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T. Ao
ZTE Corporation
G. Mirsky
ZTE Corp.
Z. Chen
China Telecom
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SFC OAM for path consistency
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Abstract

Service Function Chain(SFC) defines an ordered set of service functions(SFs) to be applied to packets and/or frames and/or flows selected as a result of classification. SFC Operation, Administration and Maintenance can monitor the continuity of the SFC, i.e., that all elements of the SFC are reachable to each other in the downstream direction. But SFC OAM must support verification that the order of traversing these SFs corresponds to the state defined by the SFC control plane or ochestrator, the metric referred in this document as the path consistency of the SFC. This document defines a new SFC OAM method to support SFC consistency, i.e. verification that all elements of the given SFC are being traversed in the expected order.

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1. Introduction

Service Function Chain (SFC) is a chain with a series of ordered Service Functions(SFs). Service Function Path (SFP) is a path of a SFC. SFC is described in detail in the SFC architecture document [RFC7665]. The SFs in the SFC are ordered and only when traffic is processed by one SF then it should be processed by the next SF, otherwise errors may occur. Sometimes, a SF needs to use the metadata from its upstream SF process. That's why it's very important for the operator to make sure that the order of traversing the SFs is exactly as defined by the control plane or the

orchestrator. This document refers to the correspondence between the state of control plane and the SFP itself as the SFP consistency.

This document defines the method to check the path consistency of the SFP. It is an extension of the Overlay Echo-Request/Echo-reply specified in the [I-D.ooamdt-rtgwg-demand-cc-cv].

2. Conventions used in this document

2.1. Terminology

SFC(Service Function Chain): An ordered set of some abstract SFs.

SFF: Service Function Forwarder

SF: Service Function

OAM: Operation, Administration and Maintenance

SFP: Service Function Path

COAM(Consistency OAM): OAM that can be used to check path consistency.

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. Consistency OAM: Theory of Operation

Consistency OAM uses two functions: COAM Request and COAM Reply. The SFF, that is ingress of the SFP, transmits COAM Request packet. Every intermediate SFF that receives the COAM Request MUST perform the following actions:

- collect information of traversed by the COAM Request packet SFs and send it to the ingress SFF as COAM Reply packet over IP network [I-D.wang-sfc-multi-layer-oam];

- forward the COAM Request to next downstream SFF if the one exists.

As result, the ingress SFF collects information about all traversed SFFs and SFs, information of the actual path the COAM packet has traveled, so that we can verify the path consistency of the SFC. The

mechanism for the SFP consistency verification is outside the scope of this document.

3.1. COAM packet

Consistency OAM introduces two new types of messages to the OOAM Echo Request/Reply operation [I-D.ooamdt-rtgwg-demand-cc-cv] with the following values Section 5.1:

- TBA1 - COAM Request
- TBA2 - COAM Reply

An SFF, upon receiving the Consistency OAM Request, MUST include the corresponding SFs information, Section 3.2, into the Value field of the COAM Reply packet.

The COAM packet is displayed in Figure 1.

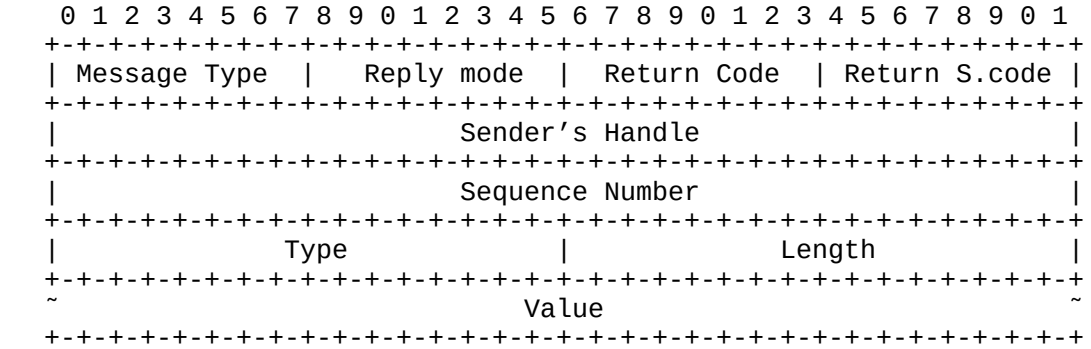

Figure 1: COAM Packet Header

3.2. SF Sub-TLV

Every SFF receiving COAM Request packet MUST include the SF characteristic data into the COAM Reply packet. The per SF data included in COAM Reply packet as SF Information sub-TLV that is displayed in Figure 2.

After the COAM traversed the SFP, all the information of the SFs on the SFP are collected in the TLVs with COAM Reply.

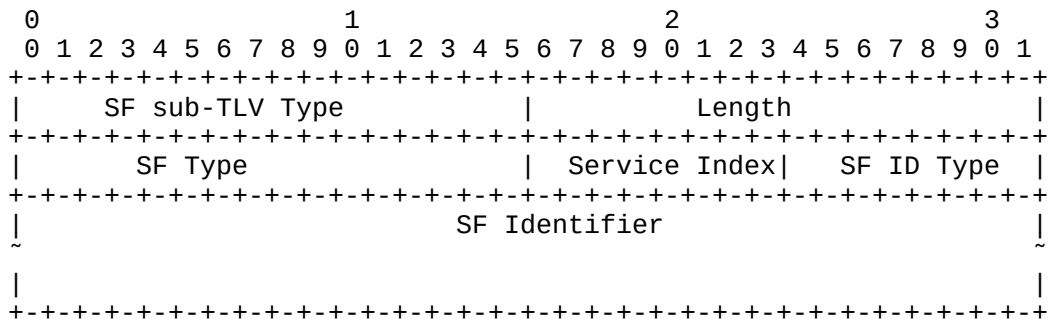

Figure 2: Service Function sub-TLV

SF TLV Type: indicate that the TLV is a SF TLV which contains the information of one SF.

SF Type: indicates the type of SF, e.g., Firewall, Deep Packet Inspection, WAN optimization controller, etc.

Service Index: indicates the SF's position on the SFP.

SF ID Type:

0x01: IPv4

0x02: IPv6

0x03: MAC address

0x04-0xFF: Reserved

SF Identifier: An identifier of the SF. The length of the SF Identifier depends on the type of the SF ID Type. For example, if the SF Identifier is its IPv4 address, the SF Identifier should be 32 bits.

4. Security Considerations

Will be added in the future updates.

5. IANA Considerations

5.1. COAM Message Types

IANA is requested to assign values from its Message Types sub-registry in Overlay Echo Request/Echo Reply Message Types registry as follows:

Value	Description	Reference
TBA1	SFP Consistency Echo Request	This document
TBA2	SFP Consistency Echo Reply	This document

Table 1: SFP Consistency Echo Request/Echo Reply Message Types

5.2. SFF Information Record TLV Type

IANA is requested to assign new type value from SFC OAM TLV Type registry as follows:

Value	Description	Reference
TBA3	SFF Information Record Type	This document

Table 2: SFF-Information Record

5.3. SF Information Sub-TLV Type

IANA is requested to assign new type value from SFC OAM TLV Type registry as follows:

Value	Description	Reference
TBA4	SF Information	This document

Table 3: SF-Information Sub-TLV Type

5.4. SF Types

IANA is requested create in the registry SF Types. All code points in the range 1 through 32759 in this registry shall be allocated according to the "IETF Review" procedure as specified in [RFC5226]. Code points in the range 32760 through 65279 in this registry shall be allocated according to the "First Come First Served" procedure as specified in [RFC5226]. Remaining code points are allocated according to the Table 4:

Value	Description	Reference
0	Reserved	This document
1- 32759	Unassigned	IETF Review
32760 - 65279	Unassigned	First Come First Served
65280 - 65519	Experimental	This document
65520 - 65534	Private Use	This document
65535	Reserved	This document

Table 4: SF Type Registry

This document defines the following new value in SF Type registry:

Value	Description	Reference
TBA5	Firewall	This document

Table 5: SF Types

5.5. SF Identifier Types

IANA is requested create in the registry SF Types the new sub-registry SF Identifier Types. All code points in the range 1 through 191 in this registry shall be allocated according to the "IETF Review" procedure as specified in [RFC5226] and assign values as follows:

Value	Description	Reference
0	Reserved	This document
TBA6	IPv4	This document
TBA7	IPv6	This document
TBA8	MAC	This document
TBA8+1-191	Unassigned	IETF Review
192-251	Unassigned	First Come First Served
252-254	Unassigned	Private Use
255	Reserved	This document

Table 6: SF Identifier Type

6. References

6.1. Normative References

[I-D.ooamdt-rtgwg-demand-cc-cv]
Mirsky, G., Kumar, N., Kumar, D., Chen, M., Yizhou, L., and D. Dolson, "Echo Request and Echo Reply for Overlay Networks", draft-ooamdt-rtgwg-demand-cc-cv-03 (work in progress), March 2017.

[I-D.wang-sfc-multi-layer-oam]
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[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 5226, DOI 10.17487/RFC5226, May 2008, <http://www.rfc-editor.org/info/rfc5226>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <http://www.rfc-editor.org/info/rfc8174>.

6.2. Informational References

[RFC7665] Halpern, J., Ed. and C. Pignataro, Ed., "Service Function Chaining (SFC) Architecture", RFC 7665, DOI 10.17487/RFC7665, October 2015, <http://www.rfc-editor.org/info/rfc7665>.

Authors' Addresses

Ting Ao
ZTE Corporation
No.889, BiBo Road
Shanghai 201203
China

Phone: +86 21 68897642
Email: ao.ting@zte.com.cn

Greg Mirsky
ZTE Corp.
1900 McCarthy Blvd. #205
Milpitas, CA 95035
USA

Email: gregimirsky@gmail.com

Zhonghua Chen
China Telecom
No.1835, South PuDong Road
Shanghai 201203
China

Phone: +86 18918588897
Email: 18918588897@189.cn