Abstract

This document specifies routing extensions in support of carrying link state information for Generalized Multi-Protocol Label Switching (GMPLS) for Flex Ethernet.

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INTERNET DRAFT       FlexE GMPLS Routing Extension          July 6, 2016

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1 Introduction

FlexE implementation agreement version 1.0 as specified by OIF supports flexible size Ethernet interfaces supported by one or more Ethernet PHY(s). FlexE interface represents the aggregate bandwidth of underlying PHY(s). In order to compute a path for a FlexE LSP that spans over one or more FlexE links, the bandwidth of FlexE interface needs to be advertised and flooded in routing domain. This document specifies the OSPF routing extension for FlexE interfaces and enables GMPLS control plane to flood FlexE link bandwidth in routing domain.

1.1 Terminology

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. FlexE TE Link

FlexE mechanism operates using calendar that assigns 66-bit block positions to sub-calendars on each PHY of the FlexE group. The calendar has a granularity of 5G, and has a length of 20 slots per 100G of FlexE group capacity. Two calendar configurations are supported, referred as "A" and "B". At any given time, one of the calendar configurations is used for mapping the FlexE clients into the FlexE group. The two calendar configurations are provided to facilitate reconfiguration. To add or remove FlexE clients from the FlexE group, the clients are added to (or removed from) the inactive calendar and configuration is switched to make it effective. The effective bandwidth is represented by active calendar.

The effective bandwidth between two FlexE group (or interfaces) is represented by FlexE TE Link.

```
+-------+               +-------+               +-------+
|FlexE  |               |FlexE  |               |FlexE  |
|Switch |<-- FlexE Link-->|Switch |<-- FlexE Link-->|Switch |
|   A   |               |   B   |               |   C   |
+-------+               +-------+               +-------+

Figure-1: FlexE TE-Link
```
In Figure-1, FlexE Switch A, B, C operates in FlexE aware mode (i.e., these switches terminate FlexE shim) and are capable of multiplexing and de-multiplexing FlexE group. In other words, the FlexE switches instantiate the FlexE Shim functions (as specified in the OIF IA) at each FlexE interface. The mux-demux capability of FlexE switch allows it to select time-slots for FlexE LSP at each hop. FlexE Link (TE-Link) exist between each FlexE aware switch.

```
+-------+ <------------ FlexE Link------------->+-------+
| FlexE |               +-------+               | FlexE |
| Switch |               | unaware |               | Switch |
|   A   |               |  (B)   |               |   C   |
+-------+               +-------+               +-------+

|<-------------- TE-Link --------------->|
```

Figure-2: FlexE TE-Link

In Figure-2, A and C are FlexE aware switches and B is unaware. In this case, FlexE group is terminated by the switch A and C. Therefore, TE-link will also exist between A and C. BW modeled by TE-link and switch capability of FlexE aware switch is used for end-to-end path calculation for FlexE LSP.

3. Flex link property

FlexE group realized by the FlexE SHIM needs to have same number of components (i.e., grouped PHYs), number of slots and slot granularity on both ends.

The bandwidth of a TE Link is represented by number of slots and size of the slots. Theoretically, it is conceivable that a FlexE TE link could be constructed out of heterogeneous collection of Ethernet PHY(s), with different rates, which may result in a FlexE TE Link bandwidth realized by multiple sets of slots where each set may have different granularity/size. However, OIF agreement doesn’t support different granularity/size, hence, it is out of scope for this document.

4. OSPF TE-LSA Extension

This section describes the OSPF TE-LSA Extensions to support
bandwidth encoding for FlexE TE-Links.

4.1. Interface Switch Capability Descriptor

The Interface Switching Capability Descriptor (ISCD) describes switching capability of an interface [RFC 4202]. The Switching capability is essentially described by:

- Interface Switching Capability
- Encoding
- Reservable Bandwidth

For FlexE interfaces this proposal uses L2 Switching Capability (L2SC) for Switching Type and proposes new encoding type

<table>
<thead>
<tr>
<th>Value</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>Flex Ethernet (FlexE)</td>
</tr>
</tbody>
</table>

Nodes advertising FlexE switching BW for for its links must use Switching Type and Encoding values as follows:
Switching Type:
L2SC [as defined in RFC4202]

Encoding Type:
FlexE [as defined in this document]

Max LSP Bandwidth:
The FlexE SHIM nominal rate (in kbps)

Reservable Bandwidth is advertised as part of Switch Capability Specific Information which is variable field in ISCD. Unused or available or reservable bandwidth is expressed as combination of [Number of Slots, Granularity]

As per OIF agreement Granularity has only one value i.e. 5G. In future additional values may be defined.

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----------------------------------------------+
|   Type=1           |           Length                          |
+-----------------------------------------------+
| Granularity      |           Reserved                        |
+-----------------------------------------------+
|                  Available Slots at priority 0                |
|                  Available Slots at priority 1                |
|                  Available Slots at priority 2                |
|                  Available Slots at priority 3                |
|                  Available Slots at priority 4                |
|                  Available Slots at priority 5                |
|                  Available Slots at priority 6                |
|                  Available Slots at priority 7                |
```

Granularity: This is 8 bit field and takes values like Enum. Current OIF agreement only allow 5G granularity. In future, this field can have more values, as further granularity are defined.
Value - Granularity
-------------------
1   -   5G

Reserved : This field is reserved and marked as 0.

Available Slots : This field (32 bits) indicates the maximum number of slots available at priority 'p' on active calendar of the TE Link.
3 Security Considerations

TBD

4 IANA Considerations

New Encoding type is defined in this document for Flex Ethernet. Proposed value is 15

5 References

5.1 Normative References


5.2 Informative References

Authors' Addresses

Khuzema Pithewan
169 W Java Dr, Sunnyvale, CA, USA
EMail: kpitthewan@infinera.com

Iftekhar Hussain
169 W Java Dr, Sunnyvale, CA, USA
EMail: ihussain@infinera.com

Radha Valiveti
169 W Java Dr, Sunnyvale, CA, USA
EMail: rvaliveti@infinera.com