MVPN using BIER over P2M

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default topology vs P2MP topology

BIER over default topology
Redundancy, Loop

BIER over P2MP topology
Less Nbrs, No Loop
No Redundancy/Loop, and No ECMP/Entropy

• No redundancy/Loop
  • R4 has Link to R3, but R4 has no Nbr of R3
  • Not need to change BitString in packet

• No ECMP/Entropy
  • R1 has 2 ECMP paths to R3 in default topology, but in P2MP topology has only one.
  • Not need to use Entropy subfield for ECMP
Optional forwarding based on P2MP

- When R1 forwarding a packet with BS<1010>, it just TRY to forward to every NHLFE, if the NHLFE F-BM AND'ing the BS<1010> is not zero, then forward, otherwise prune.

- When R2 forwarding a packet with BS<1010>, it just TRY to forward to every NHLFE, if the NHLFE F-BM AND'ing the BS<1010> is not zero, then forward, otherwise prune.
Evolution from MVPN P2MP to MVPN BIER P2MP

• **MVPN P2MP:**
  • Can use a widely-involved I-PMSI P2MP tunnel to carry 1*VPN’s N*(S,G) flows
  • Can use a more widely-involved aggregated I-PMSI tunnel to carry M*VPN’s N*(S,G) flows
  • To save more ‘states’, as a trade-off, to waste more bandwidth.
  • Because pruning is only carried out at the bottommost PE.

• **MVPN BIER P2MP:**
  • Can use a Per-vpn I-PMSI P2MP, as BIER underlay topology.
  • Can also use an Aggregated I-PMSI P2MP, as BIER underlay topology.
  • Pruning is carried out at every node, from topmost.

• Only Minor changes from MVPN P2MP:
  • Add a F-BM on P2MP NHLFE.
  • Stack a BIER-header on Packet.
  • When replicating to P2MP NHLFEs, do pruning by AND’ing Packet BitString and NHLFE F-BM.
Evolution from MVPN P2MP to MVPN BIER P2MP (RSVP-TE)

- Only One fixed BSL used.
- A batch of ‘RSVP-TE P2MP’ tunnels identified by (Tunnel Number, Tunnel Range Base)
  - $R_1...R_n$ join ‘RSVP-TE P2MP’ tunnel identified by $<P2MP \text{ ID, Tunnel Range Base, Ext Tunnel ID}>$
  - $R_{n+1}...R_{n+m}$ join ‘RSVP-TE P2MP’ tunnel identified by $<P2MP \text{ ID, Tunnel Range Base } + 1, \text{ Ext Tunnel ID}>$
  - .......

Figure 1: PTA of RSVP-TE P2MP LSP based BIER
Evolution from MVPN P2MP to MVPN BIER P2MP (mLDP)

- Only one fixed BSL used.
- A batch of ‘mLDP P2MP’ tunnels identified by (Tunnel Number, Tunnel Range Base)
  - \( R_1 \ldots R_n \) join ‘mLDP P2MP’ tunnel identified by \( \text{FEC<Root Node Address, Tunnel Range Base>} \)
  - \( R_{n+1} \ldots R_{n+m} \) join ‘mLDP P2MP’ tunnel identified by \( \text{FEC<Root Node Address, Tunnel Range Base + 1>} \)
  - .......

Figure 2: PTA of mLDP P2MP LSP based BIER
Optional Use Entropy as sequence-number

- Use Entropy as sequence-number.
- **Ingress PE (R1):** when forwarding packet from SRC to R2/R4, it imposes a sequence-number in the Entropy subfield, per-flow per-packet.
- **Transit PE (R2/R4):** not need to care about Entropy.
- **Egress PE (R3):** when forwarding packet to local receiver, it brings the sequence-number out, check with the following IP-header(S,G), on a per-flow basis.
Next Step

• mLDP extension for BIER
• RSVP-TE extension for BIER

• Questions and Comments
• Welcome more vendors and carriers involved