802.1aq Shortest Path Bridging Recap and Status

By

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History

- 802.1aq SPB started in 2005
- 4 Draft Revisions (0.1,0.3,0.4, 1.0)
- Version 1.0 (Worked Clause 6,7,8)
- Currently working Clauses 13,27,28 (merging 28&29)
- Draft 1.1 currently with the editors
- Clause 13, Clause 28 (former 29)

PAR

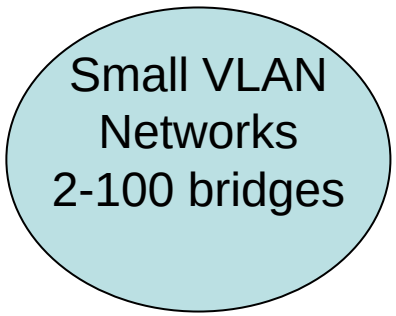
- Original Scope was VLAN Bridges
  - Shortest Path within a region
  - Interwork with RSTP, MSTP bridges
  - Scope
    - This standard specifies shortest path bridging of unicast and multicast frames, including protocols to calculate multiple active topologies that can share learnt station location information, and support of a VLAN by multiple, per topology, VLAN identifiers (VIDs).
  - Compatibility
    - This amendment will not change the conformance of IEEE Std 802.1Q to Std 802. Overview and Architecture, or its relationship to that specification.

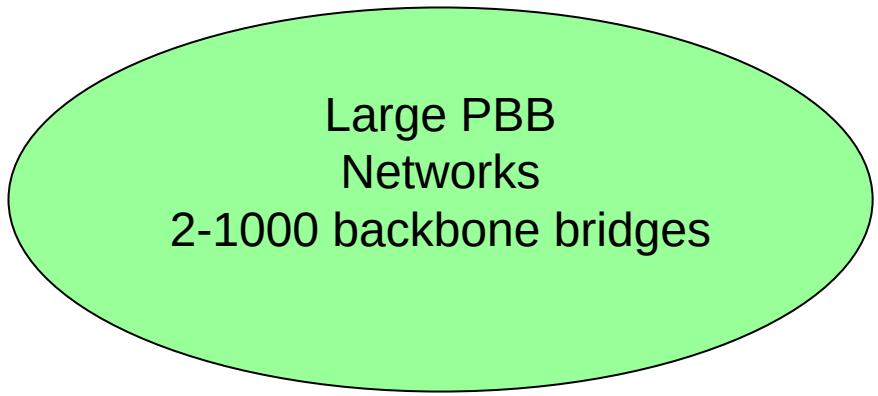
Applicability

IEEE 802.1aq

Shortest Path Bridging (SPB)

Shortest Path Backbone Bridging (SPBB)





Plug and play
Efficient
Low delay
Backwards Compatible

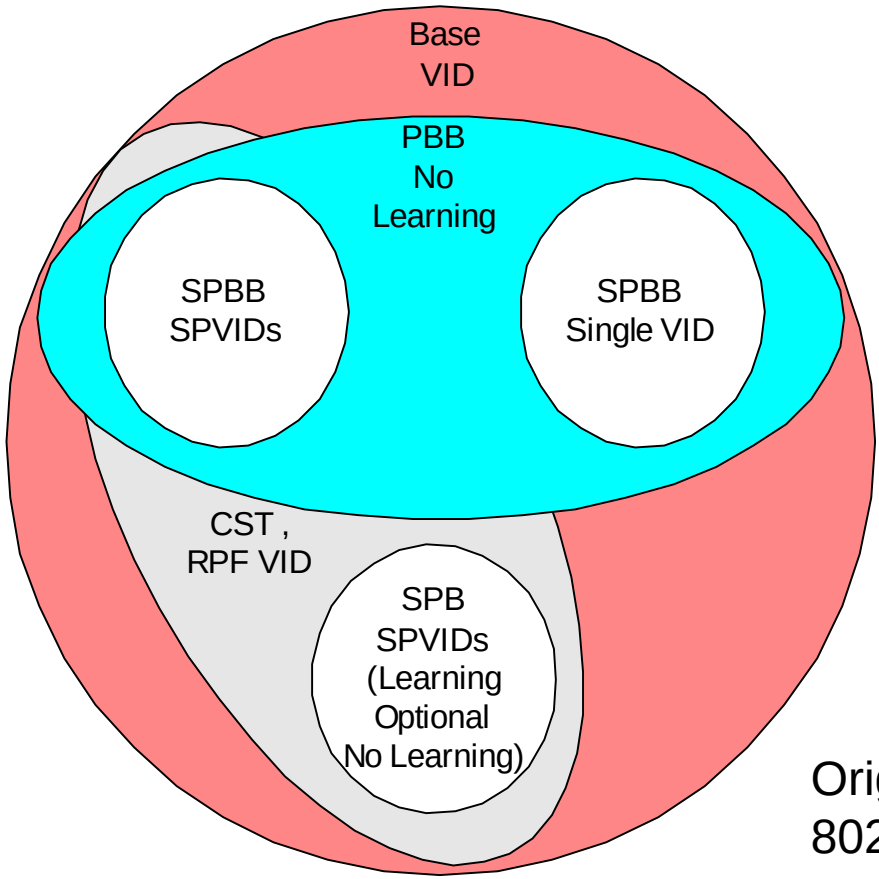
E-Line, E-Tree, E-LAN Services

Carrier Grade
Fast convergence
Efficient use of resources
B-VLAN Partitioned Forwarding Compatible

Provider E-Line, E-Tree, E-LAN Services

IEEE 802.1aq

Per VID Trees
RFPC/VID
PBB Only



Most Scalable
VID and FDB
PBB Only

Original PAR
802.1Q capable

Currently Three Variants

Link State and Spanning Tree

- Link State brings advantages by capitalizing on technology change.
  - Larger Cheaper Memory
  - Faster Processors
  - Higher Capacity Links
  - Result is Shortest path routing with speed and scale.
  - Link State comes at a cost of more hardware but offers more decoupled distributed forwarding state (a fact we need to account for when doing loop prevention.)

SPB

- Only supports IS-IS Link state protocol (instead of MSTP)
- SPB (Shortest Path Bridging) (802.1Q compliant)
  - must use VID, don't own the C-MAC
  - Solution Attributes
    - Uses VID Trees, one source per (edge) bridge, distributed in IS-IS
    - Defines a SPT (Shortest Path Tree) Region, def by "Base VID"
    - SVL learning of unicast forwarding required
    - Supports an IST in region
  - Solution Requirements
    - May Interwork at edges with RSTP, MSTP
    - The region may default to a single instance MSTP (associated with the "Base VID") if the VID allocation fails or detects errors

SPBB

- SPBB (Shortest Path Backbone Bridging)
  - IS-IS Control
  - May use VID Trees or a Single VID for an SPT Region
  - Does not use learning of B-MACs
    - Provider addresses will all be known allows for more efficient flooding (no B-MAC broadcast storms), ingress check, Reduction in forwarding space Shared Forwarding, Efficient Multicast and faster convergence Link State.
  - Works Ships in the Night with RSTP, MSTP in the B-MAC space.
    - Partitioned B-VID Space
    - No interworking with RSTP, MSTP

SPB - SPBB progress
Lots of alignment

Attribute	Status
VLAN Topology	Support shortest path Trees
VLAN Partitioning	Aligned
Link state topology	Use IS-IS
Mesh Networking	Support shortest path trees
Forwarding: backwards compatibility	Use a VID+DMAC context
Control plane objects	Similar requirements
SPT computation	Similar requirements
Multicast Groups	SPB – MRP SPBB uses IS-IS
Multicast and Unicast Congruency	Aligned
Forward & Reverse Path Congruency	Aligned

SPBB progress
Lots of alignment

Attribute	Status
VLAN Partitioning	Use a logical B-VLAN
No Learning	Use IS-IS to populate FDB
Forwarding: backwards compatibility	Use a VID+DMAC context
SPT computation	Similar requirements
Number of Trees for Unicast Forwarding	Use one tree per source BEB
Number of Trees for Multicast Forwarding	Use one per (S,G)
Multicast Trees	Use pruning of the broadcast source tree
Multicast Groups	Use Groups to represent multiple I-SIDs
Single path per VID to a destination	Aligned No per hop ECMP

Problems to Solve
Where are we now?

- Topology Distribution
  - IS-IS ---------- Only IS-IS
- Loop Prevention
  - TAP or SPBB Multicast Loop Prevention ---------- Documenting options
- Loop Mitigation
  - Optional Forwarding change Ingress Check ---------- Documenting options
- SPVID allocation
  - Leverage link State ---------- Need to Discuss
- SPBB
  - Multicast Source Tree identification
    - SPVID or B-VID&Source DA ---------- Document Both
    - MRP and Link State ---------- Need to Discuss
- Path Computation
  - Convergence ---------- Need to Discuss
- Provisioning ---------- TBD
  - Tree types (Shared Trees or Tree per source, etc)
  - MIBs
  - Mis-provisioning
- CFM ---------- TBD
  - SPB CFM
  - SPBB CFM

Loop Prevention/Loop Mitigation

- Prevention (SPB & SPBB Multicast & SPB Unicast)
  - Control plane handshakes
  - Some Blocking
  - Use this for Multicast TAP & IS-IS digests + Handshake
- Mitigation (SPBB Unicast)
  - TTL
    - Needs hardware change and Frame change
    - Kills all unicast loops after some number of hops
    - Currently out of Scope
  - Ingress Check
    - Needs hardware change (smaller than TTL)
    - Stops most unicast loops
    - Latest Thinking (source based (SA or VID))

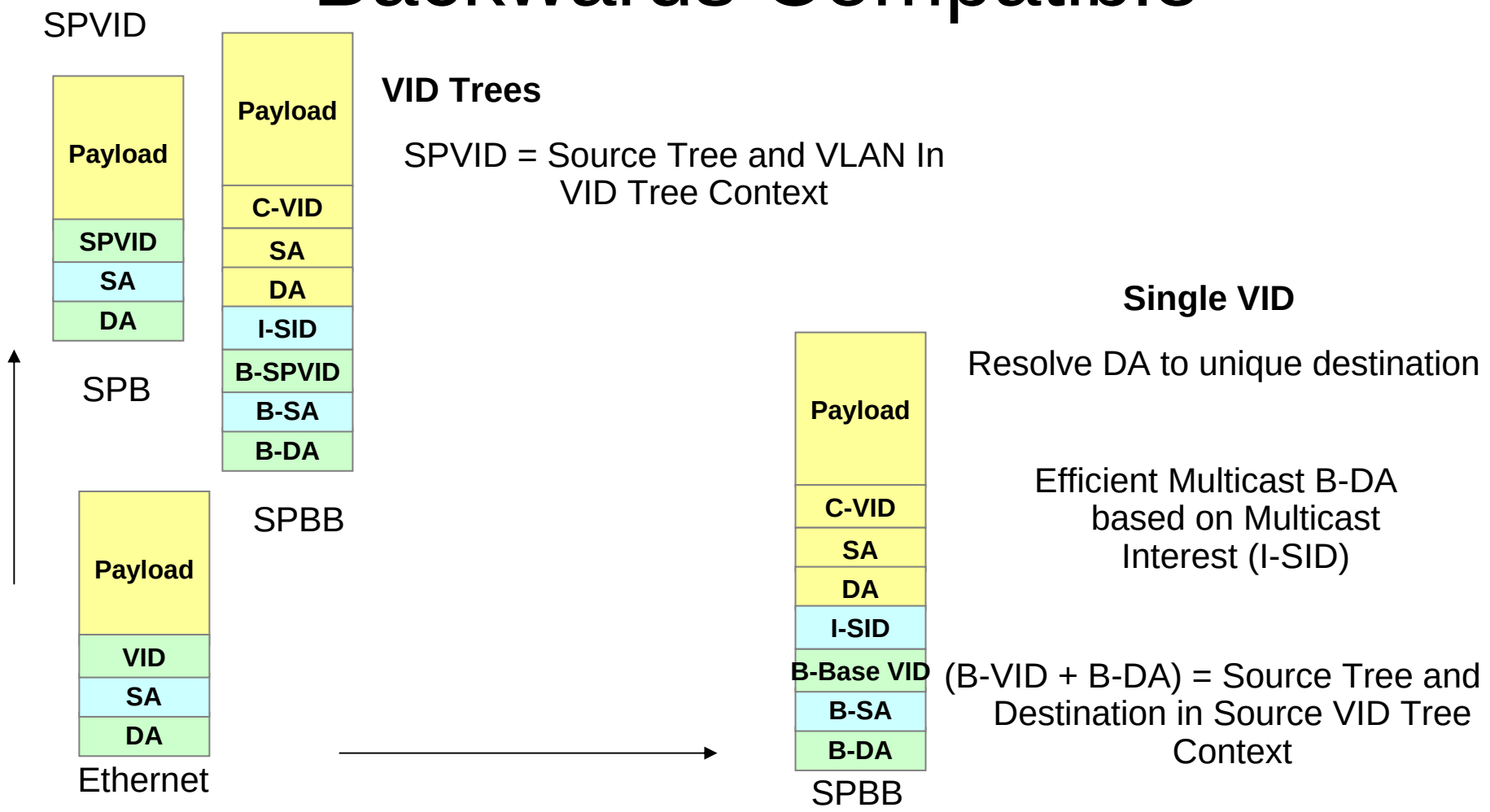
Loop Prevention and Loop Mitigation Current View

	SPB Multicast Unicast	SPBB Multicast	SPBB Unicast
Loop Prevention	Must	Must	None or Optional
Loop Mitigation	Optional Data Plane Ingress check	Optional Data Plane Ingress check	Data Plane Ingress check

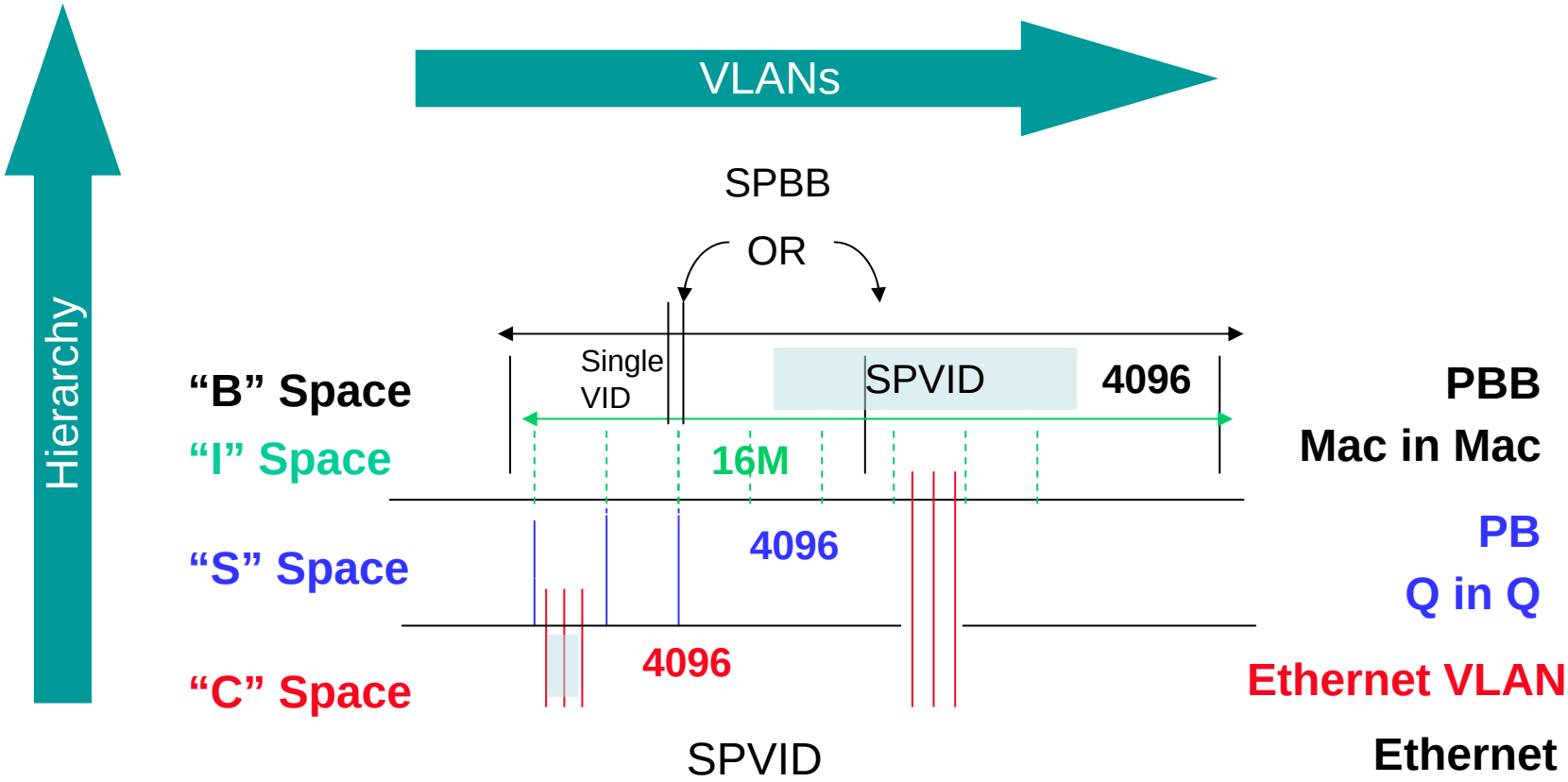
No SPBB Unicast Mitigation Implications

- SPBB Unicast forwarding can:
  - Work with no loops
  - Temporally Break with no loops
  - Temporally Break with a loop
    - This is the case of interest what happens?
      - Loops of 3 or more nodes
      - These loops are transient and short lived
      - Could use Unicast prevention wait for handshake

Switching Context of Source Tree Backwards Compatible



Control Plane Scope



SPB and SPBB Different Operating Spaces

VLAN Usage and Topology