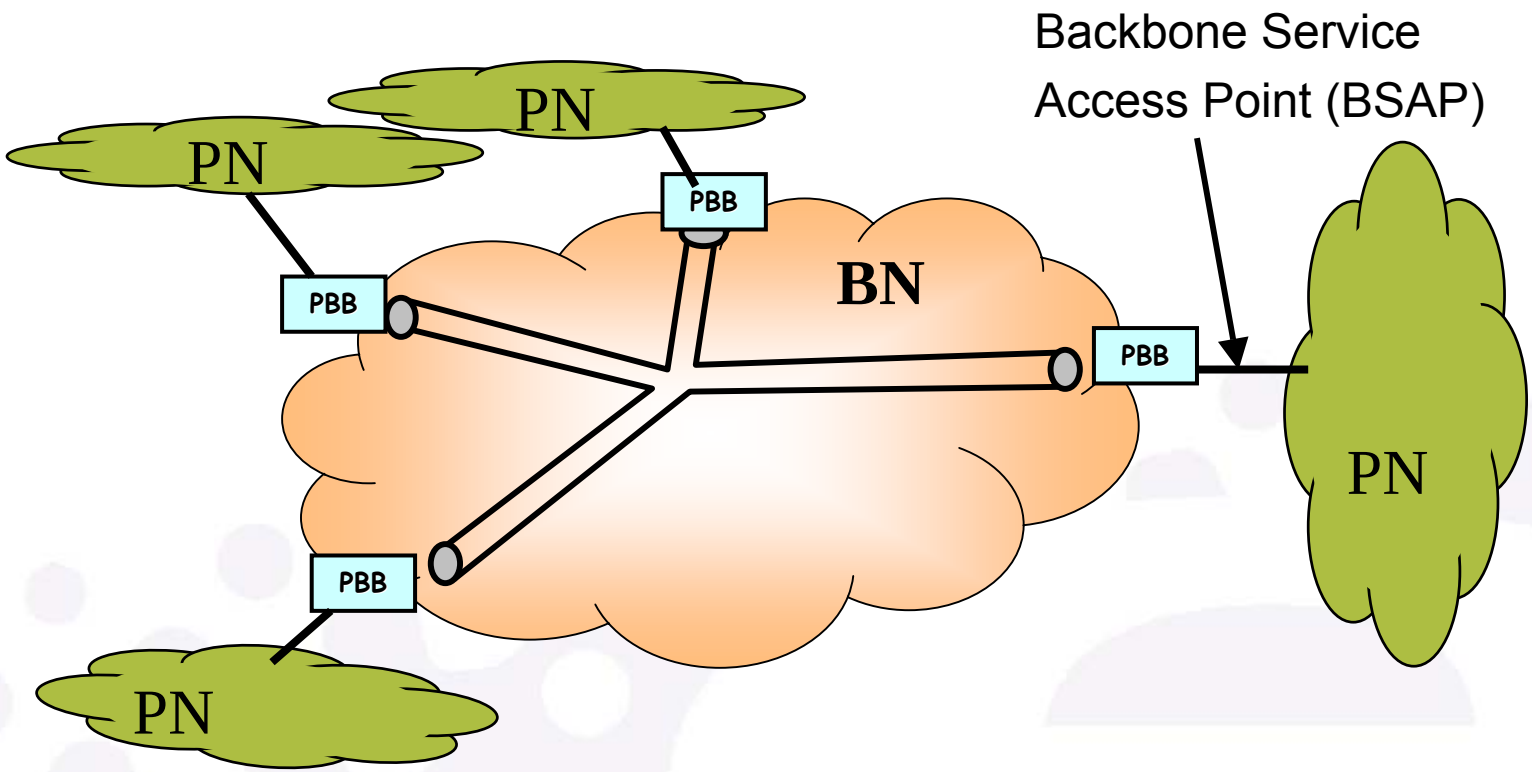
Fundamental Concepts of Provider Backbone Bridging

1. On Backbone Network, customer MAC addresses are “hidden” behind a new MAC header containing MAC addresses of the ingress and egress Backbone Service Access Point (BSAP)
2. On Backbone Network, the identification of a service (ISID) is separated from the identification of a broadcast domain on the backbone network (B-VID)
   - In Provider Bridging, both of these functions were combined in a single field – the SVID.

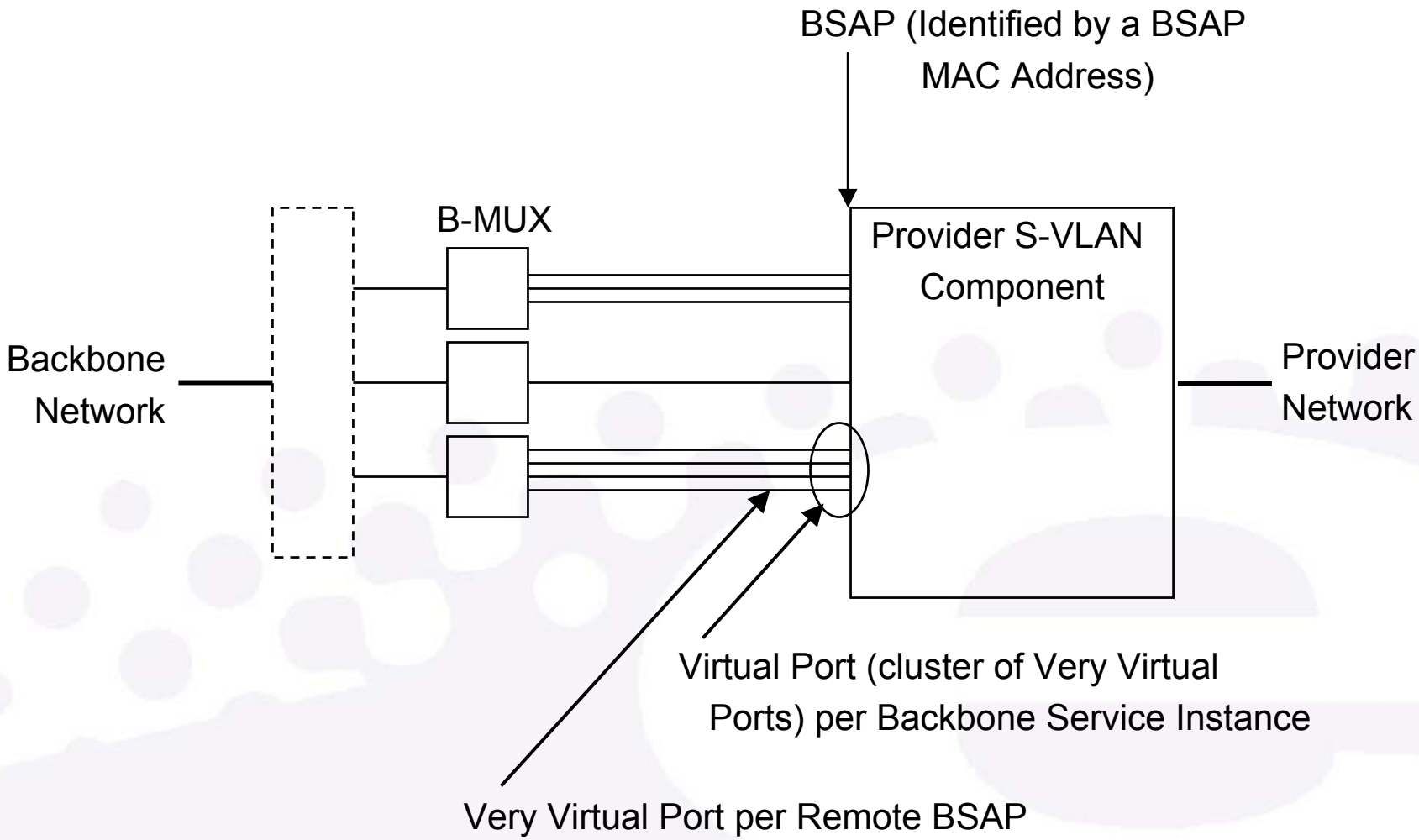
Simplified Problem Statement



- **PBB**: Provider Backbone Bridge Edge

- Need a Backbone Service Instance to interconnect two (P2P case) or more (Multipoint case) Backbone Service Access Points (BSAP) across the Backbone Network

Rudimentary Edge Bridge Model



Very Virtual Ports

- Very Virtual Port (VVP) provides a structure for MAC-in-MAC encapsulation
  - Each VVP associated with a unique combination of local BSAP address, remote BSAP address, and Backbone Service Instance
    - In packets, Local and Remote BSAP addresses are B-SA and B-DA
  - For packets going toward Backbone, Provider S-VLAN component **forwards** packets to VVP based on Customer MAC Destination Address (C-DA) and Provider Network S-VLAN Identifier (PSVID)
  - For packets coming from Backbone, Provider S-VLAN component **learns** the association of Customer MAC Source Addresses (C-SA) and PSVID with a VVP
- B-Mux structure steers packets from the Backbone to a VVP on the basis of B-SA (remote BSAP address)

VVPs and Broadcast/Unknown Flooding

- Option 1: Replicate packet for each VVP in the VP
  - This is the natural behavior of the Provider S-VLAN Component
  - Inefficient because replicating packets at the ingress to the backbone network rather than only at points where the service instance branches within the backbone network.
- Optimization: Add a VVP specifically for Flooding
  - Modify S-VLAN component to send all packets with Broadcast or Unknown C-DA to the Flood-VVP
  - Flood VVP uses broadcast address for B-DA
  - B-Mux never steers packets from backbone to Flood-VVP
- Further Optimization: Add VVPs for specific multicast
  - Allows building multicast trees with mcast B-DA within backbone network

Pros and Cons of VVP model

- Good:
  - Provider S-VLAN component sees VVP as a “port” with respect to learning, because provides association between a Customer address and remote BSAP address
- OK:
  - Creating a VVP for Broadcast and Unknown flooding avoids unnecessary packet replication at ingress to backbone network, but requires a modification to the Provider S-VLAN component behavior that is unique for VVP clusters.
- Bad:
  - When a broadcast or unknown is received from a VVP, we do not want to flood it back out other VVPs in the same cluster. Requires another change to Provider S-VLAN component.
  - Control Protocols: without delving into details here, it is unlikely we want control protocols (e.g. RSTP, GMRP) to see each VVP as a “port”.

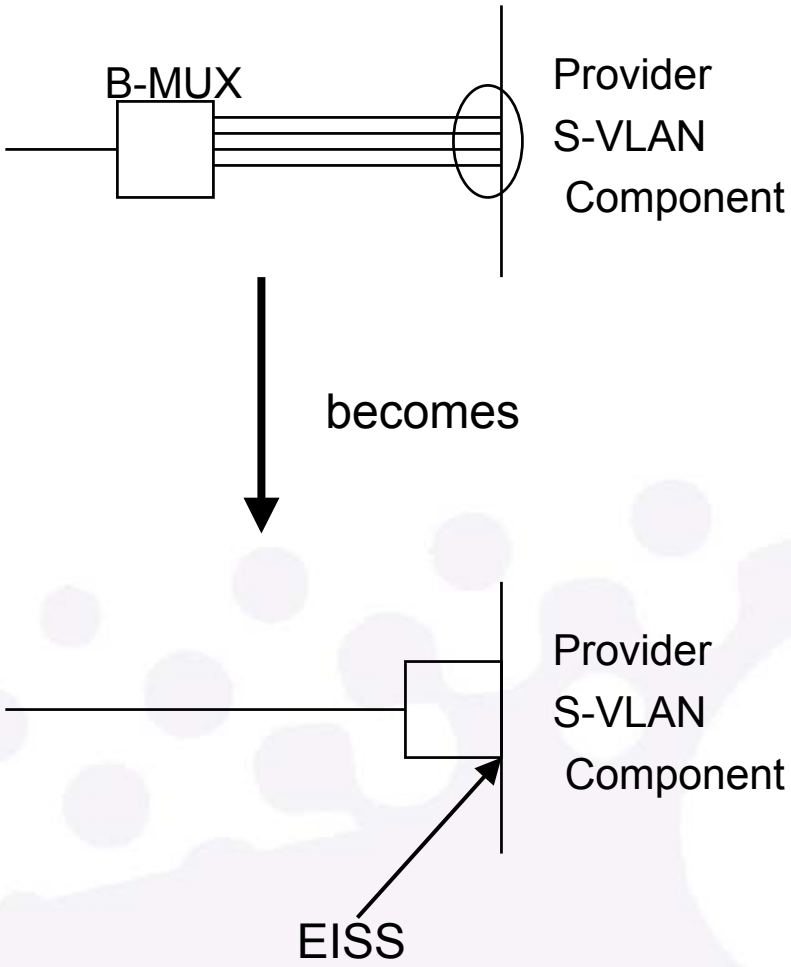
A Different Perspective

- Summary of Pros and Cons:
  - We want VVPs to look like a port for the purposes of learning, but we want the cluster of VVPs to look like a single port for all other bridge functions.
- Turn the VVP model on it's head
  - Instead of considering the unicast VVPs the base case and the broadcast/unknown VVP an optimization, consider the broadcast/unknown VVP the base case and the unicast VVPs and optimization.
  - Note that you could run the backbone with just a broadcast/unknown VVP (if you were willing to send all unicast frames to all BSAPs in the backbone service instance)
  - Create a model where the VP (cluster of VVPs) is considered the "port" by all Provider S-VLAN component functions but allows VVPs to be an optimization that applies only for learning.

Associated Data in the FIB

- Add an optional field to FIB entries named something very generic like “Associated Data”.
- Add an Associated Data parameter to the EISS.
  - When the learning functions creates a FIB entry, it stores the value from the received Associated Data parameter.
  - Static FIB entries (created by management) may have an Associated Data value.
  - When a frame is forwarded based on a FIB entry, it puts the Associated Data value in the EISS parameter.
  - If there is no FIB entry found for a packet, or if the Associated Data value is null, the parameter is null (results in bcast B-DA)
- For MAC-in-MAC support of the EISS, the Associated Data parameter is the remote BSAP address (or has a 1-to-1 mapping to the remote BSAP address).

New Model



- Cluster of VVPs becomes a single VP at the EISS
  - Looks like a single port for all Provider S-VLAN component functions
  - Resolves all “OK” and “Bad” aspects of VVP model
- VVP functionality achieved with the Associated Data parameter
  - Provides association of Customer address and PSVID to remote BSAP address
  - Preserves “Good” aspects of VVP model

Specification vs Implementation

- Specification of Associated Data as a FIB field and EISS parameter maximizes utilization of functionality already specified:
  - Leverage FIB that already contains associations with customer addresses (rather than inventing a new table in a shim),
  - Maintenance of the FIB already specified (including learning, “forgetting”, dynamic and static entries, etc.)
- Implementation options for MAC-in-MAC:
  - Associated Data is a 48 bit remote BSAP address
  - Associated Data is a smaller field that maps to remote BSAP address
  - Associated Data is not implemented in FIB and broadcast B-DA always used
  - Associated Data is not implemented in FIB, and a customer address to remote BSAP address table is created at a virtual port level