

Operations, Administration, and Maintenance for MPLS-SR over IP
draft-mirsky-mpls-oam-mpls-sr-ip-01

Abstract

Segment routing uses source routing paradigm to traffic engineering by specifying segments a packet traverses through the network. MPLS Segment Routing applies that paradigm to an MPLS data plane-based networks. SR-MPLS over IP uses MPLS label stack as a source routing instruction set and uses IP encapsulation/tunneling such as MPLS-in-UDP as defined in [RFC 7510](#) to realize a source routing mechanism across MPLS, IPv4, and IPv6 data planes. This document describes Operations, Administration, and Maintenance operations in SR-MPLS over IP environment.

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[1.](#) Introduction

Segment routing [[RFC8402](#)] uses source routing paradigm to traffic engineering by specifying segments a packet traverses through the network. MPLS Segment Routing (SR-MPLS) [[I-D.ietf-spring-segment-routing-mpls](#)] applies that paradigm to an MPLS data plane-based networks. SR-MPLS over IP uses MPLS label stack as a source routing instruction set and uses IP encapsulation/tunneling such as MPLS-in- UDP as defined in [[RFC7510](#)] to realize a source routing mechanism across MPLS, IPv4, and IPv6 data planes. This document describes Operations, Administration, and Maintenance (OAM) operations in SR-MPLS over IP environment.

[2.](#) Conventions used in this document

[2.1.](#) Terminology

MPLS: Multiprotocol Label Switching

LSP: Label Switched Path

BFD: Bidirectional Forwarding Detection

SR Segment Routing

SR-MPLS Segment Routing in MPLS data plane

FEC: Forwarding Equivalence Class

G-ACh: Generic Associated Channel

ACH: Associated Channel Header

GAL: G-ACh Label

OAM Operations, Administration, and Maintenance

2.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

3. OAM in SR-MPLS over IP

OAM operations support Fault Management and Performance Monitoring components of FCAPS framework for network management. To achieve its objectives, Fault Management OAM includes proactive and on-demand protocols to provide constant monitoring of the network to detect the failure in combination with on-demand tools to efficiently localize and characterize the defect. Performance Monitoring OAM protocols support measurement of packet loss and packet delay that enables calculation of performance metrics, e.g., packet loss ration, inter-packet delay variation, that are useful in monitoring the quality of service in the network, detect and quantify the service degradation.

3.1. Fault Management OAM in SR-MPLS over IP

Fault management OAM toolset includes protocols to perform on-demand failure detection and localization as well as proactively monitor path continuity. An example of the former is echo request/reply, e.g., Label Switched Path (LSP) Ping [[RFC8029](#)]. An example of the latter - Bidirectional Forwarding Detection (BFD) over MPLS LSP [[RFC5884](#)]. For SR-MPLS environment applicability and use of these OAM tools defined in [[RFC8287](#)] and [[I-D.mirsky-spring-bfd](#)] respectively. Both LSP Ping and BFD can be used either with IP/UDP encapsulation or in Generic Associated Channel (G-ACh) [[RFC5586](#)]. The use of IP/UDP encapsulation is well-understood and has been defined in [[RFC8029](#)]:

The IP header is set as follows: the source IP address is a routable address of the sender; the destination IP address is a (randomly chosen) IPv4 address from the range 127/8 or an IPv6

address from the range 0:0:0:0:0:FFFF:7F00:0/104. The IP TTL is set to 1. The source UDP port is chosen by the sender.

Using the sender's routable address enables the receiver to send an echo reply or BFD control packets over the IP network. In some environments, the overhead of extra IP/UDP encapsulations may be considered as overburden and make to use more compact G-ACh encapsulation instead. In such a case, the OAM control packet MUST be immediately followed by the IP Address TLV [[I-D.mirsky-mpls-p2mp-bfd](#)] with its Value field containing one of the routable IP addresses of the sender.

[3.2.](#) Performance Monitoring OAM in SR-MPLS over IP

Performance monitoring in SR-MPLS over IP may be performed using mechanisms defined in [[RFC6374](#)].

[4.](#) Security Considerations

This document does not introduce new security aspects but inherits all security considerations from [[RFC8287](#)], [[RFC8029](#)], [[RFC5884](#)], [[I-D.mirsky-spring-bfd](#)].

[5.](#) IANA Considerations

[5.1.](#) Source MEP ID IP Address Type

TBD.

[6.](#) Acknowledgements

TBD

[7.](#) Normative References

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