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                     MPLS Payload Protocol Identifier
                 draft-xu-mpls-payload-protocol-identifier-03

Abstract

   The MPLS label stack has no explicit protocol identifier field to
   indicate the protocol type of the MPLS payload. This document
   proposes a mechanism for containing a protocol identifier field
   within the MPLS packet, which is useful for any new encapsulation
   header which may need to be encapsulated with an MPLS header.

Status of This Memo

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Table of Contents

1. Introduction

The MPLS label stack has no explicit protocol identifier field to
indicate the protocol type of the MPLS payload. This document
proposes a mechanism for containing a protocol identifier field
within the MPLS packet, which is useful for any new encapsulation
header which may need to be encapsulated with an MPLS header. With
this explicit protocol identifier field, there is no need any more
for each new encapsulation header to deal with the notorious first
nibble issue associated with MPLS individually. More specifically,
there is no need to intentionally avoid the first nibble of each new
encapsulation header from being 0100 (IPv4) or 0110 (IPv6) and even
worsely misuse the first nibble of each new encapsulation header as
an MPLS payload type field (e.g., MPLS-BIER
[I-D.ietf-bier-mpls-encapsulation]). The tacit permission of
misusing the first nibble of each new encapsulation header as an MPLS
payload type field would exhause the valuable nibble space quickly.
To some extent, this situation is much similar to the MPLS reserved
label space (a.k.a., the special purpose label space) [RFC7274]. In
other words, the IETF MPLS community should take precautions before
it is too late. Furthermore, there is no need to insert one
additional label indicating the MPLS payload type when transporting
any new encapsulation header over MPLS LSPs as well, e.g.,

transporting Network Service Header (NSH) [I-D.ietf-sfc-nsh] over
MPLS LSPs.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in RFC 2119 [RFC2119].

2. Terminology

This memo makes use of the terms defined in [RFC3032].

3. Protocol Type Field

The encapsulation format for Protocol Type field is depicted as
below:
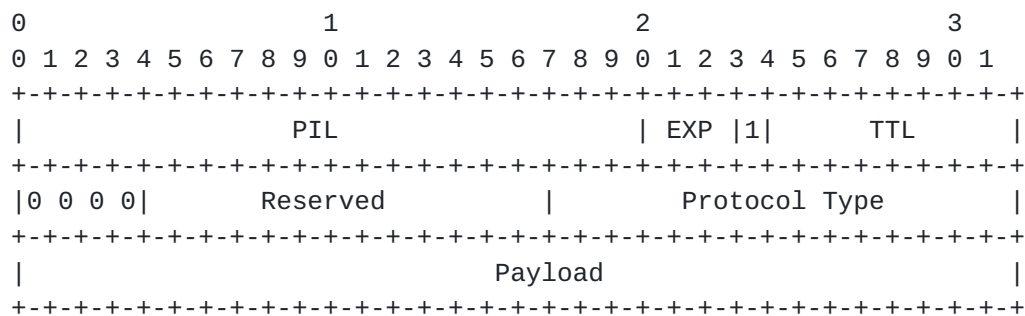
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               PIL               | EXP |1|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0 0 0 0|     Reserved      |           Protocol Type       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Payload                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                         Figure 1
```

Protocol Identifier Label (PIL): This field contains a special
purpose label with value of <TBD> or an extended special purpose
label [RFC7274] with value of <TBD> which indicates that a
Protocol Type field appears immediately after the bottom of the
label stack.

EXP: The usage of this field is in accordance with the current
MPLS specification [RFC3032].

S: The Bottom of Stack (BoS) field is set since the PIL MUST
always appear at the bottom of the label stack.

TTL: The usage of this field is in accordance with the current
MPLS specification [RFC3032].

Reserved MUST be set to 0 and ignored on reception.

Protocol Type: This field indicates the protocol type of the MPLS
payload as per [ETYPES].

   Payload: This field contains the MPLS payload which can be an IP
   packet, an Ethernet frame, or any other type of payload, e.g.,
   Network Service Header (NSH) [I-D.ietf-sfc-nsh].

4. Data Plane Processing of PIL

4.1. Egress LSRs

   Suppose egress LSR Y is capable of processing the Protocol Type field
   contained in MPLS packets. LSR Y indicates this to all ingress LSRs
   via signaling (see Section 5). LSR Y MUST be prepared to deal with
   both packets with an imposed Protocol Type field and those without;
   the PIL will distinguish these cases. If a particular ingress LSR
   chooses not to impose a Protocol Type field, LSR Y's processing of
   the received label stack (which might be empty) is as if LSR Y chose
   not to accept Protocol Type field. If an ingress LSR X chooses to
   impose the Protocol Type field, then LSR Y will receive an MPLS
   packet constructed as follows: <Top Label (TL), Application Label
   (AL), PIL> <Protocol Type field> <remaining MPLS payload>. Note that
   here the TL could be replaced with an IP-based tunnel [RFC4023] and
   the AL is optional. LSR Y recognizes TL as the label it distributed
   to its upstream LSR and pops the TL (note that the TL may be an
   implicit null label, in which case it doesn't appear in the label
   stack and LSR Y MUST process the packet starting with the AL label
   (if present) and/or the PIL.) LSR Y recognizes the PIL with S bit
   set. LSR Y then processes the Protocol Type field, which will
   determine how LSR Y processes the MPLS payload.

4.2. Ingress LSRs

   If an egress LSR Y indicates via signaling that it can process the
   Protocol Type field, an ingress LSR X can choose whether or not to
   insert it into the MPLS packet destined for LSR Y. The ingress LSR X
   MUST NOT insert the Protocol Type field into that MPLS packet unless
   the egress LSR X has explicitly announced that it could process it.
   The steps that ingress LSR X performs to insert the Protocol Type
   field are as follows:

   1. On an incoming packet, identify the application to which the
       packet belongs and determine whether the Protocol Type field
       needs to be added to the incoming packet.

   2. For packets requiring the insertion of the Protocol Type field,
       prepend the Protocol Type field to the existing MPLS payload;
       then, push the PIL on to the label stack with the S bit set.

   3. Push the application label (AL) label (if required) on to the
       label stack.

   4. Push the EL and the ELI labels [RFC6790] on to the label stack
       (if required).

   5. Determine the top label (TL) and push it on to the label stack.

   6. Determine the output interface and send the packet out.

4.3. Transit LSRs

   Transit LSRs MAY operate with no change in forwarding behavior. If a
   transit LSR recognizes the PIL and the subsequent Protocol Type
   field, it MAY be allowed to do some additional value-added
   processing, such as MPLS payload inspection, on the received MPLS
   packet containing the PIL and the Protocol Type field.

4.4. Penultimate Hop LSRs

   No change is needed at penultimate hop LSRs.

5. Signaling for PIL Processing Capability

   TBD.

6. Alternative Approaches

   As illustrated in Section 3 and Section 4, the existence of the
   Protocol Type field immediately after the MPLS label stack is
   indicated by inserting the PIL into an MPLS packet. Alternatively,
   by setting the first nibble of the 4-octet entry containing the
   Protocol Type field to a dedicated value (e.g., 1111), the existence
   of the Protocol Type field could be indicated as well (see Figure 2).
   In this way, there is no need to insert additional label(s) (i.e.,
   the PIL) into an MPLS packet.

```
    0                   1                   2                   3
    0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |             Bottom Label          | EXP |1|       TTL      |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |1 1 1 1|      Reserved       |          Protocol Type        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                           Payload                           |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
                            Figure 2
```
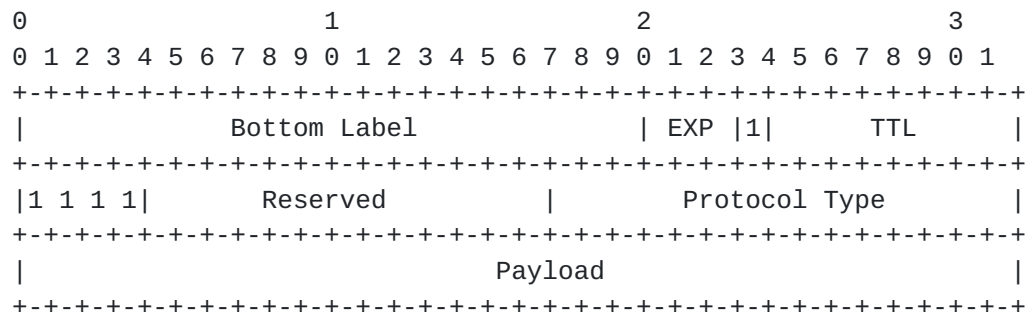
7. Acknowledgements

TBD.

8. IANA Considerations

A special purpose label with value of <TBD> or an extended special
purpose label with value of <TBD> for the PIL needs to be assigned by
the IANA

9. Security Considerations

TBD.

10. References

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