MPLS Working Group F. Yang
Internet-Draft Huawei Technologies
Intended status: Informational L. Han
Expires: May 6, 2021 China Mobile
J. Zhao
China Academy of Information Communications Technology
November 2, 2020

Problem Statement of Signal Degrade Indication for SR over MPLS
draft-yang-mpls-ps-sdi-sr-01

Abstract

This document outlines the problem statements and the use cases needed to be taken into account when the signal degrade is detected and indicated in Segment Routing (SR) over MPLS networks.

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

Copyright Notice

Table of Contents

1. Introduction

Signal Failure (SF) and Signal Degrade (SD) are categorized as the trigger to bring the survivability challenge to the network in [RFC4428]. Signal Failure (SF) can be interpreted as the absence of the network resources, and Signal Degrade (SD) can be regarded as the decrease of the signal quality quantifiable measurement. The meanings of signal failure is straightforward, indicating the failure of the interfaces, links or nodes. Meanwhile, fiber aging, fiber impairment, fiber pollution, optical module mismatch or WDM transmission error are the potential reasons to generate signal degrade.

Segment Routing(SR) leverages the source routing paradigm. In the era of source routing paradigm, Segment Routing over MPLS (SR-MPLS) [RFC8402] has been widely utilized for different kinds of network scenarios. It is valuable to investigate the necessity of supporting detection of Signal Degrade (SD) in the source routing paradigm.

This document gives the problem statements for the Signal Degrade indication and advertisement in the networks of SR over MPLS (SR-MPLS). The triggered protection mechanism is irrelevant to Signal Degrade indication and consequently is out of scope.

2. Terminology

SD: Signal Degrade

PLR: Packet Loss Rate

SLA: Service Level Agreement

FEC: Forwarding Error Correction

BFD: Bidirectional Forwarding Detection

3. Problem Statement and Use Case

3.1. Overview of Signal Degrade in SR over MPLS Network

```
               +-----+     +-----+
       +-------|LSR1 |-----|LSR2 |------+
       |       +-----+     +-----+      |
       |             \    /             |
       |              \  /              |
     +-----+         +-----+         +-----+
-----|LER1 |         |LSR5 |         |LER2 |-----
     +-----+         +-----+         +-----+
       |              /  \              |
       |             /    \             |
       |       +-----+     +-----+      |
       +-------|LSR3 |-----|LSR4 |------+
               +-----+     +-----+
```

Figure 1: Overview of Signal Degrade in SR over MPLS Network

Figure 1 depicts the overview of the signal degrade detection in the segment routing over MPLS network. LER1 and LER2 are the Label Edge Routers, and LSR1 to LSR5 are the Label Switching Routers. The signal degrade can happen at any links in the SR over MPLS network, not only the links connected to LERs, but also the links between LSRs. There is no signal degrade is defined in the current OAM [I-D.ietf-spring-sr-oam-requirement] or BFD [I-D.ali-spring-bfd-sr-policy] mechanisms designed for SR over MPLS network.

3.2. Influence on Voice and Data Service

In mobile backhaul network, signal degrade may not lead to service interruption, however it impairs the services and dissatisfies the Service Level Agreements (SLAs). Take VoLTE service as an example, signal degrade over the optical transmission can bring noise, carton, call delay, drop line or even cause base station disconnection. In addition, the download speed of data service would decrease dramatically when signal degrade increases. There are some statistics captured from live network shown in Table 1.

Packet Loss Rate	Decrease of Download Rate
0	No affect
<0.01%	No affect
0.05%	23%
0.2%	58%
1%	75%

Table 1 Relation between Packet Loss Rate and Decrease of Download Rate

3.3. Engineering Considerations

3.3.1. Signal Degrade in Diversity of PHYs

From the perspective of engineering, there are a variety of PHYs defined in IEEE 802.3. The PHYs without Forward Error Correction (FEC) generates the defects/alarms, PHYs with the FEC correct the bit errors. There is no uniform mechanism to guarantee the control of the bit errors.

3.3.2. Performance Management Detection

The approaches of OAM performance management can be used as the tools to detect the signal degrade. On one hand, active performance management cannot fulfill the Signal Degrade detection all the time. On the other hand, passive performance management consumes too much resource of the equipment so that operators can hardly use it in the networks. The current performance management mechanism is not feasible to detect signal degrade conveniently and efficiently.

3.3.3. BFD Detection

For the worst case, when signal degrade happens on LSRs, the current best practice is to make use of the result of BFD protocol on LERs to trigger the protection mechanism. The detection time is at least 3.3ms*3 later than the time when the signal degrade happens. If the LSRs can trigger the protection protocol in a more direct and efficient way, the network service interruption time can be reduced.

3.4. LER and LSR Consideration

There are local and remote request logics about the signal degrade defined in [RFC6378]. Meanwhile, the Protection State Coordination (PSC) process and the messages are utilized to advertise and exchange the signal degrade state between LERs. In the network of MPLS-TP, the LSRs stay dumb in the transmission of OAM messages.

In the SR over MPLS networks, only the headend LER knows all the segments in the label stack, the other LSRs and LER2 does not know the entire label stack. As for the signal degrade happens on either headend LER or other LSRs and LER, the mechanism of the signal degrade indication would be differently designed.

3.5. Signal Degrade Approach

In Section 4.1 of [RFC6372], approaches of detection or recognition of network defect such as signal degrade are specified. The signal degrade indication can be detected from a network defect, or advertised by an in-band data-plane-based OAM mechanism, or by in-band or out-of-band control-plane signaling, or triggered from the centralized Network Management System (NMS) or a SDN controller. The appropriate approaches should be wisely selected.

3.6. Parameter Threshold

Parameters like BER or PLR are the different quantitative measurement methods. It is flexible for the service providers to set different values of threshold based on the geographical site investigations. For an even more complicated scenario, the threshold may be defined differently in terms of services, for example to differentiate the requirements of the eMBB or URLLC applications in 5G era.

4. IANA Considerations

This document makes no request of IANA.

Note to RFC Editor: this section may be removed on publication as an RFC.

5. Security Considerations

This document has no consideration of security.

Note to RFC Editor: this section may be removed on publication as an RFC.

6. Acknowledgements

TBD

7. References

7.1. Normative References

[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>.

7.2. Informative References

[I-D.ali-spring-bfd-sr-policy]
Ali, Z., Talaulikar, K., Filsfils, C., Nainar, N., and C. Pignataro, "Bidirectional Forwarding Detection (BFD) for Segment Routing Policies for Traffic Engineering", draft-ali-spring-bfd-sr-policy-05 (work in progress), May 2020.

[I-D.ietf-spring-sr-oam-requirement]
Kumar, N., Pignataro, C., Akiya, N., Geib, R., Mirsky, G., and S. Litkowski, "OAM Requirements for Segment Routing Network", draft-ietf-spring-sr-oam-requirement-03 (work in progress), January 2017.

[RFC4428] Papadimitriou, D., Ed. and E. Mannie, Ed., "Analysis of Generalized Multi-Protocol Label Switching (GMPLS)-based Recovery Mechanisms (including Protection and Restoration)", RFC 4428, DOI 10.17487/RFC4428, March 2006, <https://www.rfc-editor.org/info/rfc4428>.

[RFC6372] Sprecher, N., Ed. and A. Farrel, Ed., "MPLS Transport Profile (MPLS-TP) Survivability Framework", RFC 6372, DOI 10.17487/RFC6372, September 2011, <https://www.rfc-editor.org/info/rfc6372>.

[RFC6378] Weingarten, Y., Ed., Bryant, S., Osborne, E., Sprecher, N., and A. Fulignoli, Ed., "MPLS Transport Profile (MPLS-TP) Linear Protection", RFC 6378, DOI 10.17487/RFC6378, October 2011, <https://www.rfc-editor.org/info/rfc6378>.

[RFC7271] Ryoo, J., Ed., Gray, E., Ed., van Helvoort, H., D'Alessandro, A., Cheung, T., and E. Osborne, "MPLS Transport Profile (MPLS-TP) Linear Protection to Match the Operational Expectations of Synchronous Digital Hierarchy, Optical Transport Network, and Ethernet Transport Network Operators", RFC 7271, DOI 10.17487/RFC7271, June 2014, <https://www.rfc-editor.org/info/rfc7271>.

[RFC8402] Filsfils, C., Ed., Previdi, S., Ed., Ginsberg, L., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing Architecture", RFC 8402, DOI 10.17487/RFC8402, July 2018, <https://www.rfc-editor.org/info/rfc8402>.

Authors' Addresses

Fan Yang
Huawei Technologies

Email: shirley.yangfan@huawei.com

Liuyan Han
China Mobile

Email: hanliuyan@chinamobile.com

Junfeng Zhao
China Academy of Information Communications Technology

Email: zhaojunfeng@caict.ac.cn