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OSPF Extensions in Support of Generalized MPLS

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Abstract

This document specifies encoding of extensions to the OSPF routing protocol in support of Generalized Multi-Protocol Label Switching.

Summary for Sub-IP Area

(This section to be removed before publication.)

0.1. Summary

This document specifies encoding of extensions to the OSPF routing protocol in support of Generalized Multi-Protocol Label Switching (GMPLS). The description of the extensions is specified in [GMPLS-ROUTING].

0.2. Where does it fit in the Picture of the Sub-IP Work

This work fits squarely in either the CCAMP or OSPF box.

0.3. Why is it Targeted at this WG

This draft is targeted at the CCAMP or the OSPF WG, because this draft specifies the extensions to the OSPF routing protocols in support of GMPLS, because GMPLS is within the scope of the CCAMP WG, and because OSPF is within the scope of the OSPF WG.

0.4. Justification

The WG should consider this document as it specifies the extensions to the OSPF routing protocols in support of GMPLS.

1. Specification of Requirements

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. Introduction

This document specifies extensions to the OSPF routing protocol in support of carrying link state information for Generalized Multi-Protocol Label Switching (GMPLS). The set of required enhancements to OSPF are outlined in [[GMPLS-ROUTING](#)].

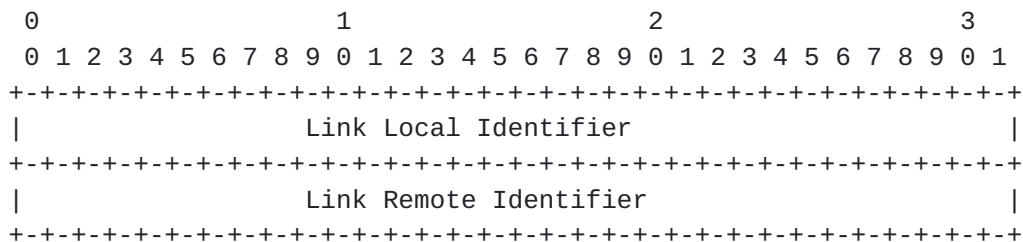
3. OSPF Routing Enhancements

In this section we define the enhancements to the TE properties of GMPLS TE links that can be announced in OSPF TE LSAs. The Traffic Engineering (TE) LSA, which is an opaque LSA with area flooding scope [[OSPF-TE](#)], has only one top-level Type/Length/Value (TLV) triplet and has one or more nested sub-TLVs for extensibility. The top-level TLV can take one of two values (1) Router Address or (2) Link. In this document, we enhance the sub-TLVs for the Link TLV in support of GMPLS. Specifically, we add the following sub-TLVs to the Link TLV:

Sub-TLV Type	Length	Name
11	8	Link Local/Remote Identifiers
14	4	Link Protection Type
15	variable	Interface Switching Capability Descriptor
16	variable	Shared Risk Link Group

3.1. Link Local/Remote Identifiers

A Link Local/Remote Identifiers is a sub-TLV of the Link TLV. The type of this sub-TLV is 11, and length is eight octets. The value field of this sub-TLV contains four octets of Link Local Identifier followed by four octets of Link Remote Identifier (see Section "Support for unnumbered links" of [[GMPLS-ROUTING](#)]). If the Link Remote Identifier is unknown, it is set to 0.



A node can communicate its Link Local Identifier to its neighbor using a link local Opaque LSA, as described in Section "Exchanging Link Local TE Information".

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								
+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-								
Shared Risk Link Group Value																																							


```

+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               .....                               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Shared Risk Link Group Value          |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

This sub-TLV carries the Shared Risk Link Group information (see Section "Shared Risk Link Group Information" of [\[GMPLS-ROUTING\]](#)).

The SRLG sub-TLV may occur at most once within the Link TLV.

3.4. Interface Switching Capability Descriptor

The Interface Switching Capability Descriptor is a sub-TLV (of type 15) of the Link TLV. The length is the length of value field in octets. The format of the value field is as shown below:

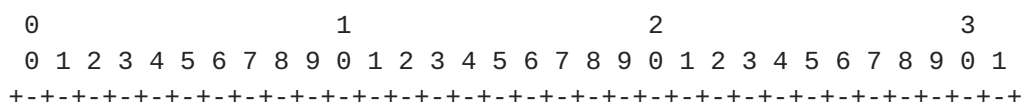
```

      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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Switching Cap | Encoding | Reserved |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 0        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 1        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 2        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 3        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 4        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 5        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 6        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               Max LSP Bandwidth at priority 7        |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
| Switching Capability-specific information |
| (variable) |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

The Switching Capability (Switching Cap) field contains one of the following values:

- 1 Packet-Switch Capable-1 (PSC-1)
- 2 Packet-Switch Capable-2 (PSC-2)




```

|               Minimum LSP Bandwidth               |
+---+---+---+---+---+---+---+---+---+---+---+---+
|  Indication  |               Padding                |
+---+---+---+---+---+---+---+---+---+---+---+---+

```

The Minimum LSP Bandwidth is encoded in a 4 octets field in the IEEE floating point format. The units are bytes (not bits!) per second. The indication whether the interface supports Standard or Arbitrary SONET/SDH is encoded as 1 octet. The value of this octet is 0 if the interface supports Standard SONET/SDH, and 1 if the interface supports Arbitrary SONET/SDH. The padding is 3 octets, and is used to make the Interface Switching Capability Descriptor sub-TLV 32-bits aligned. It SHOULD be set to zero by the sender and SHOULD be ignored by the receiver.

When the Switching Capability field is LSC, there is no Switching Capability specific information field present.

To support interfaces that have more than one Interface Switching Capability Descriptor (see Section "Interface Switching Capability Descriptor" of [[GMPLS-ROUTING](#)]) the Interface Switching Capability Descriptor sub-TLV may occur more than once within the Link TLV.

4. Implications on Graceful Restart

The restarting node should follow the OSPF restart procedures [OSPF-RESTART], and the RSVP-TE restart procedures [[GMPLS-RSVP](#)].

When a restarting node is going to originate its TE LSAs, the TE LSAs containing Link TLV should be originated with 0 unreserved bandwidth, Traffic Engineering metric set to 0xffffffff, and if the Link has LSC or FSC as its Switching Capability then also with 0 as Max LSP Bandwidth, until the node is able to determine the amount of unreserved resources taking into account the resources reserved by the already established LSPs that have been preserved across the restart. Once the restarting node determines the amount of unreserved resources, taking into account the resources reserved by the already established LSPs that have been preserved across the restart, the node should advertise these resources in its TE LSAs.

In addition in the case of a planned restart prior to restarting, the restarting node SHOULD originate the TE LSAs containing Link TLV with 0 as unreserved bandwidth, and if the Link has LSC or FSC as its Switching Capability then also with 0 as Max LSP Bandwidth. This would discourage new LSP establishment through the restarting router.

Neighbors of the restarting node should continue advertise the actual

6. Normative References

- [OSPF] Moy, J., "OSPF Version 2", STD 54, [RFC 2328](#), April 1998.
- [OSPF-TE] Katz, D., Yeung, D. and Kompella, K., "Traffic Engineering Extensions to OSPF", (work in progress)
- [GMPLS-SIG] Berger, L. (Editor), "Generalized MPLS - Signaling Functional Description", (work in progress)
- [GMPLS-RSVP] Berger, L., and Ashwood-Smith, P. (Editors), "Generalized MPLS Signaling - RSVP-TE Extensions", (work in progress)
- [GMPLS-ROUTING] Kompella, K., and Rekhter, Y. (Editors), "Routing Extensions in Support of Generalized MPLS", (work in progress)
- [OSPF-RESTART] Moy, J., "Hitless OSPF Restart", (work in progress)
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [OSPF-SIG] Murphy, S., Badger, M., and B. Wellington, "OSPF with Digital Signatures", [RFC 2154](#), June 1997.

7. Security Considerations

This document specifies the contents of Opaque LSAs in OSPFv2. As Opaque LSAs are not used for SPF computation or normal routing, the extensions specified here have no affect on IP routing. Tampering with TE LSAs may have an effect on traffic engineering computations, however, and it is suggested that whatever mechanisms are used for securing the transmission of normal OSPF LSAs be applied equally to all Opaque LSAs, including the TE LSAs specified here.

Note that the mechanisms in [\[OSPF\]](#) and [\[OSPF-SIG\]](#) apply to Opaque LSAs. It is suggested that any future mechanisms proposed to secure/authenticate OSPFv2 LSA exchanges be made general enough to be used with Opaque LSAs.

8. IANA Considerations

This memo introduces 4 new sub-TLVs of the TE Link TLV in the TE Opaque LSA for OSPF v2; [[OSPF-TE](#)] says that the sub-TLVs of the TE Link TLV in the range 10-32767 must be assigned by Expert Review, and must be registered with IANA.

This memo has four suggested values for the four sub-TLVs of the TE Link TLV; it is strongly recommended that the suggested values be granted, as there are interoperable implementations using these values.

9. Acknowledgements

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