DetNet
Internet-Draft
Intended status: Standards Track
Expires: April 29, 2020

B. Varga, Ed.
J. Farkas
Ericsson
L. Berger
LabN Consulting, L.L.C.
A. Malis
Independent
S. Bryant
Futurewei Technologies
J. Korhonen
October 27, 2019

DetNet Data Plane: MPLS over UDP/IP
draft-ietf-detnet-mpls-over-udp-ip-03

Abstract

This document specifies the MPLS Deterministic Networking data plane operation and encapsulation over an IP network. The approach is modeled on the operation of MPLS and over UDP/IP packet switched networks.

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at https://datatracker.ietf.org/drafts/current/.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on April 29, 2020.

Table of Contents

1. Introduction

Deterministic Networking (DetNet) is a service that can be offered by a network to DetNet flows. DetNet provides these flows extremely low packet loss rates and assured maximum end-to-end delivery latency. General background and concepts of DetNet can be found in [RFC8655].

This document specifies use of the MPLS DetNet encapsulation over an IP network. The approach is modeled on the operation of MPLS over an IP Packet Switched Network (PSN) [RFC7510]. It maps the MPLS data plane encapsulation described in [I-D.ietf-detnet-mpls] to the DetNet IP data plane defined in [I-D.ietf-detnet-ip].

To carry DetNet MPLS flows with full functionality at the DetNet layer over an IP network, the following components are required (these are a subset of the requirements for MPLS encapsulation listed in [I-D.ietf-detnet-mpls]):

1. A method for identifying DetNet flows to the processing element.

2. A method for carrying the DetNet sequence number.

3. A method for distinguishing DetNet OAM packets from DetNet data packets.

4. A method for carrying queuing and forwarding indication.

These requirements are satisfied by the DetNet over MPLS Encapsulation described in [I-D.ietf-detnet-mpls] and they are partly satisfied by the DetNet IP data plane defined in [I-D.ietf-detnet-ip]

2. Terminology

2.1. Terms Used in This Document

This document uses the terminology established in the DetNet architecture [RFC8655], and the reader is assumed to be familiar with that document and its terminology.

2.2. Abbreviations

The following abbreviations are used in this document:

d-CW	A DetNet Control Word (d-CW) is used for sequencing and identifying duplicate packets of a DetNet flow at the DetNet service sub-layer.
DetNet	Deterministic Networking.
A-Label	A special case of an S-Label, whose properties are known only at the aggregation and deaggregation end-points.
F-Label	A Detnet "forwarding" label that identifies the LSP used to forward a DetNet flow across an MPLS PSN, e.g., a hop-by-hop label used between label switching routers.
MPLS	Multiprotocol Label Switching.
OAM	Operations, Administration, and Maintenance.
PEF	Packet Elimination Function.
POF	Packet Ordering Function.
PREOF	Packet Replication, Elimination and Ordering Functions.
PRF	Packet Replication Function.

PSN Packet Switched Network.

S-Label A DetNet "service" label that is used between DetNet nodes that also implement the DetNet service sub-layer functions. An S-Label is also used to identify a DetNet flow at DetNet service sub-layer.

2.3. 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.

3. DetNet MPLS Operation over DetNet IP PSNs

This document builds on the specification of MPLS over UDP defined in [RFC7510]. It may replace partly or entirely the F-Label(s) used in [I-D.ietf-detnet-mpls] with UDP and IP headers. The UDP and IP header information is used to identify DetNet flows, including member flows, per [I-D.ietf-detnet-ip]. The resulting encapsulation is shown in Figure 1. There may be zero or more F-label(s) between the S-label and the UDP header.

Note that this encapsulation works equally well with IPv4, IPv6, and IPv6-based Segment Routing [I-D.ietf-6man-segment-routing-header].

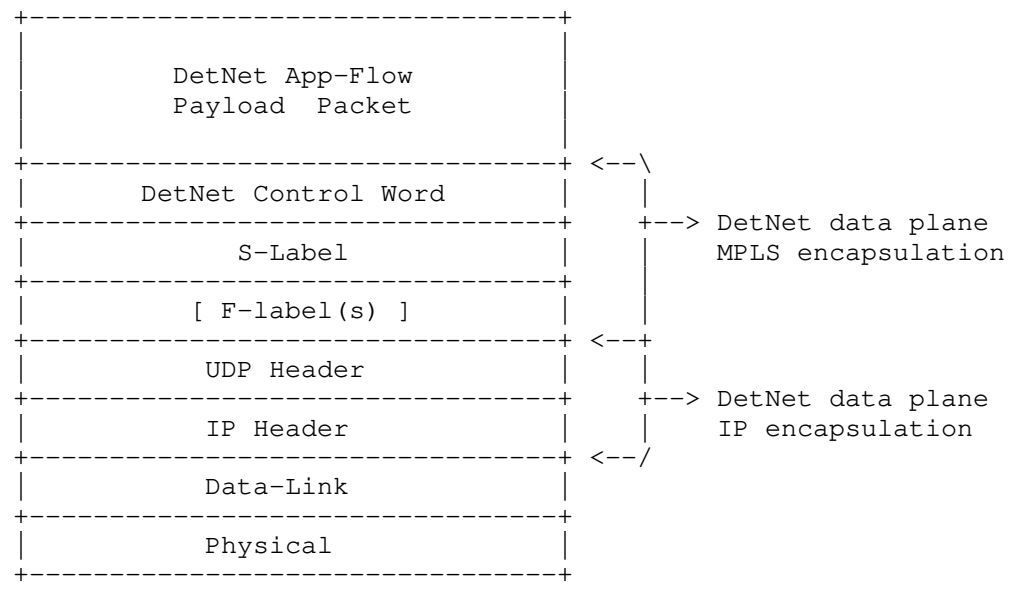

Figure 1: UDP/IP Encapsulation of DetNet MPLS

S-Labels, d-CW and zero or more F-Labels are used as defined in [I-D.ietf-detnet-mpls] and are not modified by this document. In case of aggregates the A-Label is treated as an S-Label and it too is not modified.

4. DetNet Data Plane Procedures

To support outgoing DetNet MPLS over UDP/IP encapsulation, an implementation MUST support the provisioning of UDP and IP header information in addition or in place of F-Label(s). Note, when PRF is performed at the MPLS service sub-layer, there will be multiple member flows, and each member flow will require the provisioning of their own UDP and IP header information. The headers for each outgoing packet MUST be formatted according to the configuration information and as defined in [RFC7510], with one exception. Note that the UDP Source Port value MUST be set to uniquely identify the DetNet flow. The packet MUST then be handed as a DetNet IP packet, per [I-D.ietf-detnet-ip]. This includes QoS related traffic treatment.

To support receive processing an implementation MUST also support the provisioning of received UDP and IP header information. The provisioned information MUST be used to identify incoming app-flows based on the combination of S-Label and incoming encapsulation header

information. Normal receive processing as defined in [I-D.ietf-detnet-mpls], including PEF and POF, can then take place.

5. Management and Control Information Summary

The following summarizes the set of information that is needed to configure DetNet MPLS over UDP/IP:

- Label information (S-label or F-label) to be mapped to UDP/IP flow. Note that a single S-Label can map to multiple sets of UPD/IP information when PREOF is used.
- IPv4 or IPv6 source address field.
- IPv4 or IPv6 destination address field.
- IPv4 Type of Service or IPv6 Traffic Class Fields.
- UDP Source Port.
- UDP Destination Port.

This information MUST be provisioned per DetNet flow via configuration, e.g., via the controller or management plane.

It is the responsibility of the DetNet controller plane to properly provision both flow identification information and the flow specific resources needed to provided the traffic treatment needed to meet each flow's service requirements. This applies for aggregated and individual flows.

6. Security Considerations

The security considerations of DetNet in general are discussed in [RFC8655] and [I-D.ietf-detnet-security]. MPLS and IP specific security considerations are described in [I-D.ietf-detnet-mpls] and [I-D.ietf-detnet-ip]. This draft does not have additional security considerations.

7. IANA Considerations

This document makes no IANA requests.

8. Acknowledgements

The authors wish to thank Pat Thaler, Norman Finn, Loa Anderson, David Black, Rodney Cummings, Ethan Grossman, Tal Mizrahi, David

Mozes, Craig Gunther, George Swallow, Yuanlong Jiang and Carlos J. Bernardos for their various contributions to this work.

9. References

9.1. Normative References

[I-D.ietf-detnet-ip]
Varga, B., Farkas, J., Berger, L., Fedyk, D., Malis, A., Bryant, S., and J. Korhonen, "DetNet Data Plane: IP", draft-ietf-detnet-ip-01 (work in progress), July 2019.

[I-D.ietf-detnet-mpls]
Varga, B., Farkas, J., Berger, L., Fedyk, D., Malis, A., Bryant, S., and J. Korhonen, "DetNet Data Plane: MPLS", draft-ietf-detnet-mpls-01 (work in progress), July 2019.

[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>.

[RFC7510] Xu, X., Sheth, N., Yong, L., Callon, R., and D. Black, "Encapsulating MPLS in UDP", RFC 7510, DOI 10.17487/RFC7510, April 2015, <https://www.rfc-editor.org/info/rfc7510>.

[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>.

9.2. Informative References

[I-D.ietf-6man-segment-routing-header]
Filsfils, C., Dukes, D., Previdi, S., Leddy, J., Matsushima, S., and d. daniel.voyer@bell.ca, "IPv6 Segment Routing Header (SRH)", draft-ietf-6man-segment-routing-header-26 (work in progress), October 2019.

[I-D.ietf-detnet-security]
Mizrahi, T., Grossman, E., Hacker, A., Das, S., Dowdell, J., Austad, H., Stanton, K., and N. Finn, "Deterministic Networking (DetNet) Security Considerations", draft-ietf-detnet-security-05 (work in progress), August 2019.

[RFC8655] Finn, N., Thubert, P., Varga, B., and J. Farkas, "Deterministic Networking Architecture", RFC 8655, DOI 10.17487/RFC8655, October 2019, <https://www.rfc-editor.org/info/rfc8655>.

Authors' Addresses

Balazs Varga (editor)
Ericsson
Magyar Tudosok krt. 11.
Budapest 1117
Hungary

Email: balazs.a.varga@ericsson.com

Janos Farkas
Ericsson
Magyar Tudosok krt. 11.
Budapest 1117
Hungary

Email: janos.farkas@ericsson.com

Lou Berger
LabN Consulting, L.L.C.

Email: lberger@labn.net

Andrew G. Malis
Independent

Email: agmalis@gmail.com

Stewart Bryant
Futurewei Technologies

Email: stewart.bryant@gmail.com

Jouni Korhonen

Email: jouni.nospam@gmail.com