Shortest Path Bridging

IEEE Standard 802.1aq

Ms. Generra Oliver

Mr. Marquise Cooper

IEEE Standard 802.1aq (SPB) Defined

- Shortest Path Bridging is a protocol intended to simplify the creation and configuration of networks
- Combines the effectiveness of MPLS with efficiency of Ethernet
- Sponsored The IEEE Computer Society of IEEE

Majorly supported by Avaya, Huawei and Alcatel-Lucent

Conflicts of Interest and Evolving Concerns

- There are several conflicting interest between several international businesses
  - Such as ongoing debate between SPB and TRILL
  - And the organizations behind them

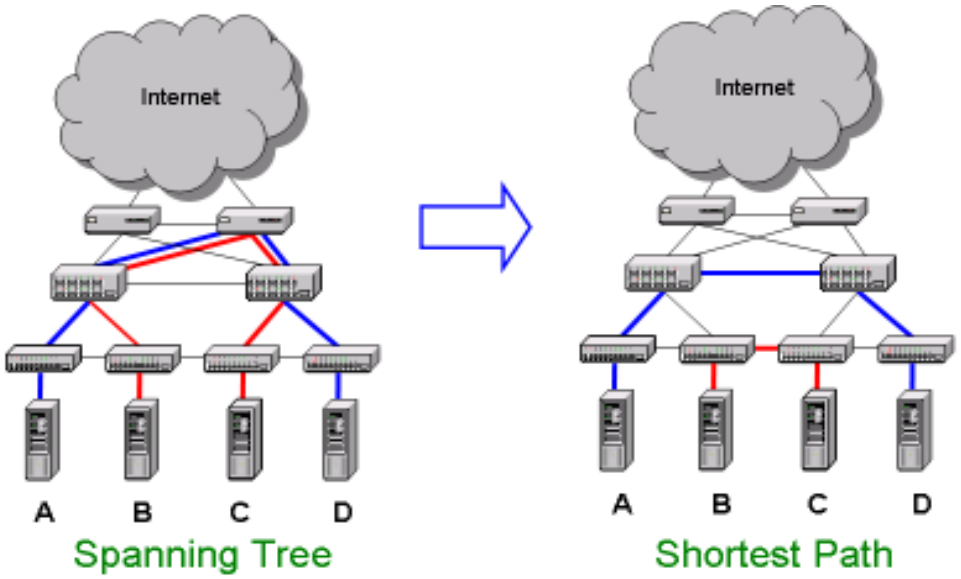
Purpose of the Standard

Prior To SPB

- IEEE standard 802.1D (STP)
- Spanning Tree Protocol generates a single spanning tree for the whole network
- Ensures a loop-free topology
- However does not meet today's demands

Why SPB

- IEEE protocol builds on 802.1 standards
- Reduces configuration errors
- Good scalability
- Faster configuration and convergence!



Testing Guidelines

- Backwards compatible
- Subject to rigorous testing
- Avaya Interoperability test
  - SPB was tested on a large network and connectivity was validated

Summary

- IS-IS builds the network topology
- SPB creates shortest path
- Shortest Path Bridging provides the value of network virtualization with the overall ease of deployment and on-going maintenance
- Future developments to include reduce complexity of networks

Competing Standards

WHO?

Currently Shipping TRILL Based Product	Currently Shipping Proprietary based Products	Current Shipping SPB based products
Cisco Broadcom Brocade Blade (IBM) Mellanox	Juniper (Qfrabric)	Alcatel-Lucent Avaya HP Huawei

- **TRILL - Transparent Interconnection of Lots of Links**
- MLAG
- VPLS
- Qfabric

WHAT?

- TRILL was invented by Radia J. Pearlman of Internet Engineering Task Force (IETF)
- Provides same function but works differently based on unicast and multicast traffic

WHY?

- By getting rid of STP and freeing up more Layer 2 paths-
  - Enterprises will be better able to migrate virtual machines
  - More available bandwidth
  - Make switches more cost effect
  - Allow switches to load balance traffic

WHEN?

- 1964: Packet switching/routing invented by Paul Baran
- 1973: Ethernet invented by Robert Metcalfe
- 1979: Link State Routing invented by John McQuillan.
- 1985: Radia Perlman invents the Spanning Tree Protocol.
- 1987: DECnet Phase V / IS-IS designed by Radia Perlman.
- 2002: Beth Israel Deaconess Hospital network in Boston melts down due to deficiencies in the Spanning Tree Protocol.
- **2004: TRILL invented by Radia Perlman, presented at Infocom.**
- 2005: TRILL presented to IEEE 802 by Radia Perlman, rejected
- 2005: IETF Charters the TRILL Working Group.
- 2008: MTU problem delays protocol while fix is incorporated.
- 2009: RFC 5556 “TRILL: Problem and Applicability Statement”
- 2009: TRILL Protocol passed up to IESG for Standards Approval.

Outlook

Past Outlook

AVAYA

Shortest Path Bridging – Network Virtualization

Standard	Year	Name	Loopfree topology by:	Service ID's	Provisioning	Virtualization of
IEEE 802.1Q	1998	Virtual Lans (VLAN Tagging)	Spanning Tree SMLT	4096	Edge and Core	Layer 2
IEEE 802.1ad	2005	Provider Bridging (QinQ)	Spanning Tree SMLT	4096x4096	Edge and Core	Layer 2
IEEE 802.1ah	2008	Provider Backbone Bridging (MacInMac)	Spanning Tree SMLT	16 Mil.	Edge and Core	Layer 2
IEEE 802.1aq	2011	Shortest Path Bridging (SPBm)	Link-State-Protocol (IS-IS)	16 Mil.	Only Service Access Points	IEEE: Layer 2 IETF draft: Layer 3 Unicast & Multicast
802.1Qbg	2012+	Edge Virtual Bridging	VEPA & VEB	QnQ Attachements to ISIDs & VLANs	VDP (LLDP) discovery of VM's	VM attachment to the network

Time

IEEE 802.1 IEEE 802.1Q IEEE 802.1ad

Current Outlook of Network Challenges, Supporting Standards, and Certifications

Equivalent shortest paths problem

Difficulty in choosing between two equally short paths in a backbone network

Future Outlook of Network Challenges, Supporting Standards, and Certifications

- Predefined explicit paths
  - provides the ability to setup traffic engineered paths
- Dual-home access

- 802.1qbh – Edge Virtual Bridging

THANK YOU

Questions?

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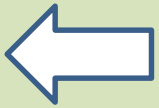
Multiprotocol Label Switching

- Multiprotocol Label Switching (MPLS) is a mechanism in high-performance telecommunications networks that directs data from one network node to the next based on short path labels rather than long network addresses, avoiding complex lookups in a routing table.

IETF

- Internet Engineering Task Force develops and promotes voluntary Internet standards, in particular the standards that comprise the Internet protocol suite (TCP/IP)



VRRP

- The Virtual Router Redundancy Protocol is a computer networking protocol that provides for automatic assignment of available Internet Protocol routers to participating hosts. This increases the availability and reliability of routing paths via automatic default gateway selections on an IP subnetwork.

MSTP

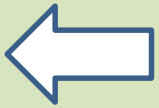
- The Multiple Spanning Tree Protocol (MSTP), originally defined in IEEE 802.1s and later merged into IEEE 802.1Q-2005, defines an extension to RSTP to further develop the usefulness of virtual LANs (VLANs). This Multiple Spanning Tree Protocol configures a separate Spanning Tree for each VLAN group and blocks all but one of the possible alternate paths within each Spanning Tree.

MLAG

- Multilink aggregation is the ability of two and sometimes more switches to act like a single switch when forming link bundles.

VPLS

- Virtual Private LAN Service is a way to provide Ethernet-based multipoint to multipoint communication over IP or MPLS networks. It allows geographically dispersed sites to share an Ethernet broadcast domain by connecting sites through pseudo-wires.

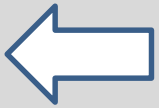


QFabric

- QFabric is a Juniper brand highly scalable proprietary system that improves application performance with low latency and converged services in a non-blocking, lossless architecture that supports Layer 2, Layer 3, and Fiber Channel over Ethernet capabilities.

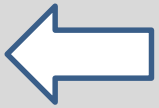
IEEE 802.1

- 802 LAN/MAN architecture
- internetworking among 802 LANs, MANs and wide area networks
- 802 Link Security
- 802 overall network management
- protocol layers above the MAC & LLC layers



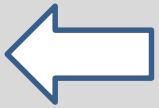
Backbone network

At the local level, a backbone is a line or set of lines that local area networks connect to for a wide area network connection or within a local area network to span distances efficiently



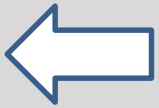
IEEE 802.1Q

- IEEE 802.1Q is the networking standard that supports virtual LANs on an Ethernet network.
- The standard defines a system of VLAN tagging for Ethernet frames and the accompanying procedures to be used by bridges and switches in handling such frames.



IEEE 802.1ad

- Allows a single Virtual Local Area Network (VLAN) header to be inserted into an Ethernet frame.
- QinQ allows multiple VLAN tags to be inserted into a single frame, an essential capability for implementing Metro Ethernet network topologies.



L2 Fabrics

- General term for the new architectures
  - A flatter architecture that looks to overcome the limitations of Spanning Tree Protocol
- L2 fabric refers layer 2 multipaths