

SR based Loop-free implementation

[draft-deng-rtgwg-sr-loop-free-00](#)

Lijie Deng , Yongqing Zhu , Xuesong Geng , Zhibo Hu

Presenter: Lijie Deng

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Motivation

■ Microloops

- An IP network computes paths based on the distributed IGP protocols. If a node or link fails, a loop may occur on the network because LSDBs are not synchronized. However, such a loop disappears after all devices on the forwarding path complete convergence. Such a transient loop is called a “microloop”.
- Microloops may cause packet loss, delay variation, and packet disorder on the network.

■ **This document describes some optional implementation methods of SR for microloop avoidance in different scenarios.**

- Anti-Microloop Scheme for Tangent Scenarios
- Anti-Microloop Scheme for Cut-back Scenarios
- Anti-Microloop Scheme for Multi-source Scenarios
- Anti-Microloop Scheme for Multi-point Scenarios

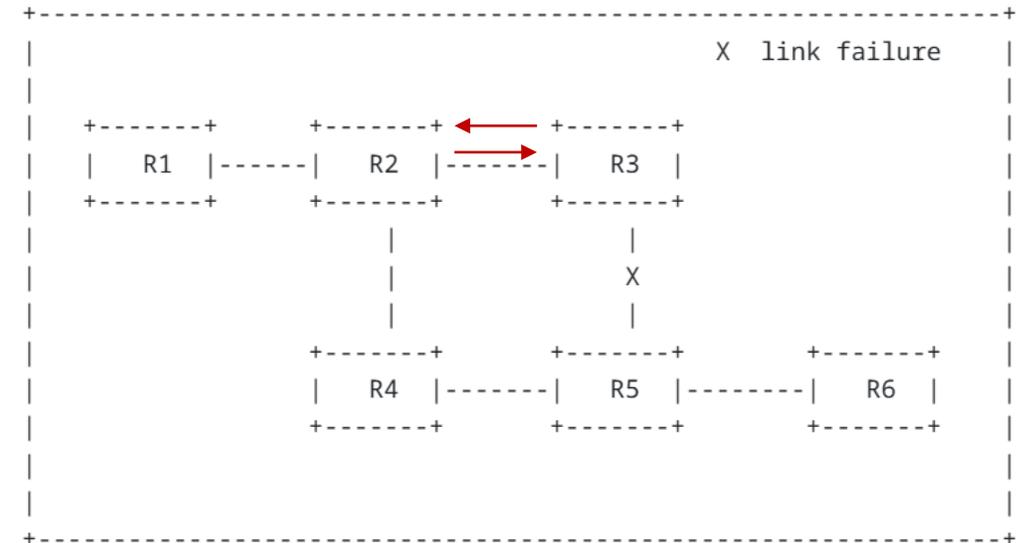
Tangent Scenario

■ Scenario Analysis

- When the link between R3 and R5 fails, it is assumed that R3 completes convergence first and R2 does not complete convergence. R1 and R2 forward the packet along the previous path to R3. Since R3 has converged, it forwarded the traffic to R2 according to the route after convergence. Thus, the tangent microloops happened between R2 and R3.

■ Anti-Microloop Scheme

- Phase 1: A hold-down timer T1 is configured on R3 which is the neighboring node (R3) of the failed node/link and R3 uses TI-LFA forwarding for the duration of T1;
- Phase 2: A hold-down timer T2 is configured on the remote node and the node forwards traffic to R3 (specify the Node Sid of R3) for the duration of T2;
- Phase 3: T2 timeout, the remote node returns to normal convergence firstly;
- Phase 4: T1 timeout, R3 reverts back to normal convergence.



Tangent illustrative scenario, failure of link R3-R5

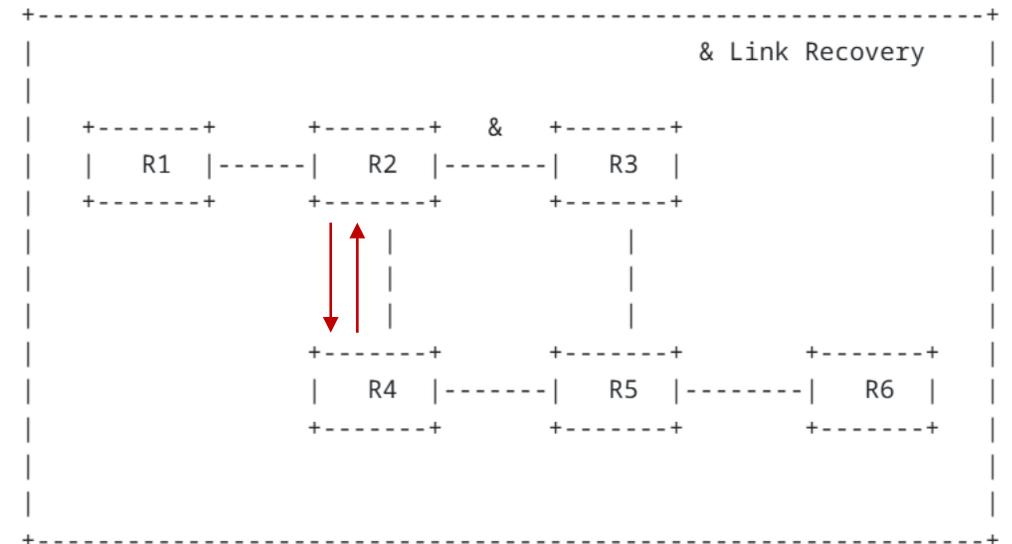
Cut-back Scenario

■ Scenario Analysis

- Since the network does not enter the TI-LFA forwarding process after the node/link failure is recovered, the delay convergence cannot be used in the back-cut scenario to prevent the generation of microloops as in the tangent scenario.
- The recovery of the faulty link R2-R3 does not affect the SR path from R4 to R2, so the path from R4 to R2 must be a loop-free path.

■ Anti-Microloop Scheme

- Insert an End.X SID from R2 to R3 in the converged path of R4 End. X SID instructs the message to be forwarded from R2 to R3, and the path from R4 to R6 is guaranteed to be loop-free.



Cut-back illustrative scenario, recovery of link R2-R3

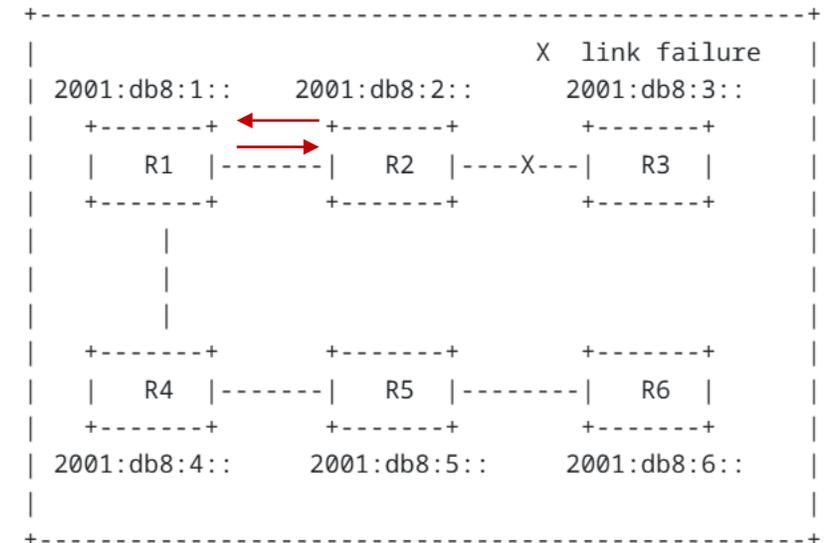
Multi-source Scenario

■ Scenario Analysis

- R3 and R6 both import the route 2001:db8:3::. The link between R2 and R3 fails. It is assumed that R2 first completes convergence, and R1 hasn't completed convergence yet.
- R1 forwards the packet to R2 along the path before the failure.
- Because R2 has completed convergence, R2 forwards packets to R1 according to the next hop of the route. In this way, a loop is formed between R1 and R2.

■ Anti-Microloop Scheme

- The preferred destination node of the packets destined for 2001:db8:3:: changes from R3 to R6. In this case, timer T1 on R2 can be started. Before T1 expires, for a packet that accesses the R6, an End.X SID between the R5 and the R6 or an End SID of the R6 is added to the encapsulation in order to ensure that the packet is forwarded to the R6. A basic principle is similar to that of SR-MPLS.



Multi-source illustrative scenario, failure of link R2-R3

Next steps

- Update the draft to add anti-microloop scheme for multi-point scenario.
- Any comments or any suggestions?

Thanks!