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                    Special Purpose Label terminology
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Abstract

   This document discusses and recommends a terminology that may be used
   when MPLS Special Purpose Labels (SPL) are specified and documented.

   This document applies that terminology change to the relevant IANA
   registry and also clarifies the use of the Entropy Label Indicator
   (7) when immediately preceded by the Extension Label (15).

   This document updates RFC 7274 and RFC 3032.

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Table of Contents

1. Introduction

RFC 7274 [RFC7274] made some changes to the terminology used for MPLS
Special Purpose Labels, but did not define consistent terminology.

One thing that RFC 7274 did was to deprecate use of the term
"reserved labels" when describing a range of labels allocated from a
registry maintained by IANA. The term "Reserved" in such a registry
means "set aside, not to be used", but that range of labels was
available for allocation according to the policies set out in that
registry. The name "Special Purpose Labels" was introduced in RFC
7274 in place of the previous term, and the abbreviation SPL was
recommended.

At the time of writing the first version of this document, the IETF
was in the process of allocating the very first SPLs from the
Extended SPL (eSPL) range [RFC8595]. This document discusses and
recommends terminology and abbreviations to be used when talking
about and documenting Special Purpose Labels.

This document updates RFC 3032 [RFC3032] and RFC 7274 [RFC7274] in
that it changes the terminology for both Base SPLs and Extended SPLs.

This document applies that terminology change to the relevant IANA
registry and also clarifies the use of the Entropy Label Indicator
(7) when immediately preceded by the Extension Label (15).

1.1. Terminology

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. Background

Two sets of SPLs are defined for use in MPLS:

   The range of 0-15, Base Special Purpose Labels (bSPLs), is
   specified in RFC 3032 [RFC3032].

   The range 0-1048575 of eSPLs is specified in RFC 7274 [RFC7274].

   * the values 0-15 have been reserved never to be allocated

   * the values 16-239 are available for allocation

   * the values 240-255 are for experimental use

   * the values 256-1048575 are currently not available for
      allocation. A standard track RFC will be needed to allocate
      any labels from this range.

2.1. GMPLS Special Purpose Labels

Note that IANA maintains a registry called "Special Purpose
Generalized Label Values". Labels in that registry have special
meaning when present in certain signalling objects, are 32 bits long,
and are not to be confused with MPLS forwarding plane labels. This
document does not make any changes to the GMPLS registry or to how
labels from that registry are described.

3. Terminology and Abbreviations

IANA maintains a name space for 'Special-Purpose Multiprotocol Label
Switching (MPLS) Label Values' code points [SPL-NAME-SPACE]. Within
this name space there are two registries. One is called the
'Special-Purpose MPLS Label Values' registry [bSPL]. The other is
called 'Extended Special-Purpose MPLS Label Values' registry [eSPL].

The difference in the name of the name space and the first registry
is only that the MPLS abbreviation is expanded. This document
changes the name of the first registry to 'Base Special-Purpose MPLS
Label Values', but leaves the name of the latter registry unchanged
as 'Extended Special-Purpose MPLS Label Values'.

The following conventions will be used in specifications and when
talking about SPLs.

o Collectively, the two (unrelated) ranges (0-15 and 16-1048575) are
   known as Special Purpose Labels (SPL).

o Special purpose labels from the range 0-15 are called Base Special
   Purpose Labels (bSPL).

o Special purpose labels from the range 16-1048575 are called
   Extended Special Purpose Labels (eSPL). (Note that the reserved
   values 0-15 from the 'Extended Special-Purpose MPLS Label Values'
   registry do not need a name as they are not available for
   allocation and MUST NOT be used.)

This results in a label stacks such as the illustrative examples
shown in Figure 1 and Figure 2.

```
              0                                31
              |      MPLS Label Stack entry      |
              +--------+--------+--------+--------+
              |      MPLS Label Stack entry      |
              +--------+--------+--------+--------+
bSPL          |             Base SPL            |
              +--------+--------+--------+--------+
              | MPLS Label Stack entry (cont.)   |
```

Figure 1: Example of Label Stack

```
          0                              31
          |      MPLS Label Stack entry     |
          +--------+--------+--------+--------+
          |      MPLS Label Stack entry     |
          +--------+--------+--------+--------+
   xSPL   |        Extension Label (XL)     | <--+
          +--------+--------+--------+--------+    |--- cSPL
   eSPL   |              Extended SPL       | <--+
          +--------+--------+--------+--------+
          |  MPLS Label Stack entry (cont.)  |
```
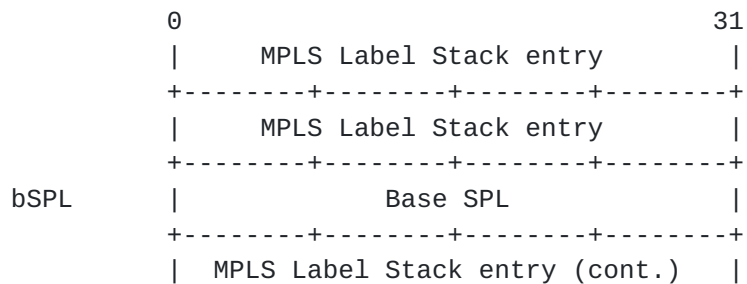
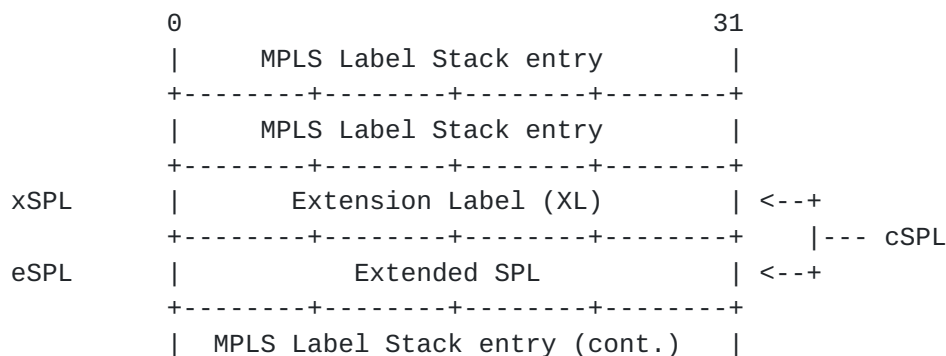   Figure 2: Example of Label Stack

4. Clarification on Handling of the Entropy Label Indicator

   Section 3.1 of [RFC7274] contains two paragraphs that describe the
   handling of the Entropy Label Indicator (label 7). These paragraphs
   have introduced some confusion about whether the Entropy Label
   Indicator can be present when immediately preceded by the Extension
   Label. This document updates [RFC7274] by replacing those paragraphs
   as follows.

   OLD

      Values 0-15 of the "Extended Special-Purpose MPLS Label Values"
      registry are set aside as reserved. Furthermore, values 0-6 and
      8-15 MUST NOT appear in the data plane following an XL; an LSR
      processing a packet with an XL at the top of the label stack
      followed by a label with value 0-6 or 8-15 MUST drop the packet.

      Label 7 (when received) retains its meaning as Entropy Label
      Indicator (ELI) whether a regular special-purpose label or an
      ESPL; this is because of backwards compatibility with existing
      implemented and deployed code and hardware that looks for the ELI
      without verifying if the previous label is XL or not. However,
      when an LSR inserts an entropy label, it MUST insert the ELI as a
      regular special-purpose label, not as an ESPL.

   NEW

      Values 0-15 of the "Extended Special-Purpose MPLS Label Values"
      registry are set aside as reserved. Furthermore, an
      implementation MUST NOT place a label with value 0-15 in the label
      stack immediately following an XL; an LSR processing a packet with
      an XL at the top of the label stack immediately followed by a
      label with value 0-15 MUST drop the packet.

When inspecting a label stack to find an Entropy Label Indicator
(ELI - label 7) a pre-existing implementation may fail to inspect
the previous label, and so not notice that it is an XL. Such
systems can continue to process the entropy information and
forward the packet when the previous label is an XL without
causing harm. However, the packet will be dropped when the XL
reaches the top of the stack at another LSR.

END

5. Security Considerations

The document describes the terminology to be used when describing and
specifying the use of SPLs. It does not effect the forwarding in the
MPLS data plane, nor does it have any effect on how LSPs are
established by an MPLS control plane or by a centralized controller.

This document does not aim to describe existing implementations of
SPLs or potential vulnerabilities of SPLs.

6. IANA Considerations

IANA is requested to change the name of the registry that today is
called "Special-Purpose MPLS Label Values" is changed to "Base
Special- Purpose MPLS Label Values".

7. Acknowledgements

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detailed, careful and insightful review, and Tom Petch for pointing
out several issues of clarity.

8. Contributors

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Figure 3

9. References

9.1. Normative References

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[SPL-NAME-SPACE]
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9.2. Informative References

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