RTGWG Working Group
Internet-Draft
Intended status: Informational
Expires: December 30, 2018

G. Mirsky
ZTE Corp.

June 28, 2018

Identification of Overlay Operations, Administration, and Maintenance (OAM)

draft-mirsky-rtgwg-oam-identify-00

Abstract

This document analyzes how the presence of Operations, Administration, and Maintenance (OAM) control command and/or special data is identified in some overlay networks, and an impact on the choice of identification may have on OAM functionality.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

Operations, Administration, and Maintenance (OAM) protocols are used to detect, localize defects in the network, and monitor network performance. Some OAM functions, e.g., failure detection, work in the network proactively, while others, e.g., defect localization, usually performed on-demand. These tasks achieved by a combination of active, passive, and hybrid OAM methods, as defined in [RFC7799].

This document analyzes how the presence of Operations, Administration, and Maintenance (OAM) control command and/or special data, i.e., OAM packet, is identified in some overlay networks, and an impact the choice of identification may have on OAM functionality of active and hybrid OAM methods for the respective overlay network encapsulation.

2. Conventions used in this document

2.1. Terminology

AMM Alternate Marking method

BIER Bit Indexed Explicit Replication

DetNet Deterministic Networks

GUE Generic UDP Encapsulation

HTS Hybrid Two-step

NSH Network Service Header

NVO3 Network Virtualization Overlays

OAM Operations, Administration and Maintenance

SFC Service Function Chaining

TLV Type-Length-Value

VXLAN-GPE Generic Protocol Extension for VXLAN

Underlay Network or Underlay Layer: The network that provides connectivity between the DetNet nodes. MPLS network providing LSP connectivity between DetNet nodes is an example of underlay layer.

2.2. Keywords

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. Overlay Network Encapsulations

New overlay network encapsulations analyzed in two groups:

- encapsulations that support optional meta-data;
- fixed-size encapsulations.

3.1. Encapsulations with Meta-data

Number of the new encapsulation protocols (e.g., Geneve [I-D.ietf-nvo3-geneve], GUE [I-D.ietf-intarea-gue], and SFC NSH [RFC8300]) support use of Type-Length-Value (TLV) encoding to include optional information into the header. The identification of OAM in these protocols is as the following:

Geneve:

O (1 bit): OAM packet. This packet contains a control message instead of a data payload. Endpoints MUST NOT forward the payload and transit devices MUST NOT attempt to interpret or process it. Since these are infrequent control messages, it is

RECOMMENDED that endpoints direct these packets to a high priority control queue (for example, to direct the packet to a general purpose CPU from a forwarding ASIC or to separate out control traffic on a NIC). Transit devices MUST NOT alter forwarding behavior on the basis of this bit, such as ECMP link selection.

GUE:

Undefined.

SFC NSH:

O bit: Setting this bit indicates an OAM packet.

Common between Geneve and NSH is the use of the dedicated flag to identify the OAM packet and, at the same time, the presence of the field that identifies the protocol of the payload that immediately follows after the encapsulation header. [RFC8393] points that if the value of that field interpreted as none, i.e., no payload follows the header, then OAM may be included in TLVs, thus creating an active OAM packet. The problem with this mechanism to support active OAM methods may be a limitation of the size of data that can be included in a TLV. For example, the maximum size of data in an NSH Meta-data Type 2, as defined in section 2.5.1 [RFC8300], is 512 octets. The maximum length of data in Geneve Option, per section 3.5 [I-D.ietf-nvo3-geneve], is 128 octets. Thus, using one TLV as active OAM packet, would not allow creating test packets of larger size, which is useful when measuring packet loss and latency with synthetic traffic as part of service activation procedure.

[I-D.ietf-sfc-oam-framework] suggests that the O bit used to identify OAM packet and the Next Protocol field identifies the OAM function:

> While the presence of OAM marker in the overlay header (e.g., O bit in the NSH header) indicates it as OAM packet, it is not sufficient to indicate what OAM function the packet is intended for.

At the same time, some of in-situ OAM proposals, e.g., [I-D.ietf-sfc-ioam-nsh], suggest using TLV to communicate hybrid OAM commands and data. The proposed resolution of using the combination of O bit and the Next Protocol field:

> ... the O bit MUST NOT be set for regular customer traffic which also carries IOAM data and the O bit MUST be set for OAM packets which carry only IOAM data without any regular data payload.

implies that the O bit only identifies the active OAM packet and not set when hybrid OAM methods used.

3.2. Fixed-size Encapsulations

Number of the new encapsulation protocols (e.g., VXLAN-GPE [I-D.ietf-nvo3-vxlan-gpe], BIER [RFC8296]) suse fixed-size header. The identification of OAM in these protocols is as the following:

VXLAN-GPE:

OAM Flag Bit (O bit): The O bit is set to indicate that the packet is an OAM packet.

BIER:

OAM packet identified by the value of the Next Protocol field. IANA BIER Next Protocol Identifiers registry includes the identifier for OAM (5).

VXLAN-GPE use of a combination of OAM Flag Bit and the Next Protocol field requires clarification of the header interpretation when the OAM Flag Bit is set and the value of the Next Protocol field is one of defined in section 3.2 of [I-D.ietf-nvo3-vxlan-gpe].

BIER encapsulation, defined in [RFC8296], identifies OAM message immediately following the BIER header by the value of the Next Protocol field.

3.3. Source Information Availability

Availability of the packet originator’s source information is required for active two-way OAM, e.g., echo request/reply. In cases when the underlay network is IPv4/IPv6 the source information will be provided by the encapsulation of the underlay. But when using MPLS underlay network encapsulation of an active OAM packet have to follow certain rules:

- o if available, use Sender ID in the overlay domain (example BFIR ID in BIER [RFC8296];
- o use IP/UDP encapsulation of an OAM packet in overlay (similar to Section 4.3 [RFC8029]).

3.4. On-path OAM

In addition to active methods, OAM toolset may include methods that don’t use specially constructed and injected in the network test packets. [RFC7799] defines OAM methods that are neither entirely active nor passive but are combine both as hybrid methods.

One of the examples of the hybrid OAM method, in-situ OAM, mentioned in Section 3.1. Another example, Alternate Marking method (AMM) [RFC8321], enables on-path OAM functions, e.g., delay and loss measurements, using the data traffic. Because AMM impact on the network can be minimized, measured metrics can be correlated to the network conditions experienced by the specific service. Of all listed in Section 3, BIER allocated the field that may be used for AMM, as discussed in [I-D.ietf-bier-pmmm-oam]. Applicability of AMM to other overlay protocols, i.e. SFC NSH discussed in [I-D.mirsky-sfc-pmamm] and Geneve [I-D.fmm-nvo3-pm-alt-mark], been actively discussed.

Hybrid Two-step (HTS), defined in [I-D.mirsky-ippm-hybrid-two-step], is provides on-path collection and transport of the telemetry information. HTS enables accurate and consistent measurements by separating the measurement action from the transport while ensuring that the follow-up packet that carries the telemetry information does follow the data packet that had triggered the measurement.

4. Conclusions

OAM control commands and data may be present as part of the overlay encapsulation header or as a payload that follows the overlay network header. The recommendations:

- o OAM in the overlay header, if supported by the overlay network, identified by the dedicated flag. Use of this method as active OAM is possible but functionality is limited.

- o OAM that follows the overlay header identified as payload type, e.g. by the value of the Next Protocol field.

5. IANA Considerations

This document does not propose any IANA consideration. This section may be removed.

6. Security Considerations

This document lists the OAM requirements for a DetNet domain and does not raise any security concerns or issues in addition to ones common to networking.

7. Acknowledgment

TBD

8. References

8.1. 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>.

8.2. Informational References

[I-D.fmm-nvo3-pm-alt-mark]
Fioccola, G., Mirsky, G., and T. Mizrahi, "Performance Measurement (PM) with Alternate Marking in Network Virtualization Overlays (NVO3)", draft-fmm-nvo3-pm-alt-mark-02 (work in progress), June 2018.

[I-D.ietf-bier-pmmm-oam]
Mirsky, G., Zheng, L., Chen, M., and G. Fioccola, "Performance Measurement (PM) with Marking Method in Bit Index Explicit Replication (BIER) Layer", draft-ietf-bier-pmmm-oam-04 (work in progress), June 2018.

[I-D.ietf-intarea-gue]
Herbert, T., Yong, L., and O. Zia, "Generic UDP Encapsulation", draft-ietf-intarea-gue-05 (work in progress), December 2017.

[I-D.ietf-nvo3-geneve]
Gross, J., Ganga, I., and T. Sridhar, "Geneve: Generic Network Virtualization Encapsulation", draft-ietf-nvo3-geneve-06 (work in progress), March 2018.

[I-D.ietf-nvo3-vxlan-gpe]
Maino, F., Kreeger, L., and U. Elzur, "Generic Protocol Extension for VXLAN", draft-ietf-nvo3-vxlan-gpe-06 (work in progress), April 2018.

[I-D.ietf-sfc-ioam-nsh]
Brockners, F., Bhandari, S., Govindan, V., Pignataro, C., Gredler, H., Leddy, J., Youell, S., Mizrahi, T., Mozes, D., Lapukhov, P., and R. Chang, "NSH Encapsulation for In-situ OAM Data", draft-ietf-sfc-ioam-nsh-00 (work in progress), May 2018.

[I-D.ietf-sfc-oam-framework]
Aldrin, S., Pignataro, C., Kumar, N., Akiya, N., Krishnan, R., and A. Ghanwani, "Service Function Chaining (SFC) Operation, Administration and Maintenance (OAM) Framework", draft-ietf-sfc-oam-framework-04 (work in progress), March 2018.

[I-D.mirsky-ippm-hybrid-two-step]
Mirsky, G., Lingqiang, W., and G. Zhui, "Hybrid Two-Step Performance Measurement Method", draft-mirsky-ippm-hybrid-two-step-00 (work in progress), February 2018.

[I-D.mirsky-sfc-pmamm]
Mirsky, G., Fioccola, G., and T. Mizrahi, "Performance Measurement (PM) with Alternate Marking Method in Service Function Chaining (SFC) Domain", draft-mirsky-sfc-pmamm-03 (work in progress), June 2018.

[RFC7799] Morton, A., "Active and Passive Metrics and Methods (with Hybrid Types In-Between)", RFC 7799, DOI 10.17487/RFC7799, May 2016, <https://www.rfc-editor.org/info/rfc7799>.

[RFC8029] Kompella, K., Swallow, G., Pignataro, C., Ed., Kumar, N., Aldrin, S., and M. Chen, "Detecting Multiprotocol Label Switched (MPLS) Data-Plane Failures", RFC 8029, DOI 10.17487/RFC8029, March 2017, <https://www.rfc-editor.org/info/rfc8029>.

[RFC8296] Wijnands, IJ., Ed., Rosen, E., Ed., Dolganow, A., Tantsura, J., Aldrin, S., and I. Meilik, "Encapsulation for Bit Index Explicit Replication (BIER) in MPLS and Non-MPLS Networks", RFC 8296, DOI 10.17487/RFC8296, January 2018, <https://www.rfc-editor.org/info/rfc8296>.

[RFC8300] Quinn, P., Ed., Elzur, U., Ed., and C. Pignataro, Ed., "Network Service Header (NSH)", RFC 8300, DOI 10.17487/RFC8300, January 2018, <https://www.rfc-editor.org/info/rfc8300>.

[RFC8321] Fioccola, G., Ed., Capello, A., Cociglio, M., Castaldelli, L., Chen, M., Zheng, L., Mirsky, G., and T. Mizrahi, "Alternate-Marking Method for Passive and Hybrid Performance Monitoring", RFC 8321, DOI 10.17487/RFC8321, January 2018, <https://www.rfc-editor.org/info/rfc8321>.

[RFC8393] Farrel, A. and J. Drake, "Operating the Network Service Header (NSH) with Next Protocol "None"", RFC 8393, DOI 10.17487/RFC8393, May 2018, <https://www.rfc-editor.org/info/rfc8393>.

Author’s Address

Greg Mirsky
ZTE Corp.

Email: gregimirsky@gmail.com