MPLS Fast Re-route using extensions to LDP

draft-kini-mpls-frr-ldp-01

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Motivation and Goal

›

› LDP LSPs are widely deployed.
(IGP shortest path)

Goal of sub 50msec recovery for traffic on routed paths

(IGP shortest path)

› Full coverage needed

Solution should be self-contained. It should be independent of other protocols and mechanisms such as IP-FRR,

Solution characteristics

- Computation intensive tasks are performed much before the actual failure (during steady state).
- Only PLR reacts to the failure trigger to recover the traffic
- Actions at the PLR to recover the traffic are simple (and pre-computed)

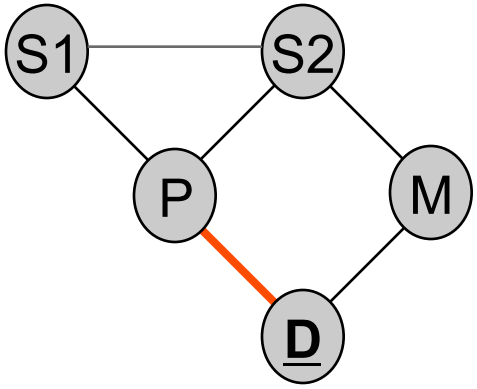
Solution summary

- Defined for link-state IGP. And for platform label space.
  - Backup shortest path (BSP) LDP LSP setup before failure whenever LFA does not exist
  - BSP LSP starts at PLR and merges into shortest path LDP LSP tree. Merge point referred to as BSP-MP.
  - Fast re-route action on detecting failure
    - PLR label switches to pre-selected BSP LDP LSP
    - Stack label to aggregate failures. Use shortest-path LSP from PLR

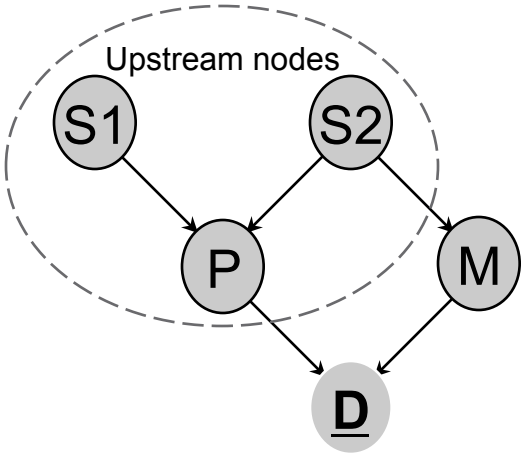
Computation

- SPT for a destination
- Failure at PLR
- Nodes upstream of failure in the SPT is affected
- Nodes not upstream of failure in the SPT is not affected
- Compute SPT with “failure” excluded – Exclude-SPT
- Alternate path from PLR to destination in Exclude-SPT merges back into SPT @ BSP-MP (not upstream of failure)
- BSP LSP from PLR to BSP-MP protects the traffic under

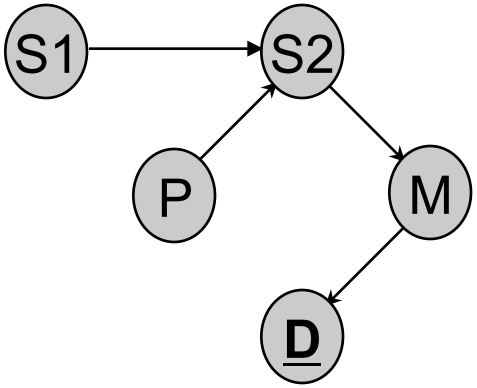
SPT & Exclude-SPT



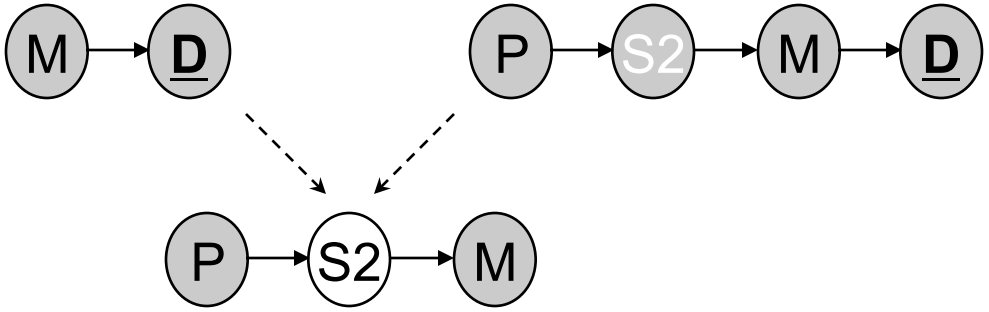
Topology



SPT

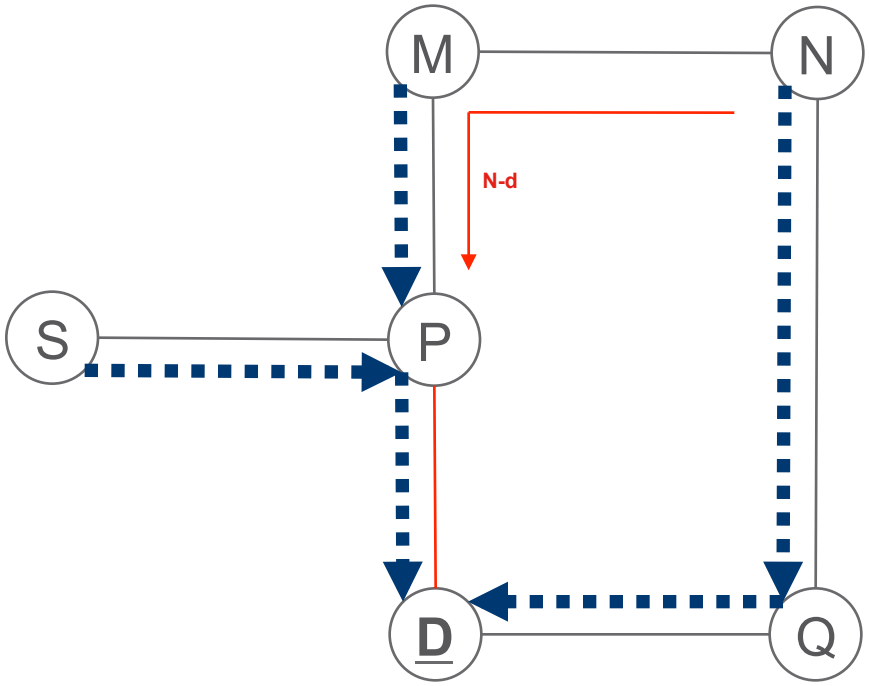


Exclude-SPT



BSP LSP

Link failure protection example



Protect link P-D failure

› For Destination **D**

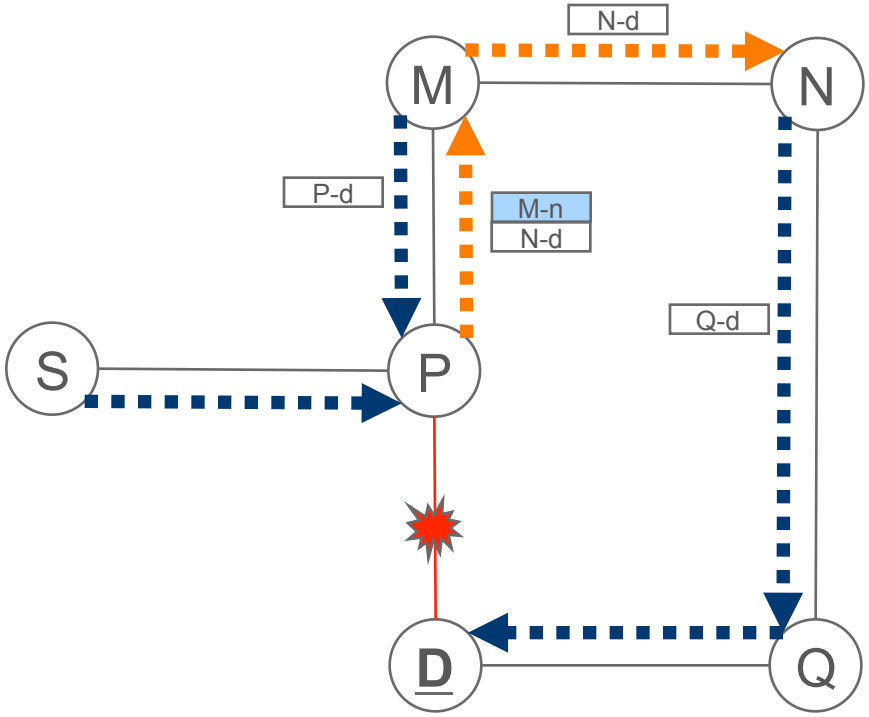
– N advertises label for the backup shortest-path to P for the backup shortest-path LSP

– **N-d** is the shortest-path LDP LSP label at N for D

– P uses shortest-path LSP from P to N to tunnel label **N-d**

Traffic flow over shortest path LSP

Link failure protection fast re-routed traffic

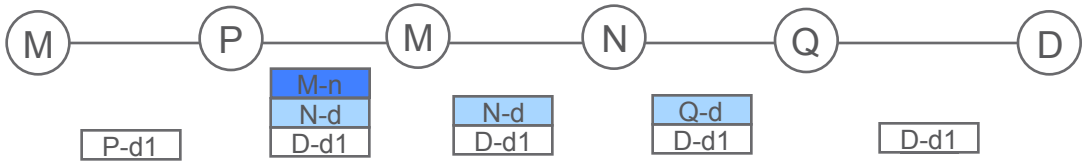


FRR traffic paths to **D** when link P-D fails

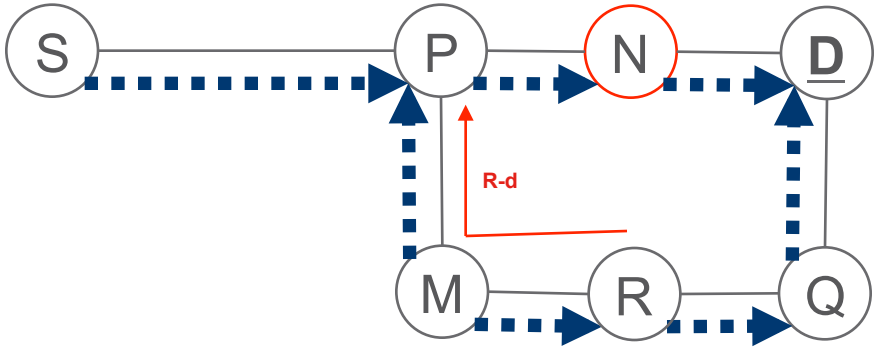
- P, M, N, Q, **D**
- S, P, M, N, Q, **D**
- M, P, M, N, Q, **D**

For entire network

- No 'new' labels needed in the network
- 12 additional label advertisements needed



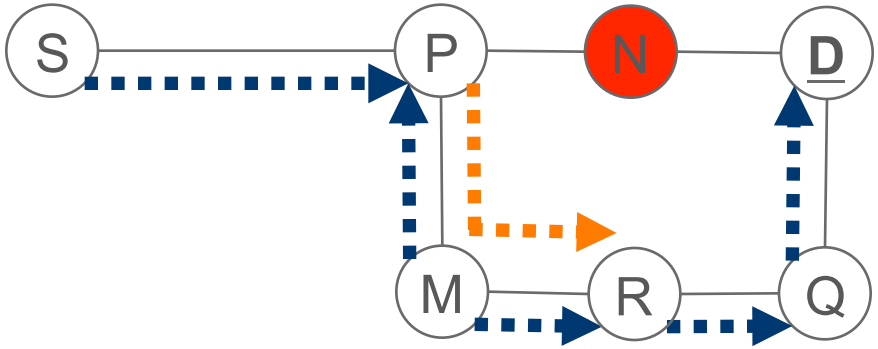
Node failure protection example



- Node N failure
- Destination **D**
- P is PLR
- R is merge point
- R advertises label **R-d** to P for the backup shortest-path LSP

Traffic flow over shortest path LSP

Node failure protection fast re-routed traffic



FRR traffic paths to **D** when node N fails

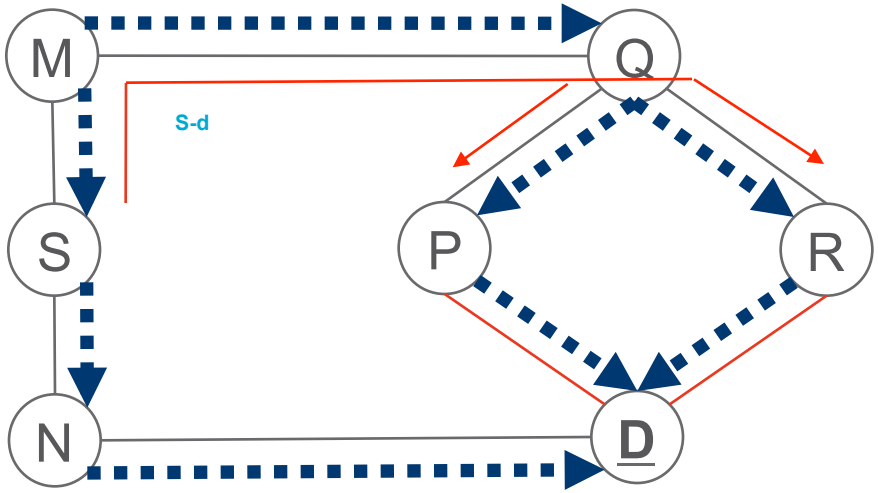
- P, M, R, Q, **D**
- S, P, M, R, Q, **D**
- M, P, M, R, Q, **D**

Fast re-routed traffic

For entire network

- No 'new' labels needed in the network
- 6 additional label advertisements needed

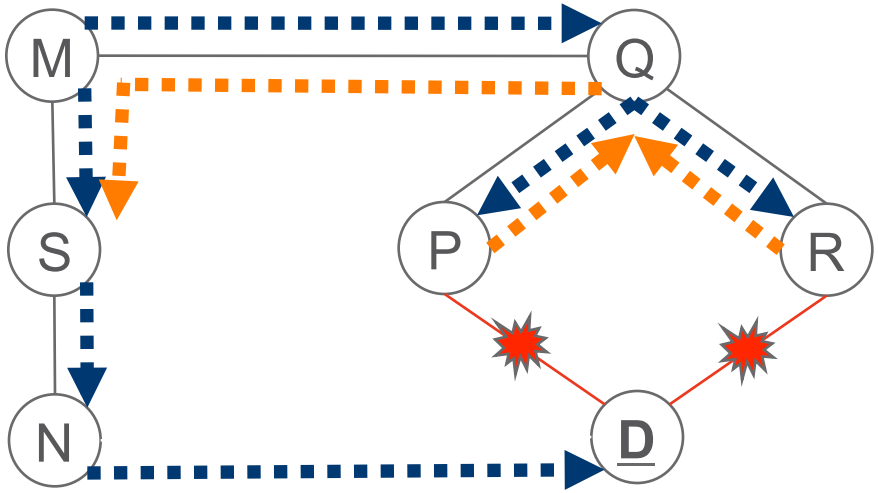
SRLG failure protection example



- SRLG (link P-D)
- Destination D; P, R are PLRs against SRLG
- S is merge point
- S advertises its shortest path LSP label (S-d) to P and R for failure against SRLG

Traffic flow over shortest path LSP

SRLG failure protection fast re-routed traffic



FRR traffic paths to **D** when SRLG fails

- P, Q, M, S, N, **D**
- Q, P, Q, M, S, N, **D**
- Q, R, Q, M, S, N, **D**
- M, Q, P, Q, M, S, N, **D**
- M, Q, R, Q, M, S, N, **D**

Fast re-routed traffic

Operational details

- Per-nexthop protection can reduce number of BSP LSPs
- What happens when a shortest-path LSP is not available for tunneling ?
  - Explicit routing for BSP LSP using extensions to LDP
- Protocol Extensions
  - Failure Element TLV
  - Tunneled FEC TLV (when label stacking not used)
  - Backup Path Vector TLV

Comparison with other approaches

- LDP over RSVP
  - Less OpEx (managing one less protocol). Simplicity.
  - Less protocol state
  - Multi-path on backup
- LFA & Not-via
  - Full coverage
  - Re-uses MPLS FRR infrastructure
  - No IP address management issues

Future Work

- Analyze applicability

Questions/Comments