# Bridging Solution for the MAN: Service Separation

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# Problem Context

- An Ethernet Service Provider supplies Ethernet Layer 2 services among customer sites
- IETF's Provider Provisioned Virtual Private Networks (PPVPN) WG is defining L2-VPNs
  - PPVPN drafts do not assume that bridges, as defined by 802.1, are essential to providing the service
  - They assume that devices which learn MAC addresses and forward packets based on that learned information are essential, but these are not bridges
- How can bridges supply these services?

# Objective

- Proposal of an Ethernet bridging solution for the MAN
  - Carrier service separation
- Solution alignment with 802 and 802.1 Architecture
- Solution interworking with MPLS/IP/EoS network

# Carrier Grade Ethernet: Part II – Service Separation

# Carrier Service Identifier

- A service instance represents a set of customer sites participating in a service
  - Forms a closed user group within the carrier's network
- A carrier's network can support multiple service instances
  - O(1E03) to O(1E06)
- Service identification is achieved by tagging the customer packet with a Carrier grade tag

# Carrier Service Identification Tag

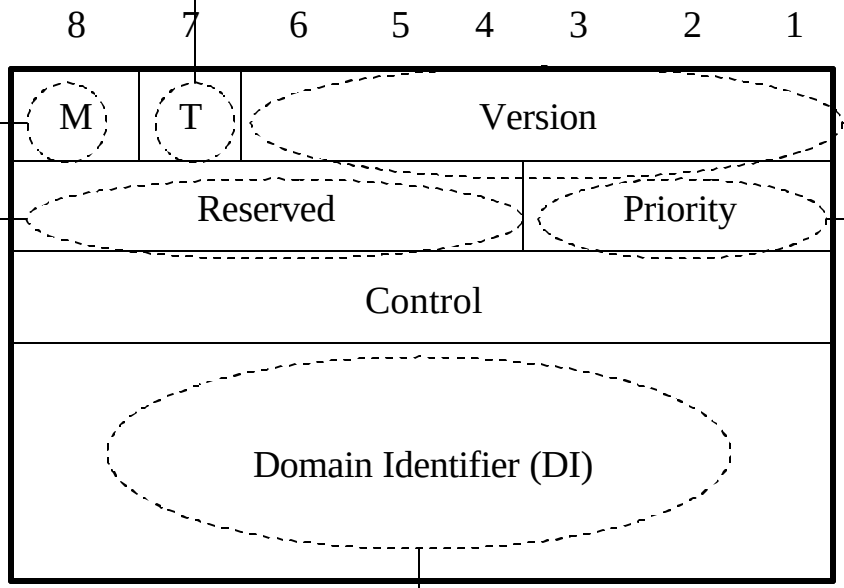
- Q-tag could provide 12 bits (4094) of domain identification. However
  - VLAN encapsulation is not currently a standard
  - 12 bits of domain identification does not support range partitioning in a way which allows a service provider to properly assign different layer 2 segments to more than 4K clients (especially in the context of a typical FTTH EFM deployment or TLS deployment)
- Define a service indicator tag with a space greater than 4K that can support realizable FTTH, TLS, etc deployments

# Carrier Service ID Tag

*1-bit field indicating the customer's user group mapping mode*
- *0 indicates (DI) derived from mapping customer Q-tag and port*
- *1 indicates DI derived from mapping of port only*

*1-bit field indicating the type of data*
- *0 indicates client data*
- *1 indicates control data*

*6-bit field indication*
- *TLS*
- *FTTH*
- *etc*




*5-bit field reserved for future growth*

*3-bit field indicating user priority within Carrier's network*

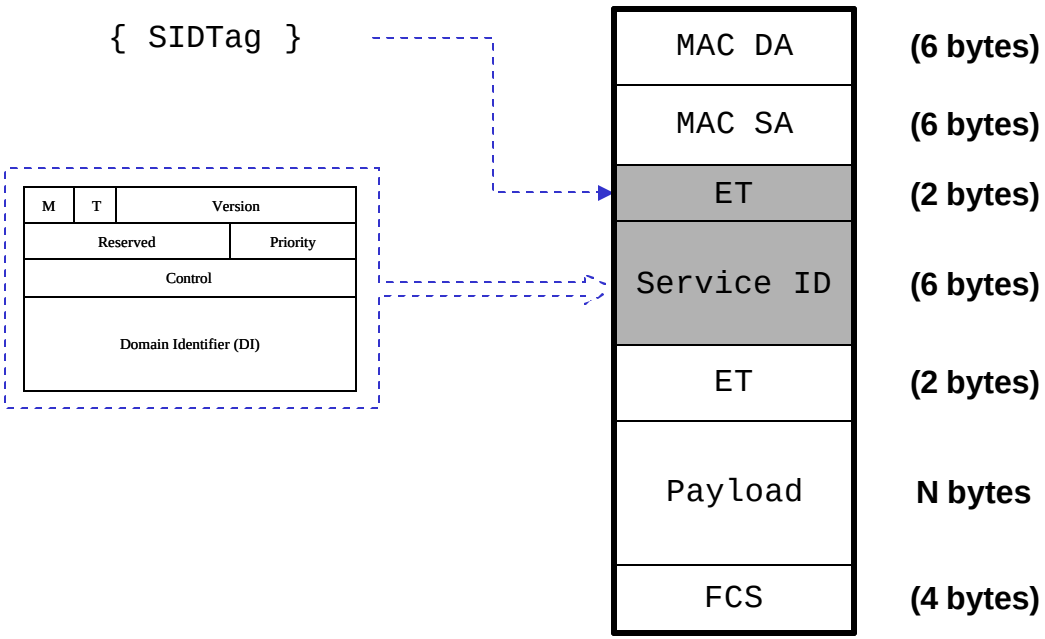
*24-bit field indicating the domain identifier O(10E06)*

# Carrier Service Tag Value Proposition

- Allows service providers to realize scalable Service identification within an IEEE 802 network
  - Does not require higher layer technologies to scale IEEE 802 solution
  - Removes dependency on higher layer protocols for VPN resolution
- Independence from control plane
  - No requirement for end-to-end control plane
  - Supports multiple networks running disparate control planes
- Enables cheap access devices that need not run complex protocols

# 802 Frame Format

- Use the EtherType (ET) field to indicate that a frame contains a Carrier service identification tag
  - Additional ET value is being proposed
  - New value that is being considered is `SIDTag`



# Additional Value Proposition

- Full transparency is possible since carrier network elements do not have to deal with any flow identification process involving customer supplied information of any type
- Customer VLAN bundles could have separate Filtering Database from carrier domain identifier bundles; unlike Q-in-Q solution

# Carrier Grade Ethernet: Service Provider Network Applicability

# Approach

- Build on top of Norm's "Bridge Based Ethernet Provisioned" proposal (rev 2.0)
- Use concepts of Islands, Inter-Island Trunks, and Service Instances

# Enlarging Provider Networks

- Same direction as Norm

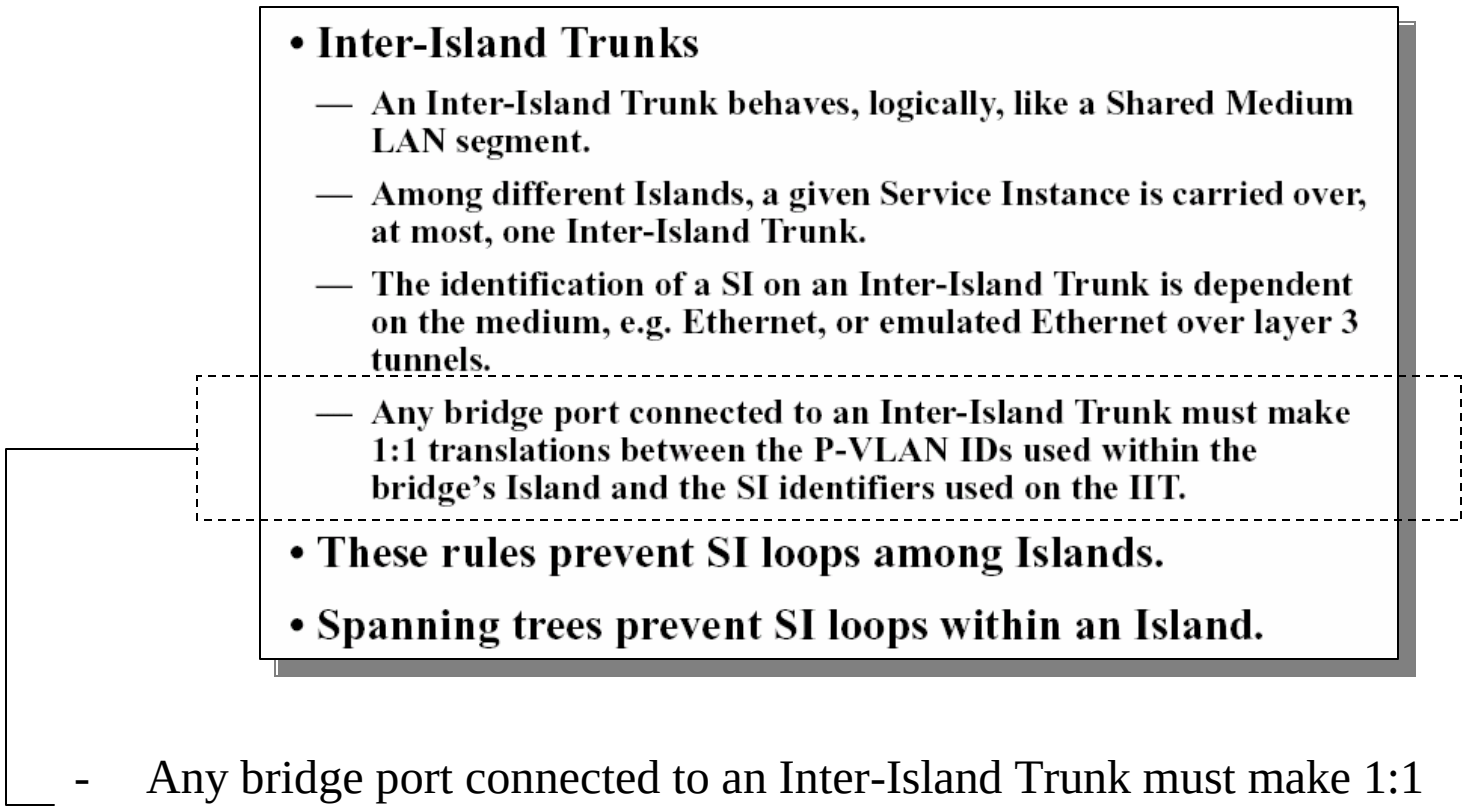
- ***Many*** **techniques have been implemented, and even more discussed, to expand the size of a bridged network.**
  - **Separate spanning trees at edges which run on top of central spanning tree.**
  - **Running two disconnected spanning trees in one bridge.**
  - **Substituting hop count for Max Age in Rapid Spanning Tree. (Standardized by 802.1y: 64k hops allowed across network!)**
  - **Enforce topology restrictions by some non-spanning tree means.**
- **We will look at just one: Topology restrictions.**
  - **This also promises to interact well with the IETF solution(s).**

# Service Instance, Islands and Inter-Island Trunks

- Same terminology used by Norm; subtle difference in definition however
  - A “Service Instance” is the carrier analog of a VLAN in an 802.1Q enterprise network
    - It is uniquely identified by the domain identifier in the domain tag
    - It can uniquely identify the Service provided by the Service Provider’s network
  - The provider network carriers “Service Instances” via “Islands” connected by “Inter-Island Trunks”
  - Islands
    - An Island consists of one or more bridges connected by normal LAN segments and/or Inter-island Trunks
    - Different Islands must be connect only via Inter-Island Trunks

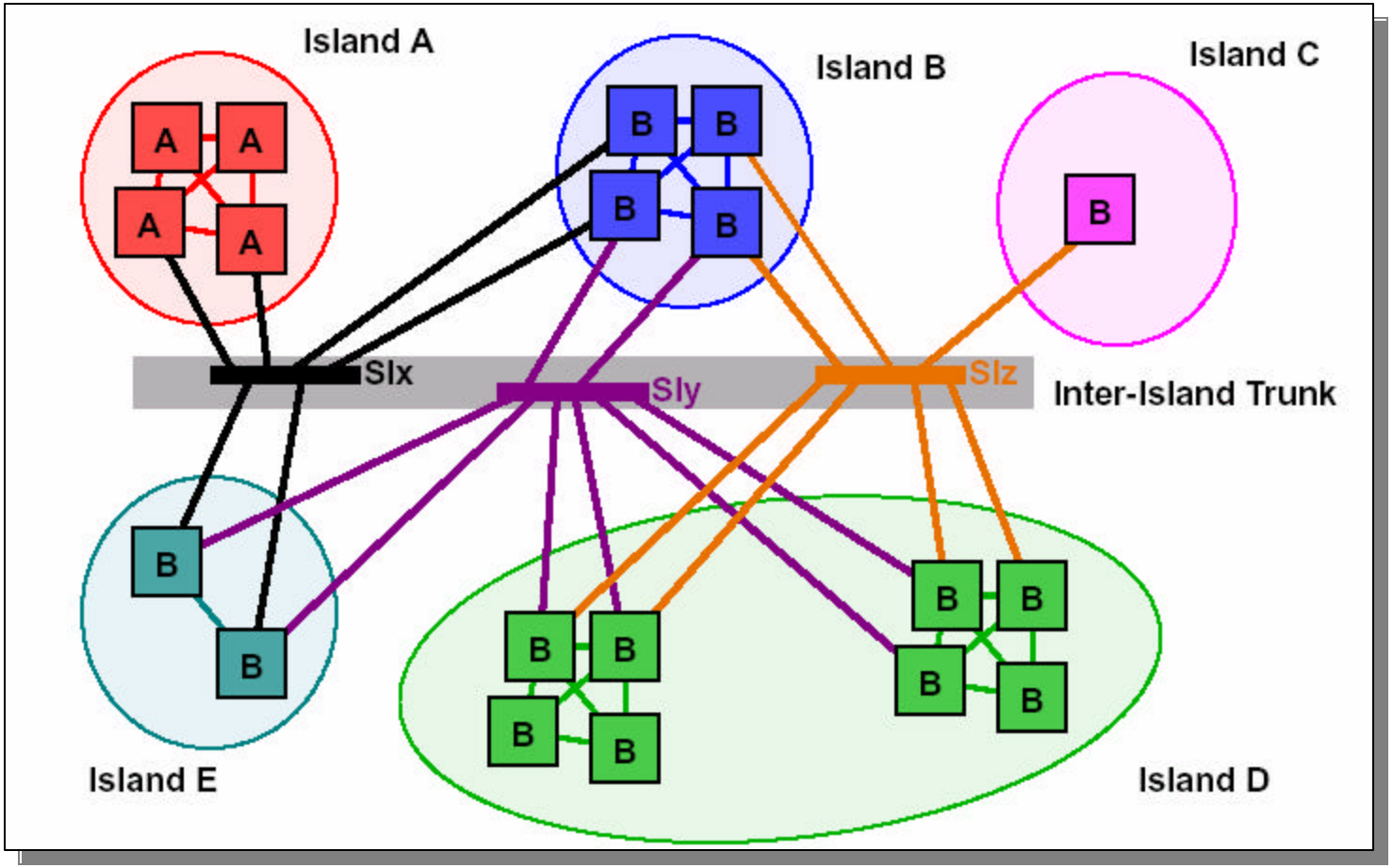
# Inter-Island Trunks

- Same as Norm with 1 notable exception:



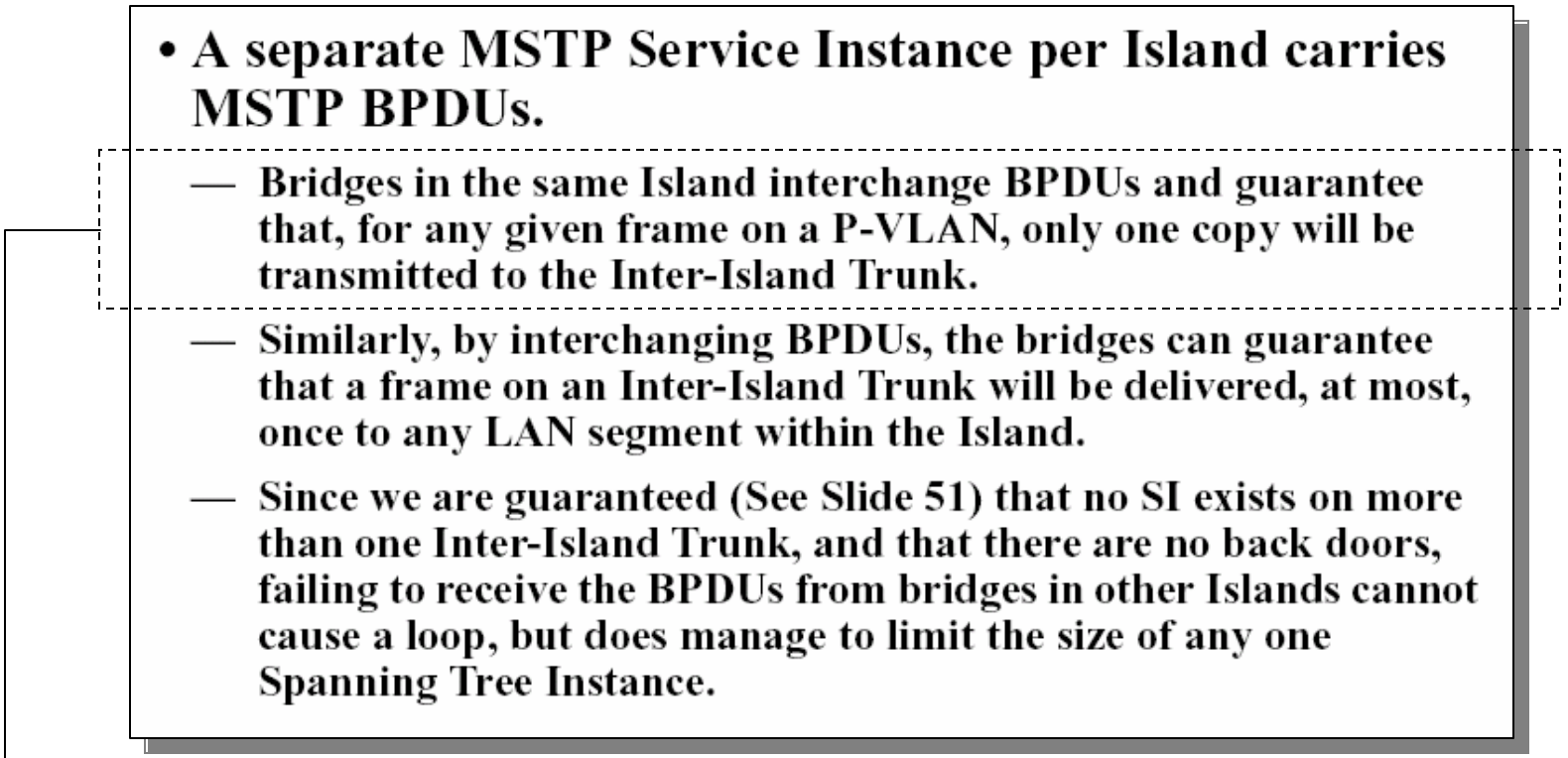

- Any bridge port connected to an Inter-Island Trunk must make 1:1 translations between the domain identifier used on the Inter-Island Trunk

# SIs, Islands, and IITs



# Interconnecting Islands

- Same as Norm with the 1 notable exception



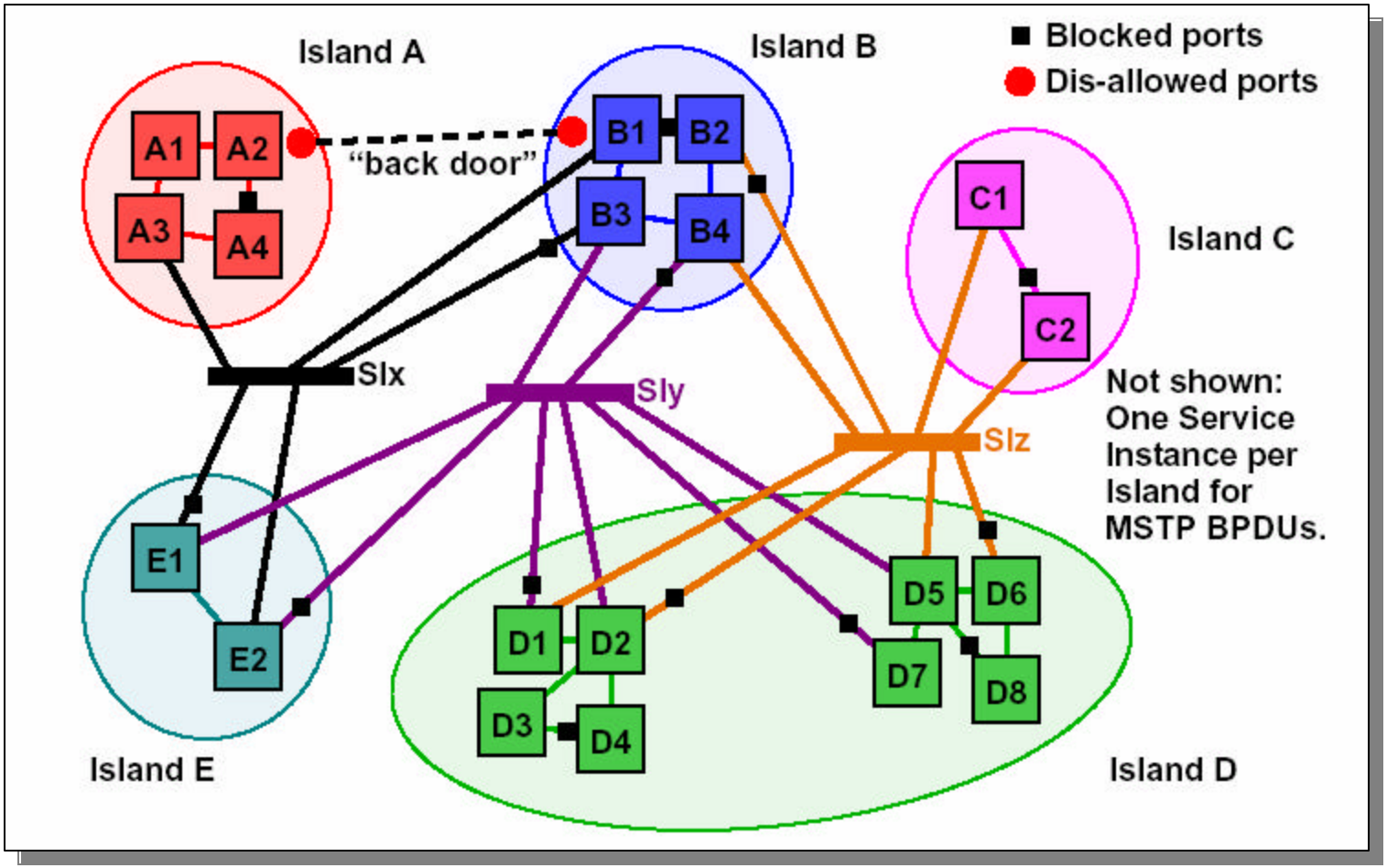

- Bridges in the same Island interchange BPDUs and guarantee that, for any given frame associated with a domain identifier, only one copy will be transmitted to the Inter-Island Trunk

# Interconnection Islands and Topology Change Notification

- Same direction as Norm

- **A new Topology Change Notice is required.**
  - **Islands may have completely different MSTP configurations.**
  - **Forgetting all addresses is too much, but we must forget some.**
  - **The other "Island" may, in fact, be an IETF implementation.**
  - **This new Topology Change Notice must signal topology changes based on Service Instance (Inter-Island Trunk).**

# Interconnection Islands Example



# UNI “Wart”

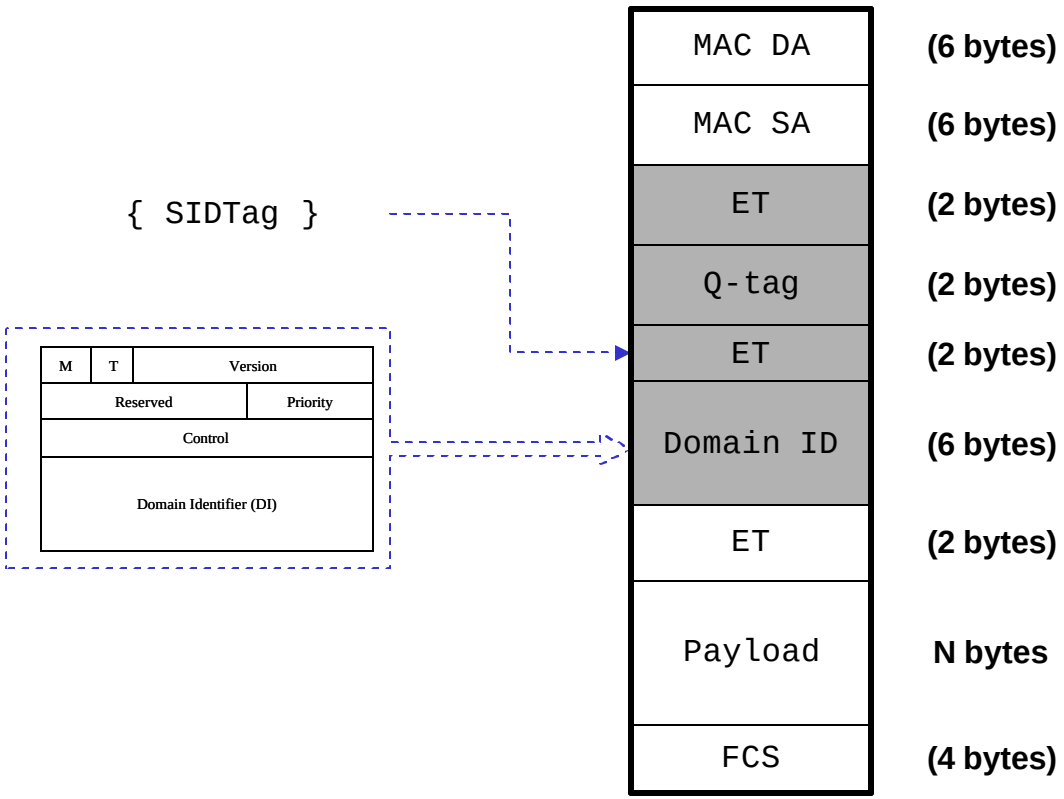
- Once again, utilization of same terminology used by Norm
- UNI Warts
  - Associated with a hierarchy bridge port
  - Map customer VLAN (and customer site port) to carrier’s Domain ID
  - Provides address separation between carrier and customer MAC address space for packets entering/exiting service provider’s network
  - Service demarc point for service provider
  - Controls L2 control protocols within service provider’s network and between customer and carrier demarc

# 802 Specification Impacts – Step (1)

- Use service provider Q-tag along with Service ID tag within each island
  - Provider Q-tag dictates the connectivity associated with customer sites within an Island
    - Provider Q-tag is localized to an Island
  - Carrier service ID tag used to denote the service instance
    - Carrier service ID tag can be localized to an Island or can be used ubiquitously across Service Provider network (includes Islands and Inter-Island Trunking network); further analysis required

# 802 Specification Impacts – Step (1)

- Outer Q-tag used by interior bridging devices to forward traffic and support Spanning Tree specifications within Islands

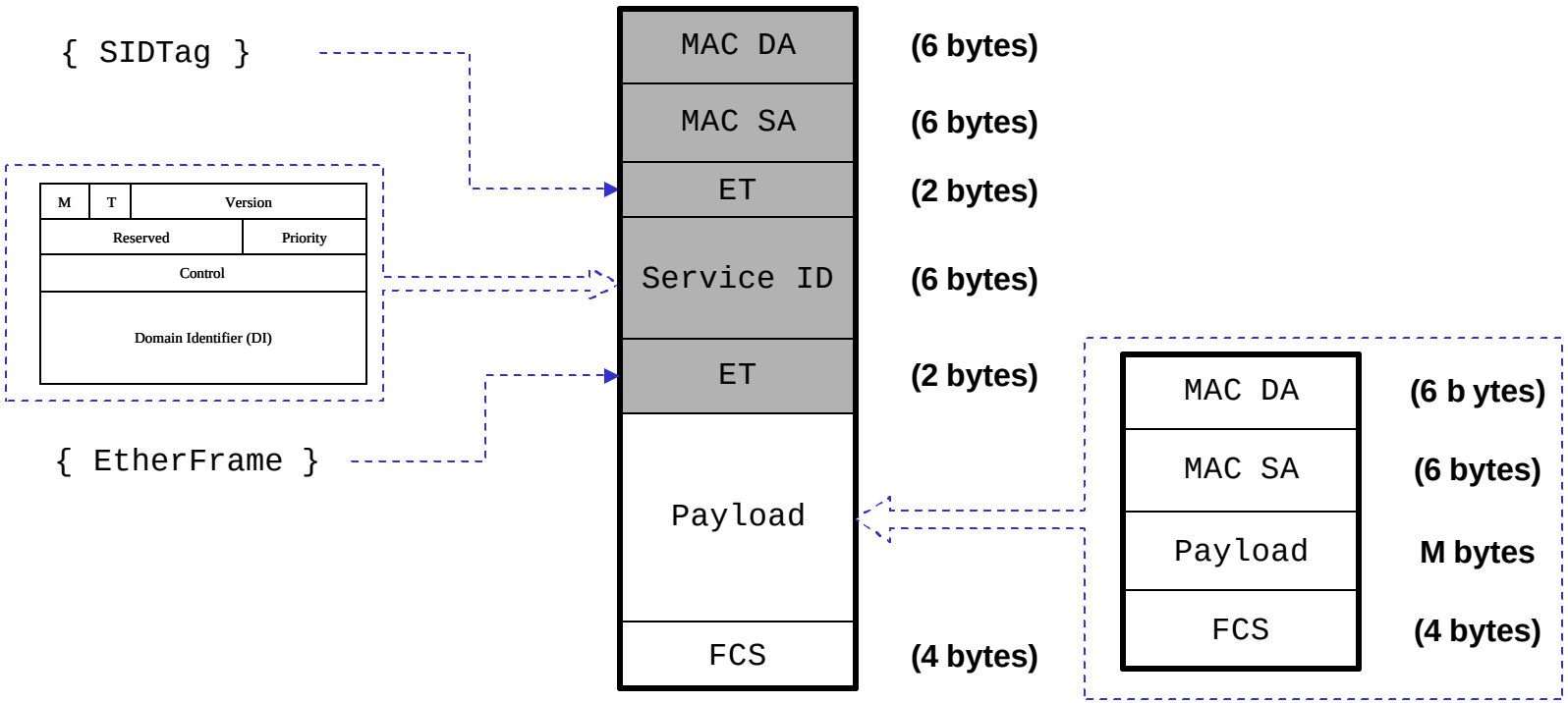


# 802 Specification Impacts – Step (2)

- Fold connectivity identification (provided by Provider Q-tag) and carrier service identification into Provider service identification into domain tag
  - Requires extensions to 802.1Q/s specifications to support domain tag
  - Extensions are simple in that specification reference to VID (found in Q-tag) need to include DID (domain identifier) found in Domain tag
- Hierarchy bridge extended to include domain tag usage

# 802 Specification Impacts – Step (2)

- "Carrier Grade Ethernet" supports address separation and service separation within layer 2 switched networks (i.e., Islands)



# Observations

- Domain identifier uniquely identifies Service across the Service Provider's network
- The Service Provider's network can support over 16 million (i.e., O(1E06)) services
- Customer separation is achieved by a domain-tag encapsulation of the customers frame across the Service Provider's network
- Islands are composed of hierarchy bridges at the edge and transparent bridges* at the interior. Consequently, the Service Provider's interior devices per Island scale with the Service Providers network elements. In general, Islands have much larger scaling properties
- Interworking with EEoMPLS (Ethernet Emulation over MPLS) network