Segment Routing

Fast ReRoute use case

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Fast ReRoute Use Case

- Presented in IETF 87 – STATUS BoF:
  - IGP convergence time sometimes not enough for applications
  - FRR required to fill the gap
- draft-filsfils-rtgwg-segment-routing-use-cases-02
- Will be enhanced and moved to draft-francois-segment-routing-resiliency-use-cases (TBD).

Segment Routing is directly applicable to existing FRR solutions

1. Remote LFA without dynamic T-LDP sessions to PQ
   - draft-ietf-rtgwg-remote-lfa
   - link protection with 90-100% coverage
   - some node protection
2. Directed LFA
   - draft-francois-sr-frr
   - link protection with 100% coverage for links with symmetric cost
   - some node protection

Going further with SR

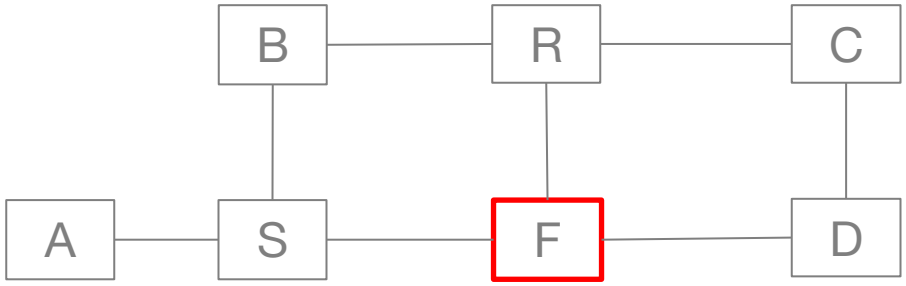
SR capability	Benefits for FRR
Any number of tunnels	- Any number of Q nodes. - Path optimized per failure & per destination
Along any route	- May reach any Q - May use any route toward Q

Let's use & enforce the IGP

Post Convergence path

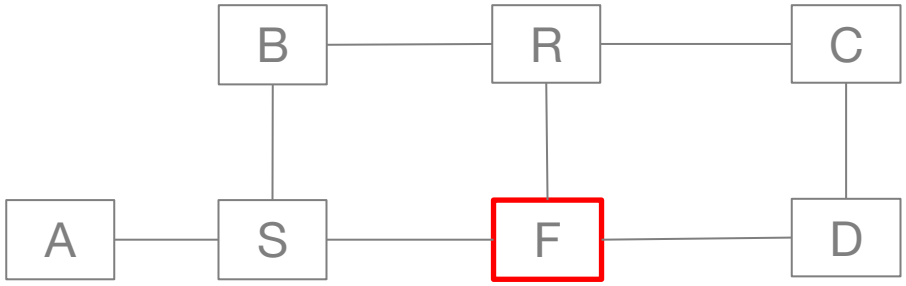
from the PLR to the Destination.

Overview of the algorithm



1. Compute Post Convergence Path: SPT_new (S)
2. From S to D, along SPT_new, find the first Q node.
3. Compute the smallest list of segments from S to Q

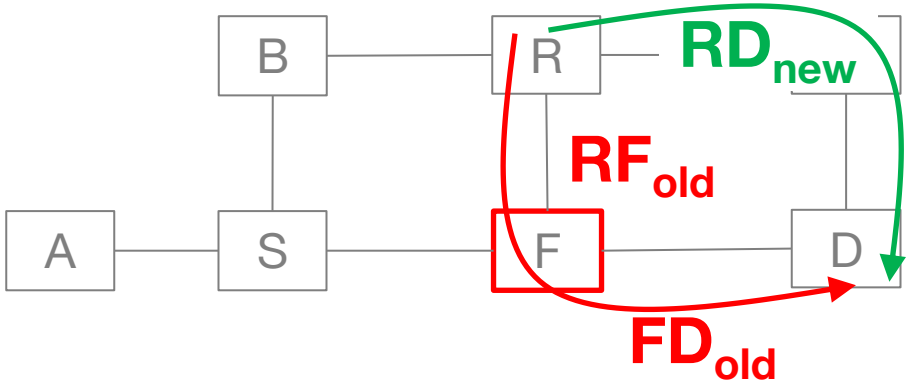
Find the first Q node



- 4 algorithms proposed in the draft:
  - link or node protection
  - per next-hop (simplified) or per prefix.
- We'll overview: node protection & per-prefix
- Compute (r)SPT (per protected node):
  - Post Convergence Tree: SPT_{new} (S) (computed in step 1)
  - Q space: $rSPT_{old}$ (F)
  - P space: SPT_{old} (S) (already known)

Find the first Q node

Legend:
AB: distance from A to B
Old topology
New topology



- Explore nodes R along the shortest path from S to D until Q found.
- For R, computes distances:

1. RF_{old}
2. $FD_{old} = SD_{old} - SF_{old}$
3. $RD_{new} = SD_{new} - SR_{new}$

from $rSPT_{old}$ (F)

from SPT_{old}(S) & F is on the old path from S to D by hypothesis

from SPT_{new}(S) & R is on the new path from S to D by design

- R is in the Q space if $RF_{old} + FD_{old} > RD_{new}$
  - Idem Node-Protecting Inequality (3) from RFC 5286 (LFA)

Shortest list of segments to reach Q

- P space (S) is known (current SPT) → get last P: P_0
- recurse: compute P space (P_N) → get last P: P_{N+1}

- In most cases (99%), 2 P/segments are enough.

Called Topology Independent FRR

- Provides 100% coverage for link and node protection.
- Enforce the post convergence path which is nice:
  - best path per IGP metrics (e.g. delay, bandwidth based…)
  - typically provisioned with enough capacity
  - by default should be policy friendly
    - draft-ietf-rtgwg-lfa-manageability
    - e.g. not use a PE to protect a P-P link
    - e.g. not use an oversea node to protect an intra continental destination.
  - well known to people
- draft-francois-segment-routing-ti-frr-00 (TBR)

TI FRR applicability

- Directly applicable to SPT destinations
  - Node Segments (SR)
  - MPLS/LDP FECs
  - IP IGP prefixes

SR FRR applicability - SR Adjacency Segments

- To protect adjacency segments, we need to also lookup next segment.
- Protecting [Adjacency, Adjacency]
  - skip adjacency segment (MPLS POP)
  - force route to F: PUSH node segment F, then idem FRR to F
- Protecting [Adjacency, Nodal].
  - skip adjacency segment (MPLS POP), then 2 options:

  a) force route to F: PUSH node segment F, then idem FRR to F

  b) skip F and take shortest path to next Node segment: idem FRR to Nodal
- FRR protection of adjacency segments may also be disabled by policy.

Thank you