MPLS Fast Re-route using extensions to LDP

draft-kini-mpls-frr-ldp-02

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Solution

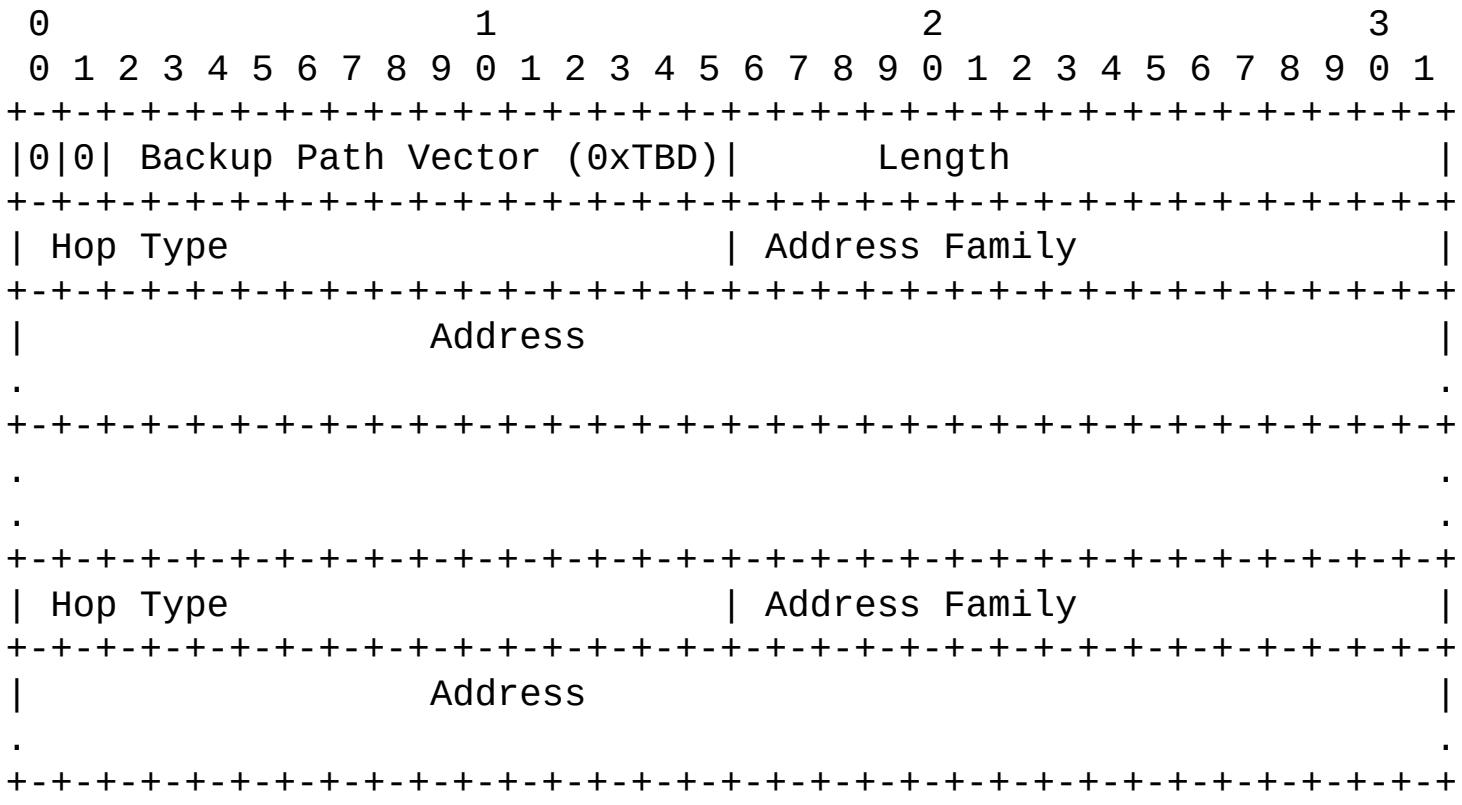
- Recovery characteristsics similar to RSVP-TE FRR (sub 50msec recovery) for traffic on routed paths
- Local repair mechanism – Only PLR reacts to the failure trigger to recover the traffic
- Backup shortest path (BSP) LDP LSP setup before failure whenever LFA does not exist
- 100% coverage for link, node and SRLG failure
- BSP LSP starts at PLR and merges into shortest path LDP LSP tree. Merge point referred to as BSP-MP

Diff 01 and 02

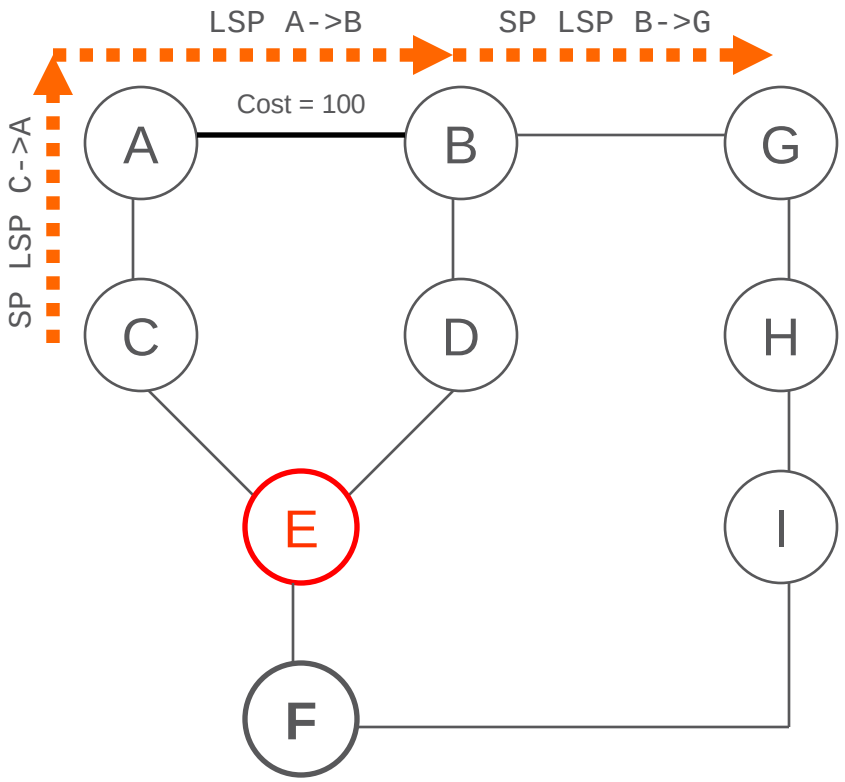
- Simplified BSP LSP definition
  - BSP LSP is Shortest path LSP from PLR to the BSP Merge point
  - When there is no single shortest path, multiple shortest path LSPs are stitched together
- Backup Path Vector TLV differentiates BSP LSP related label exchanges from other FEC label exchanges
- Failure Element TLV and Tunneled FEC TLV are removed
- Defined capability TLVs

Backup Path Vector TLV

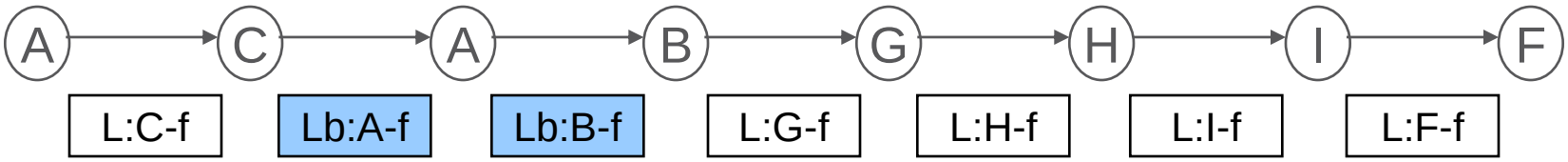
- Backup Path Vector TLV – contains list of addresses of stitching LSRs



Example



- Cost of link A-B is 100, rest is 1
- Failure of node E
- C is PLR
- BSP LSP = C – A – B – G
- L:X-y – Label assigned by Node X for FEC y
- Lb:X-y – BSP Label assigned by Node X for FEC y



Operational details

- Per-nexthop protection can reduce number of BSP LSPs
- What happens when a single shortest-path LSP is not available for tunneling ?
  - Shortest path LSPs are stitched together using simple extensions to LDP
- Protocol Extensions
  - Backup Path Vector TLV

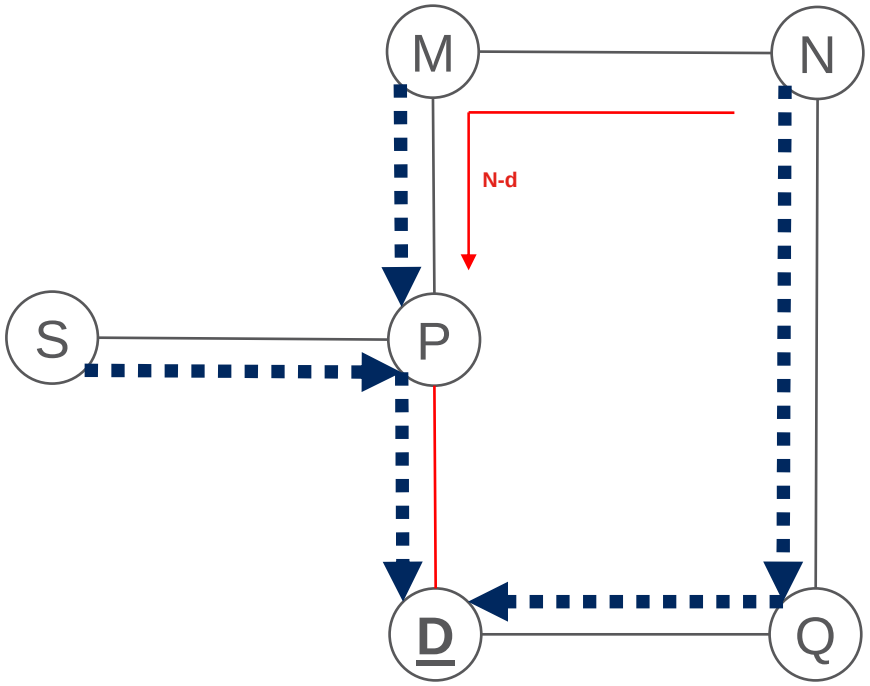
Comparison with other approaches

- 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
  - Simple

Questions/Comments

(Backup slides included with several examples)

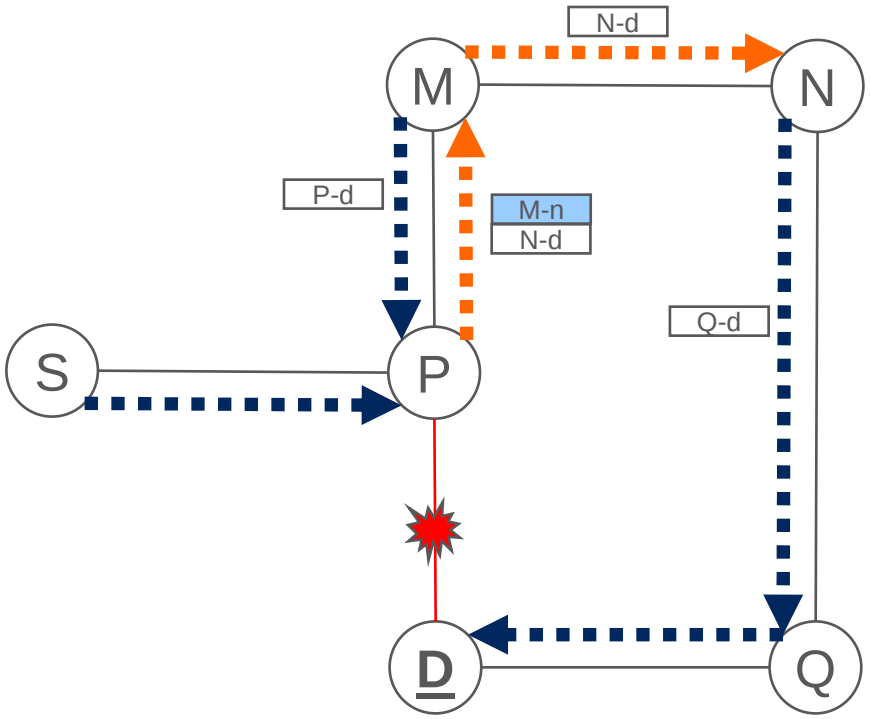
Link failure protection example



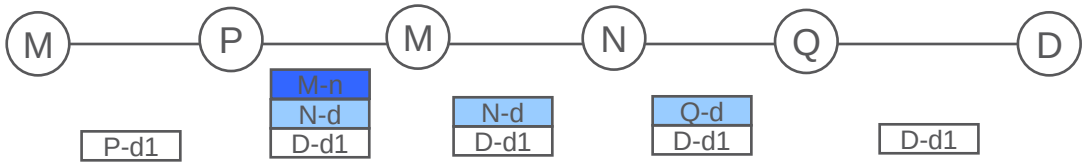
- Protect link P-D failure
- For Destination **D**
  - P is PLR
  - N is merge point
  - N advertises label **N-d** to P for the backup shortest-path LSP
  - **N-d** is the shortest-path LDP LSP label at N for D
  - P uses shortest-path LSP from P to N to tunnel label **N-d**

Traffic flow over shortest path LSP

Link failure protection fast re-routed traffic



Fast re-routed traffic



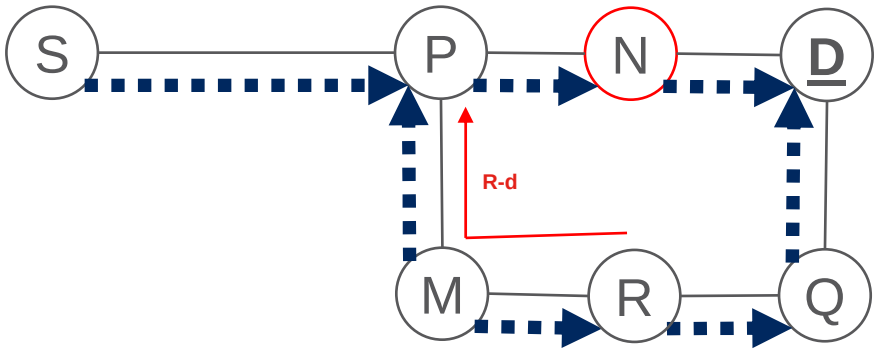
FRR traffic paths to **D** when link P-D fails

- 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

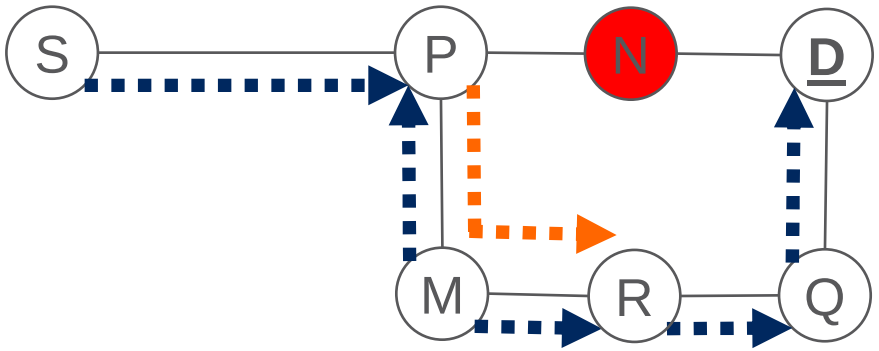
Node failure protection example



- 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

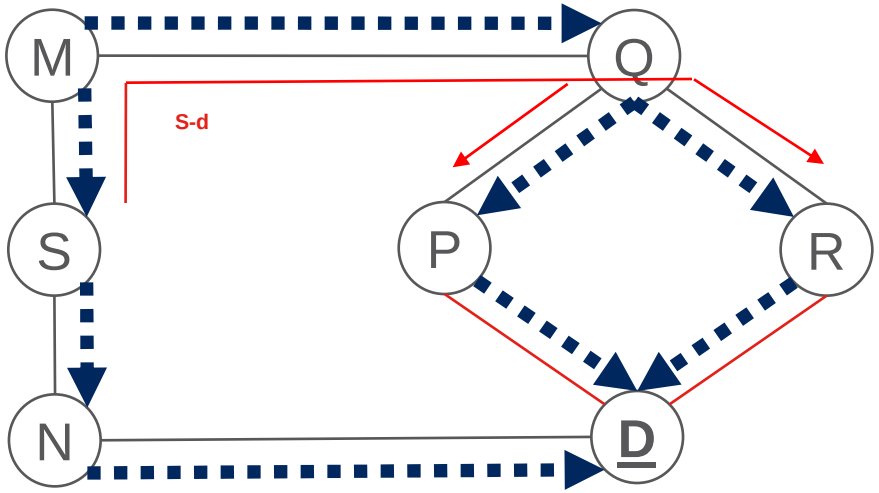
- P, M, R, Q, **D**
- S, P, M, R, Q, **D**
- M, P, M, R, Q, **D**

For entire network

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

Fast re-routed traffic

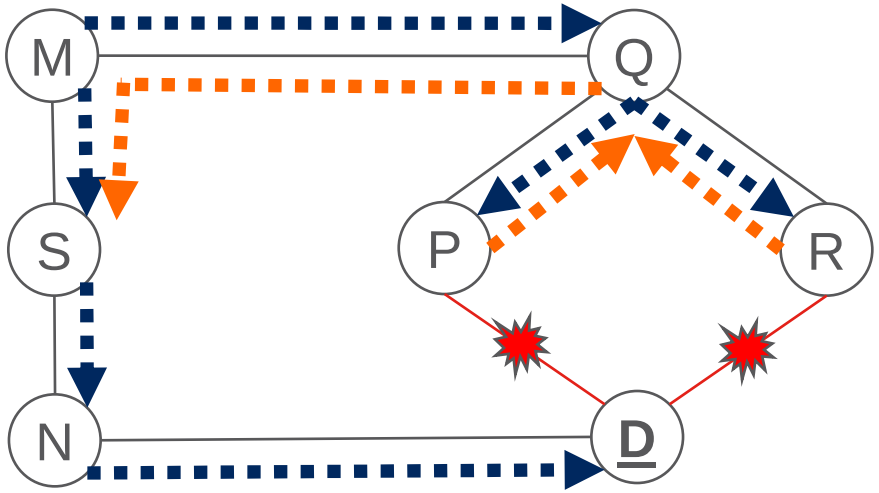
SRLG failure protection example



- SRLG (link P-**D**, link R-**D**) failure
- Destination **D**
- P, R are PLRs
- 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

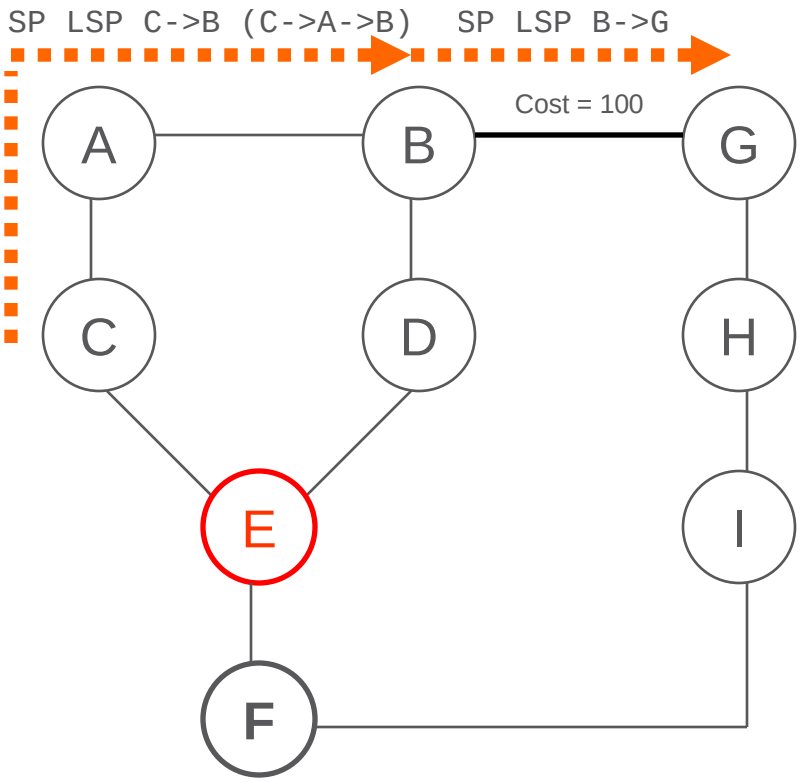


FRR traffic paths to **D** when SRLG fails

- 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

Example - 2



- Cost of link B-G is 100, rest is 1
- Failure of node E
- C is PLR
- BSP LSP = C – B – G
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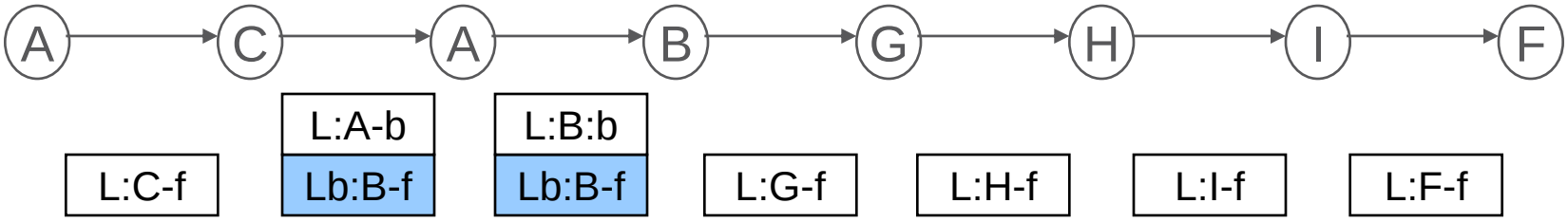
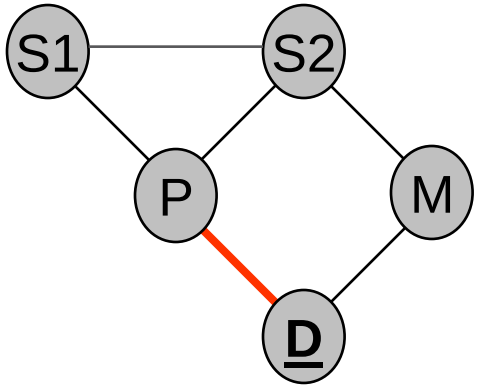


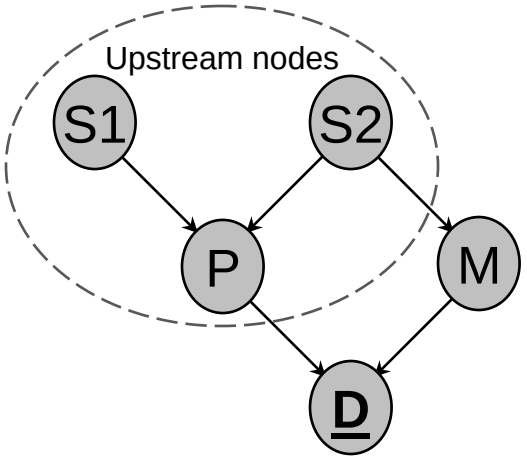
Computation

- 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 failure

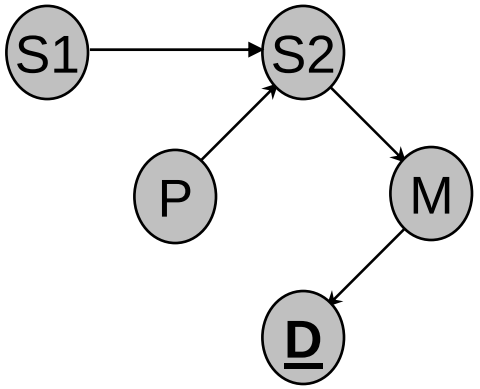
SPT & Exclude-SPT



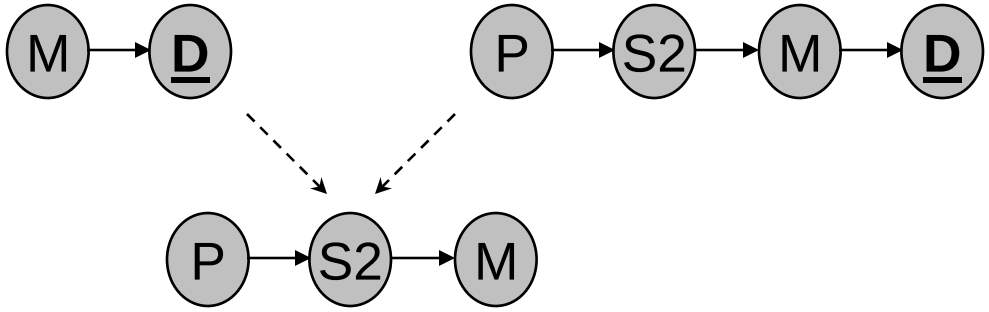
Topology



SPT



Exclude-SPT



BSP LSP