PW History

- Historically, a Pseudo-Wire (PW) is a P2P service between 2 endpoints.

  - A PW context in both control and data-plane (i.e. the MPLS label) represents both the service and the service endpoint.
  - This led to scale issues specially with ELAN service, where a 10,000 service distributed over 100 endpoints would need 100K+ PW labels (service IDs) per endpoint.
  - PW(s) follow L2 semantics had no Active/Active redundancy.

- SR-Optimized ELAN with data-plane MAC learning:

  - Improves the scale issue (e.g., 10,000 services will be presented by only 10,000 Service SIDs regardless of how many endpoints participate in the service).
  - Maintains the PW P2P semantics between 2 endpoints by presenting the endpoint by another SID under the service SID in the SID list.
  - Solves the Active/Active Redundancy and multipathing using Segment Routing anycast SIDs.
SR-Optimized ELAN Service discovery

- **ELAN Service SID advertised by BGP** for service auto discovery:
  - Such that a single route contains a bitmap of all service SIDs as well as the Broadcast Node SID (for BUM traffic) associated with the advertising node.

- Upon receiving BGP update, a node can **discover** the service(s) hosted on the advertising node and hence can build P2MP flooding trees for L2 BUM traffic.

- P2MP flooding trees can be built for a given service or a group of services (**aggregate inclusive**)

- **Ingress replication per service** can be performed using broadcast SID.
SR-Optimized ELAN service A/A Redundancy

- Anycast SID per Ether Segment (ES) is configured on all nodes attached to the MH site and advertised by the nodes connected to a Multi-Home site.

- Each node attached to the MH site advertises the same anycast SID to allow other nodes to discover the group membership and perform DF election.

- Aliasing/Multi-pathing achieved using the same mechanisms used for anycast SID.

- For example, node 5 learns a MAC address from the CE in dataplane and floods the BUM data packet to all other nodes including node 6. Thus, a receiver can learn the MAC as reachable via the anycast SID configured on node 5 and node 6 in “data-plane”

- Node 6 applies Split Horizon and hence does not send the received data packet back to the MH CE but programs the MAC as reachable via the MH CE.
SR-Optimized ELAN service Data-Plane MAC learning

- **MAC learned** in data-plane **against** the source node SID, encapsulated under the service SID in the L2 forwarded packets.

- **Node 3 learns** the CE MAC address and **floods** the BUM packet to all nodes configured with the same service SID.

- **Node 1, 2, 4, 5 and 6 learn** the MAC as **reachable** via the source node SID hosted on **node 3**.
- **Gleaning** ARP packet requests and replies can be used to learn IP/MAC binding for ARP suppression.

- ARP replies are unicast however flooding ARP replies can allow all nodes to learn the MAC/IP bindings for the destinations too.
SR-Optimized ELAN service Mass withdrawal

- Node failure is learned via BGP/IGP, and there is no need for additional MAC withdrawal mechanism.

- On link failure the node can withdraw in IGP/BGP the anycast SID associated with the site so as not to receive any packets destined to the MH site.

- On link failure between node 5 and CE, node 5 can forward the received L2 packet from the core to node 6 (using anycast SID shared by both 5 and 6) for fast convergence until it withdraws the anycast SID associated with the MH site.
Packets destined to the MH CE connected to node 5 and node 6 can be **load-balanced (ECMP/UCMP)** across the core given that the MAC addresses were **learned** via anycast SID hosted node 5 and 6.
Benefits of SR-Optimized ELAN

- Maintain data-plane MAC learning benefits such as fast convergence, fast MAC move, and scale through conversational learning.

- Bring the benefits of A/A multihoming, multipathing, and ARP suppression.

- Simpler and much better control plane scale over legacy PWs, by splitting the endpoint ID from the service ID and representing them by 2 SIDs in the SID segment list.

- Leverage the benefits of Segment Routing anycast SID for redundancy and fast convergence, and to discover nodes sharing the same anycast SID to perform DF election.

- Eliminate the need for any overlay fast convergence mechanism.
Thank You