

Multicast over VPLS

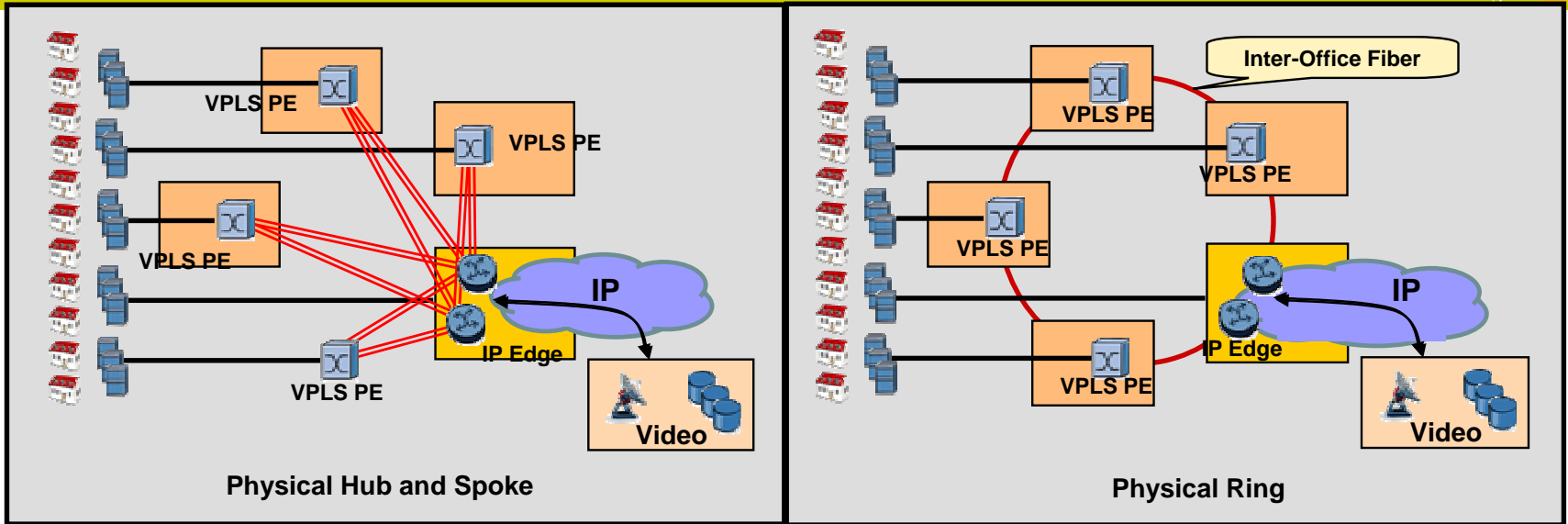
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Chris Liljenstolpe, CTO IP Division, APAC

<chris.liljenstolpe@alcatel.com>



VPLS Physical Network Considerations



➤ VPLS is flexible for both Mesh and Ring topology

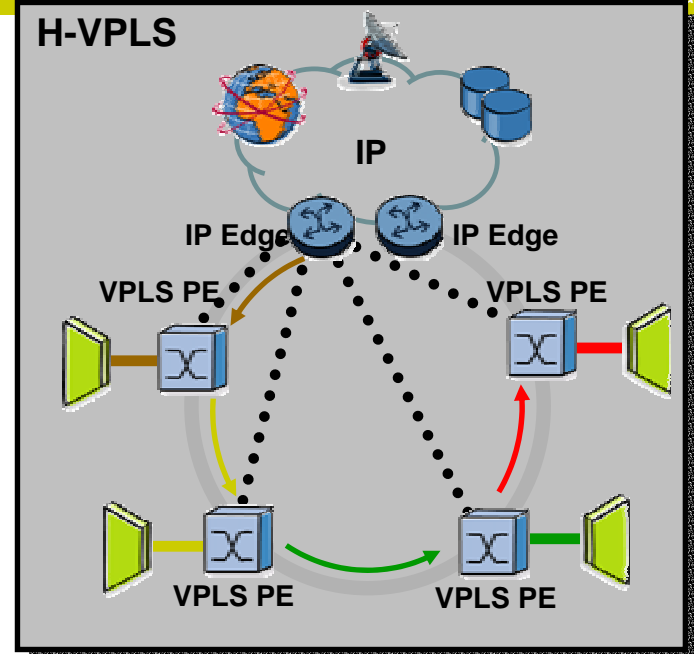
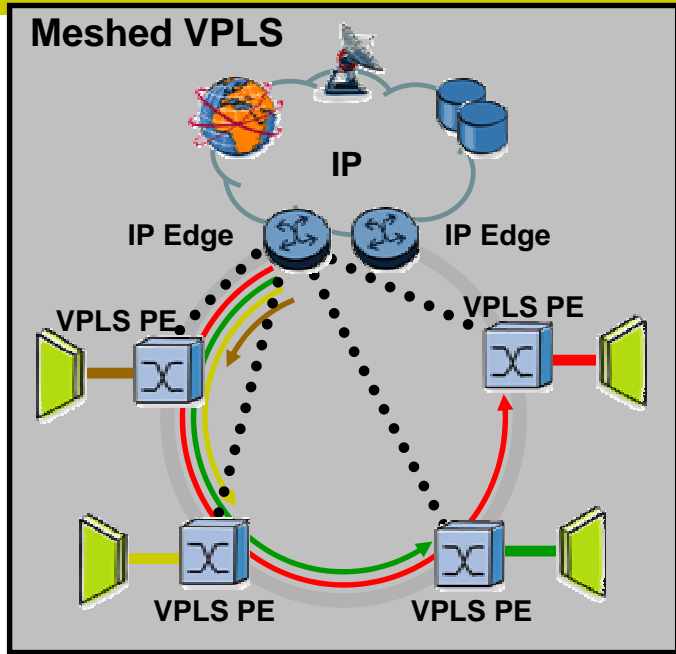
■ Mesh

- can avoid spanning tree and use 802.3ad for redundancy
- but more fiber use

■ Ring

- H-VPLS provides sub-50ms restoration and bandwidth efficiency with better fiber efficiency

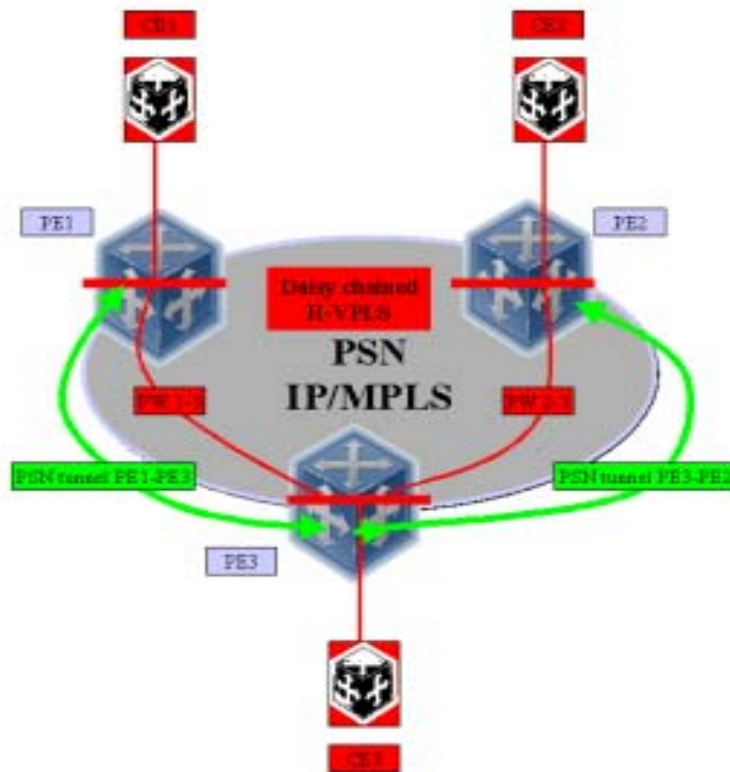
Bandwidth Efficiency for Multicast on VPLS Ring



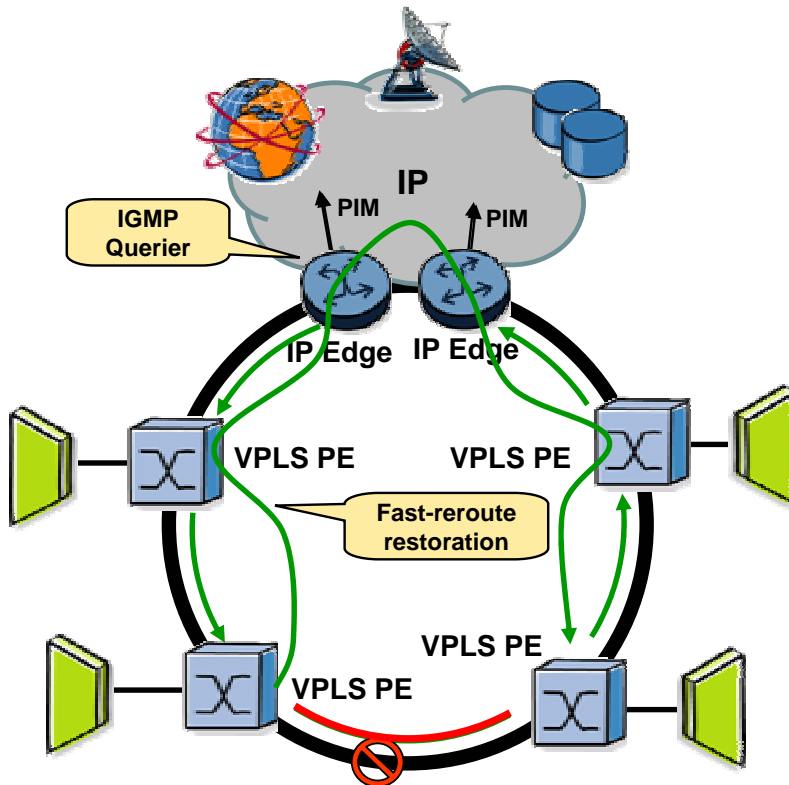
VPLS benefits in ring topology for Multicast:

- No spanning tree
- Sub-50ms recovery with MPLS Fast-reroute
- Bandwidth efficiency for broadcast TV service with H-VPLS

Daisy chained H-VPLS for Multicast

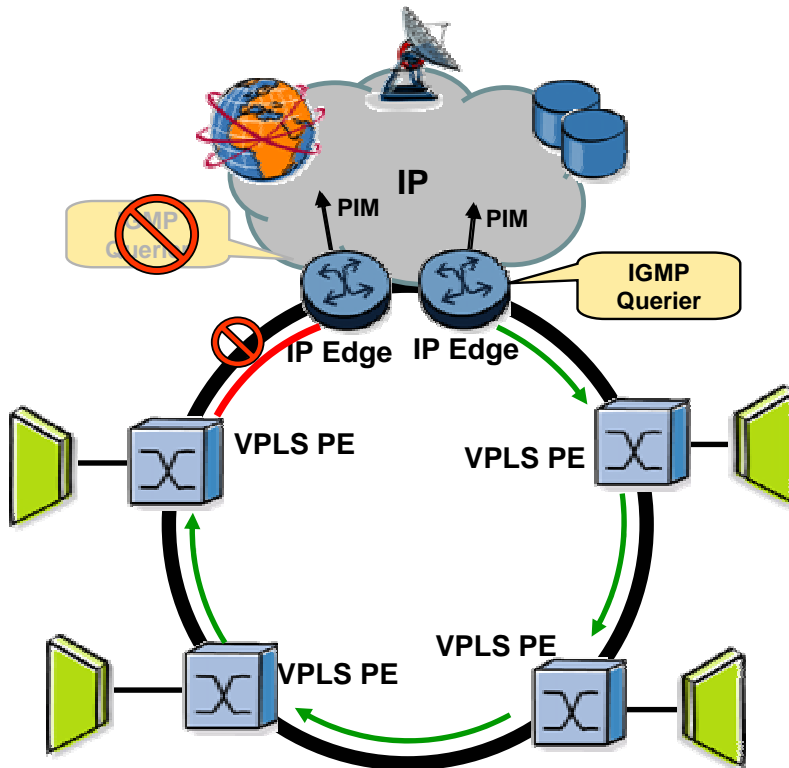


Broadcast TV based on H-VPLS Ring: Redundancy



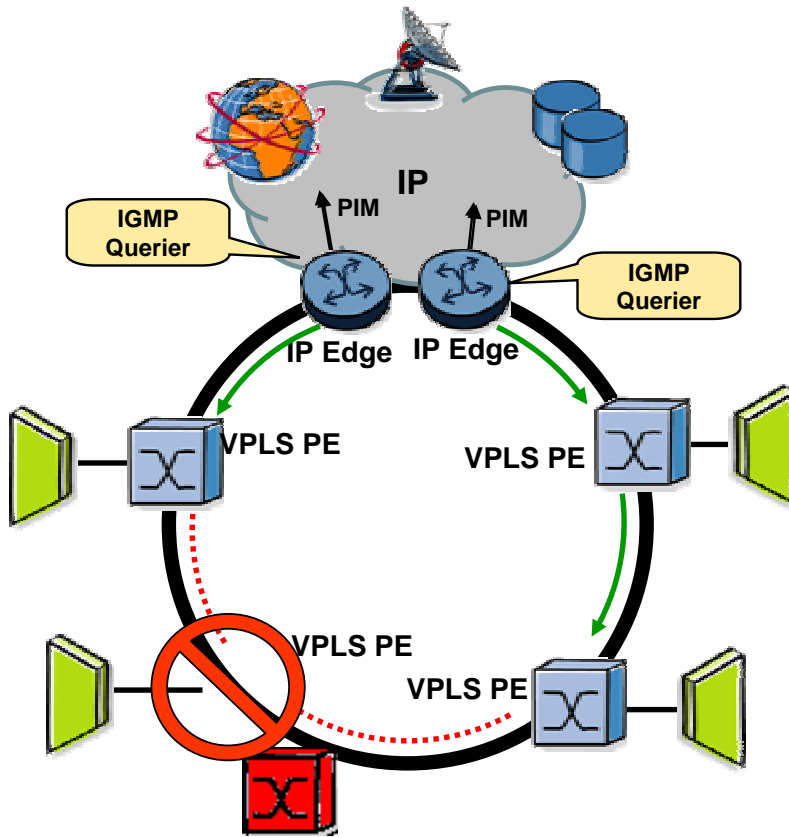
- H-VPLS Ring provides full redundancy
- In case of inter-7450 link failure recovery is via MPLS fast-reroute
 - Sub 50ms recovery

Broadcast TV based on H-VPLS Ring: Redundancy



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 - Sub 50ms recovery
- In case of link failure to 7750, IGMP election process will cause 7750 2 to take over multicast
 - 2 3recovery (IGMP timers)

Broadcast TV based on H-VPLS Ring: Redundancy



- H-VPLS Ring provides full redundancy
- In case of inter-7450 link failure recovery is via MPLS fast-reroute
 - Sub 50ms recovery
- In case of link failure to 7750, IGMP election process will cause 7750 2 to take over multicast
 - 2 3recovery (IGMP timers)
- In case of 7450 node failure, the ring is broken and both multicast routers become active
 - 2 3recovery

New development in MPLS Multicast

What do we mean by MPLS Multicast?

- ▼ Do we mean “don’t send traffic to uninterested listeners?”
- or
- ▼ Do we mean “optimize network bandwidth utilization in the core?”

- ▼ These two, while related, are distinct problem spaces.

The un-interested listener problem

▼ What we are attempting to solve

- Primary goal - prevent un-interested listeners from getting traffic from multicast groups that they have not registered for.
- Secondary goal - be as bandwidth optimal as possible, without changing the underlying MPLS mechanisms

▼ What we can't solve

- Given point two, above, we can't be bandwidth optimal **BETWEEN** LSPs.

The un-interested listener problem (continued)

- ▼ To date, almost all customer traffic ingressing/egressing an MPLS network is related to a VPN or the public Internet.
- ▼ As public Internet traffic in each LSP is routed at layer three at each LSP end-point, classical IP Multicast capabilities will address this first problem type (LSPs are behaving as simple “wires”).
- ▼ VPN traffic (either L2 or L3) may be switched at the LSP level (in most cases, actually), the Multicast information may not be visible on the “surface” of the packet in question

The un-interested listener problem (VPN)

- ▼ As the Multicast data may not be exposed on the surface of the packet at the LSP end-point, the LER must snoop for Multicast data to implement the solution to the un-interested listener problem.
- ▼ The snooping targets must include IGMP, and PIM-*, at a minimum.
- ▼ The proposed L2 and L3 Multicast snooping state machines are similar in the IETF standards work.
- ▼ The snooping device must then decide, based on snooped state, as to Multicast tree maintenance to insure that the interested listener can receive the intended Multicast data, and the un-interested is not burdened with “un-interesting” groups.

Bandwidth Optimization

- ▼ While, in the previous discussion, the maintenance of a Multicast tree within an end-to-end VPN service will somewhat optimize bandwidth (especially at the edges of the network or within a specific LSP), it will do nothing to optimize Multicast bandwidth between LSPs
- ▼ Assume three nodes, S, L and L'. S is a multicast source; while L and L' are multicast listeners. SL is an LSP that links S to L, and SL' is the LSP that links S to L'. Both SL and SL' share the same physical link circuit, C., and S-L' is another LSP, but both traverse over the same physical circuit C.

Bandwidth Optimization (con't)

- ▼ If we use the previous mechanisms to address the multicast requirement, then SL and SL' would be somewhat optimized for bandwidth utilization, SL and SL' would each carry one packet for each packet originated by S on the two LSPs.
- ▼ To address this, LSPs need to have the flexibility to operate as p-to-mp or mp-to-mp links.
- ▼ Two basic architectures have been proposed in the IETF for *p-to-mp LSPs.
 - RSVP-TE signaled p-to-mp LSPs
 - LDP signaled p-to-mp LSPs

RSVP-TE signalled p-to-mp LSPs (traffic engineered)

▼ Positives

- High levels of control available

▼ Negatives

- Need a-priory knowledge of listeners
- Need to know topology of the network

▼ Non +/-

- Sender initiated

LDP signaled p-to-mp LSPs (Routed)

▼ Positive

- No apriory listener knowledge needed
- No need to know topology

▼ Negatives

- No RSVP/traffic engineering treatment

▼ Non +/-

- Receiver initiated

Routed p-to-mp LSPs

- ▼ A complete LDP signaling solution (draft minei)
 - No need to run another protocol
 - Need to update LDP to carry Multicast information in TLVs.
- ▼ A hybrid PIM-SSM and LDP signalling solution (draft boddapati)
 - PIM-SSM required
 - No need to update LDP
 - Use PIM to calculate the tree and signal Multicast memberships
 - Use LDP to distribute labels
- ▼ Most work is on (S,G) Multicast. (*,G) Multicast would be implemented, in most cases, as $n(S,G)$ where n is the number of senders in the network.

More Carrier Input Needed

- ▼ Is the listener or bandwidth problem more important?
- ▼ If solving the bandwidth problem, is TE or routed p-to-mp setup more interesting?
- ▼ Is PIM acceptable in the MPLS core?

B R O A D E N Y O U R L I F E

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