3. Fast convergence in MPLS networks:

Principles

- Pre-establish secondary LSPs to protect for the failures of important primary LSPs.

  These LSPs don't carry traffic unless there is a failure.

- Switch to using secondary LSPs upon detecting the failure!

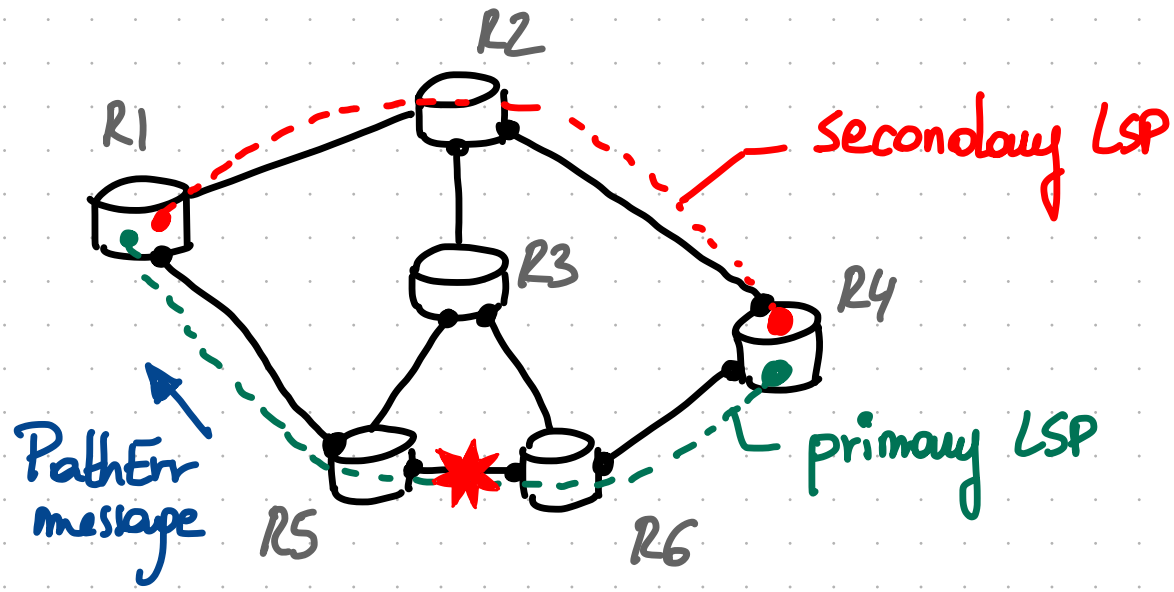
  This can be done immediately without any coordination with neighboring routers, provided the secondary LSP exist and is NOT impacted by the failure...

Existing solutions can be divided into:

3.1. End-to-end LSP protection.

3.2. Local LSP protection.

3.1. End-to-end LSP protection :

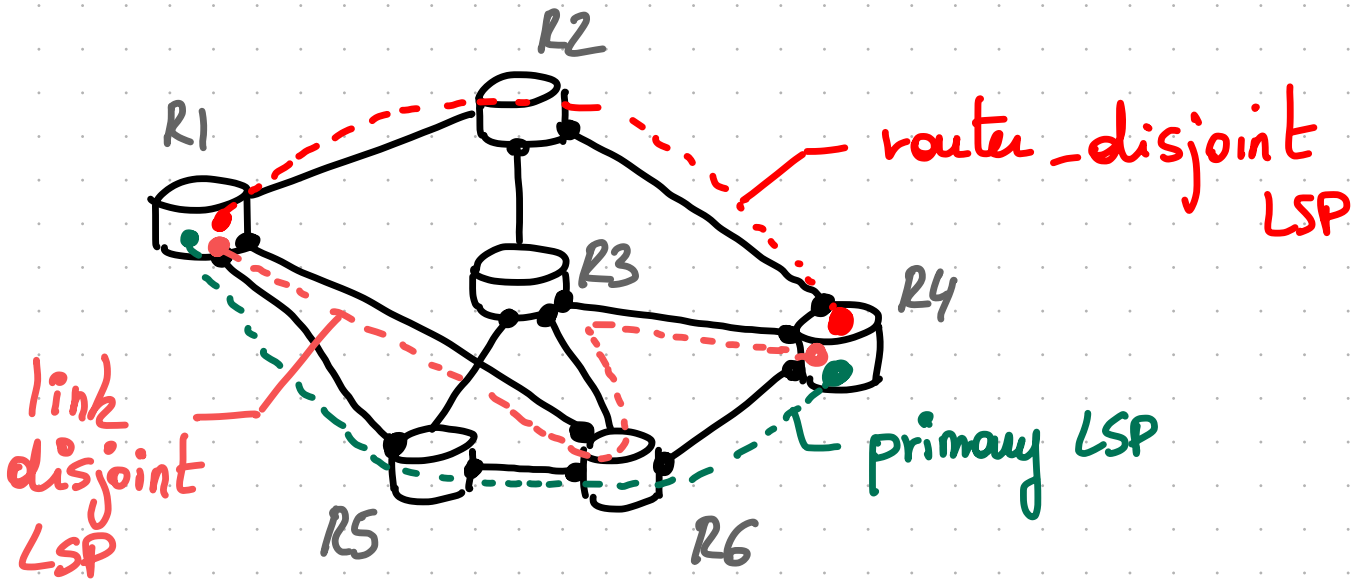


In this mode, a secondary LSP (here, in red) is established between the ingress and the egress LSR. When a failure happens, the adjacent router sends a PathErr message to the ingress which triggers the switch.

For this to work, the secondary LSP must rely on disjoint physical ressources...

Typical protection schemes include:

- Router_disjoint protection LSP which do not use any of the same routers as the primary LSP.
- Link_disjoint protection LSP which do not use any of the same links as the primary LSP.



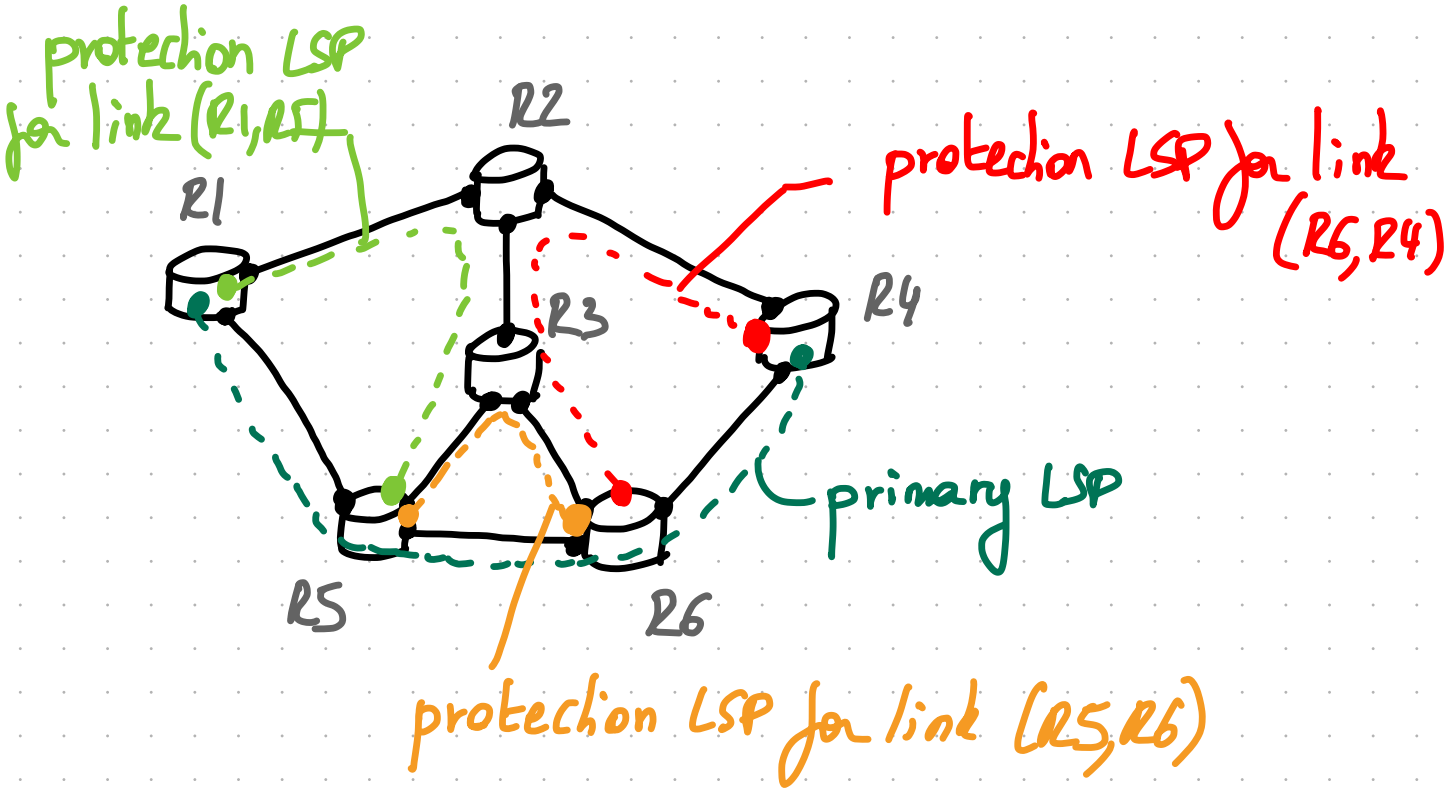
The ingress LSR can compute these LSRs using its path selection algorithm and signal them using RSVP-TE (using the Explicit Route Object / ERO).

Pros: Ingress can IMMEDIATELY activate the secondary LSP, without any coordination.

Cons:

- One protection LSP must be established for each primary LSP. This effectively doubles the amount of memory needed.
- The failure information (PathErr) must travel all the way to the ingress before connectivity can be retrieved. This is slow...

3.2. Local LSP protection



In this mode, each LSR crossed by the primary LSP will signal a protection LSP to cover for the failure of each link used by the primary LSP.

The above example can be generalized to protect for routers failures.

Pros: Traffic can be immediately switched onto a protection LSP by the router detecting the failure (not only the ingress).

Cons: Depending on the network, a large number of protection LSPs might be required.

As usual, there are many optimizations possible such as reusing protection LSPs to protect many primary LSPs.