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Trill Traffic Engineering
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Abstract

This document specifies the control plane procedures to support Traffic Engineering (TE) in the TRILL protocol. Traffic Engineering permits management configuration of the path followed by certain unicast frames in a TRILL campus.

Status of this Memo

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1. Introduction

The IETF TRILL (Transparent Interconnection of Lots of Links) protocol implemented by devices called RBridges (Routing Bridges, [RFC6325]), provides optimal pair-wise data frame forwarding without configuration, safe forwarding even during periods of temporary loops, and support for multipathing of both unicast and multicast traffic. TRILL accomplishes this by using IS-IS [RFC1195] link state routing and encapsulating traffic using a header that includes a hop count.

TE(Traffic Engineering) in a flexible technique that can enhance the performance of an operational network at both the traffic and resource. To support TE in IP networks, extensions to IS-IS [RFC5305], have been specified.

Similarly, for TE in TRILL networks, this document describes the control plane procedures and necessary extensions to IS-IS in the context of TRILL protocol.

1.1. Comparison of TE with Multi-Topology

Multi-topology [I-D.eastlake-trill-rbridge-multi-topo] affects all frames, multi-destination as well as known unicast. It constrains frames being routed by a particular topology to certain links and, in general, different costs can be provided for the same link as used in different topologies. The number of available topologies is typically limited due to the multiplicative effect of the number of topologies on the routing computation effort.

Traffic Engineering applies only to unicast frames as indicated by the use of a TE egress nickname in TRILL network. The forwarding for such frames at each RBridge along the traffic-engineered path can be statically configured or computed based on TE routing metric.

However, in both cases, the topology or TE status of a frame can be determined from the egress nickname in the TRILL Header.

1.2. Comparison with Layer 3 IS-IS Traffic Engineering

Layer 3 IS-IS Traffic Engineering uses Router ID TLV(TLV 134) [RFC5305] which is typically extracted from the IP address of a loopback interface, to identify the endpoints of tunnels for Traffic Engineering paths.

While for TRILL Traffic Engineering, there are no complicated signal protocols and explicitly tunnels signaled, so some "TE Router ID TLV for TRILL" is not required.

1.3. 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].

2. Solution Overview

Instead of using explicitly signaled "tunnels" (e.g., MPLS LSP-tunnels for TE), which will require dedicated signaling protocols (e.g., RSVP-TE or CR-LDP) and additional encapsulation in forwarding procedures, nicknames allocated for TE routing path are specially marked in the LSP of the RBridge holding the nickname. The TE path may be calculated based on the TE metrics carried by sub-TLVs inside the existing Extended IS Reachability TLV (TLV type 22, defined in [RFC5305]) or may be statically configured. Ultimately, a shared forwarding table is generated to maintain forwarding information for the basic routing path and forwarding information for the TE routing path. Other procedures of TRILL protocol for routing and encapsulation are not changed.

How to determine whether a frame should be forwarded along least cost routing path or along a particular TE egress nickname routing path is out of the scope of this document.

3. TRILL TE Nickname Allocation

A dedicated space of nickname, named TE nickname MUST be allocated for TE path calculation. TE nickname allocation and selection procedures MUST follow what have been specified in [RFC6325]. The TE nickname should be marked in the link state database for TE routing path calculation. The RBridges with TE function enabled should acquire both nicknames and TE nicknames.

This document uses Interested VLANs and Roots sub-TLV ([RFC6325]) to specify TE nickname. The VID value 0xFFF reserved in [IEEE802.1Q-2005], is redefined to mark the TE nicknames.

Another solution is to use the T flag in the nicknanme Flag Sub-TLV defined in ([RFC6326bis]) to indicats that the nickname is used for traffic engineering routing.

4. Uses of Traffic Engineering

Traffic Engineering is a flexible facility with a variety of uses.

4.1. Protection

Reliability is one important purpose of TE deployment. TE path can be calculated as the backup path for the basic path, and used for link or node protection of the basic path. The TE path is identified and formed by TE nickname. When nodes or links on basic path fail, frame traffic can switch to TE routing path. See the following example:

```
         +-----+      +-----+   basic   +-----+      +-----+
         | RB1 |--+---| RB2 |-----------| RB3 |---+--| RB4 |
         +-----+  |   +-----+           +-----+   |  +-----+
                  |                               |
                  |   +-----+     TE    +-----+   |
                  +---| RB5 |-----------| RB6 |---+
                      +-----+           +-----+
```

RB1->RB2->RB3->RB4 is the primary routing path, and the nicknames of RB1, RB2, RB3 and RB4 are N1, N2, N3 and N4. The TE routing path is RB1-> RB5->RB6->RB4, and the TE nicknames of RB1, RB5, RB6 and RB4 are Nte1, Nte5, Nte6 and Nte4. If for example, RB2, or RB3, or the link between RB2 and RB3 fails, when RB1 detects the failure, it switches the frame traffic to the TE routes by encapsulating the TRILL frame with Nte4 as the egress nickname instead of N4. The frame traffic will then be forwarded based on the routing information for the TE path.

When the basic route path is recovered or a new basic path is set up, the traffic should be able to switched back over the basic route path. While the switchover function should be configurable and deployment specific.

4.2. Special Link Characteristics

TE can be used to send frames over paths so that the links in the path have selected special characteristics. For example, assume MTU testing ([RFC6325])is performed and the results reported in Extended IS-IS Reachability sub-TLVs as described in ([RFC6326bis])and some links in a campus can handle jumbo frames while others can only handle a little over the classic Ethernet maximum. TE could then be used to engineer paths that were limited to links that could handle jumbo frames.

5. Security Considerations

For general TRILL Security Considerations, see([RFC6325]).

6. Acknowledgements

TBD

7. IANA Considerations

IANA is requested to allocate capability bit TBD in the TRILL-VER sub-TLV capability bits ([RFC6326bis]) to indicate an RBridge has TE implemented and enabled.

8. References

8.1. Normative References

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