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Segment Routing Header encapsulation for In-situ OAM Data
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Abstract

OAM and PM information from the SR endpoints can be piggybacked in the data packet. The OAM and PM information piggybacking in the data packets is also known as In-situ OAM (IOAM). IOAM records operational and telemetry information in the data packet while the packet traverses a path between two points in the network. This document defines how IOAM data fields are transported as part of the Segment Routing with IPv6 data plane (SRv6) header.

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1. Introduction

OAM and PM information from the SR endpoints can be piggybacked in the data packet. The OAM and PM information piggybacking in the data packets is also known as In-situ OAM (IOAM). IOAM records OAM information within the packet while the packet traverses a particular network domain. The term "in-situ" refers to the fact that the IOAM data fields are added to the data packets rather than being sent within probe packets specifically dedicated to OAM.

This document defines how IOAM data fields are transported as part of the Segment Routing with IPv6 data plane (SRv6) header [I-D.6man-segment-routing-header].

The IOAM data fields carried are defined in [I-D.ietf-ippm-ioam-data], and can be used for various use-cases including Performance Measurement (PM) and Proof-of-Transit (PoT).

2. Conventions

2.1. Requirement 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 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2.2. Abbreviations

Abbreviations used in this document:

IOAM In-situ Operations, Administration, and Maintenance

OAM Operations, Administration, and Maintenance

PM Performance Measurement

PoT Proof-of-Transit

SR Segment Routing

SRH SRv6 Header

SRv6 Segment Routing with IPv6 Data plane

RESERVED: 8-bit reserved field MUST be set to zero upon transmission and ignored upon receipt.

IOAM Option and Data Space: IOAM option header and data is present as defined by the IOAM-Type field, and is defined in Section 4 of [I-D.ietf-ippm-ioam-data].

4. Procedure

This section summarizes the procedure for IOAM data encapsulation in SRv6 SRH. The SR nodes implementing the IOAM functionality follows the MTU and other considerations outlined in [I-D.6man-extension-header-insertion].

4.1. Ingress Node

As part of the SRH encapsulation, the ingress node of an SR domain or an SR Policy [I-D.ietf-spring-segment-routing-policy] MAY add the IOAM TLV in the SRH of the data packet. If an ingress node supports IOAM functionality and, based on a local configuration, wants to collect IOAM data, it adds IOAM TLV in the SRH. Based on the size of the segment list (SL), the ingress node preallocates space in the IOAM TLV.

If IOAM data from the last node in the segment-list (Egress node) is desired, the ingress uses an Ultimate Segment Pop (USP) SID advertised by the Egress node.

The ingress node MAY also insert the IOAM data about the local information in the IOAM TLV in the SRH at index 0 of the preallocated IOAM TLV.

4.2. Intermediate SR Segment Endpoint Node

The SR segment endpoint node is any node receiving an IPv6 packet where the destination address of that packet is a local SID. As part of the SR Header processing as described in [I-D.ietf-6man-segment-routing-header] and [I-D.ietf-spring-srv6-network-programming], the SR Segment Endpoint node performs the following IOAM operations.

If an intermediate SR segment endpoint node is not capable of processing IOAM TLV, it simply ignores it. I.e., it does not have to look or process SRH TLV.

If an intermediate SR segment endpoint node is capable of processing IOAM TLV and the local SID supports IOAM data recording, it checks if any SRH TLV is present in the packet using procedures defined in [I-D.ietf-6man-segment-routing-header]. If the node finds IOAM TLV in the SRH it finds the local index at which it is expected to record the IOAM data. The local index is found using the SRH.SL field. The node records the IOAM data at the desired preallocated space.

4.3. Egress Node

The Egress node is the last node in the segment-list of the SRH. When IOAM data from the Egress node is desired, a USP SID advertised by the Egress node is used by the Ingress node.

The processing of IOAM TLV at the Egress node is similar to the processing of IOAM TLV at the SR Segment Endpoint Node. The only difference is that the Egress node may telemeter the IOAM data to an external entity.

5. IANA Considerations

IANA is requested to allocate a mutable SRH TLV Type for IOAM TLV data fields under registry name "Segment Routing Header TLVs" requested by [I-D.6man-segment-routing-header].

SRH TLV Type	Description	Reference
TBA1 Greater than 128	TLV for IOAM Data Fields	This document

6. Security Considerations

The security considerations of SRv6 are discussed in [I-D.spring-srv6-network-programming] and [I-D.6man-segment-routing-header], and the security considerations of IOAM in general are discussed in [I-D.ietf-ippm-ioam-data].

IOAM is considered a "per domain" feature, where one or several operators decide on leveraging and configuring IOAM according to their needs. Still, operators need to properly secure the IOAM domain to avoid malicious configuration and use, which could include injecting malicious IOAM packets into a domain.

7. Acknowledgements

The authors would like to thank Shwetha Bhandari and Vengada Prasad Govindan for the discussions on IOAM.

8. References

8.1. Normative References

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8.2. Informative References

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In-situ OAM SRv6 encapsulation

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