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**DetNet Data Plane: MPLS over IP**  
**draft-ietf-detnet-mpls-over-udp-ip-00**

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 PseudoWires (PW) over IP.

Status of This Memo

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## [1.](#) Introduction

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

The DetNet Architecture decomposes the DetNet related data plane functions into two sub-layers: a service sub-layer and a forwarding sub-layer. The service sub-layer is used to provide DetNet service protection and reordering. The forwarding sub-layer is used to provides congestion protection (low loss, assured latency, and limited reordering) leveraging MPLS Traffic Engineering mechanisms.

This document specifies use of the MPLS DetNet encapsulation over an IP network. The approach is modeled on the operation of MPLS and PseudoWires (PW) over an IP Packet Switched Network (PSN) [[RFC3985](#)][[RFC4385](#)][[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 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 of identifying the DetNet flow group to the processing element.
2. A method of carrying the DetNet sequence number.
3. A method of distinguishing DetNet OAM packets from DetNet data packets.
4. A method of carrying queuing and forwarding indication.

These requirements are satisfied by the DetNet over MPLS Encapsulation described in [[I-D.ietf-detnet-mpls](#)].

## **[2. Terminology](#)**

### **[2.1. Terms Used in This Document](#)**

This document uses the terminology established in the DetNet architecture [[I-D.ietf-detnet-architecture](#)], 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:

CW	Control Word.
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.
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 (LSR).
LSR	Label Switching Router.
MPLS	Multiprotocol Label Switching.
OAM	Operations, Administration, and Maintenance.
PEF	Packet Elimination Function.



PRF	Packet Replication Function.
PREOF	Packet Replication, Elimination and Ordering Functions.
POF	Packet Ordering Function.
PSN	Packet Switched Network.
PW	PseudoWire.
S-Label	A DetNet "service" label that is used between DetNet nodes that implement also the DetNet service sub-layer functions. An S-Label is also used to identify a DetNet flow at DetNet service sub-layer.

### **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.

### **4. DetNet MPLS Operation over DetNet IP PSNs**

This document builds on the specification of MPLS over UDP and IP defined in [[RFC7510](#)]. It replaces 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.

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



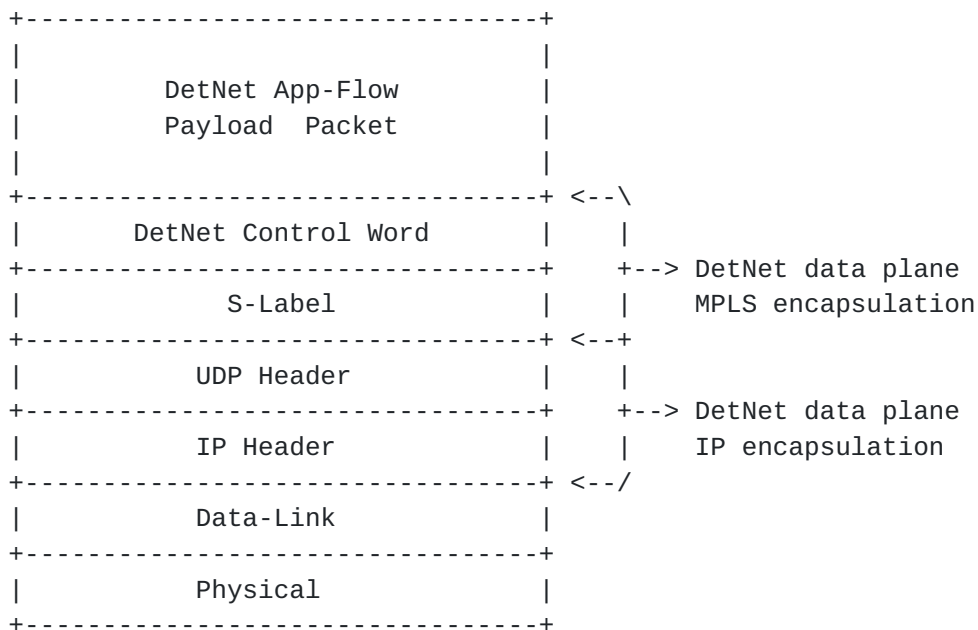


Figure 1: IP Encapsulation of DetNet MPLS

d-CW and S-Labels are used as defined in [[I-D.ietf-detnet-mpls](#)] and are not modified by this document.

To support outgoing DetNet MPLS over IP, an implementation **MUST** support the provisioning of IP/UDP header information in place of sets of F-Labels. Note that multiple sets of F-Labels can be provisioned to support PRF on transmitted DetNet flows and therefore, when PRF is supported, multiple IP/UDP headers **MAY** be provisioned. When multiple IP/UDP headers are provisioned for a particular outgoing app-flow, a copy of the outgoing packet, including the pushed S-Label, **MUST** be made for each. The headers for each outgoing packet **MUST** be based on the configuration information and as defined in [[RFC7510](#)], with one exception. The one exception is that the UDP Source Port value **MUST** be set to uniquely identify the DetNet (forwarding sub-layer) flow. The packet **MUST** then be handed as a DetNet IP packet, per [[I-D.ietf-detnet-ip](#)].

To support receive processing an implementation **MUST** also support the provisioning of received IP/UDP header information. When S-Labels are taken from platform label space, all that is required is to provision that receiving IP/UDP encapsulated DetNet MPLS packets is permitted. Once the IP/UDP header is stripped, the S-label uniquely identifies the app-flow. When S-Labels are not taken from platform label space, IP/UDP header information **MUST** be provisioned. The provisioned information **MUST** then be used to identify incoming app-





flows based on the combination of S-Label and incoming IP/UDP header. Normal receive processing, including PEOF can then take place.

## 5. Security Considerations

The security considerations of DetNet in general are discussed in [[I-D.ietf-detnet-architecture](#)] and [[I-D.sdt-detnet-security](#)]. Other security considerations will be added in a future version of this draft.

## 6. IANA Considerations

This document makes no IANA requests.

## 7. Contributors

[RFC7322](#) limits the number of authors listed on the front page of a draft to a maximum of 5, far fewer than the many individuals below who made important contributions to this draft. The editor wishes to thank and acknowledge each of the following authors for contributing text to this draft. See also [Section 8](#).

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