802.1ad Architecture Diagrams

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802.1D – 1998

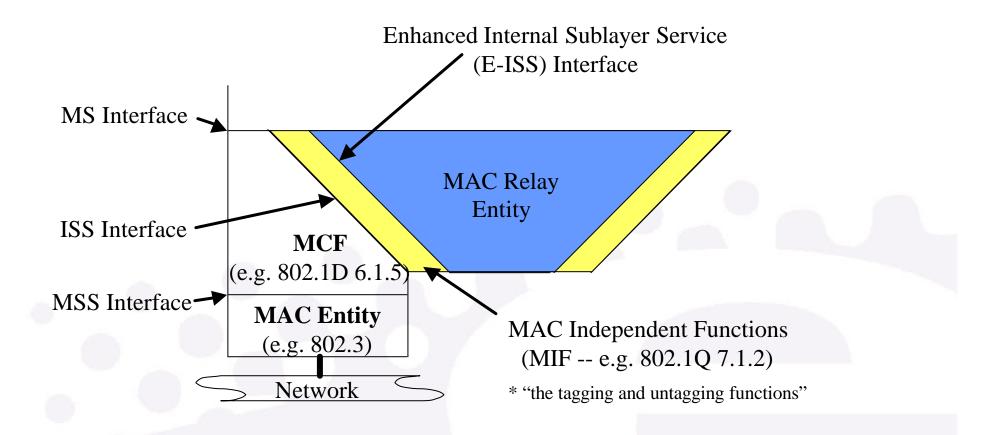MAC Service
(MS) Interface

Bridge Control and Management Functions

Internal Sublayer Service
(ISS) Interface

**MAC Relay
Entity**

MAC Convergence Functions

MCF
(e.g. 6.5.1)

MCF
(e.g. 6.5.1)

MAC Specific Service
(MSS) Interface

MAC Entity
(e.g. 802.3)

MAC Entity
(e.g. 802.3)

Network

Network

802.1Q – 1998

Enhanced Internal Sublayer Service
(E-ISS) Interface

MS Interface

ISS Interface

MCF
(e.g. 802.1D 6.1.5)

MSS Interface

MAC Entity
(e.g. 802.3)

Network

MAC Relay
Entity

MAC Independent Functions
(MIF -- e.g. 802.1Q 7.1.2)

* "the tagging and untagging functions"

E-ISS Functions -- Receive

ISS Parameters: ⟶ E-ISS Parameters:

- destination_address
- source_address
- mac_service_data_unit
- frame_check_sequence
- [default] user_priority

(others not relevant to 802.3)

- destination_address
- source_address
- mac_service_data_unit
- frame_check_sequence
- VLAN_identifier
- user_priority
- canonical_format_indicator
- rif_info (optional)

If the ISS mac_service_data_unit received from the network contains a VLAN tag, then this tag is removed to form the E-ISS mac_service_data_unit and the fields of the tag are used to fill in the new parameters. Otherwise the parameters are assigned port-specific default values.

E-ISS Functions -- Transmit

E-ISS Parameters: $\longrightarrow$ ISS Parameters:

E-ISS Parameters:
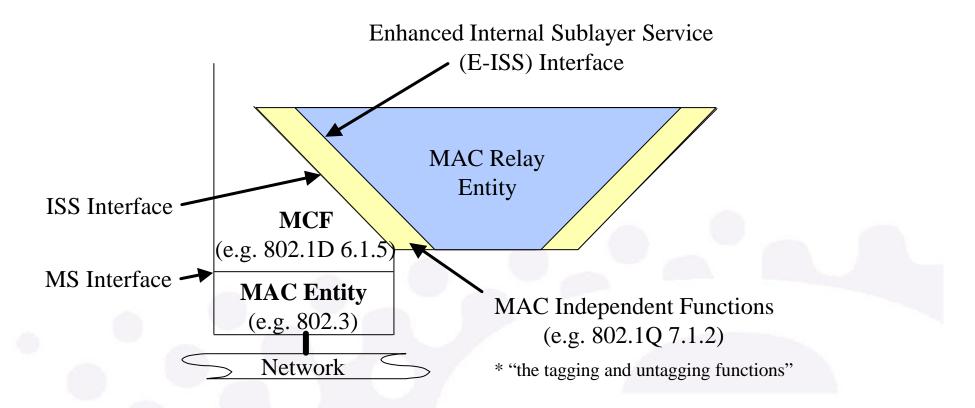- destination_address
- source_address
- mac_service_data_unit
- frame_check_sequence
- access_priority
- VLAN_classification
- user_priority
- canonical_format_indicator
- rif_info (optional)
- include_tag (boolean)

ISS Parameters:
- destination_address
- source_address
- mac_service_data_unit
- frame_check_sequence
- access_priority

If the include_tag Boolean is "true", then the VLAN tag is composed from the appropriate parameters and is inserted into the E-ISS mac_service_data_unit to create the ISS mac_service_data_unit.
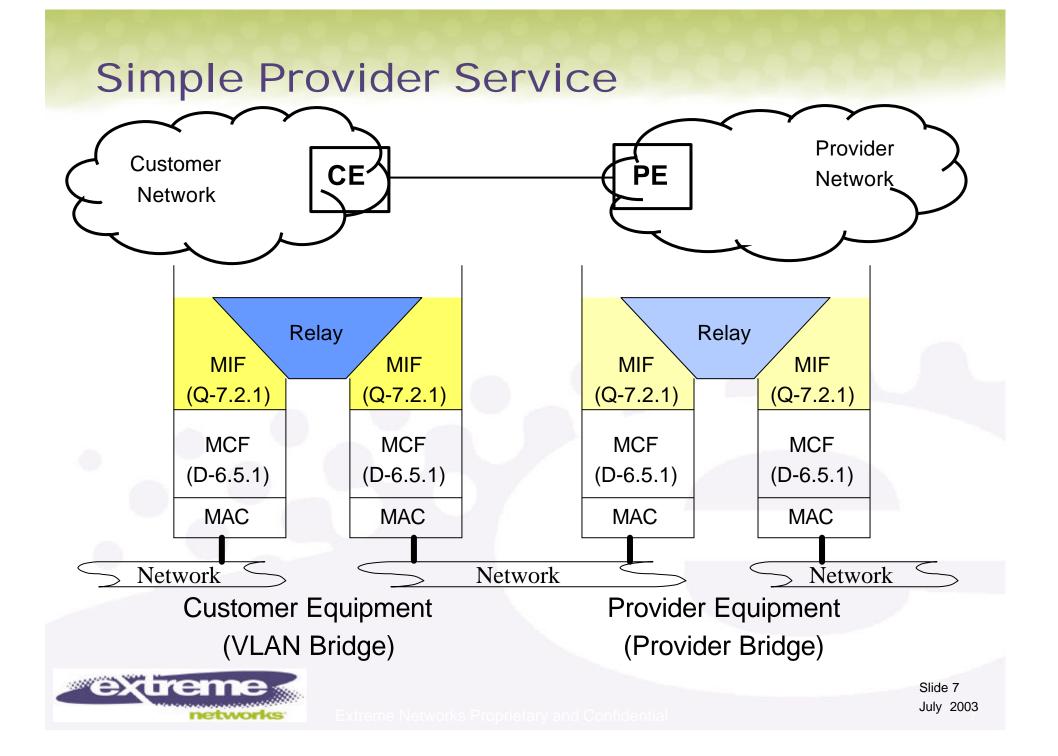
802.1ad – Provider Bridge

Enhanced Internal Sublayer Service
(E-ISS) Interface

MAC Relay
Entity

ISS Interface

MCF
(e.g. 802.1D 6.1.5)

MS Interface

MAC Entity
(e.g. 802.3)

Network

MAC Independent Functions
(e.g. 802.1Q 7.1.2)

* "the tagging and untagging functions"

The mapping between the ISS and the E-ISS is the same as in 802.1Q 7.1.2
except that the operations are performed on a different tag – the Provider Tag
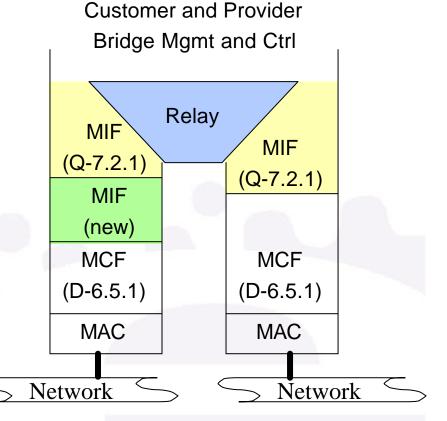rather than the [Customer] VLAN Tag.

Simple Provider Service

Customer Network — CE —— PE — Provider Network

Relay		Relay	
MIF (Q-7.2.1)	MIF (Q-7.2.1)	MIF (Q-7.2.1)	MIF (Q-7.2.1)
MCF (D-6.5.1)	MCF (D-6.5.1)	MCF (D-6.5.1)	MCF (D-6.5.1)
MAC	MAC	MAC	MAC

Network — Network — Network

Customer Equipment
(VLAN Bridge)

Provider Equipment
(Provider Bridge)

Simple Provider Service

- All the Provider Bridge does is slap a Provider Tag on all frames received from the Customer Equipment.

- No changes are required to convert 802.1Q to 802.1ad beyond assigning a new Provider Bridge Address block and a Provider Tag Ethertype.

- This is sufficient provided that:

    - All customer traffic maps to a single provider service instance.

    - All customer traffic has the same priority in the provider network.

    - Any given provider bridge only has one connection to any customer for a given service instance.

- But what if we want service multiplexing, multiple priorities, or multiple connections?

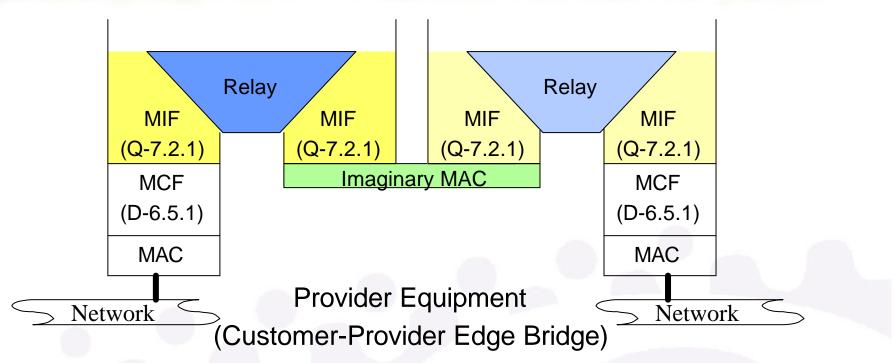# Option 1: New CPE Function

- **Define new MAC Independent Functions block**

  - Appears only on Customer Facing Ports of a Provider Bridge.

  - Aware of Customer VLAN tags as well as Provider Tags.

- **Also need to specify handling of both Customer and Provider BPDUs and Configuration protocols.**

- **May ultimately be how we specify Provider Bridges, but not helpful in understanding required and desirable operation.**

Customer and Provider
Bridge Mgmt and Ctrl

Relay

MIF (Q-7.2.1)		MIF (Q-7.2.1)
MIF (new)		
MCF (D-6.5.1)		MCF (D-6.5.1)
MAC		MAC

Network   Network

Provider Equipment
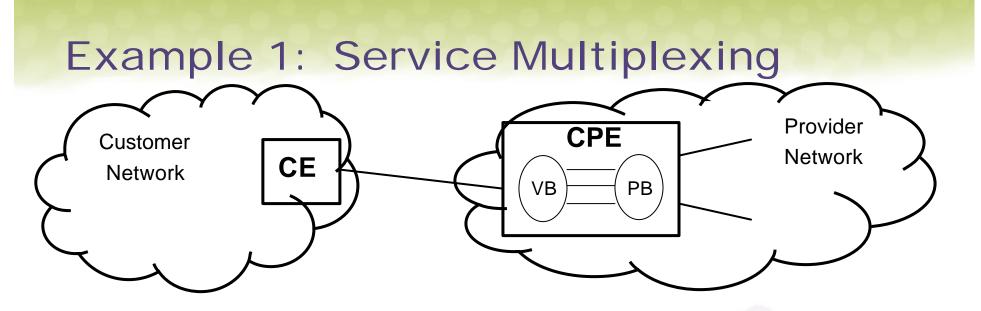(Customer-Provider Edge Bridge)
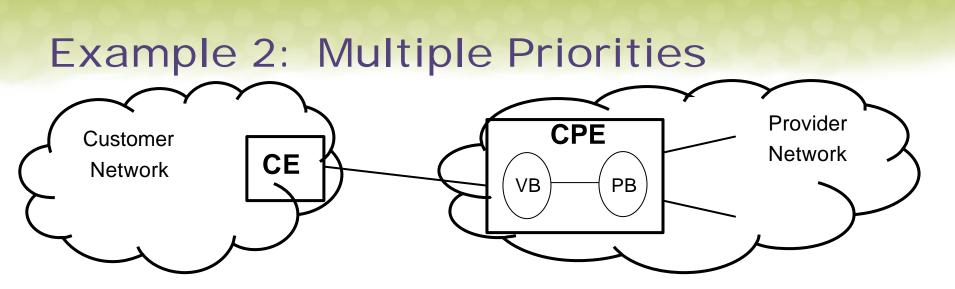
Option 2: "Dual Bridge" CPE Model

- Specify behavior of a CPE as two bridges in one box.
  - Customer facing side operates on Customer VLAN Tags and BPDUs
  - Provider facing side operates on Provider Tags and BPDUs
  - Interconnect with an "imaginary port" per service instance

Example 1: Service Multiplexing

Customer Network

CE

CPE

VB ─ PB

Provider Network

- Customer accesses 3 different Provider Services over a single physical link to the Customer-Provider Edge Bridge.

  - VLAN Bridge portion of CPE connects to Provider Bridge portion via 3 imaginary ports – one per service instance.

  - VLAN Bridge portion of CPE selects service based on Customer VLAN IDs by forwarding packets for each service to the appropriate imaginary port.

  - Provider Bridge portion creates Provider Tag using PVID assigned to the imaginary port.
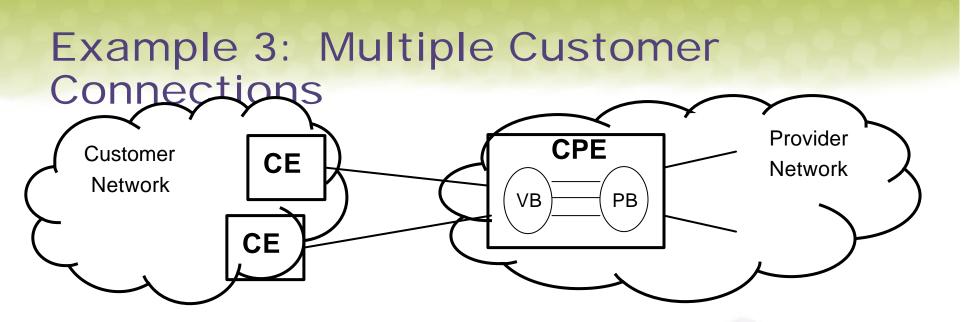
Example 2: Multiple Priorities

- Customer accesses single Provider Services that handles multiple priorities.
    - VLAN Bridge portion of CPE uses the user_priority field of the Customer VLAN tag to determine the access_priority for the imaginary MAC.
    - Imaginary MAC sets the PB_ISS_user_priority to equal to the VB_ISS_user_priority.
    - Provider Bridge portion creates Provider Tag with PB_EISS_user_priority "regenerated" from PB_ISS_user_priority.
        - "Regeneration" allows PB to map Customer specified priorities to different priority levels on the Provider network.

Example 3: Multiple Customer Connections

- Customer accesses 1 or more Provider Services over two links from different Customer Equipment.

  - Selection of multiple services discussed in Example 1.

  - VLAN Bridge portion of CPE participates in Customer Spanning Tree – receives, processes, and transmits Customer BPDUs on each customer facing port and each imaginary port.

  - Provider Bridge portion "tunnels" Customer BPDUs from imaginary ports across the Provider Network.

  - Provider Bridge portion participates in Provider Spanning Tree.

Summary

- A simple model of a Provider Bridge is adequate for the core of a Provider Network

  - Only modification from VLAN bridge is new Tag ethertype and new block of Bridge Addresses.

- The simple model is also adequate for Customer-Provider Edge, but only in a very limited scenario

  - No service multiplexing; single priority; single customer connection.

- A "dual-bridge" model of the Customer-Provider Edge resolves how to provide a richer set of functionality for the attachment of Customers to Services.