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S. Bhandari
F. Brockners
C. Pignataro
Cisco
H. Gredler
RtBrick Inc.
J. Leddy
Comcast
S. Youell
JMPC
T. Mizrahi
Huawei Network.IO Innovation Lab
A. Kfir
B. Gafni
Mellanox Technologies, Inc.
P. Lapukhov
Facebook
M. Spiegel
Barefoot Networks, an Intel company
S. Krishnan
Kaloom
R. Asati
Cisco
March 08, 2020

In-situ OAM IPv6 Options
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Abstract

In-situ Operations, Administration, and Maintenance (IOAM) records operational and telemetry information in the packet while the packet traverses a path between two points in the network. This document outlines how IOAM data fields are encapsulated in IPv6.

Status of This Memo

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[1.](#) Introduction

In-situ Operations, Administration, and Maintenance (IOAM) records operational and telemetry information in the packet while the packet traverses a path between two points in the network. This document outlines how IOAM data fields are encapsulated in the IPv6 [[RFC8200](#)].

[2.](#) Conventions

2.1. 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.

2.2. Abbreviations

Abbreviations used in this document:

E2E: Edge-to-Edge

IOAM: In-situ Operations, Administration, and Maintenance

OAM: Operations, Administration, and Maintenance

POT: Proof of Transit

3. In-situ OAM Metadata Transport in IPv6

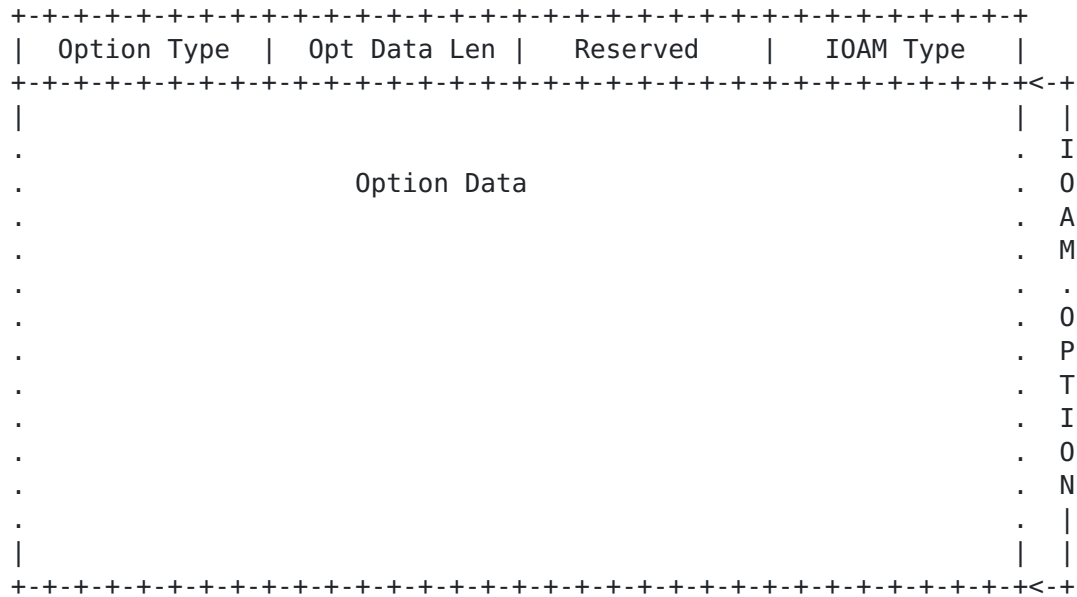
In-situ OAM in IPv6 is used to enhance diagnostics of IPv6 networks. It complements other mechanisms proposed to enhance diagnostics of IPv6 networks, such as the IPv6 Performance and Diagnostic Metrics Destination Option described in [\[RFC8250\]](#).

IOAM data fields are encapsulated in "option data" fields of two types of extension headers in IPv6 packets - either Hop-by-Hop Options header or Destination options header. The selection of a particular extension header type depends on IOAM usage, as described in section 4 of [\[I-D.ietf-ippm-ioam-data\]](#). Multiple options with the same Option Type MAY appear in the same Hop-by-Hop Options or Destination Options header, with varying content.

In order for IOAM to work in IPv6 networks, IOAM MUST be explicitly enabled per interface on every node within the IOAM domain. Unless a particular interface is explicitly enabled (i.e. explicitly configured) for IOAM, a router MUST drop packets which contain extension headers carrying IOAM data-fields. This is the default behavior and is independent of whether the Hop-by-Hop options or Destination options are used to encode the IOAM data. This ensures that IOAM data does not unintentionally get forwarded outside the IOAM domain.

An IPv6 packet carrying IOAM data in an Extension header can have other extension headers, compliant with [\[RFC8200\]](#).

IPv6 Hop-by-Hop and Destination Option format for carrying in-situ OAM data fields:



Option Type: 8-bit identifier of the type of option.

Opt Data Len: 8-bit unsigned integer. Length of the Reserved and Option Data field of this option, in octets.

Reserved: 8-bit field MUST be set to zero upon transmission and ignored upon reception.

IOAM Type: 8-bit field as defined in section 7.2 in [\[I-D.ietf-ippm-ioam-data\]](#).

Option Data: Variable-length field. Option-Type-specific data.

In-situ OAM Options are inserted as Option data as follows:

1. Pre-allocated Tracing Option: The in-situ OAM Preallocated Tracing option defined in [\[I-D.ietf-ippm-ioam-data\]](#) is represented as a IPv6 option in hop by hop extension header:

Option Type: 001xxxxx 8-bit identifier of the IOAM type of option. xxxxx=TBD.

IOAM Type: IOAM Pre-allocated Trace Option Type.

2. Incremental Tracing Option: The in-situ OAM Incremental Tracing option defined in [[I-D.ietf-ippm-ioam-data](#)] is represented as a IPv6 option in hop by hop extension header:

Option Type: 001xxxxx 8-bit identifier of the IOAM type of option. xxxxx=TBD.

IOAM Type: IOAM Incremental Trace Option Type.

3. Proof of Transit Option: The in-situ OAM POT option defined in [[I-D.ietf-ippm-ioam-data](#)] is represented as a IPv6 option in hop by hop extension header:

Option Type: 001xxxxx 8-bit identifier of the IOAM type of option. xxxxx=TBD.

IOAM Type: IOAM POT Option Type.

4. Edge to Edge Option: The in-situ OAM E2E option defined in [[I-D.ietf-ippm-ioam-data](#)] is represented as a IPv6 option in IPv6 option in destination options extension header:

Option Type: 000xxxxx 8-bit identifier of the IOAM type of option. xxxxx=TBD.

IOAM Type: IOAM E2E Option Type.

All the in-situ OAM IPv6 options defined here have alignment requirements. Specifically, they all require 4n alignment. This ensures that 4 octet fields specified in [[I-D.ietf-ippm-ioam-data](#)] such as transit delay are aligned at a multiple-of-4 offset from the start of the Hop-by-Hop Options header. In addition, to maintain IPv6 extension header 8-octet alignment and avoid the need to add or remove padding at every hop, the Trace-Type for Incremental Tracing Option in IPv6 MUST be selected such that the IOAM node data length is a multiple of 8-octets.

An outline of how the options defined here can be enabled and used in an IPv6 network is provided in [[I-D.ioametal-ippm-6man-ioam-ipv6-deployment](#)].

4. Security Considerations

This document describes the encapsulation of IOAM data fields in IPv6. Security considerations of the specific IOAM data fields for each case (i.e., Trace, Proof of Transit, and E2E) are described in defined in [[I-D.ietf-ippm-ioam-data](#)].

As this document describes new options for IPv6 , these are similar to the security considerations of [RFC8200] and the new weakness documented in [RFC8250].

5. IANA Considerations

This draft requests the following IPv6 Option Type assignments from the Destination Options and Hop-by-Hop Options sub-registry of Internet Protocol Version 6 (IPv6) Parameters.

<http://www.iana.org/assignments/ipv6-parameters/ipv6-parameters.xhtml#ipv6-parameters-2>

Hex Value	Binary Value			Description	Reference
	act	chg	rest		
TBD_1_0	00	0	TBD_1	IOAM	[This draft]
TBD_1_1	00	1	TBD_1	IOAM	[This draft]

6. Acknowledgements

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7. References

7.1. Normative References

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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, <<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.ioametal-ippm-6man-ioam-ipv6-deployment]
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Authors' Addresses

Shwetha Bhandari
Cisco Systems, Inc.
Cessna Business Park, Sarjapura Marathalli Outer Ring Road
Bangalore, KARNATAKA 560 087
India

Email: shwethab@cisco.com

Frank Brockners
Cisco Systems, Inc.
Kaiserswerther Str. 115,
RATINGEN, NORDRHEIN-WESTFALEN 40880
Germany

Email: fbrockne@cisco.com

Carlos Pignataro
Cisco Systems, Inc.
7200-11 Kit Creek Road
Research Triangle Park, NC 27709
United States

Email: cpignata@cisco.com

Hannes Gredler
RtBrick Inc.

Email: hannes@rtbrick.com

John Leddy
Comcast

Email: John_Leddy@cable.comcast.com

Stephen Youell
JP Morgan Chase
25 Bank Street
London E14 5JP
United Kingdom

Email: stephen.youell@jpmorgan.com

Tal Mizrahi
Huawei Network.IO Innovation Lab
Israel

Email: tal.mizrahi.phd@gmail.com

Aviv Kfir
Mellanox Technologies, Inc.
350 Oakmead Parkway, Suite 100
Sunnyvale, CA 94085
U.S.A.

Email: avivk@mellanox.com

Barak Gafni
Mellanox Technologies, Inc.
350 Oakmead Parkway, Suite 100
Sunnyvale, CA 94085
U.S.A.

Email: gbarak@mellanox.com

Petr Lapukhov
Facebook
1 Hacker Way
Menlo Park, CA 94025
US

Email: petr@fb.com

Mickey Spiegel
Barefoot Networks, an Intel company
4750 Patrick Henry Drive
Santa Clara, CA 95054
US

Email: mickey.spiegel@intel.com

Suresh Krishnan
Kaloom

Email: suresh@kaloom.com

Rajiv Asati
Cisco Systems, Inc.
7200 Kit Creek Road
Research Triangle Park, NC 27709
US

Email: rajiva@cisco.com