Abstract

The concept of "make-before-break (MBB)" while rerouting MPLS RSVP-TE tunnels is discussed in [RFC3209]. In the procedure that is outlined, the behavior of downstream label assignment for the new LSP (new tunnel instance) is not well defined. As a general practice, a different label is assigned by each downstream router and advertised to the upstream router in the RESV message for the new LSP; this results in a separate end-to-end data-plane path for the new LSP (with the exception of PHP LSPs or UHP LSP with explicit label on the last hop). This practice allows independent end to end LSP path data-plane verification for each tunnel instance. The consequence of this practice is that the label entry gets added/deleted in the LFIB at every non-ingress router along the LSP path during MBB. Also, the ingress router would need to update all the applications using this LSP when switching to the new tunnel instance, as the new tunnel instance uses different outgoing label. This in turn may also cause other elements of the network which are dependent on the LSP to do the update.

Such network churn can be avoided/minimized if the same label can be re-used (kept intact) wherever it is affecting neither the routing functionalities nor the data path verification of each instance. In addition, whenever label is reused, the setup time for the new tunnel instance would be faster because there is no need for the transit routers along the path of the new LSP to wait for the new LFIB entry to be added. This document proposes a set of procedures to facilitate label reuse when there is a total or partial path overlap between the two tunnel instances during MBB.
Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

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1. Introduction

MPLS RSVP-TE make-before-break (MBB) procedure is defined in [RFC3209]. The behavior of downstream label assignment for the new LSP (new tunnel instance) is not well-defined in this procedure. In most MBB implementations, a different label is assigned by each downstream router and advertised to upstream router in the RESV message for the new Label Switched Path (LSP). This means a separate end-to-end data-plane path for the new tunnel instance (with the exception of PHP LSPs or UHP LSPs with explicit NULL label at the last hop). Although this allows for independent end-to-end path verification for each tunnel instance, it requires an LFIB entry add/delete at every non-ingress router along the path of the LSP during MBB even if the paths for the new tunnel instance and the old tunnel instance might be partially or totally overlapping. Label reuse under partial or total overlap condition reduces unnecessary LFIB update, reduces the possibility of errors and improves network convergence latency. In cases where there is a total overlap of paths between the two tunnel instances and the label is reused at each hop along the overlapping path, the necessity of data plane verification for the new tunnel instance is no longer needed.

1.1. Common LSP MBB triggers

The MBB procedure can be triggered because of a change to any property of the RSVP-TE tunnel. The most common case is a change to the bandwidth requirement, especially with the widely implemented auto-bandwidth feature, which dynamically adjusts the LSP bandwidth based on traffic-monitoring feedback. With CSPF commonly used to compute path to meet the new bandwidth requirements, it is possible that the existing path is still one of the best paths which can satisfy the new requirements. This provides the opportunity to reuse labels to maximize the benefits described. If given the choice and the goal of selecting the best path is not the highest priority, CSPF can also prefer the existing path to other possible paths to take full advantage of the label reuse as long as the requirements are still met by the existing path.

2. Recommended conditions for label reuse

The notion of "Label reuse" can be applied for both point-to-point (P2P) LSP and point-to-multipoint (P2MP) LSP, but due to the complexity of P2MP and many possible variations of the solutions, this document will only focus on the recommendations for P2P LSPs.
Labels can be reused when the primary paths of the two tunnel instances have complete overlap starting from a certain point in the paths and going all the way to the egress router of the LSP. The best case scenario is complete overlap of the two paths end to end; in which case there is no need for any label changes and LFIB updates, both in the transit as well as in the ingress routers. In this scenario there is also no need to perform data plane verification for the new tunnel instance. For the case where the two paths overlaps only from a certain transit router (rather than from the ingress), label reuse starts at that router and continues all the way to the egress router. In this case the existing data plane verification method can still be used to verify new tunnel instance as before. Data traversing on either instance will take a different label path from the ingress to this transit router and from then on the traffic will merge into the shared label switched path towards the egress router.

The conditions under which label reuse can be applied are as following:

- **Egress router of LSP:** Reuse-label functionality can always be applied.
- **Transit routers of the LSP:** For any given transit router of P2P LSP, label can be reused if the following conditions are met:
  - (a) Downstream label received is the same
  - (b) NHOP is the same
- **Ingress router of the LSP:** When the same conditions as listed under transit router are met, instead of no label change, there is no need for ingress route update for LSP to applications depending on it.

The label reuse procedure starts from the egress of the LSP as RESV traverses upstream towards the ingress of the LSP; it terminates at the first transit router where paths of the two tunnel instances diverge towards the ingress of the LSP or at the transit router which doesn’t support label reuse.

### 3. Control of label-reuse behavior

#### 3.1. Enable/Disable label-reuse capability

This document recommends enabling "label-reuse" capability by default. Allow it to be disabled if needed by changing configuration.
3.2. Prefer overlapping path to facilitate label-reuse

In order to take full advantage of the label-reuse capability, path computation for the new tunnel instance may seek to maximize path overlap. This can be achieved through two approaches.

- The first approach is to select from the best paths available the path which has the most path overlap with the existing path starting from the egress router.

- The second approach is to prefer the existing path if it still satisfies the new requirement, even though it might not be the best path.

The choice between the approaches is a matter of local computation policy and can be different for different types of MBB trigger.

4. IANA Considerations

This document makes no request for IANA action.

5. Security Considerations

This document does not introduce new security issues.

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7. Normative References


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