Network Working Group
Internet-Draft
Expires: August 20, 2005

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February 19, 2005

Traffic Engineering Extensions to OSPF version 3
draft-ietf-ospf-ospfv3-traffic-03.txt

Status of this Memo

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Abstract

This document describes extensions to OSPFv3 to support intra-area Traffic Engineering (TE). This document extends OSPFv2 TE to handle IPv6 networks. A new TLV and several new sub-TLVs are defined to support IPv6 networks.

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1. Introduction

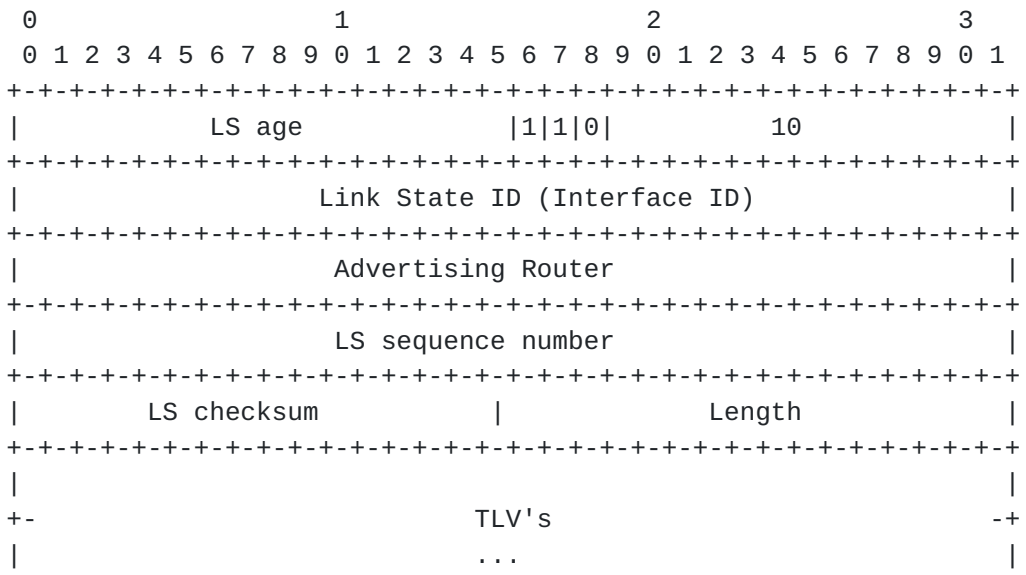
OSPFv3 has a very flexible mechanism for adding new LS types. Unknown LS types are flooded properly based on the flooding scope bits in the LS type [OSPFV3]. This document proposes the addition of the Intra-Area-TE LSA to OSPFv3.

For Traffic Engineering, this document uses "Traffic Engineering Extensions to OSPF" [TE] as a base for TLV definitions. New TLSs and sub-TLVs are added to [TE] to extend TE capabilities to IPv6 networks. Some TLVs and sub-TLVs require clarification for OSPFv3 applicabilty.

GMPLS [GMPLS] and the Diff-Serv MPLS Extensions [TE-DIFF] are based on [TE]. These functions can also be extended to OSPFv3 by utilizing the TLV and sub-TLVs described in this document.

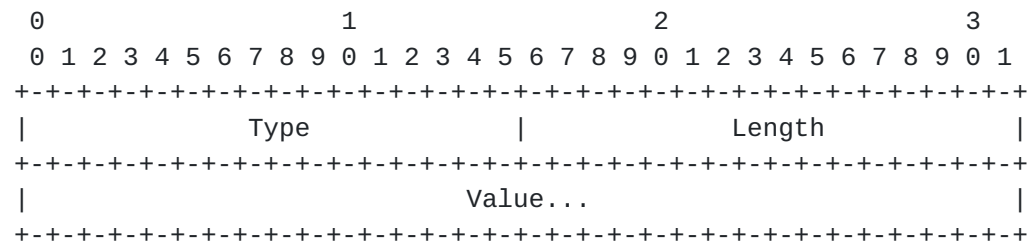
2. Intra-Area-TE-LSA

A new LS type is defined for the Intra-Area-TE LSA. This is different from OSPFv2 Traffic Engineering [TE] where opaque LSAs are used to advertise TE information [OPAQUE]. The LSA function code is 10, the U bit is set, and the scope is set to 01 for area-scoping. When the U bit is set to 1 an OSPFv3 router must flood the LSA at its defined flooding scope even if it does not recognize the LS type [OSPFV3].



The Link State ID of an Intra-Area-TE LSA will be the Interface ID of the link.

The format of the TLV's within the body of a router information LSA is the same as the format used by the Traffic Engineering Extensions to OSPF [TE]. The LSA payload consists of one or more nested Type/ Length/Value (TLV) triplets. The format of each TLV is:

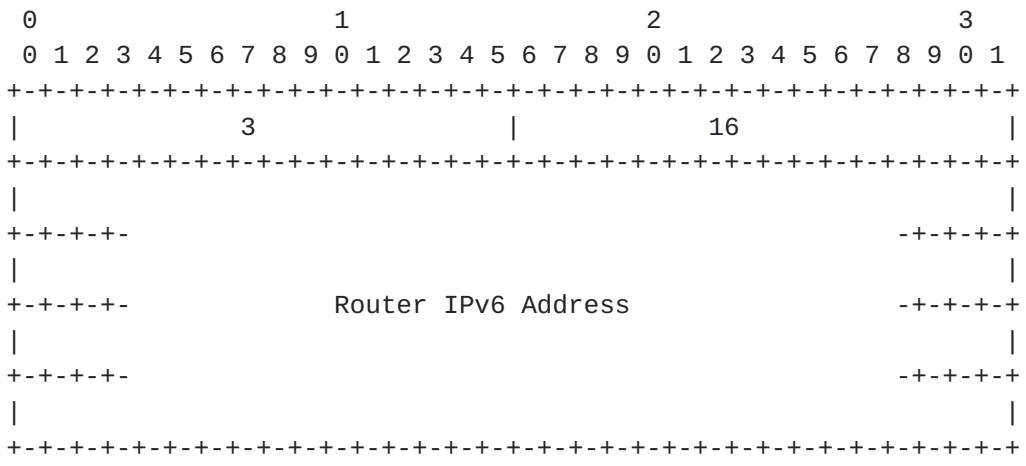


The Length field defines the length of the value portion in octets (thus a TLV with no value portion would have a length of zero). The TLV is padded to four-octet alignment; padding is not included in the length field (so a three octet value would have a length of three, but the total size of the TLV would be eight octets). Nested TLV's are also 32-bit aligned. For example, a one byte value would have the length field set to 1, and three octets of padding would be added to the end of the value portion of the TLV. Unrecognized types are ignored.

3. Router IPv6 Address TLV

The Router IPv6 Address TLV will advertise a reachable IPv6 address. This is a stable IPv6 address that is always reachable if there is connectivity to the OSPFv3 router.

The Router IPv6 Address TLV has type 3, length 16, and a value containing a 16 octet local IPv6 address. It MUST appear in exactly one Traffic Engineering LSA originated by an OSPFv3 router supporting the TE extensions.



Type A 16 bit field set to 3.
Length A 16 bit field that indicates the length of the value portion in octets. For this TLV it is always 16.
Value A stable and routable IPv6 address.

4. Link TLV

The Link TLV describes a single link and consists a set of sub-TLVs [TE]. All of sub-TLVs in [TE] other than the Link ID sub-TLV are applicable to OSPFv3. The Link ID sub-TLV can't be used in OSPFv3 due to the protocol differences between OSPFv2 and OSPFv3.

Three new sub-TLVs for the Link TLV are defined:

17 - Neighbor ID (8 octets)
18 - Local Interface IPv6 Address (16N octets)
19 - Remote Interface IPv6 Address (16N octets)

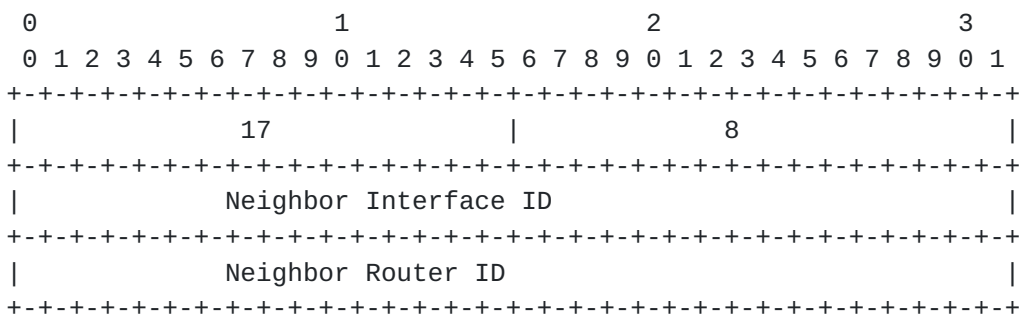
4.1 Link ID Sub-TLV

The Link ID sub-TLV is used in OSPFv2 to identify the other end of the link. In OSPFv3, the Neighbor ID sub-TLV should be used for link identification. In OSPFv3, The Link ID sub-TLV should not be sent and should be ignored upon receipt.

4.2 Neighbor ID Sub-TLV

In OSPFv2, the Link ID is used to identify the other end of a link. In OSPFv3, the combination of Neighbor Interface ID and Neighbor Router ID are used for neighbor link identification. Both are advertised in the Neighbor ID Sub-TLV.

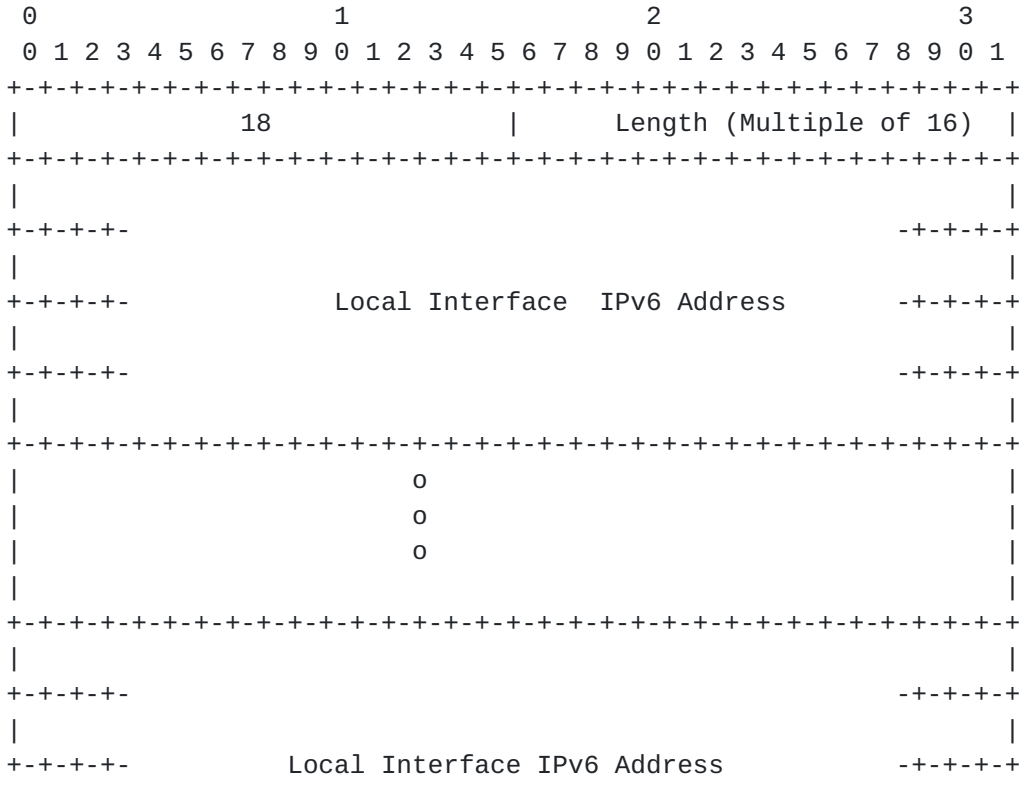
Neighbor Interface ID and Neighbor Router ID values are the same as described in RFC 2740 [OSPFV3] A.4.3 Router-LSAs.

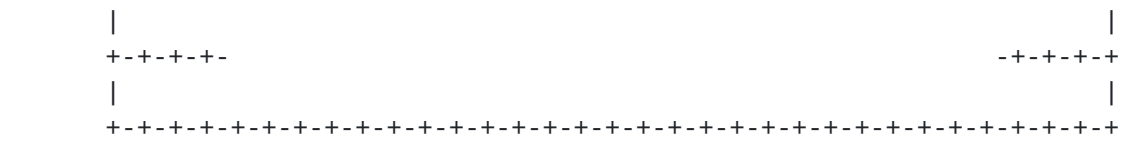


Type A 16 bit field set to 17.
Length A 16 bit field that indicates the length of the value portion in octets. For this sub-TLV it is always 8.
Value The neighbor's interface ID and router ID.

4.3 Local Interface IPv6 Address Sub-TLV

The Local Interface IPv6 Address sub-TLV specifies the IPv6 address(es) of the interface corresponding to this link. If there are multiple local addresses on the link, they are all listed in this sub-TLV. Link-local address should not be included in this sub-TLV.

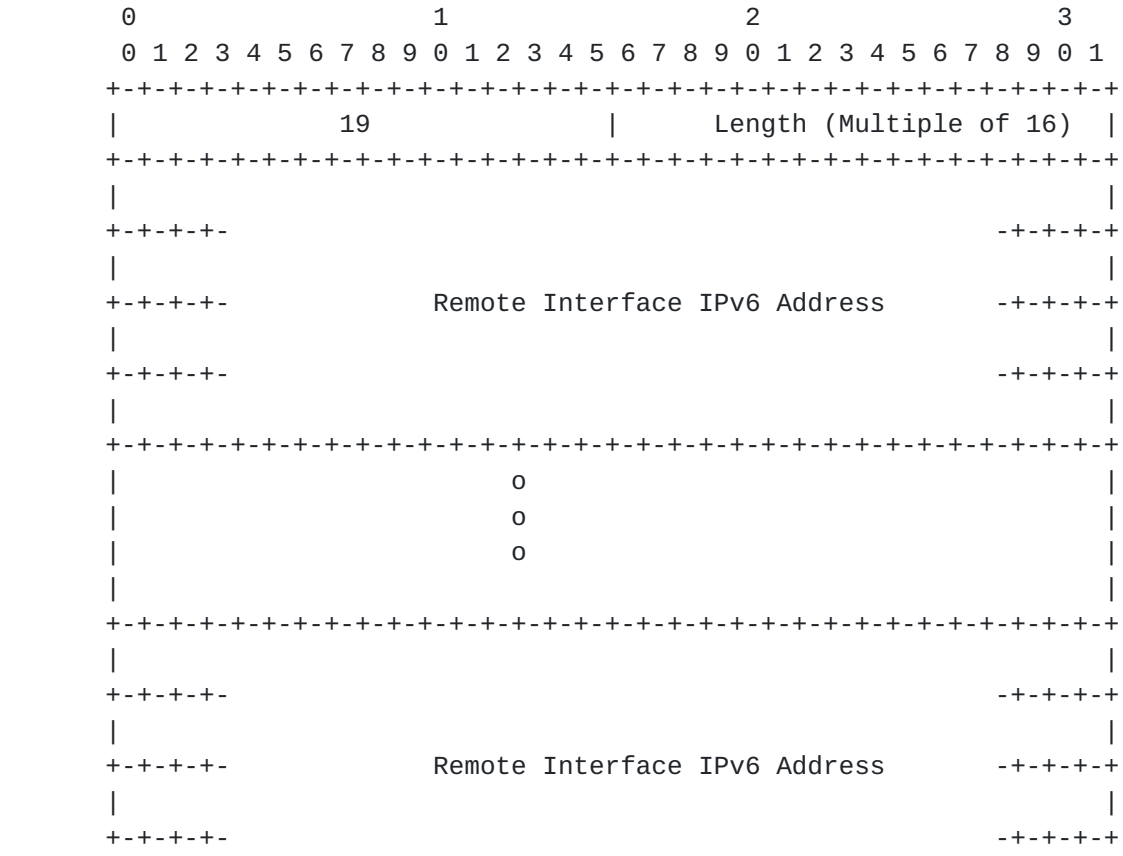


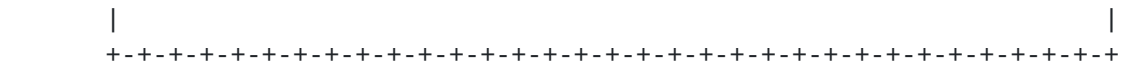


Type A 16 bit field set to 18.
Length A 16 bit field that indicates the length of the value portion in octets. For this sub-TLV it will alway be a multiple of 16 octets dependent on the number of IPv6 addresses advertised.
Value A variable length local interface IPv6 address list.

4.4 Remote Interface IPv6 Address Sub-TLV

The Remote Interface IPv6 Address sub-TLV advertises the IPv6 address(es) associated with neighbor's interface. This Sub-TLV and the Local Interface IPv6 address Sub-TLV are used to discern amongst parallel links between OSPFv3 routers. If the Link Type is multi-access, the Remote Interface IPv6 Address is set to ::. Link-local addresses should not be contained in this sub-TLV.





Type A 16 bit field set to 19.
Length A 16 bit field that indicates the length of the value portion in octets. For this sub-TLV it will alway be a multiple of 16 octets dependent on the number of IPv6 addresses advertised.
Value A variable length remote interface IPv6 address list.

5. Security Considerations

The function described in this document does not create any new security issues for the OSPFv3 protocol. Security considerations for the base OSPFv3 protocol are covered in [OSPFV3].

6. IANA Considerations

The following IANA assignments are to be made from existing registries:

1. The OSPFv3 LSA type function code 10 will need to be reserved for the OSPFv3 Intra-Area-TE-LSA.
2. The Router IPv6 Address TLV type 3 will be assigned from the existing registry for OSPF TE TLVs.
3. The Neighbor ID Sub-TLV (17), Local Interface IPv6 Address Sub-TLV (18), and Remote Interface IPv6 Address Sub-TLV (19), will be assigned from the existing registry for OSPF TE Sub-TLVs.

7. References

7.1 Normative References

[OSPF] Moy, J., "OSPF Version 2", RFC 2328, April 1998.

[OSPFV3] Coltun, R., Ferguson, D. and J. Moy, "OSPF for IPv6", RFC 2740, April 1998.

[RFC2119] Bradner, S., "Key words for use in RFC's to Indicate Requirement Levels", RFC 2328, March 1977.

[TE] Katz, D., Yeung, D. and K. Kompella, "Traffic Engineering Extensions to OSPF", RFC 3630, September 2003.

7.2 Informative References

[GMPLS] Kompella, K. and Y. Rekhter, "OSPF Extensions in Support of Generalized MPLS", draft-ietf-ccamp-ospf-gmpls-extensions-12.txt (work in progress).

[OPAQUE] Coltun, R., "The OSPF Opaque LSA Option", RFC 2370, July 1998.

[TE-DIFF] Le Faucheur, F., Wu, L., Davie, B., Davari, S., Vaananen, P., Krishnan, R., Cheval, P. and J. Heinanen, "Multi-Protocol Label Switching (MPLS) Support of Differentiated Services", RFC 3270.

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Appendix A. Acknowledgments

Thanks to Vishwas Manral, Kireeti Kompella and Alex Zinin for their comments.

The RFC text was produced using Marshall Rose's xml2rfc tool.

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Acknowledgment

Funding for the RFC Editor function is currently provided by the Internet Society.