ippm
Internet-Draft
Intended status: Standards Track
Expires: October 30, 2020

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April 28, 2020

EtherType Protocol Identification of In-situ OAM Data
draft-weis-ippm-ioam-eth-03

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 defines an EtherType that identifies IOAM data fields as being the next protocol in a packet, and a header that encapsulates the IOAM data fields.

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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 particular network domain. The term "in-situ" refers to the fact that the IOAM data fields are added to the data packets rather than being sent within packets specifically dedicated to OAM. This document defines how IOAM data fields are carried as part of encapsulations where the IOAM data follows a header that uses an

EtherType to denote the next protocol in the packet. Examples of these protocols are GRE [RFC2890] and Geneve [I-D.ietf-nvo3-geneve]). This document outlines how IOAM data fields are encoded in these protocols.

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

Geneve: Generic Network Virtualization Encapsulation

GRE: Generic Routing Encapsulation

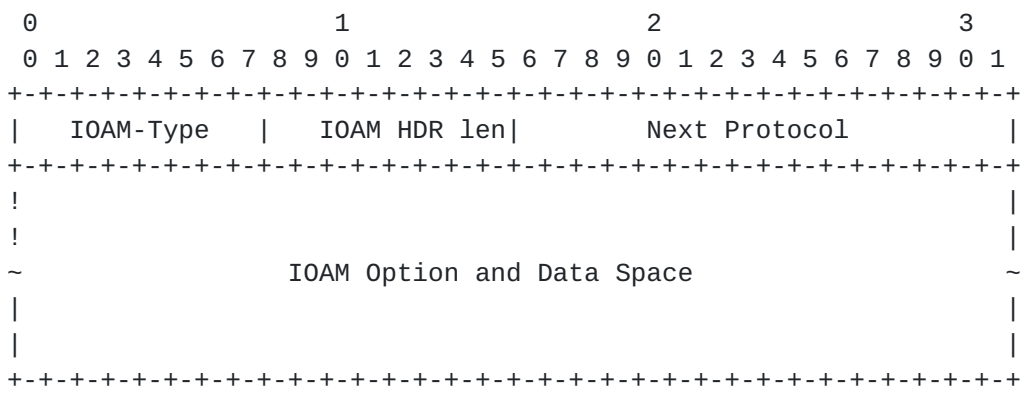
IOAM: In-situ Operations, Administration, and Maintenance

OAM: Operations, Administration, and Maintenance

POT: Proof of Transit

3. IOAM EtherType

When the IOAM data fields are included within an encapsulation that identifies the next protocol using an EtherType (e.g., GRE or Geneve) the presence of IOAM data fields are identified with TBD_IOAM. When this EtherType is used, an additional IOAM header is also included. This header indicates the type of IOAM data that follows, and the next protocol that follows the IOAM data.



The IOAM encapsulation is defined as follows.

IOAM Type: 8-bit field defining the IOAM Option type, as defined in Section 7.2 of [I-D.ietf-ippm-ioam-data].

IOAM HDR Len: 8 bit Length field contains the length of the IOAM header in 4-octet units.

Next Protocol: 16 bits Next Protocol Type field contains the protocol type of the packet following IOAM protocol header. Protocol Type is defined to be an EtherType value from [ETYPES]. An implementation receiving a packet containing a Protocol Type which is not listed in one of those registries SHOULD discard the packet.

IOAM Option and Data Space: IOAM option header and data is present as specified by the IOAM-Type field, and is defined in Section 4 of [I-D.ietf-ippm-ioam-data].

Multiple IOAM options MAY be included within the IOAM Option and Data Space. For example, if two IOAM options are included, the Next Protocol field of the first IOAM option will contain the value of TBD_IOAM, while the Next Protocol field of the second IOAM option will contain the EtherType indicating the type of the data packet.

4. Usage Examples of the IOAM EtherType

The IOAM EtherType can be used with many encapsulations. The following sections show how it can be used with GRE and Geneve.

4.1. Example: GRE Encapsulation of IOAM Data Fields

When IOAM data fields are carried in GRE, the IOAM encapsulation defined above follows the GRE header, as shown in Figure 1.

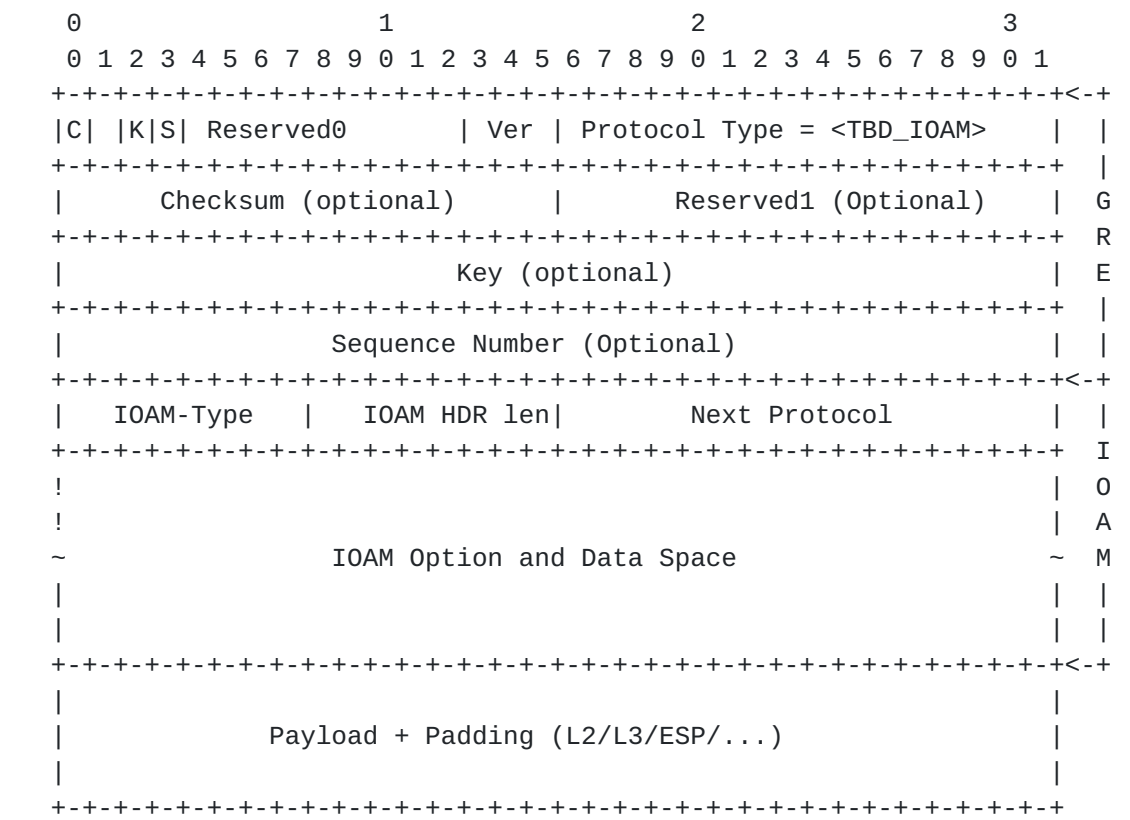


Figure 1: GRE Encapsulation Example

The GRE header and fields are defined in [RFC2890]. The GRE Protocol Type value is TBD_IOAM.

Figure 2 shows two example protocol header stacks that use GRE along with IOAM. IOAM-Option-Types (the below diagram uses "IOAM" as shorthand for IOAM-Option-Types) are sequenced in behind the GRE header that follows the "outer" IP header.

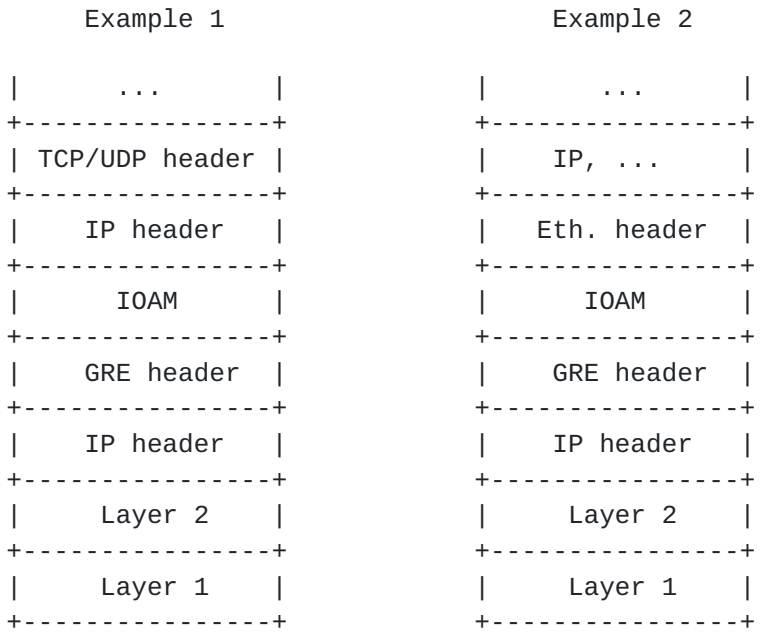


Figure 2: GRE with IOAM examples

4.2. Example: Geneve Encapsulation of IOAM Data Fields

When IOAM data fields are carried in Geneve, the IOAM encapsulation defined above follows the Geneve header, as shown in Figure 3.

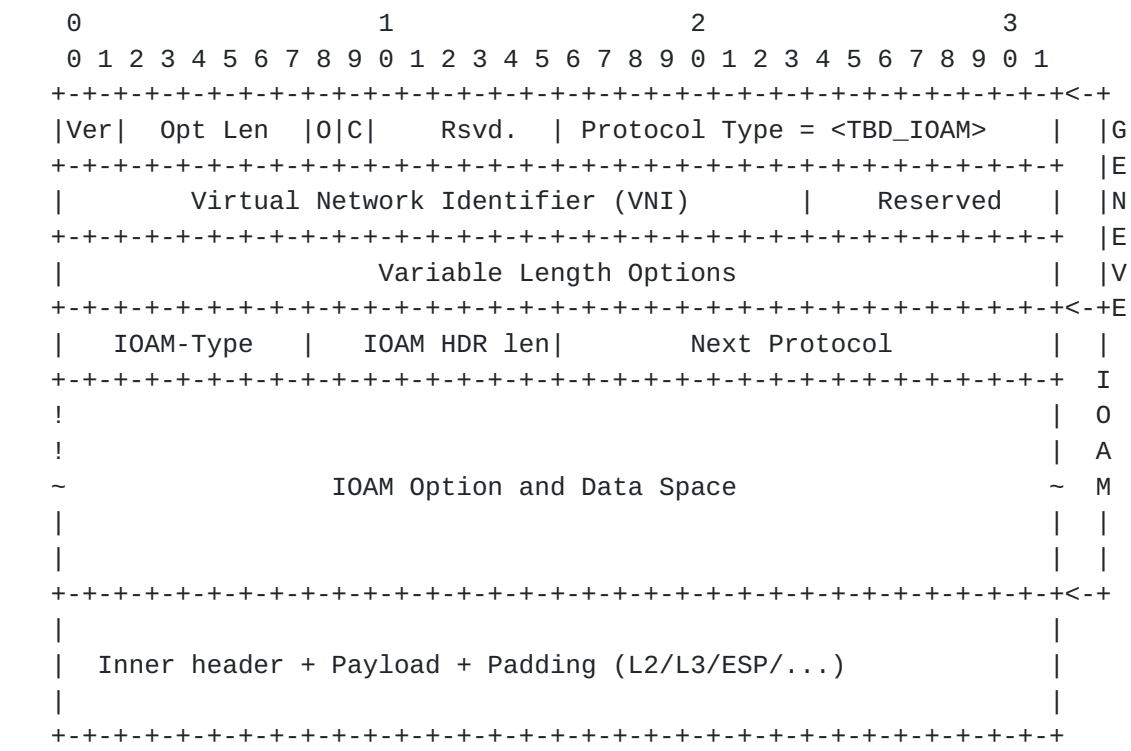


Figure 3: Geneve Encapsulation Example

The GENEVE header and fields are defined in [I-D.ietf-nvo3-geneve]. The Geneve Protocol Type value is TBD_IOAM.

5. Security Considerations

This document describes the encapsulation of IOAM data fields in GRE. 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 protocol fields within the existing GRE encapsulation, these are similar to the security considerations of [RFC2890].

IOAM data transported in an OAM E2E header SHOULD be integrity protected (e.g., with IPsec ESP [RFC4303]) to detect changes made by a device between the sending and receiving OAM endpoints.

6. IANA Considerations

A new EtherType value is requested to be added to the [ETYPES] IANA registry. The description should be "In-situ OAM (IOAM)".

7. References

7.1. Normative References

[ETYPES] "IANA Ethernet Numbers", <https://www.iana.org/assignments/ieee-802-numbers/ieee-802-numbers.xhtml>.

[I-D.ietf-ippm-ioam-data] Brockners, F., Bhandari, S., Pignataro, C., Gredler, H., Leddy, J., Youell, S., Mizrahi, T., Mozes, D., Lapukhov, P., remy@barefootnetworks.com, r., daniel.bernier@bell.ca, d., and J. Lemon, "Data Fields for In-situ OAM", draft-ietf-ippm-ioam-data-09 (work in progress), March 2020.

[I-D.ietf-nvo3-geneve] Gross, J., Ganga, I., and T. Sridhar, "Geneve: Generic Network Virtualization Encapsulation", draft-ietf-nvo3-geneve-16 (work in progress), March 2020.

[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>.

[RFC2890] Dommety, G., "Key and Sequence Number Extensions to GRE", RFC 2890, DOI 10.17487/RFC2890, September 2000, <https://www.rfc-editor.org/info/rfc2890>.

[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

[RFC4303] Kent, S., "IP Encapsulating Security Payload (ESP)", RFC 4303, DOI 10.17487/RFC4303, December 2005, <https://www.rfc-editor.org/info/rfc4303>.

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