           Generalized MPLS (GMPLS) Data Channel Switching Capable (DCSC) and
                        Channel Set Label Extensions

                     draft-ietf-ccamp-gmpls-dcsc-channel-ext-00.txt

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Abstract

   This document describes two technology independent extensions to
   Generalized Multi-Protocol Label Switching. The first extension
   defines the new switching type Data Channel Switching Capable. Data
   Channel Switching Capable interfaces are able to support switching of
   the whole digital channel presented on single channel interfaces.
   The second extension defines a new type of generalized label and
   updates related objects. The new label is called the Generalized
   Channel_Set Label and allows more than one data plane label to be
   controlled as part of an LSP.

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[1](#). Introduction

This document describes two technology independent extensions to
Generalized Multi-Protocol Label Switching (GMPLS). Both of
extensions were initially defined to in the context of Ethernet
services, see [[GMPLS-ESVCS](#)] and [[GMPLS-MEF-UNI](#)], but are generic in
nature and may be useful to any switching technology controlled via
GMPLS.

The first extension defines a new switching type, which is called
Data Channel Switching Capable, or DCSC. DCSC interfaces are able to
support switching of the whole digital channel presented on single
channel interfaces. The second extension defines a new type of
generalized label and updates related objects. The new label is
called the Generalized Channel_Set Label and allows more than one
data plane label to be controlled as part of an LSP.

[1.1](#). Conventions used in this document

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 [[RFC2119](#)].

[2](#). Data Channel Switching

Current GMPLS switching types are defined in [[RFC3945](#)] and [[RFC3471](#)]
and support switching at the packet (PSC), frame (L2SC), time-slot
(TDM), frequency (LSC) and fiber (FSC) granularities. One type of
switching that is not well represented in this current set switching
that takes all data received on an ingress port and switches it
through a network to an egress port. While there are similarities
between this level of switching and the "opaque single wavelength"
case described in [Section 3.5 of [RFC4202]](#), such port-to-port
switching is not limited to the optical switching technology implied
by the LSC type. Therefore, a new switching type is defined.

The new switching type is called Data Channel Switching Capable
(DCSC). (Port switching seems a more intuitive name, but it collides
with PSC so isn't used.) DCSC interfaces are able to support
switching of the whole digital channel presented on single channel
interfaces. Interfaces that inherently support multiple channels,
e.g., WDM and channelized TDM interfaces, are specifically excluded
from this type. Any interface that can be represented as a single
digital channel are included. Examples include concatenated TDM and
line encoded interfaces. Framed interfaces may also be included when
they support switching on an interface granularity.

DCSC is represented in GMPLS, see [RFC3471] and [RFC4202], using the value TBA (by IANA).

Port labels, as defined in [RFC3471], SHOULD be used for LSPs signaled using the DCSC Switching Type.

3. Generalized Channel_Set Label Related Formats

This section defines a new type of generalized label and updates related objects. This section updates the label related definitions of [RFC3473]. The ability to communicate more than one label as part of the same LSP was motivated by the support for the communication of one or more VLAN IDs, but the formats defined in this section are not technology specific and may be useful for other switching technologies.

3.1. Generalized Channel_Set LABEL_REQUEST Object

The Generalized Channel_Set LABEL_REQUEST object is used to indicate that the Generalized Channel_Set LABEL Object is to be used with the associated LSP. The format of the Generalized Channel_Set LABEL_REQUEST object is the same as the Generalized LABEL_REQUEST object and uses of C-Type of TBA.

3.2. Generalized Channel_Set LABEL Object

The Generalized Channel_Set LABEL Object communicates one or more labels, all of which can be used equivalently in the data path associated with a single LSP. The format of the Generalized Channel_Set LABEL Object is based on the LABEL_SET object defined in [RFC3473]. It differs from the the LABEL_SET object in that the full set may be represented in a single object rather than the multiple objects required by the [RFC3473] LABEL_SET object. The object MUST be used on LSPs that use the Generalized Channel_Set LABEL_REQUEST object. The object MUST be processed per [RFC3473]. Make-before-break procedures, see [RFC3209], SHOULD be used when modifying the Channel_Set LABEL object.

The format of the Generalized Channel_Set LABEL object is:

o Generalized Channel_Set LABEL object: Class = 16, C-Type = TBA (By
   IANA)

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                    Channel_Set Sub-Object 1                  |
   |                           ...                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   :                            :                               :
   :                            :                               :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                    Channel_Set Sub-Object N                  |
   |                           ...                               |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The Channel_Set Sub-Object size is measured in bytes and MUST always
be a multiple of 4, and at least 4, and has the following format:

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |    Action     |  Num Subchannels  |        Label Type       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                          Subchannel 1                        |
   |                           +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |      ...          |                                          :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+                                  :
   :                            :                               :
   :                            :                               :
   :                            :                               :
   :                            :                               :
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                          Subchannel N                        |
   |                           +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |          ...      |              Padding                     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Action: 8 bits

   See [RFC3471] for definition of actions. Range actions SHOULD
   be used when possible to minimize the size of the Channel_Set
   LABEL Object.

Number of Subchannels: 10 bits

   Indicates the number of subchannels carried in the sub-object.
   When the number of subchannels required exceeds the limit of
   the field, i.e., 1024, multiple Channel_Set Sub-Objects MUST be
   used. Note that the size of the sub-object may result in a
   Path message being larger than a single unfragmented IP packet.
   See section 4.4 for an example of how this case may be handled.

   A value of zero (0) has special meaning and MAY be used in
   either the LABEL or UPSTREAM_LABEL object. A value of zero (0)
   is used in a LABEL or UPSTREAM_LABEL object to indicate that
   the subchannel(s) used in the corresponding (downstream or
   upstream) direction MUST match the subchannel(s) carried in the
   reverse directions label object. When value of zero (0) is
   used, no Subchannels are included in the Channel_Set Sub-Object
   and only one Channel_Set Sub-Object may be present. The zero
   (0) value MUST NOT be used in both the LABEL and UPSTREAM_LABEL
   object of the same LSP.

Label Type: 14 bits

   See [RFC3473] for a description of this field.

Subchannel: Variable

   See [RFC3471] for a description of this field. Note that this
   field may not be 32 bit aligned.

Padding: Variable

   Padding is used to ensure that the length of a Channel_Set Sub-
   Object meets the multiple of 4 byte size requirement stated
   above. The field is only required when the Subchannel field is
   not 32 bit aligned and the number of included Subchannel fields
   result in the Sub-Object not being 32 bit aligned.

   The Padding field MUST be included when the number of bits
   represented in all the Subchannel fields included in a
   Generalized Channel_Set Sub-Object result in the Sub-Object not
   being 32 bit aligned. When present, the Padding field MUST
   have a length that results in the Sub-Object being 32 bit
   aligned. When present, the Padding field MUST be set to a zero
   (0) value on transmission and MUST be ignored on receipt.
   These bits SHOULD be passed through unmodified by transit
   nodes.

3.3. Other Label related Objects

   The previous section introduces a new LABEL object. As such the
   formats of the other label related objects are also impacted.
   Processing of these objects is not modified and remain per their
   respective specifications. The other label related objects are
   defined in [RFC3473] and include:
       - SUGGESTED_LABEL object
       - LABEL_SET object
       - ACCEPTABLE_LABEL_SET object
       - UPSTREAM_LABEL object
       - RECOVERY_LABEL object

4. IANA Considerations

   IANA is requested to administer assignment of new values for
   namespaces defined in this document and reviewed in this section.

4.1. Data Channel Switching Type

   Upon approval of this document, the IANA will make the assignment in
   the "Switching Types" section of the "GMPLS Signaling Parameters"
   registry located at http://www.iana.org/assignments/gmpls-sig-
   parameters:

   Value   Type   Reference
   -----   --------------------------   ---------
     125*   Data Channel Switching Capable (DCSC) [This document]

   (*) Suggested value.

4.2. Generalized Channel_Set LABEL_REQUEST Object

   Upon approval of this document, the IANA will make the assignment in
   the "Class Names, Class Numbers, and Class Types" section of the
   "RSVP PARAMETERS" registry located at
   http://www.iana.org/assignments/rsvp-parameters.

A new class type for the existing LABEL_REQUEST Object class number
(19) with the following definition:

    Class Types or C-Types:

      5* Generalized Channel_Set   [This document]

   (*) Suggested value.

4.3. Generalized Channel_Set LABEL Object

   Upon approval of this document, the IANA will make the assignment in
   the "Class Names, Class Numbers, and Class Types" section of the
   "RSVP PARAMETERS" registry located at
   http://www.iana.org/assignments/rsvp-parameters.

   A new class type for the existing RSVP_LABEL Object class number (16)
   with the following definition:

    Class Types or C-Types:

      4* Generalized Channel_Set   [This document]

   (*) Suggested value.

5. Security Considerations

   This document introduces new message object formats for use in GMPLS
   signaling [RFC3473]. It does not introduce any new signaling
   messages, nor change the relationship between LSRs that are adjacent
   in the control plane. As such, this document introduces no additional
   security considerations. See [RFC3473] for relevant security
   considerations.

6. References

6.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
             Requirement Levels," RFC 2119.

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   [RFC4202] Kompella, K., Ed., and Y. Rekhter, Ed., "Routing
             Extensions in Support of Generalized Multi-Protocol
             Label Switching (GMPLS)", RFC 4202, October 2005.

6.2. Informative References

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   [GMPLS-MEF-UNI] Berger, L., Papadimitriou, P., Fedyk, D.,
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                 (UNI)", Work in Progress,
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7. Acknowledgments

   Dimitri Papadimitriou provided substantial textual contributions to
   this document and coauthored earlier versions of this document.

   The authors would like to thank Evelyne Roch, Stephen Shew, and
   Adrian Farrel for their valuable comments.

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Acknowledgement

Generated on: Fri Aug 8 09:53:22 EDT 2008