FlexE GMPLS Signaling Extensions

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Abstract

This document describes GMPLS signaling extensions for configuring a FlexE group and adding or removing FlexE client(s) to a FlexE group [OIFFLEXE1].

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1. Introduction

This document describes GMPLS signaling extensions for configuring a FlexE group and adding or removing FlexE client(s) to a FlexE group [OIFFLEXE1]. The various usecases that arise when transporting Flexible Rate Ethernet signals in Optical transport networks are described in [FLEXEUSECASES]. The routing extensions in support of carrying link state information for a FlexE group are described in [FLEXEROUTING].

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

a. Ethernet PHY: an entity representing 100G-R Physical Coding Sublayer (PCS), Physical Media Attachment (PMA), and Physical Media Dependent (PMD) layers.

b. FlexE Group: a group of from 1 to 254 bonded Ethernet PHYs.

c. FlexE Client: an Ethernet flow based on a MAC data rate that may or may not correspond to any Ethernet PHY rate (e.g., 10, 40, m x 25 Gb/s).
d. FlexE Shim: the layer that maps or demaps the FlexE clients carried over a FlexE group.

e. FlexE Calendar: Representation of a FlexE group of n PHYs as a calendar of 20n slots logical length with 20 slots per PHY for scheduling of slots (i.e., a PHY bandwidth) among the FlexE clients.

3. Protocol Extensions

This section describes extensions to RSVP-TE signaling for GMPLS [RFC3473] to support FlexE.

3.1. Generalized Label

Figure 1 shows the proposed FlexE generalized label format to be carried in the Generalized Label Request [RFC3471]. This document proposes LSP Encoding type = Flexible Ethernet (FlexE) (a new value of 15 as defined in [FLEXEROUTING]), Switching type = Layer-2 Switch Capable (L2SC) (a value of 51 as defined in [RFC3471]) and Generalized PID (G-PID) = FlexE (a new value of 71 as defined in this document). A FlexE Group consists of 1 to n 100GBASE-R Ethernet PHYs. The label lists all PHY numbers (1 to 254) that are members of the FlexE group. For a client, the label also lists calendar slots in each member PHY that are assigned to the client.

```
+---------------------------------------+-----------------------+
|         FlexE Group Number            |        Reserved       |
+---------------------------------------+-----------------------+
| Client (being added or removed) |  Flags                      |
+----------------+--------------------------------+-------------+
|  PHY Number    |     Rate       | Granularity   | Unav. Slots |
+----------------+----------------+-------------+-+-------------+
| Slot Map (0 to 19 slot for 100G PHY)         |   Reserved    |
+-----------------------------------------------+---------------+
|                           ......                              |
+----------------+----------------+---------------+-------------+
|   PHY Number   |     Rate       |  Granularity  | Unav.  Slots|
+----------------+----------------+-------------+-+-------------+
| Slot Map (0 to 19 slot for 100G PHY)         |   Reserved    |
+-----------------------------------------------+---------------+
|                           ......                              |
+---------------------------------------------------------------+
```

Figure 1: FlexE Generalized Label
FlexE Group Number (20 bits) fields allows to check that the correct PHY is being received from the correct group number [OIFFLEXE1].

Client (16 bits) field indicates which of the FlexE clients is mapped into a given calendar slot in the A and B calendar configurations for the sub-calendar carried over that PHY [OIFFLEXE1].

Flags (8 bits) field is reserved for future use. [OIFFLEXE1].

PHY Number (8 bits) field is used to identify PHY by a number in the 1-254 range [OIFFLEXE1].

Rate (8 bits) field is used to specify rate of the given PHY number. Currently [OIFFLEXE1] has defined a 100G PHY rate. In the future, this field may be used to indicate other PHY rates (e.g., 400G).

Granularity (8 bits) field is used to indicate granularity of the FlexE calendar. Currently [OIFFLEXE1] has defined 5G granularity. In future, this field can have additional values, as further granularity are defined.

Slot Map (20 bits) field is used to indicate which calendar slots of the associated PHY number is assigned to a given FlexE client. For a PHY with a rate of 100G and granularity of 5G, the slot map consists of 20 slots (0-19 range). In the future, when other PHY rates and/or calendar granularities are defined, the slot map size for a PHY can be derived based on the Rate and Granularity fields values.

Unavailable Slots (8 bits) field is used to indicate the number of unavailable calendar slots (0-19 range) for example due to transport network constraints (i.e., no FlexE client should be assigned to the unused slots). Unavailable slots are placed at the end of each relevant sub-calendar (i.e., the highest numbered slots) [OIFFLEXE1].

3.2. FlexE Group Initial Setup

Suppose it is desired to establish a FlexE group containing two 100G PHYs between node A and B. This can be accomplished by having node A send a RSVP-TE message containing a FlexE generalized label to node B with the following field values:

a. FlexE Group Number = 100 (say), Client = 0x0000 (i.e., no client)
b. First PHY Number = 5 (say), Rate= 100G, Granularity=5G, Unavailable Slots=0, Slot Map = 0-19 bit set to 0 (i.e., all slots available)

c. Second PHY Number = 7 (say), Rate-100G, Granularity=5G, Unavailable Slots=0, Slot Map = 0-19 bit set to 0 (i.e., all slots available)

Thus both ends will have the same FlexE group configuration and the FlexE group can be brought in service.

3.3. FlexE Client Setup

Suppose it is desired to establish a FlexE client of rate 50G node A and B to the FlexE group created in the Section 3.2. This can be accomplished by having node A send a RSVP-TE message containing a FlexE generalized label to node B with the following field values:

a. FlexE Group Number = 100, Client = 0x0001 (i.e., client id = 1)

b. First PHY Number = 5 , Rate= 100G, Granularity=5G, Unavailable Slots=0, Slot Map = 0 to 4 bit set to 1 (i.e., 25G on this PHY)

c. Second PHY Number = 7, Rate-100G, Granularity=5G, Unavailable Slots=0, Slot Map = 0 to 4 bit set to 1 (i.e., 25G on this PHY)

3.4. Related Work

The generalized label described in [FLEXESIGNAL] is limited to 100G PHY only. In contrast, the generalized label proposed in this document is extendible to PHY rates beyond 100G. Specifically, the label proposed in this document introduces additional per PHY fields, namely, Rate and Granularity. This enables to drive per PHY calendar size information in the face of calendar granularity and/or calendar size changes that might be required for PHY rates beyond 100G (such as 400G).

4. Acknowledgements

5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

None.
7. References

7.1. Normative References

[FLEXEROUTING]

[FLEXESIGNAL]

[FLEXEUSECASES]

[OIFFLEXE1]
OIF, "FLEX Ethernet Implementation Agreement Version 1.0 (OIF-FLEXE-01.0)", March 2016.


7.2. Informative References


Appendix A. Additional Stuff

This becomes an Appendix.

Authors’ Addresses