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MPLS-LSP Data Plane for Cyclic Queuing and Forwarding draft-chen-mpls-cqf-lsp-dp-00

Abstract

Large-scale Deterministic Network (LDN) [ldn] aims to achieve bounded latency forwarding on layer-3 networks that contain long-distance links, large number of nodes and flows. LDN requires a data plane mechanism to indicate different forwarding cycles in the upstream node. This document proposes to use multiple MPLS labels to indicate this kind of information, for MPLS-LSP data plane.

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].

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction (LDN Background)

Large-scale Deterministic Network (LDN) [ldn] aims to achieve bounded latency forwarding on layer-3 networks that contain long-distance links, large number of nodes and flows. Figure 1 illustrates the basic mechanism of LDN, where an upstream Node A and a downstream Node B are considered. Each interface of a LDN router has three cyclic scheduled queues, i.e., at any given time (or cycle), one of the queues is sending packets and the others are receiving.

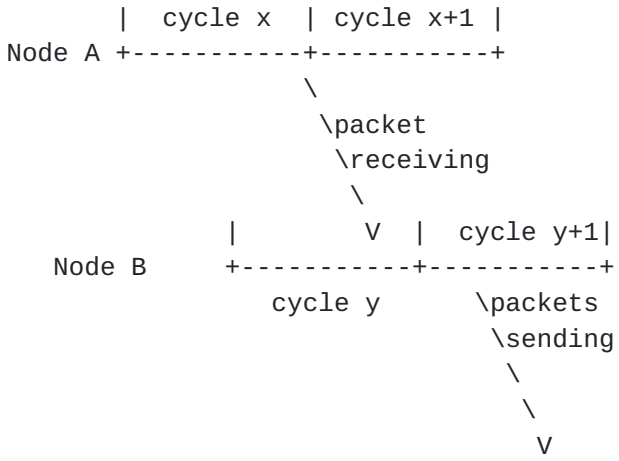

Figure 1

In order to achieve end-to-end bounded latency, LDN requires that all packets sent from the upstream router in a specific cycle MUST be sent by the downstream router within another (one) specific cycle.

For example, as shown in Figure 1, the packets sent by Node A within cycle x MUST be put into single receiving queue in Node B, and then be sent out within cycle y+1. The mapping relationship between x and y+1 could be configured by a centralized controller, or be self-learned by each peer of neighbors at the data plane.

Therefore, LDN requires a data plane mechanism to indicate which upstream node's cycle a packet belongs to, so that the downstream node could use this indication to put the packet into the right receiving queue. This document proposes to use multiple MPLS labels to indicate this kind of information, for MPLS-LSP data plane.

2. MPLS-LSP Data Plane for CQF

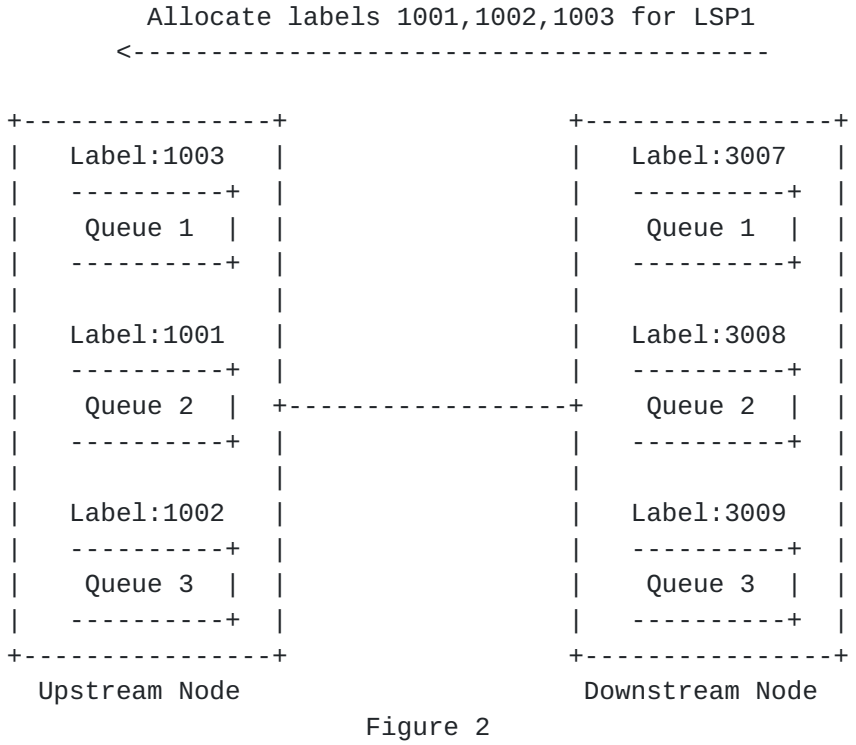

Figure 2

Figure 2 shows the overall mechanism of MPLS-LSP data plane for CQF, where the downstream node allocates three different MPLS labels (i.e., 1000, 1002, and 1003) for LSP1, and advertises this information to the upstream node by using signaling protocols such as RSVP-TE. Each of these labels is associated with a specific queue in the upstream node.

Assume that packets sent from the upstream node's queue 1, queue 2, and queue 3 SHOULD be put into the downstream node's queue 3, queue1, and queue 2, respectively. Note that how to establish such mapping

relationships is out of the scope of this document. Based on these mapping relationships, the downstream node SHOULD install its FIB like the one shown in Figure 3.

Downstream Node's FIB

In-label	OutIF	OutQ	Out-label
1003	3	3	3009
1001	3	1	3007
1002	3	2	3008

Figure 3

Therefore, the packets sent from the upstream node's queue 1 will be put into the downstream node's queue 3, the packets sent from the upstream node's queue 2 will be put into the downstream node's queue 1, and the packets sent from the upstream node's queue 3 will be put into the downstream node's queue 2. In this way, end-to-end latency could be bounded, as per [ldn].

3. IANA Considerations

TBD.

4. Security Considerations

TBD.

5. Acknowledgements

TBD.

6. Normative References

[ldn] Qiang, L., Liu, B., Eckert, T., and L. Geng, "Large-Scale Deterministic Network", March 2019.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

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