Layer 2 VPNs Overview

Types of Layer 2 VPN

- **Point-to-Point**
  - Virtual Private Wire Service (VPWS)
    - Layer 2 Tunneling Protocol v3 (L2TPv3)
    - Any Transport over MPLS (AToM)
- **Point-to-Multipoint**
  - Virtual Private LAN Service (VPLS)
  - Hierarchical Virtual Private LAN Service (H-VPLS)

VPWS Overview

- What is Virtual Private Wire Service?
  - Point-to-point layer 2 overlay tunnel
  - E.g. EoMPLS, E-LINE, etc.
- Provider does not does not participate in customer routing
  - Unlike MPLS L3VPN
- Can be encapsulated as either…
  - Layer 2 over IP (L2TPv3)
  - Layer 2 over MPLS (AToM)

L2TPv3 Overview

- **What is L2TPv3?**
  - Point-to-point layer 2 over IP tunnel
- **Standards based**
  - RFC 3931 - Layer Two Tunneling Protocol - Version 3 (L2TPv3)

L2TPv3 Overview (cont.)

- **Payload agnostic**
  - I.e. supports Ethernet, Frame Relay, ATM, HDLC, PPP *over IP*
- **Supports both same-to-same and same-to-different (Interworking) payloads**
  - Same-to-same tunnels
    - Ethernet to Ethernet, ATM to ATM, Frame Relay to Frame Relay, etc.
  - Interworking
    - Ethernet/ATM/Frame Relay/HDLC/PPP to Ethernet/ATM/Frame Relay/HDLC/PPP

AToM Overview

- **What is AToM?**
  - Point-to-point layer 2 over MPLS tunnel
- **Standards based**
  - RFC 4906 - Transport of Layer 2 Frames Over MPLS
  - AKA “Draft Martini”
- **Signaling through targeted LDP session**
  - PE’s form multi-hop LDP session to exchange “pseudowire” (VPN) label

AToM Overview (cont.)

- **Payload agnostic**
  - I.e. supports Ethernet, FR, ATM, HDLC, PPP *over MPLS*
- **Supports both same-to-same and same-to-different (Interworking) payloads**
  - Same-to-same tunnels
    - Ethernet to Ethernet, ATM to ATM, Frame Relay to Frame Relay, etc.
  - Interworking
    - Ethernet/ATM/Frame Relay/HDLC/PPP to Ethernet/ATM/Frame Relay/HDLC/PPP

VPLS Overview

What is VPLS?

- Point-to-multipoint Ethernet over MPLS overlay tunnel
  - PE routers learn CE MAC addresses
  - Traffic is transparently bridged over MPLS core
  - CE routers think they are all attached to the same LAN
    - E.g. E-LAN

VPLS Signaling

- Two Standards based methods
- BGP
  - RFC 4761 - Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling
- LDP
  - RFC 4762 - Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling
- Both can work together
  - BGP for discovery
  - LDP for label allocation

H-VPLS

- **With VPLS, PEs form a full mesh of tunnels**
  - n*(n-1)/2 scaling problem
- **Hierarchical VPLS (H-VPLS) helps address this**
  - User facing "U-PE" peers to CE
  - Network facing "N-PE" peers to U-PE and N-PE
  - Result is hub-and-spoke hierarchy
  - Split horizon must be selectively disabled

Q&A

L2TPv3

Q&A

VPLS

Q&A

VPLS BGP Based Autodiscovery

Q&A

H-VPLS

Hierarchical VPLS (H-VPLS)

- With VPLS, PEs form a full mesh of tunnels
  - n*(n-1)/2 scaling problem
- Hierarchical VPLS (H-VPLS) helps address this
  - User facing "U-PE" peers to CE
  - Network facing "N-PE" peers to U-PE and N-PE
- Result is hub-and-spoke hierarchy
  - i.e. "E-TREE"

Forwarding in H-VPLS

- **In regular VPLS, all PEs are full mesh**
  - Split horizon is needed to stop broadcast loops
  - Frames received in an xconnect cannot leave via another xconnect
- **In H-VPLS, split horizon must be selectively disabled**
  - N-PE to U-PE, split horizon off
  - N-PE to N-PE, split horizon on
- **Forwarding result is any-to-any with loop prevention**
  - On N-PE, frames received from U-PE go to other U-PEs and N-PEs
  - On N-PE, frames received from N-PE only go to U-PEs

Q&A