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**Traffic Engineering Extensions to OSPF version 3**  
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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.

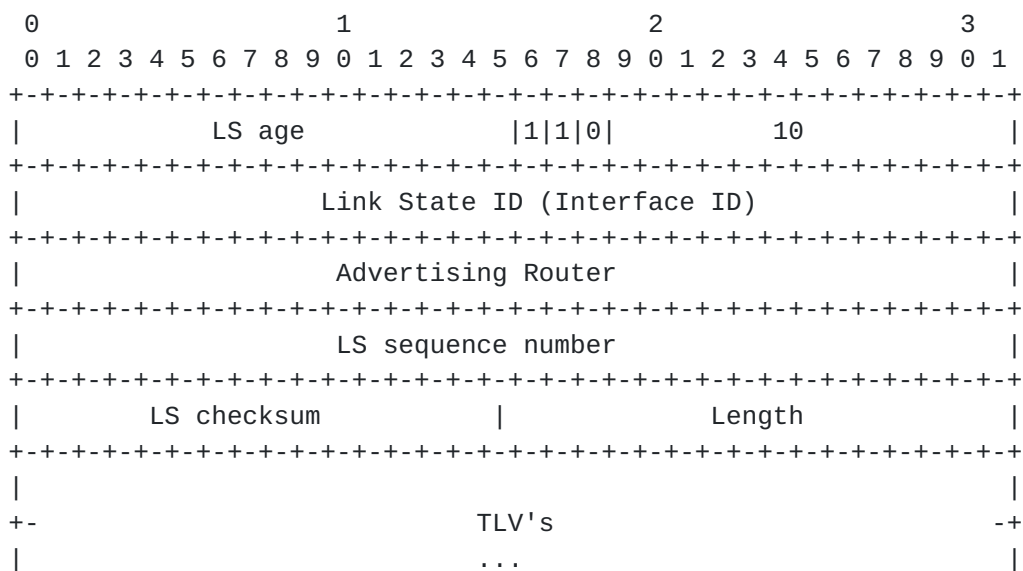
For Traffic Engineering, this document uses "Traffic Engineering Extensions to OSPF" [[TE](#)] as a base for TLV definitions. New TLVs and sub-TLVs are added to [[TE](#)] to extend TE capabilities to IPv6 networks. Some TLVs and sub-TLVs require clarification for OSPFv3 applicability.

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:





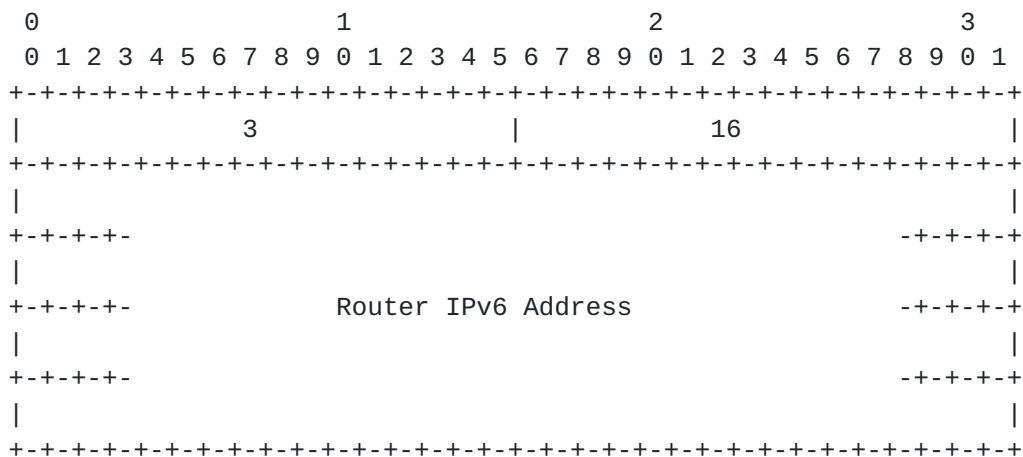




### 3. Router IPv6 Address TLV

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 18.

Length    A 16 bit field that indicates the length of the value portion in octets. For this sub-TLV it will always 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.

```

      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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|               19               | Length (Multiple of 16) |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|
+---+---+
|
+---+---+ Remote Interface IPv6 Address +---+---+
|
+---+---+
|
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|               0               |
|               0               |
|               0               |
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+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|
+---+---+
|
+---+---+ Remote Interface IPv6 Address +---+---+
|
+---+---+

```





## **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

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