SPRING Working Group
Internet-Draft
Intended status: Standards Track
Expires: January 13, 2022

F. Yang
T. Zhou
Y. Wang
Huawei Technologies

July 12, 2021

ACH6 for OAM in Segment Routing
draft-yang-spring-ach6-oam-sr-00

Abstract

This document defines an OAM toolset encapsulated in ACH6 to provide the functions of performance measurement, continuity check and verification to an SRv6 path.

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.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on January 13, 2022.

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1. Introduction

ACH6 [I-D.yang-spring-ach6-sr] provides a method of supporting an OAM toolset with a unified TLV format in Segment Routing over IPv6 network. There are several advantages:

- An Associated Channel ID in ACH6 provides a unified identifier to OAM sessions for a specific SRv6 path.

- In Segment Routing networks, ACH6 TLV is proposed to be encapsulated in IPv6 Destination Options Header. Together with IPv6 Segment Routing Header, OAM functions like continuity check and performance management can be monitored either hop-by-hop on every SR endpoint or end-to-end from the first endpoint to the last.

- By leveraging native semantics of IPv6 extension headers, ACH6 OAM messages target to be processed in fast path to improve OAM accuracy and efficiency.

- By leveraging native semantics of IPv6 extension headers, ACH6 OAM can help network nodes reduce OAM configurations and session management.

In this method, ACH6 OAM categorizes OAM functionalities into three types of messages, including On-demand Echo Request/Reply, Proactive Continuity Check and Performance Measurement.

2. Terminology

This document uses the following terms:

OAM: Operations, Administration, and Maintenance

ACH6: Associated CHannel over IPv6

3. ACH6 OAM for SRv6

3.1. ACH6 OAM Message

Figure 1 defines the format of ACH6 OAM message.

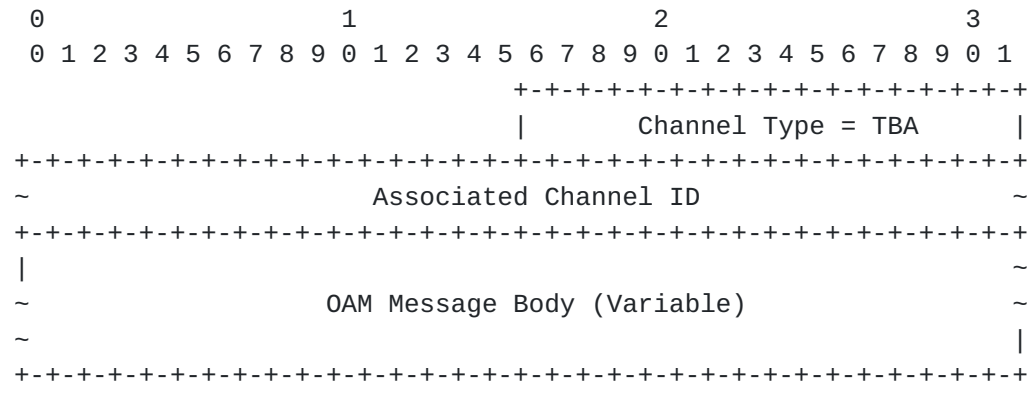

Figure 1 ACH6 OAM Message Format

ACH6 Channel Type indicates which type of OAM message is encapsulated in the following OAM message body, and OAM message body contains the OAM messages. Three types of OAM messages are defined:

- TBA 1 = On-demand Echo Request/Reply
- TBA 2 = Proactive Continuity Check
- TBA 3 = Performance Measurement

3.2. ACH6 On-Demand Echo Request/Reply

On-demand Echo Request/Reply provides a method of on-demand continuity check and connectivity verification. Figure 2 defines ACH6 OAM format of On-demand Echo Request/Reply message.

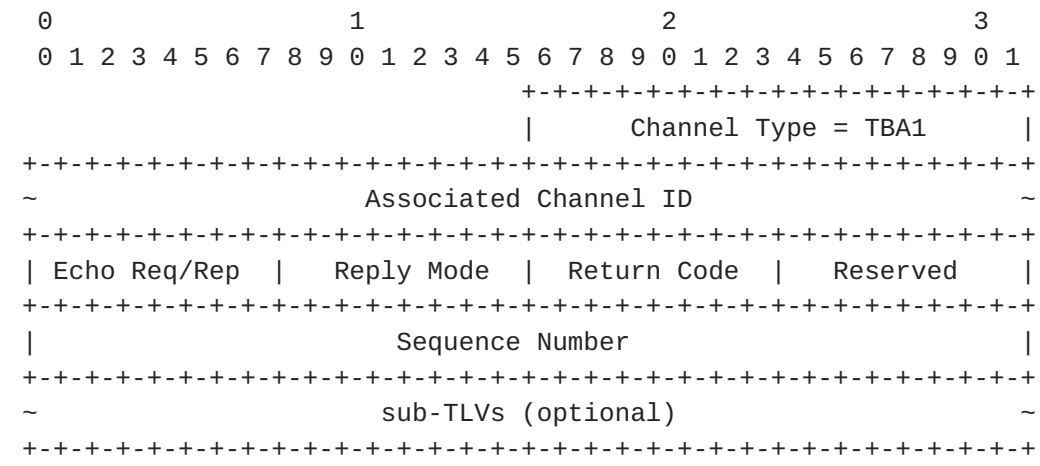

Figure 2 ACH6 OAM On Demand Echo Request/Reply Message

Associated Channel ID: indicates the identifier of OAM session.

Message Type:

- 1 = Echo Request
- 2 = Echo Reply

Reply Mode:

- 1 = Do not reply
- 2 = Reply via an IPv6 UDP packet
- 3 = Reply via an IPv6 packet without payload
- 4 = Reply via application-level control channel

Return code:

- 0 = No return code
- 1 = Malformed echo request received
- 2 = One or more of the TLVs was not understood
- 3 = Packet-rorward-success
- 4 = No route to destination
- 5 = Communication with destination administratively prohibited

- 6 = Beyond scope of source address
- 7 = Address unreachable
- 8 = Port unreachable
- 9 = Source address failed ingress/egress policy
- 10 = Reject route to destination
- 11 = Exceeding the minimum IPv6 MTU
- 12 = Hop limit exceeded in transit
- 13 = Fragment reassembly time exceeded
- 14 = Erroneous header field encountered
- 15 = Unrecognized Next Header type encountered
- 16 = Unrecognized IPv6 option encountered

Sequence number: is allocated by the sender of echo request to detect whether the reply packet is lost.

3.3. ACH6 Proactive Continuity Check

Proactive Continuity Check provides a method of proactive continuity check to continuously detect the path status and fault. Figure 3 defines ACH6 OAM format of Proactive Continuity Check message.

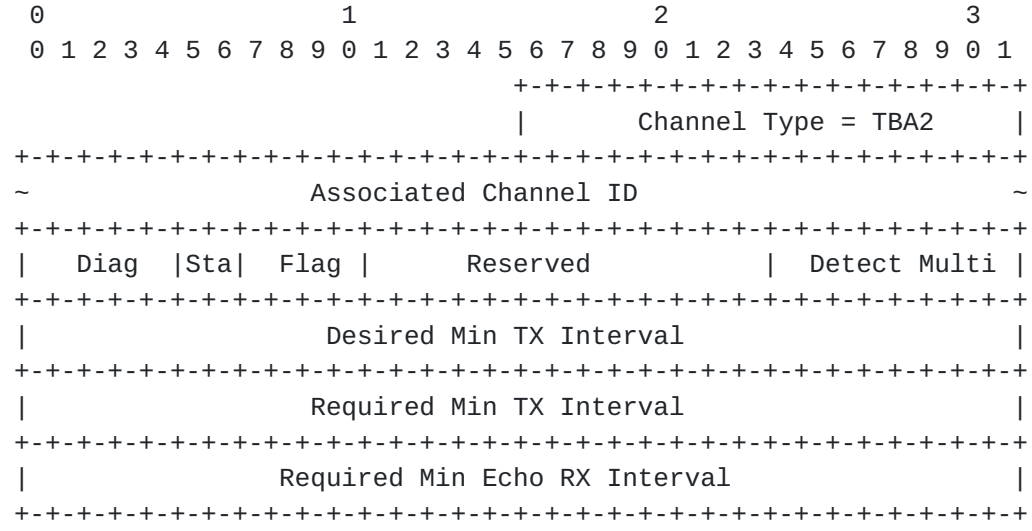

Figure 3 ACH6 OAM ProCC Message

Associated Channel ID: indicates the identifier of OAM session.

Diag:

- 0 = no diagnostic
- 1 = control detection time expired
- 2 = echo function failed
- 3 = neighbor signaled session down
- 4 = forwarding plane reset
- 5 = path down
- 6 = concatenated path down
- 7 = administratively down
- 8 = reverse concatenated path down
- 9-31 = reserved for future use

State:

- 0 = adminDown
- 1 = down
- 2 = Init
- 3 = up

Flag:

- P flag: if set, the transmitting node is requesting verification of connectivity, or of a parameter change, and is expecting a packet with the F bit in reply. If clear, the transmitting node is not requesting verification.

- F flag: if set, the transmitting node is responding to a received Proactive Continuity Check packet that had the P bit set. If clear, the transmitting node is not responding to a requesting packet that had the P bit set.

- D flag: if set, Demand mode is active in the transmitting node. The node wishes to operate in Demand mode and direct the remote

node to cease the periodic transmission of Proactive Continuity Check packets. If clear, Demand mode is not active in the transmitting node.

- o M flag: this bit is reserved for future point-to-multipoint extensions to ACH6 Proactive Continuity Check. It MUST be zero on both transmit and receipt.

Detect Mult: detection time multiplier.

Desired Min TX Interval: this is the minimum interval, in microseconds, that the local system would like to use when transmitting ACH6 Proactive Continuity Check packets.

Required Min RX Interval: this is the minimum interval, in microseconds, between received ACH6 Proactive Continuity Check packets that this system is capable of supporting, less any jitter applied by the sender.

Required Min Echo RX Interval: this is the minimum interval, in microseconds, between received Echo packets that this system is capable of supporting, less any jitter applied by the sender.

3.4. ACH6 Performance Measurement

Performance Measurement provides a method of measuring packet loss and delay. Figure 4 defines ACH6 OAM format of Performance Measurement message.

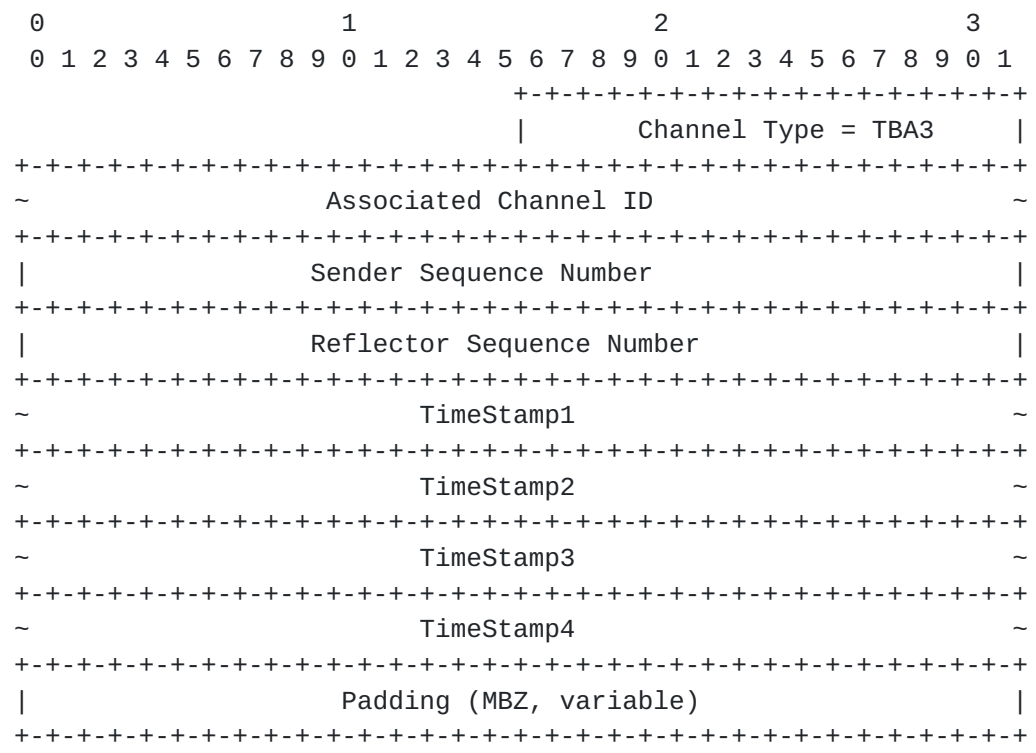

Figure 4 ACH6 OAM Performance Measurement Message

Associated Channel ID: indicates the identifier of OAM session.

Sender Sequence Number: the counter of performance measurement test packets sent from sender

Reflector Sequence Number: the counter of performace measurement test packets set by reflector

Timestamp 1-4: When a query is sent from A, timestamp 1 is set to T1, timestamp 2-4 fields are set to 0. When the query is received at B, timestamp 2 is set to T2. In this case, B copies timestamp 1 to timestamp 3, copies timestamp 2 to timestamp 4, and initializes timestamp 1 and timestamp 2 to 0. When B sends a response, timestamp 1 is set to T3. When a response is received at A, timestamp 2 is set to T4.

4. IANA Considerations

- This document requests IANA to assign a codepoint of On-demand Echo Request/Reply of ACH6 Channel Types.

- This document requests IANA to assign a codepoint of Proactive Continuity Check of ACH6 Channel Types.

- This document requests IANA to assign a codepoint of Performance Measurement of ACH6 Channel Types.

5. Security Considerations

TBD

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>.

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

7.2. Informative References

[I-D.yang-spring-ach6-sr] Yang, F. and T. Zhou, "ACH6 in Segment Routing", draft-yang-spring-ach6-sr-00 (work in progress), July 2021.

Authors' Addresses

Fan Yang
Huawei Technologies
Beijing
China

Email: shirley.yangfan@huawei.com

Tianran Zhou
Huawei Technologies
Beijing
China

Email: zhoutianran@huawei.com

Yali Wang
Huawei Technologies
Beijing
China

Email: wangyali11@huawei.com