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Signal Degrade Indication in Segment Routing over MPLS Network
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Abstract

This document describes a typical use case of MPLS-TP, where signal degrade defect needs to be correctly detected and transmitted via OAM messages within network. When MPLS-TP evolves to Segment Routing MPLS, transit node has no knowledge of labels to be encapsulated in MPLS label stack. Transit node cannot spread OAM messages with signal degrade defect indication. Thus, a solution is proposed in this draft.

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.](#) Background

In early era of telecommunication, transport network is set up to provide voice service. The connection in network is always connection-oriented and circuit switching. With the rapid increasing bandwidth brought by Ethernet, transport network transforms into the packet-switched transport network. Technologies like MPLS/PWE3 perfectly meet the requirements of supporting both packet-transport and circuit-transport. It led to the work of MPLS Transport Profile (MPLS-TP), collaborated between ITU-T and IETF at the first decade of the 21st century.

MPLS-TP is a subset of MPLS. Features that are not applicable to transport network are excluded, and features to meet the requirements of transport network, e.g., bidirectional path, deterministic control and management, etc., are strictly required. According to the Joint

Working Team consensus, any extension of MPLS-TP would be included in MPLS field.

With the emerge of Segment Routing (SR) and Software Defined Network (SDN), MPLS-TP network technologies are adapted as well. In this draft, we recognize one use case where the signal degrade defect can be correctly detected and transmitted via MPLS-TP OAM in MPLS-TP, but not fulfilled in SR-MPLS. To fix this problem is the motivation of this draft.

Editor's note: This section gives a historical introduction of MPLS-TP, since it has been extensively deployed in packet switched transport networks for years. The intention of this section is to help readers understand the unique of requirements from packet transport network. Once the draft becomes RFC, part of this section can be moved to Appendix.

[2.](#) Terminology

MPLS: MultiProtocol Label Switching

PWE3: Pseudo Wire Emulation Edge to Edge

MPLS-TP: MultiProtocol Label Switching - Transport Profile

SR: Segment Routing

SDN: Software Defined Network

OAM: Operation, Administration and Maintenance

SD: Signal Degrade

BER: Bit Error Rate

WDM: Wavelength Division Multiplexing

NMS: Network Management System

G-ACh: Generic Associated Channel

PDU: Protocol Data Unit

CCM: Continuity Check Message

MEP: Maintenance Entity Group End Point

MIP: Maintenance Entity Group Intermediate Point

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AIS: Alarm Indication Signal

[3.](#) Problem Statement

[3.1.](#) Defect Triggered Procedure

Signal Degrade (SD) describes a status of signal associated data has degraded and a degraded defect is active. Signal degrade of a physical link is usually measured and represented by Bit Error Rate (BER) value. Fiber aging, impairment and pollution, optical module mismatch or WDM transmission error are the reasons to lead to signal degrade. More information about signal degrade can be found in [I-D.yang-mpls-ps-sdi-sr].

In practice, when physical link degrades in network, signal degrade defect is firstly detected and reported by the node. A specific type of alarm is generated and sent to Network Management System (NMS) or a SDN controller. It is a report to management plane and strongly required from perspective of network management. However, the problem is the notification to management plane is usually not fast enough to assist the network recovery. It may result in hour or even day level of service interruption time.

As mentioned in [[RFC6372](#)], defect may trigger system to perform a survivability action, when notification of an issue is reported from equipment in a lower layer, system fails to receive an OAM continuity check message, or receives of an OAM message reporting a failure condition. Similarly, when signal degrade defect is reported from the lower layer, e.g. physical layer, local protection mechanism can

be triggered within the internal system of nodez. In case of protection switchover selector is at the source or destination node, while the signal degrade is happened at intermediate node, an OAM message should be transmitted to notify the degrade condition to the nodes actually perform the protection switchover. This action is preferred to be triggered by events in the data plane [[RFC6372](#)].

[3.2.](#) MPLS-TP Solution

Generic Associated Channel (G-ACh) [[RFC5586](#)] is defined to carry OAM messages for MPLS pseudowires, LSPs and sections. The Generic Associated Channel format used in MPLS is shown in Figure 1. By using the generic associated channel and indication of channel type, different OAM mechanisms with different formats can be encapsulated uniformly as well as independently.

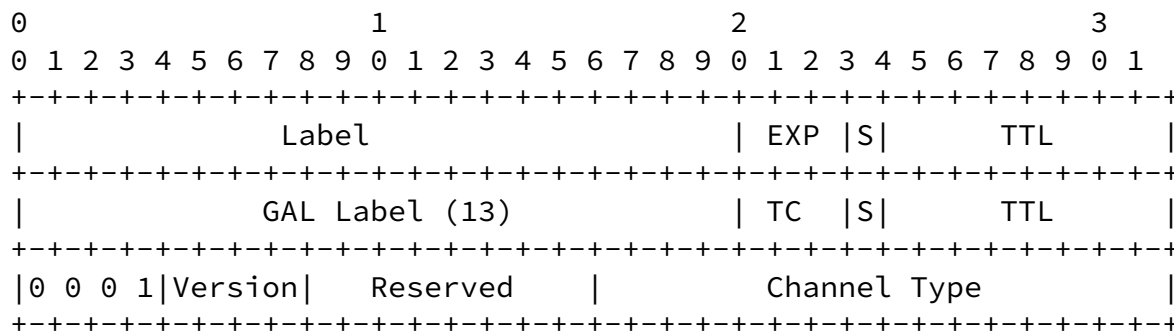
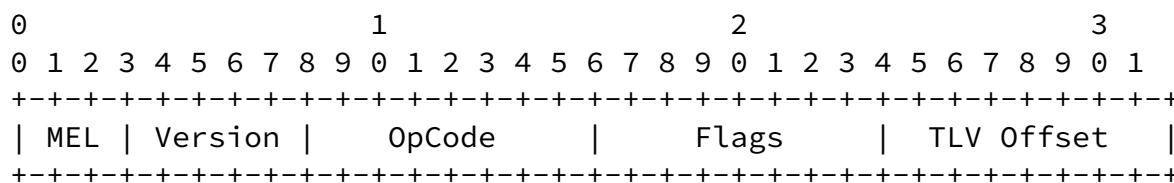


Figure 1 G-ACh Format in MPLS

In MPLS-TP, ITU-T G.8113.1 [ITU-T G.8113.1] specifies a large set of OAM mechanisms and has been widely deployed in packet transport networks. Figure 2 shows the common OAM PDU format of different OAM mechanisms.



ought to be encapsulated in MPLS label stack. Either the label information of forwarding path can be obtained on transit node, or the defect can be indicated in different messages could help the defect spread in network. It is valuable to keep transit node with the capability of reporting defects in SR-MPLS.

4. Solution in SR-MPLS

Segment routing is designed to reduce the states in transit nodes, any defects like SD defect cannot be indicated in a newly generated OAM message on transit node. Alternative way is to indicate the defect in other OAM messages. Continuity Check Message (CCM) is proposed to indicate the signal degrade defect for two reasons. Firstly, CCM is designed to be applicable for fault management, performance monitoring, or protection switching applications. Secondly, consider the merit of CCM's various transmission period, the defect indication can be flexibly transmitted according to operator's needs.

One reservation bits in Flag section in CCM OAM PDU message can be used as Error Indication (EI) to indicate signal degrade. Flag format with EI extension is shown in Figure 3.

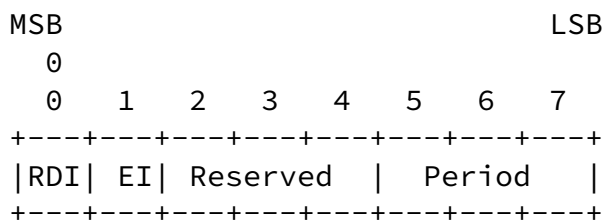


Figure 3 CCM OAM PDU Flags Format with EI Extension

RDI: Remote Defect Indication, set to 1 to indicate RDI, otherwise it is set to 0.

Period: Indicate the transmission period.

EI: Error indication, 0 indicates no error, 1 indicates error.

Reserved: Reserved fields are set to all ZEROes.

If the node detects the signal degrade defect, EI field is set in CCM OAM message and transmitted to other nodes. Note that, Maintenance Entity Group Intermediate Point (MIP) is required to be transparent to CCM message in MPLS-TP. In order to support BER indication on each node along the forwarding path, extra configuration and intervening implementation to process CCM message would be required on MIP.

Editor's Note: When other OAM mechanisms used in generic associated channel (G-ACh), there might be various solutions to transmit signal degrade defect, or any other defects detected by transit nodes. This draft introduces a very light-weight solution, which has already been implemented and deployed in networks.

[5.](#) IANA Considerations

This document requests IANA to assign one bit from Flags of MPLS-TP OAM PDU format to indicate "Signal Degrade".

[6.](#) Security Considerations

There are MEP and MIP node defined in OAM mechanisms. Some types of OAM message are defined to be transparent to MIP node, and requires no extra configuration or message processing on MIP nodes. If the transit node of SR-MPLS acts as MIP in OAM maintenance domain, this MIP node needs to process the OAM messages to indicate the defects. At the moment, explicit configuration is required on MIP to have the authority to process OAM messages.

[7.](#) Acknowledgements

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