           Indicators and anxillary data in the MPLS Label Stack
           draft-andersson-mpls-indicators-and-anxillary-data-00

Abstract

   This document is a living document, meaning that during the life
   timme of the MPLS Open Design Team we will to survey the relationship
   between indicators and anxillary dat.

   Ideally when the Design Team is closed this document will be empty,
   or maybe we just add a pointer to where the answer to quesstion is
   documented. Thus this document will never go on to become an RFCc.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

   This document discusses in-label-stack indicators to locate anxillary
   data carried in the label stack or after the Bottom of Stack (BoS)
   bit.

   The document is intended to be a "living document", meaning that it
   will be updated as long as the Open DT finds it useful, but it is not
   intended to become an RFC. Information in this document might be
   captured in "real" output documents from the Open DT.

   "Living Documents" are not commonly used in the IETF, but we have
   considered it to be a good way of documenting the state of the issues
   worked on by the design team.

1.1. Requirement 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.

For a document that is not intended to become and RFC on the
Standards Track it might seem moot to have the requirement language
included, however it might be that a question or an answer to one of
the questions might use the BCP 14 language, so to avoid ambiguity we
left it in.

1.2. Local terminology

Two terms are frequently used in this document. "indicator" and
"anxillary data". This section gives a high level definition of the
two terms.

1.2.1. Indicator

An indicator is a Spoecial Purpose Label (bSPL or eSPL), or part of
such a label, carried in MPLS Lael Stack.

1.2.2. Anxillary Data

Anxillary data is data that is used to improve the precission of
packet forwarding, it can be carried as part of a indicator label or
after the the label with BoS bit set.

1.2.3. Scan, Parse and Readable Depth

The three terms are used in the context of finding e.g. indicators or
the BoS in a label stack.

The terms "scan" and "parse" are virtually synonymous aand relates to
an activity to consequtively read the labels in a label stack in
order to find certain information.

Readable depths tell you have deep into the label stack a scanning
(a.k.a parsing) operation can go, expressed in the number of labels.

2. Background

When MPLS was first designed the label stack was fairly simple, you
had a label at the top of the stack on which a forwarding decision
were taken. The only exception the few labels (values 0-15) that
were set aside as Special Purpose Labels, such labels have a special
action or interpretation assigned to them.

When Pseudowires were designed it beccame clear that i would be
beneficial to be possible to send anxillary data together with the
MPLS packets that transported the Pseudowire payload data.

The method develooped was to create an Associated Channel as a shim
between the bottom of the label stack and the Pseudowire payload.

When the MPLS Transport Profile (MPLS-TP) the assiciated channel were
were generalized to applocable to all MPLS networks.

From the start only one associated channel is allowed per packet.
Lately there has been discussions on allowing multiple associated
channels or other types of channelized ifo, like MPLS Extension
headers.

It should be noted that this "background" does not aspire to be 100%
historically corect, but is the recollection of the author.

3. Combiinations or Indicators anbd Anxillary Data

The aim of this docment is to list all the combinations of of
indicators and anxillary data that we can think of. And also make
note for each case if it is a "requirement" or not. The different
types indicators and anxillary data are discussed as they they are
listed.

3.1. No extra data

For completness the Plain Old MPLS Service label stack is included
here, it does not carry any indicator or anxillary data.

```
                 +-------------+
                 |   L1 (0)    |
                 +-------------+
                 |   L2 (0)    |
                 +-------------+
                 |   L3 (0)    |
                 +-------------+
                 |   L4 (1)    |
                 +-------------+
                 |  Pay Load   |
                 ~             ~
                 |             |
                 +-------------+
```

Figure 1: Plain Old MPLS Service

Question: If we normally scan the label stack for indicators is it
possible to stop the scanning for this type of packet?

In scope: Yes

3.2. Associated Channel Style

The combination of a GAL in the label stack and an Associated Channel
after the BoS is the the original model for the "Associated Channel".
Originally only one set of anxillary data and only one indicator was
allowed.

```
              +------------------+
              |      L1 (0)      |
              +------------------+
              |   indicator (0)  |
              +------------------+
              |      L3 (0)      |
              +------------------+
              |      L4 (1)      |
              +------------------+
              |  anxillary data  |
              ~                  ~
              |                  |
              +------------------+
              |     Pay Load     |
              ~                  ~
              |                  |
              +------------------+
```
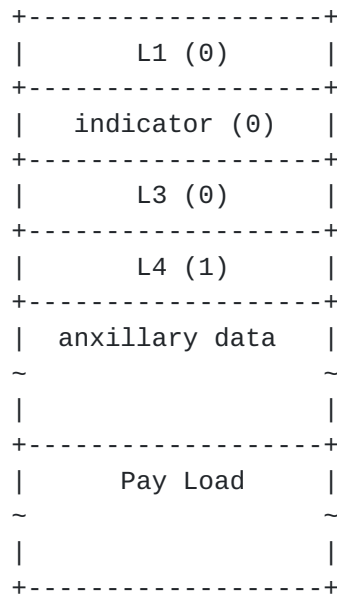
Figure 2: Associated Channel Service

Question: If we normally scan the label stack for indicators is it
possible to stop the scanning once the single indicator for this type
of packet is found?

In scope: Yes

3.3. Extended Associated Channel Style

Recently there has been a discussion about what happen if the label
stack grow to such a depth that some LSRs can't scan the stack to
such a depth that the indicator can't be read. The maximum readable
depth has been exceeded. It has been proposed to allow inserting a
copy of the indicator higher up in the stack. There is still only
one set of anxillary data after the BoS.

```
                    +------------------+
                    |      L1 (0)      |
                    +------------------+
                    |  indicator b (0) |
                    +------------------+
                    |      L3 (0)      |
                    +------------------+
                    |      L4 [0]      |
                    +------------------+
                    |  indicator a (0) |
                    +------------------+
                    |      L6 (1)      |
                    +------------------+
                    |  anxillary data  |
                    ~                  ~
                    |                  |
                    +------------------+
                    |     Pay Load     |
                    ~                  ~
                    |                  |
                    +------------------+
```
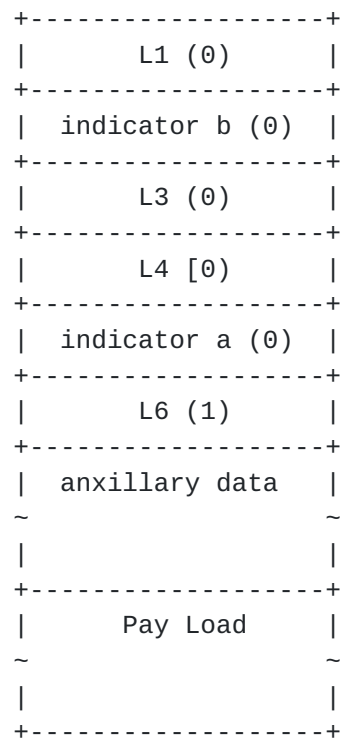
Figure 3: Extended Associated Channel Service

Question: If we normally scan the label stack for indicators is it
possible to stop the scanning once the first copy indicator for this
type of packet is found?

In scope: Yes

3.4. Modified Associated Channel Style

It has been discussed to allow more than one set of anxillary data,
indicated byt different indicators in the label stack.

```
                    +------------------+
                    |      L1 (0)      |
                    +------------------+
                    |  indicator 2 (0) |
                    +------------------+
                    |      L3 (0)      |
                    +------------------+
                    |      L4 [0]      |
                    +------------------+
                    |  indicator 1 (0) |
                    +------------------+
                    |      L6 (1)      |
                    +------------------+
                    | anxillary data 1 |
                    ~                  ~
                    |                  |
                    +------------------+
                    | anxillary data 2 |
                    ~                  ~
                    |                  |
                    +------------------+
                    |     Pay Load     |
                    ~                  ~
                    |                  |
                    +------------------+
```

Figure 4: Modified Associated Channel Service

Question: There might be a problem to decide which set of anxillary
data is indicated by which indicator. Some method to disambiguiate
this need to be designed.

In scope: Yes

3.5. Modified Associated Channel Style

It has been discussed to allow more than one set of anxillary data,
indicated byt different indicators in the label stack.

```
                    +------------------+
                    |      L1 (0)      |
                    +------------------+
                    |  indicator 2 (0) |
                    +------------------+
                    |      L3 (0)      |
                    +------------------+
                    |      L4 [0]      |
                    +------------------+
                    |  indicator 1 (0) |
                    +------------------+
                    |      L6 (1)      |
                    +------------------+
                    | anxillary data 1 |
                    ~                  ~
                    |                  |
                    +------------------+
                    | anxillary data 2 |
                    ~                  ~
                    |                  |
                    +------------------+
                    |     Pay Load     |
                    ~                  ~
                    |                  |
                    +------------------+
```

Figure 5: Modified Associated Channel Service

Question: There might be a problem to decide which set of anxillary
data is indicated by which indicator. Some method to disambiguiate
this need to be designed.

In scope: Maybe, but we should really aim for Section 3.6
Enhanced Associated Channel Style if we want to do multiple sets of
anxillary data.

3.6. Enhanced Associated Channel Style

The discussion to allow more than one set of anxillary data,
indicated by different indicators in the label stack, also has
resulted in that a need to have the indicators to better indicate
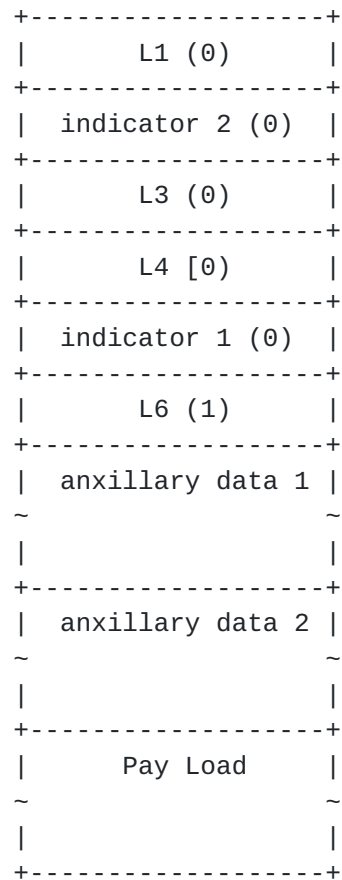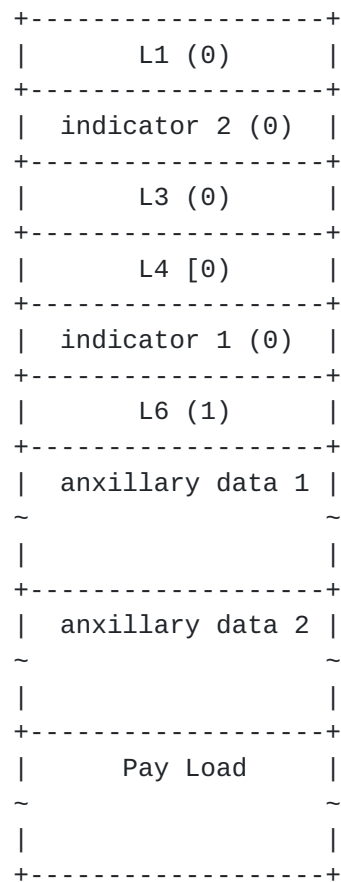which set of anxillary data is the target.

```
                  +------------------+
                  |     L1 (0)       |
                  +------------------+
              +---|  indicator 2 (0) |
              |   +------------------+
              |   |     L3 (0)       |
              |   +------------------+
              |   |     L4 [0]       |
              |   +------------------+
              |   | indicator 1 (0)  |---+
              |   +------------------+   |
              |   |     L6 (1)       |   |
              |   +------------------+   |
              |   | anxillary data 1 |<--+
              |   ~                  ~
              |   |                  |
              |   +------------------+
              +-->|  anxillary data 2 |
                  ~                  ~
                  |                  |
                  +------------------+
                  |     Pay Load     |
                  ~                  ~
                  |                  |
                  +------------------+
```
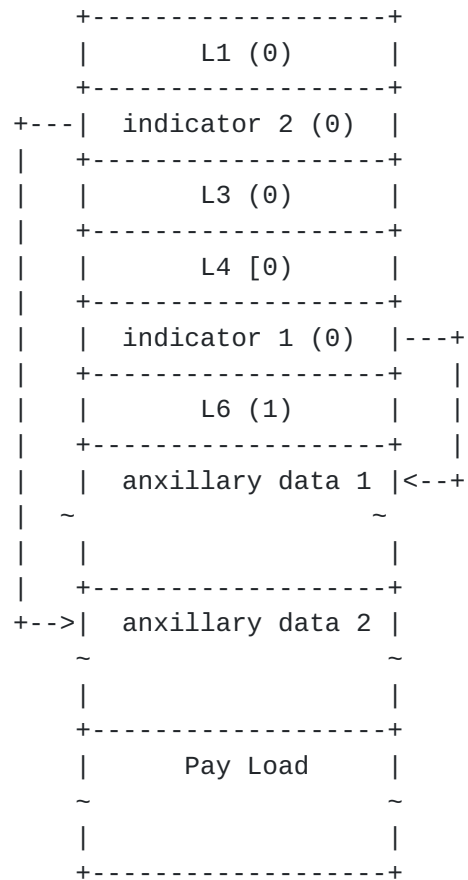
         Figure 6: Enhanceded Associated Channel Service

   Question: Nil

   In scope: Yes

3.7. Enhanced Associated Channel Style

   There is also a proposal to allocate a new bSPL called Farwarding
   Action Indicator (FAI). The FAI uses the "unused" bits in the label
   format, i.e. the TTL and the TC bits. These bits can bothe be "self
   contained", i.e. the bit give all the information needed for the
   required forwarding action, or they point to anxillary data after the
   BoS.

```
                              +------------------+
                              |      L1 (0)      |
                              +------------------+
    (the FAI expanded below)  |     FAI (0)      |
                              +------------------+
                              |      L3 (0)      |
                              +------------------+
                              |      L4 [0)      |
                              +------------------+
                              |  indicator 1 (0) |---+
                              +------------------+   |
                              |      L6 (1)      |   |
                              +------------------+   |
                              |  anxillary data 1|<--+
                              ~                  ~
                              |                  |
                              +------------------+
                              |  anxillary data 2|
                              ~                  ~
                              |                  |
                              +------------------+
                              |     Pay Load     |
                              ~                  ~
                              |                  |
                              +------------------+
                               1                2                          3
         0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 8 9 0 1 2 3 4 5 6 7 8 9 0 1
        +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  name  |                 FAI                | TC  |S|       TTL      |
        +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  bits  |        [to be alloacted)           |x x x|-|x x x x x x x x|
        +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  Exmp  |                                    |0 0 0|-|0 0 0 1 0 0 1 0|
        +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

   Legend:
           The "-" in the BoS  (s) means that it is not availabel for
           FAI encoding
           Bits 20-22 and 24-31 are availabel for FAI encodings
           On the example line two bits are set, bit 27 and 30.
           Without claiming that this aligns with the existing
           proposal, we can imaging that bit 27 is self contained and
           directly gives forwarding actioins required, and that
           bit 30 indicates presence of anxillary data after the BoS.
```
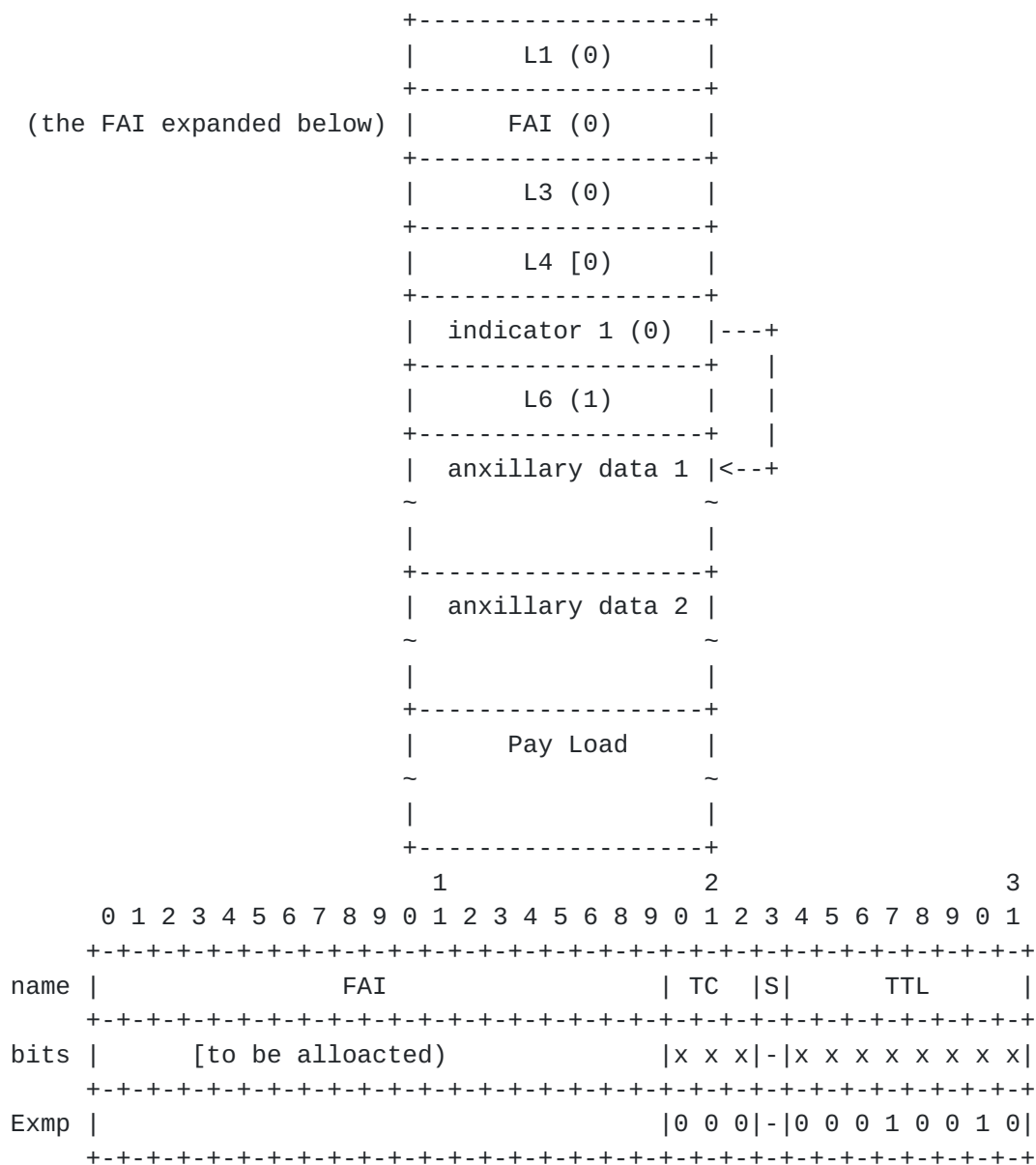
Figure 7: Enhanced Associated Channel Service

Question: Can we make the bits in an SPL exactly point out which set of anxillary data that should be used?

In scope: Likely

4. IANA Considerations

This document does not make any allocations of code points from IANA registries.

5. Acknowledgements

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6. Normative References

[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>.

[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>.

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