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Controlled Return Path for Service Function Chain (SFC) OAM
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Abstract

This document defines extensions to the Service Function Chain (SFC) Operation, Administration and Maintenance (OAM) that enable control of the Echo Reply return path by specifying it as Reverse Service Function Path. Enforcing the specific return path can be used to verify bidirectional connectivity of SFC and increase the robustness of SFC OAM.

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1. Introduction

While Service Function Chain (SFC) Echo Request, defined in [I-D.ietf-sfc-multi-layer-oam], always traverses the SFC it directed to, the corresponding Echo Reply is sent over IP network [I-D.ietf-sfc-multi-layer-oam]. There are scenarios when it is beneficial to direct the responder to use a path other than the IP network. This document defines extensions to the Service Function Chain (SFC) Operation, Administration and Maintenance (OAM) that enable control of the Echo Reply return path by specifying it as Reply Service Function Path. This document defines a new Type-Length-Value (TLV), Reply Service Function Path TLV, for Reply via Specified Path mode of SFC Echo Reply (Section 4).

The Reply Service Function Path TLV can provide an efficient mechanism to test SFCs, such as bidirectional and hybrid SFC, as these were defined in Section 2.2 [RFC7665]. For example, it allows an operator to test both directions of the bidirectional or hybrid SFP with a single SFC Echo Request/Echo Reply operation.

2. Conventions used in this document

2.1. Terminology

SF - Service Function

SFF - Service Function Forwarder

SFC - Service Function Chain, an ordered set of some abstract SFs.

SFP - Service Function Path

SPI - Service Path Index

OAM - Operation, 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. Extension

Following reply modes had been defined in [I-D.ietf-sfc-multi-layer-oam]:

- o Do Not Reply
- o Reply via an IPv4/IPv6 UDP Packet
- o Reply via Application Level Control Channel
- o Reply via Specified Path

The Reply via Specified Path mode is intended to enforce the use of the particular return path specified in the included TLV. This mode may help to verify bidirectional continuity or increase the robustness of the monitoring of the SFC by selecting a more stable path. In the case of SFC, the sender of Echo Request instructs the destination SFF to send Echo Reply message along the SFP specified in the SFC Reply Path TLV as described in Section 4.

4. SFC Reply Path TLV

The SFC Reply Path TLV carries the information that sufficiently identifies the return SFP that the SFC Echo Reply message is expected to follow. The format of SFC Reply Path TLV is shown in Figure 1.

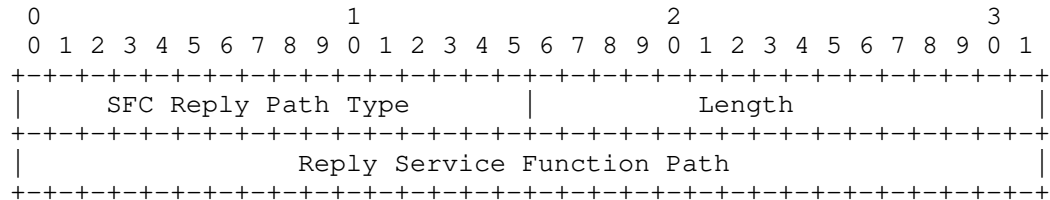


Figure 1: SFC Reply TLV Format

where:

- o Reply Path TLV Type: is two octets long, indicates the TLV that contains information about the SFC Reply path.
- o Length: is two octets long, MUST be equal to 4
- o Reply Service Function Path is used to describe the return path that an SFC Echo Reply is requested to follow.

The format of the Reply Service Function Path field displayed in Figure 2

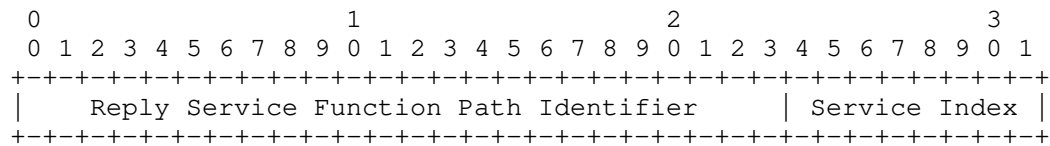


Figure 2: Reply Service Function Path Field Format

where:

- o Reply Service Function Path Identifier: SFP identifier for the path that the SFC Echo Reply message is requested to be sent over.
- o Service Index: used for forwarding in the reply SFP.

5. Theory of Operation

[RFC7110] defined mechanism to control return path for MPLS LSP Echo Reply. In case of SFC, the return path is a SFP along which SFC Echo Reply message MUST be transmitted. Hence, the SFC Reply Path TLV included in the SFC Echo Request message MUST sufficiently identify the SFP that the sender of the Echo Request message expects the receiver to use for the corresponding SFC Echo Reply.

When sending an Echo Request, the sender MUST set the value of Reply Mode field to "Reply via Specified Path", defined in [I-D.ietf-sfc-multi-layer-oam], and if the specified path is SFC path, the Request MUST include SFC Reply Path TLV. The SFC Reply Path TLV includes identifier of the reverse SFP and an appropriate Service Index.

Echo Reply is expected to be sent by the destination SFF of the SFP being tested or by the SFF at which SFC TTL expires as defined [RFC8300]. The processing described below equally applies in both cases and referred to as responding SFF.

If the Echo Request message with SFC Reply Path TLV, received by the responding SFF, has Reply Mode value of "Reply via Specified Path" but no SFC Reply Path TLV is present, then the responding SFF MUST send Echo Reply with Return Code set to "Reply Path TLV is missing" value (TBA2). If the responding SFF cannot find requested SFP it MUST send Echo Reply with Return Code set to "Reply SFP was not found" and include the SFC Reply Path TLV from the Echo Request message.

5.1. Bi-directional SFC Case

Ability to specify the return path to be used for Echo Reply is handy in bi-directional SFC. For bi-directional SFC, since the last SFF of the forward SFP may not co-locate with a classifier of the reverse SFP, it is assumed that the last SFF doesn't know the reply path of a SFC. So even for bi-directional SFC, a reverse SFP also need to be indicated in reply path TLV in echo request message.

6. Security Considerations

Security considerations discussed in [RFC8300] apply to this document.

In addition, the SFC Return Path extension, defined in this document, can be used for potential "proxying" attacks. For example, an echo request initiator may specify a return path that has a destination different from that of the initiator. But usually, such attacks will

not happen in an SFC domain where the initiators and receivers belong to the same domain, as specified in [RFC7665]. Even if the attack occurs, in order to prevent using the SFC Return Path extension for proxying any possible attacks, the return path SFP SHOULD have a path to reach the sender of the echo request, identified in SFC Source TLV [I-D.ietf-sfc-multi-layer-oam]. The receiver MAY drop the echo request when it cannot determine whether the return path SFP has the route to the initiator. That means, when sending echo request, the sender SHOULD choose a proper source address according to specified return path SFP to help the receiver to make the decision.

7. IANA Considerations

7.1. SFC Return Path Type

IANA is requested to assign from its SFC Echo Request/Echo Reply TLV registry new type as follows:

Value	Description	Reference
TBA1	SFC Reply Path Type	This document

Table 1: SFC Return Path Type

7.2. New Return Codes

IANA is requested to assign new return codes from the SFC Echo Request/Echo Reply Return Codes registry as following:

Value	Description	Reference
TBA2	Reply Path TLV is missing	This document
TBA3	Reply SFP was not found	This document

Table 2: SFC Echo Reply Return Codes

8. References

8.1. Normative References

- [I-D.ietf-sfc-multi-layer-oam]
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- [RFC7110] Chen, M., Cao, W., Ning, S., Jounay, F., and S. Delord, "Return Path Specified Label Switched Path (LSP) Ping", RFC 7110, DOI 10.17487/RFC7110, January 2014, <<https://www.rfc-editor.org/info/rfc7110>>.
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