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W. Cheng
China Mobile
X. Min
ZTE
T. Zhou
Huawei
X. Dong
FiberHome
Y. Peleg
Broadcom

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Encapsulation For MPLS Performance Measurement with Alternate Marking Method
draft-cheng-mpls-inband-pm-encapsulation-02

Abstract

This document defines the encapsulation for MPLS performance measurement with alternate marking method, which performs flow-based packet loss, delay, and jitter measurements on live traffic.

Status of This Memo

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

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This Internet-Draft will expire on May 5, 2020.

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1. Introduction

[I-D.fioccola-spring-flow-label-alt-mark] describes how the alternate marking method can be used as the passive performance measurement method in an IPv6 domain, actually the alternate marking method can also be applied to an MPLS domain, and what's missed is the encapsulation for MPLS performance measurement with alternate marking method.

[RFC8372] discusses the desired capabilities for MPLS flow identification, in order to perform a better in-band performance monitoring of user data packets. Synonymous Flow Label (SFL), which is introduced in [I-D.ietf-mpls-sfl-framework], is identified as a method of accomplishing MPLS flow identification. This document employs a method, other than SFL, to accomplish MPLS flow identification. The method described in this document is simple and flexible, furthermore, it complies with the current MPLS forwarding paradigm.

The method described in this document is complementary to the SFL method, the former targets at hop-by-hop performance measurement, and the latter targets at end-to-end performance measurement, furthermore, the former supports the application scenario where Flow-

ID is applied to MPLS LSP and MPLS VPN synchronously, and the latter doesn't support this kind of application scenario.

This document defines the encapsulation for MPLS performance measurement with alternate marking method, which performs flow-based packet loss, delay, and jitter measurements on live traffic.

1.1. Conventions Used in This Document

1.1.1. Terminology

LSP: Label Switched Path

MPLS: Multi-Protocol Label Switching

NMS: Network Management System

PM: Performance Measurement

PW: PseudoWire

SFL: Synonymous Flow Label

TC: Traffic Class

TTL: Time to Live

VC: Virtual Channel

VPN: Virtual Private Network

1.1.2. 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. Flow-based PM Encapsulation in MPLS

Flow-based MPLS performance measurement encapsulation with alternate marking method has the following format:

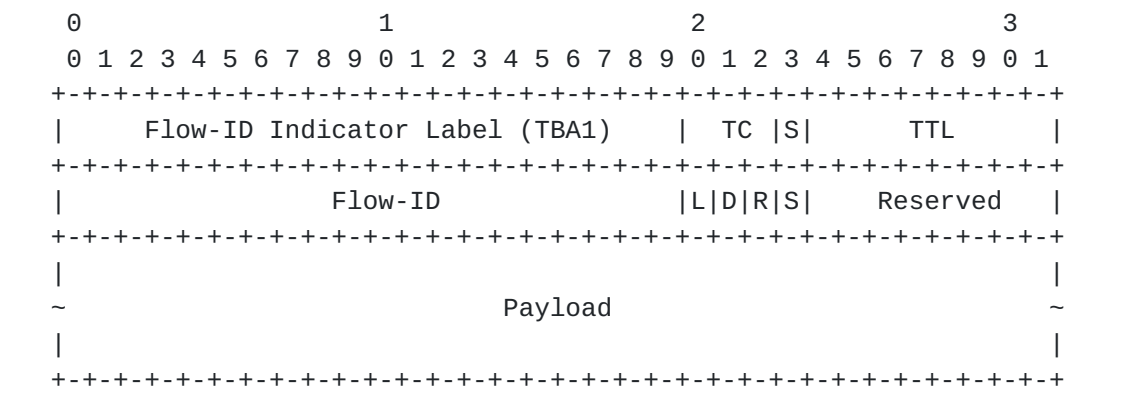

Figure 1: Flow-based PM Encapsulation in MPLS

Where Flow-ID Indicator Label is defined in this document as value TBA1, and the other fields related to the Flow-based PM encapsulation are defined as follows:

- Flow-ID - an MPLS label value used as MPLS flow identification [RFC8372], it should be unique within the administrative domain. Flow-ID values can be allocated by an external NMS or a controller, based on measurement object instance such as LSP and PW. There is a one-to-one mapping between Flow-ID and flow. The specific method on how to allocate the Flow-ID values is described in Section 4. Note that the Flow-ID Label can be placed either at the bottom of the MPLS label stack or not, and the Flow-ID Indicator Label MAY appear multiple times in a label stack, which means more than one Flow-ID can be present within an MPLS label stack. Section 2.1 of this document provides several examples to illustrate how to apply Flow-ID in a label stack.

- L and D - L(oss) bit and D(elay) bit are used for coloring the packets (called double-marking methodology), which is required by the alternate marking method.

- R - R bit is reserved for future use and MUST be set to zero.

- Reserved - one octet long field reserved for future use and MUST be set to zero.

2.1. Examples for Applying Flow-ID in a label stack

Three examples on different layout of Flow-ID label (4 octets) are illustrated as follows:

(1) Layout of Flow-ID label when applied to MPLS LSP.

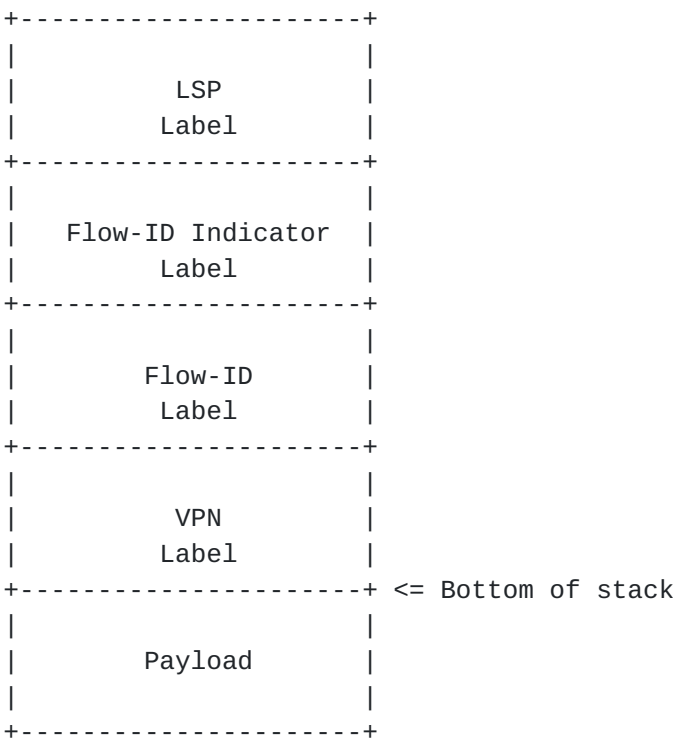

Figure 2: Applying Flow-ID to MPLS LSP

(2) Layout of Flow-ID label when applied to MPLS VPN traffic.

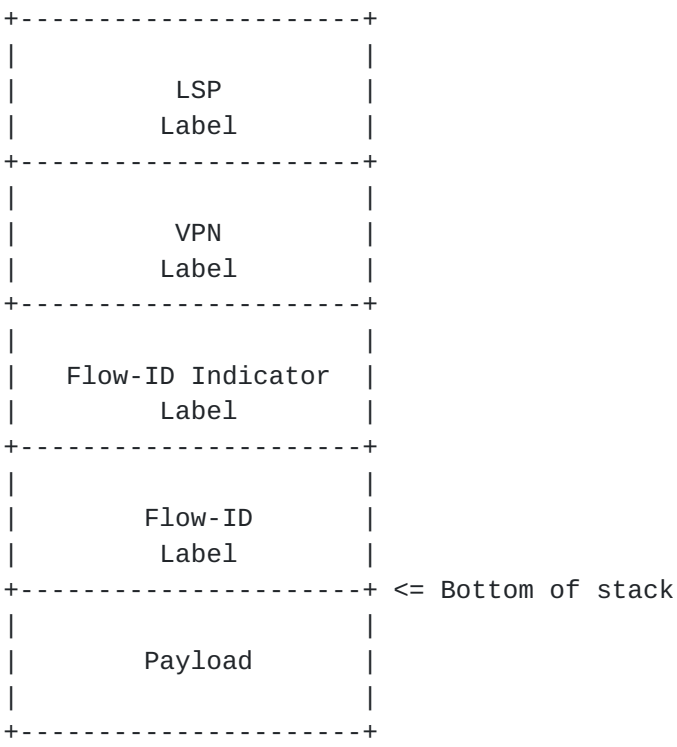

Figure 3: Applying Flow-ID to MPLS VPN

(3) Layout of Flow-ID label when applied to both MPLS LSP and MPLS VPN traffic.

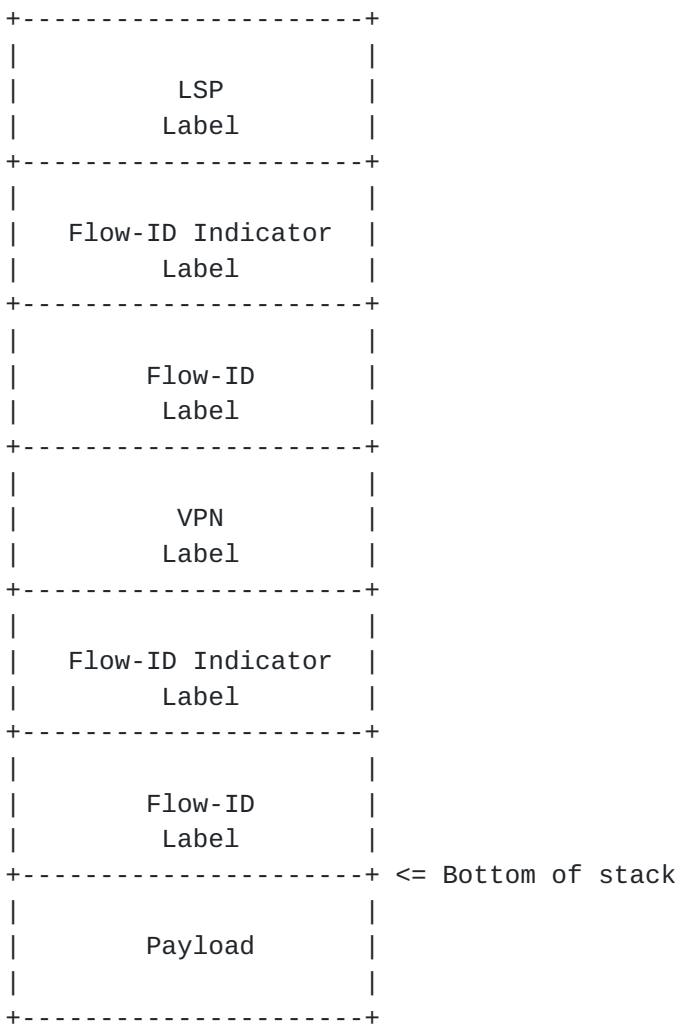

Figure 4: Applying Flow-ID to both MPLS LSP and MPLS VPN

Note that here VPN label can be MPLS PW label, MPLS Ethernet VPN label or MPLS IP VPN label, and it's also called VC label as defined in [RFC4026].

Also note that for this example the two Flow-ID values appearing in a label stack MUST be different, that is to say, Flow-ID applied to MPLS LSP and Flow-ID applied to MPLS VPN share the same value space.

3. Procedures of Encapsulation, Look-up and Decapsulation

The procedures for Flow-ID label encapsulation, look-up and decapsulation are summarized as follows:

- The ingress node inserts the Flow-ID Indicator Label, alongside with the Flow-ID label, into the MPLS label stack. At the same

time, the ingress node sets the L bit and D bit, as needed by alternate-marking technique, and sets the Flow-ID value, as defined in this document.

- The transit nodes look up the Flow-ID label with the help of the Flow-ID Indicator Label, and transmit the collected information to an external NMS or a controller, which includes the values of the block counters and the timestamps of the marked packets, along with the value of the Flow-ID, referring to the procedures of alternate marking method.

- The egress node pops the Flow-ID Indicator Label, alongside with the Flow-ID label, from the MPLS label stack. This document doesn't introduce any new procedure regarding to the process of the decapsulated packet.

4. Procedures of Flow-ID allocation

There are two ways of allocating Flow-ID, one way is to allocate Flow-ID by manual trigger from the network operator, and the other way is to allocate Flow-ID by automatic trigger from the ingress node, details are as follows:

- In the case of manual trigger, the network operator would manually input the characteristics (e.g. IP five tuples and IP DSCP) of the measured IP traffic flow, then the NMS or the controller would generate one or two Flow-IDs based on the input from the network operator, and provision the ingress node with the characteristics of the measured IP traffic flow and the corresponding allocated Flow-ID(s).

- In the case of automatic trigger, the ingress node would identify the IP traffic flow entering the measured path, export the characteristics of the identified IP traffic flow to the NMS or the controller by IPFIX [RFC7011], then the NMS or the controller would generate one or two Flow-IDs based on the export from the ingress node, and provision the ingress node with the characteristics of the identified IP traffic flow and the corresponding allocated Flow-ID(s).

The policy pre-configured at the NMS or the controller decides whether one Flow-ID or two Flow-IDs would be generated. If the performance measurement on VPN traffic is enabled, then one Flow-ID applied to MPLS VPN would be generated; if the performance measurement on LSP tunnel is enabled, then one Flow-ID applied to MPLS LSP would be generated; if both of them are enabled, then two Flow-IDs respectively applied to MPLS VPN and MPLS LSP would be generated.

Whether using manual trigger or using automatic trigger, the NMS or the controller MUST guarantee every generated Flow-ID is unique within the administrative domain.

5. Security Considerations

This document does not introduce additional security requirements and mechanisms.

6. IANA Considerations

In the Special-Purpose MPLS Label Values registry defined in [SP-MPLS-Label], a new Special-Purpose MPLS Label Value for Flow-ID Indicator is requested from IANA as follows:

Special-Purpose MPLS Label Value	Description	Semantics Definition	Reference
TBA1	Flow-ID Indicator Label	Section 2	This Document

Table 1: New Special-Purpose MPLS Label Value for Flow-ID Indicator

7. Acknowledgements

The authors would like to acknowledge Greg Mirsky, Aihua Liu, Shuangping Zhan and Ming Ke for their careful review and very helpful comments.

8. References

8.1. Normative References

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[SP-MPLS-Label] "Special-Purpose MPLS Label Values", 2014, <https://www.iana.org/assignments/mpls-label-values/mpls-label-values.xml>.

8.2. Informative References

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Authors' Addresses

Weiqiang Cheng
China Mobile
Beijing
China

Email: chengweiqiang@chinamobile.com

Xiao Min
ZTE
Nanjing
China

Email: xiao.min2@zte.com.cn

Tianran Zhou
Huawei
Beijing
China

Email: zhoutianran@huawei.com

Ximing Dong
FiberHome
Wuhan
China

Email: dxm@fiberhome.com

Yoav Peleg
Broadcom
USA

Email: yoav.peleg@broadcom.com