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Traffic Engineering Extensions to OSPF version 3

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Status of this Memo

Abstract

This document describes extensions to OSPFv3 to support intra-area Traffic Engineering (TE).

This document extends OSPFv2 TE to both IPv4 and IPv6 networks. A new TLV and several new sub-TLVs are defined to support IPv6 networks. The use of the new TLV and sub-TLVs is not limited to OSPFv3. They may also be used in OSPFv2.

Conventions used in this document

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 [5].

1. Applicability

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 [1]. This document proposes the addition of the Intra-Area-TE LSA to OSPFv3.

For Traffic Engineering, this document uses "Traffic Engineering Extensions to OSPF" [2] as a base for TLV definitions. New sub-TLVs are added to [2] to extend TE capabilities to IPv6 networks. Some TLVs require clarification for OSPFv3 applicabilty. The new sub-TLVs described in this document can also be carried in OSPFv2 as described in [2].

GMPLS [3] and the Diff-Serv aware MPLS Extensions [4] are based on [2]. These functions can also be extended to OSPFv3 by utilizing the TLV and sub-TLVs described in this document.

2. Router Address TLV

In OSPFv3, the Router Address TLV value should be a Router ID of the advertising router. [2] states that the Router Address TLV is "a stable IP address of the advertising router that is always reachable if there is any connectivity to it". An OSPFv3 router's Router ID is not an IPv6 address and is not reachable in an IPv6 network.

The Router Identifier TLV has type 1, length 4, and a value containing the the four octet OSPFv3 Router ID. It MUST appear in exactly one Traffic Engineering LSA originated by an OSPFv3 router supporting the TE extentions.

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 extentions.

4. Link TLV

The Link TLV describes a single link and consists a set of sub-TLVs [2]. All of sub-TLVs in [2] 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

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

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.

The Neighbor ID sub-TLV has type 17, length 8, and contains the 4 octet Neighbor Interface ID and the 4 octet Neighbor Router ID. Neighbor Interface ID and Neighbor Router ID values are the same as described in RFC 2740 [1] A.4.3 Router-LSAs.

In OSPFv2, the Neighbor ID sub-TLV should not be sent and should be ignored upon receipt.

4.3 Local Interface IPv6 Address

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.

The Local Interface IPv6 Address sub-TLV has type 18, length 16N (where N is the number of local addresses), and contains the link's local addresses.

4.4 Remote Interface IPv6 Address

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.

The Remote Interface IPv6 Address sub-TLV has type 19, length 16N (where N is the number of local addresses), and contains the link neighbor's local addresses.

5. Intra-Area-TE-LSA

A new LS type is defined for the Intra-Area-TE LSA. The LSA function code is 10, the U bit is set, and the scope is 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 [1].

LSA function code	LS Type	Description
10	0xa00a	Intra-Area-TE-LSA

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

6. Security Considerations

This memo does not create any new security issues for the OSPFv3 protocol [1] or OSPFv2 Traffic Engineering extensions [2]. Security considerations for OSPFv2 Traffic Engineering are covered in [2].

7. Acknowledgements

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

8. Normative References

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

[2] Katz, D., Yeung, D., Kompella, K., "Traffic Engineering Extensions to OSPF", draft-katz-yeung-ospf-traffic-09.txt, work in progress.

9. Informative References

[3] K. Kompella, Y. Rekhter, "OSPF Extensions in Support of Generalized MPLS", draft-ietf-ccamp-ospf-gmpls-extensions-09.txt, work in progress.

[4] F. L. Faucheur, J. Boyle, K. Kompella, W. Townsend, D. Skalecki, "Protocol extensions for support of Diff-Serv-aware MPLS Traffic Engineering", draft-ietf-tewg-diff-te-proto-02.txt, work in progress.

[5] Bradner, S., "Key words for use in RFCs to Indicate Requirement Level", BCP 14, RFC 2119, March 1997.

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