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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:

OAM: Operations, Administration, and Maintenance

IOAM: In-situ OAM

POT: Proof of Transit

E2E: Edge-to-Edge

[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](#)].

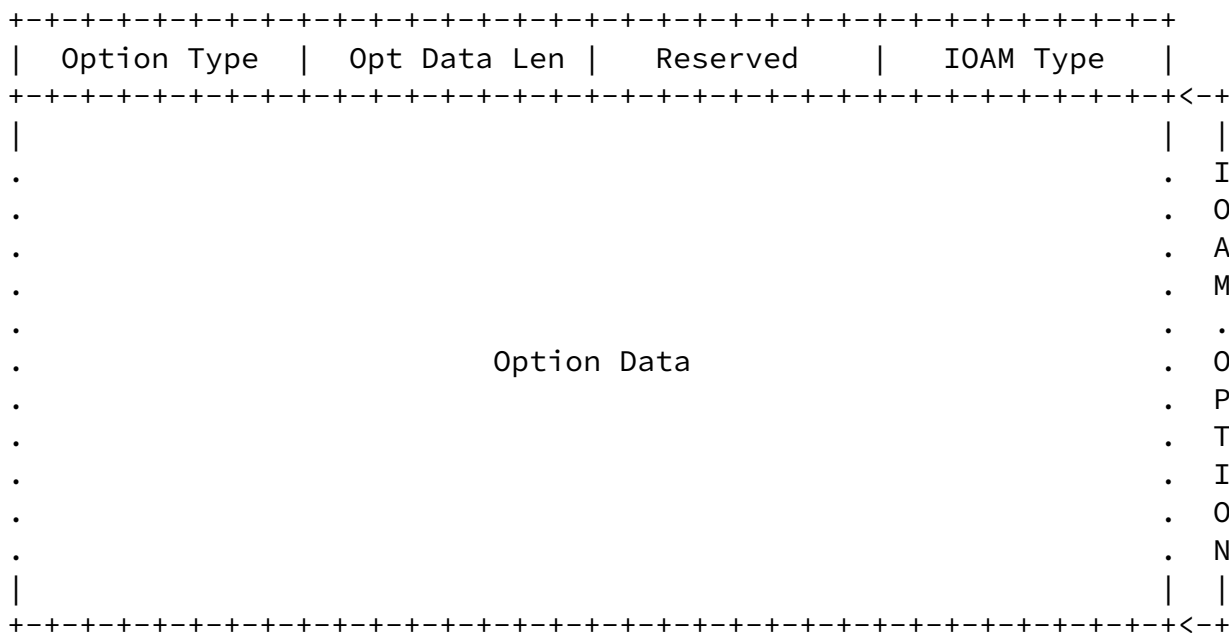
IOAM data fields are encapsulated in "option data" fields of two types of extension headers in IPv6 packets - either Hop-by-Hop Options header or Destination options header. The selection of a particular extension header type depends on IOAM usage, as described in section 4 of [[I-D.ietf-ippm-ioam-data](#)]. 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 option type identifier as defined in [Section 5](#).
Opt Data Len: 8-bit unsigned integer. Length of this option, in octets, not including the first 2 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 Trace Option: The in-situ OAM Preallocated Trace option defined in [\[I-D.ietf-ippm-ioam-data\]](#) is represented as an 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 Trace Option: The in-situ OAM Incremental Trace option defined in [\[I-D.ietf-ippm-ioam-data\]](#) is represented as an 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 an 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 an IPv6 option in Destination 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 fields specified in [[I-D.ietf-ippm-ioam-data](#)] are aligned at a multiple-of-4 offset from the start of the Hop-by-Hop and Destination 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 Trace 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 and defined in [[I-D.ietf-ippm-ioam-data](#)].

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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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[RFC8250] Elkins, N., Hamilton, R., and M. Ackermann, "IPv6 Performance and Diagnostic Metrics (PDM) Destination Option", [RFC 8250](#), DOI 10.17487/RFC8250, September 2017, <<https://www.rfc-editor.org/info/rfc8250>>.

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