IP/LDP Fast-Reroute Using Maximally Redundant Trees

draft-ietf-rtgwg-mrt-frr-architecture-01

Alia Atlas, Maciek Konstantynowicz, Robert Kebler, Gábor Enyedi, András Császár, Russ White, Mike Shand

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Status

• WG draft after Taipei
• Moved Multicast-related section to separate draft-atlas-rtgwg-mrt-mc-arch
• Focused on required forwarding mechanisms
• Added detail on IGP extensions, inter-area/inter-level behavior, phased deployment, and multi-homed prefixes
Forwarding Mechanisms

• For LDP, MUST support single LDP label representing FEC plus MT-ID
  – Uses extensions from draft-ietf-mpls-ldp-multi-topology

• For IP, SHOULD support single LDP label representing FEC plus MT-ID
  – IP-in-IP also feasible
Multi-homed Prefixes for IP

• A proxy-node represents the multi-homed prefix and is attached to 2 routers in the graph.

• The Red MRT to proxy will go through the router X >> Proxy

  – So for IP traffic, the LDP label for (MT-ID=Red, X) or X’s Red loopback address can be used for traffic destined to the Proxy and forwarded on the Red MRT.

• The Blue MRT to proxy will go through the router Y << Proxy

  – So the LDP label for (MT-ID=Blue,Y) or Y’s Blue loopback address can be used.
Desired Inter-area/inter-level behavior

• For unicast fast-reroute, want to leave the blue/red MRT forwarding topology at the ABR/LBR and return to SPT
  – SPT uses shortest paths
  – Failures that appear in multiple areas (e.g. ABR/LBR failures) can be separately identified and repaired around
  – Packets can be fast-rerouted again in the next area/level, if necessary, due to a failure in a different area/level.

• How to get this behavior without additional/complex forwarding?
Inter-area/Inter-level Special Behavior

• IP-in-IP: traffic is sent to a loopback address meaning either (X, Red) or (Y, Blue)
  – When an ABR/LBR gets a packet destined to its Blue or Red loopback address, the outer IP header is removed and the packet is forwarded on the SPT. Trivially gives desired behavior.

• In LDP: traffic sent to (FEC, Red) or (FEC, Blue)
  – If FEC represents the ABR/LBR, then action is packet pop and traffic is forwarded based on internal label/IP address
  – If FEC is for router A (in other area), then
    • ABR/LBR uses Label_A_SPT for the FEC in the ABR/LBR’s best area/level
    • ABR/LBR provides Label_A_SPT for (FEC, Red) and (FEC, Blue) into the non-best area/level
    • ABR/LBR installs its best SPT next-hops for Label_A_SPT
    • Effect is equivalent to removing the MT marking on the way to the ABR/LBR

Good behavior – little extra computation – ABR/LBR decides and causes correct forwarding.
MRT Phased deployment:
2 adjacent routers provide benefit

For each destination, determine the adjacent loop-free nodes outside the MRT-supported sub-area to which traffic could be sent.

E and F are loop-free for destinations E, F, G and H with regard to the sub-area. SPT to G is shown.

For a destination G, traffic from the sub-area can only go to adjacent loop-free nodes – so pick 2 closest to the destination G.

Then, create a proxy-node connected to the sub-area by the links of the 2 selected loop-free nodes.

Finally, compute the destination-rooted MRTs. This shows the MRTs rooted at the proxy that represents E, F, G and H.

Note: A, B nodes sent non-MRT encapsulated packets to E, F.

Same method with proxy-nodes as for multi-homed prefixes.
IGP Extensions

• Future Extensibility built in
  – MRT Island Decision ID
  – MRT Algorithm ID

• Information to Share
  – Blue MRT MT-ID, Red MRT MT-ID
  – GADAG Root Election Priority
  – Red MRT Loopback Address, Blue MRT Loopback Address

• Forwarding Mechanisms Supported

• Capabilities Required & Available
  – IP FRR, LDP FRR, PIM FRR, mLDP FRR, PM Global Protection, mLDP Global Protection
Summary

• Filling in the details for a full solution
• Have modeled and verified correct alternate selection inside an area.
• Detailed feedback would be welcome.