

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: February 12, 2015

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OSPFv2 LSA Extendibility
draft-ietf-ospf-lsa-extend-00.txt

Abstract

OSPFv2 requires functional extension beyond what can readily be done with the fixed-format Link State Advertisements (LSAs) as described in [RFC 2323](#). This document defines OSPF opaque LSAs based on Type-Length-Value (TLV) tuples that can be used to associate additional attributes with advertised prefixes or links. The OSPF opaque LSAs are optional and fully backward compatible.

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OSPFv2 LSA Extendibility

August 2014

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1. Introduction

OSPFv2 requires functional extension beyond what can readily be done with the fixed-format Link State Advertisements (LSAs) as described in [RFC 2328](#) [[OSPFV2](#)]. This document defines OSPF opaque LSAs based on Type-Length-Value (TLV) tuples that can be used to associate additional attributes with advertised prefixes or links. The OSPF opaque LSAs are optional and fully backward compatible. This is in contrast to the approach taken in OSPFv3 [[OSPFV3-LSA-EXTEND](#)] where the existing LSAs will be replaced TLV-based extended LSAs.

New requirements such as source/destination routing, route tagging, and segment routing necessitate this extension.

The specification defines the following OSPFv2 opaque LSAs:

1. OSPFv2 Extended Prefix LSA - Allows advertisement of additional attributes for prefixes advertised in Router-LSAs, Network-LSAs, Network-Summary-LSAs, NSSA-LSAs, and AS-External-LSAs [[OSPFV2](#)]
2. OSPFv2 Extended links LSA - Allows advertisement of additional attributes for links advertised in Router-LSAs.

Additionally, the following TLVs are defined:

1. OSPFv2 Extended Prefix TLV - Top level TLV advertising attributes for a prefix in the OSPFv2 Extended Prefix LSA.
2. OSPFv2 Extended Link TLV - Top level TLV advertising attributes

for a link in the OSPFv2 Extended link LSA.

1.1. Requirements notation

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 [\[RFC-KEYWORDS\]](#).

1.2. Acknowledgments

We would like to thank Anton Smirnov for his contribution.

2. OSPFv2 Extended Prefix Opaque LSA

The OSPFv2 Extended Prefix Opaque LSA will be used to advertise additional prefix attributes. Opaque LSAs are described in [OPAQUE].

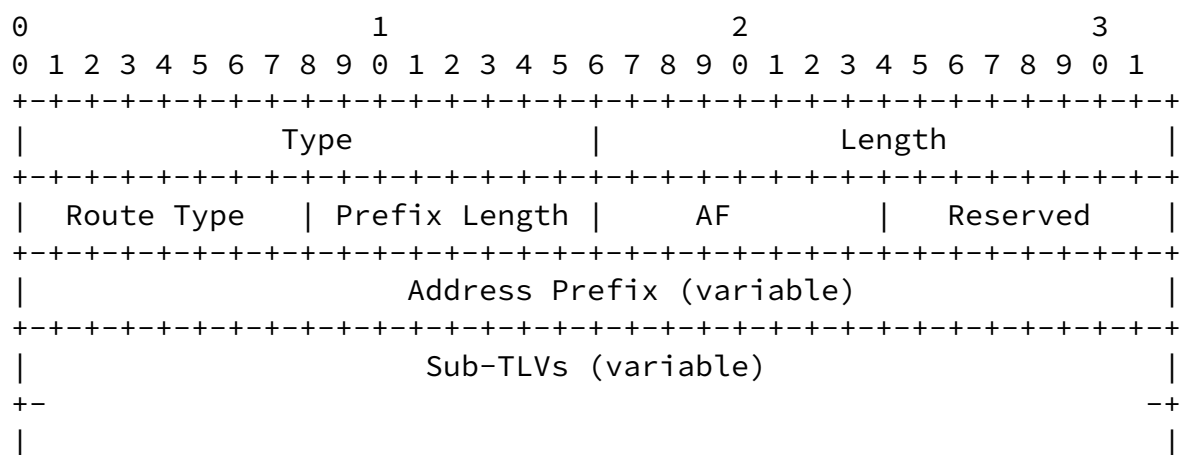
Multiple OSPFv2 Extended Prefix Opaque LSAs can be advertised by an

OSPFv2 router. The flooding scope of the OSPFv2 Extended Prefix Opaque LSA depends on the scope of the advertised prefixes and is under the control of the advertising router. In some cases (e.g., mapping server deployment), the LSA flooding scope may be greater than the scope of the corresponding prefixes.

The format of the OSPFv2 Extended Prefix Opaque LSA is as follows:

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	2	3	4	5	6	7	8	9
LS age										Options										9, 10, or 11																			
Opaque type										Instance																													
Advertising Router																																							
LS sequence number																																							
LS checksum										length																													

MUST have the same flooding scope. The OSPF Extended Prefix TLV has the following format:



OSPFv2 Extended Prefix TLV

Type

The TLV type. Suggested value is 1.

Length

Variable dependent on sub-TLVs.

Route Type

Route type: type of the OSPF route. If the route type is 0 (unspecified), the information inside the OSPF External Prefix TLV applies to the prefix regardless of prefix's route-type. This is useful when prefix specific attributes are advertised by ax

external entity, which is not aware of the route-type associated with the prefix. Supported types are:

0 - unspecified

1 - intra-area

3 - inter-area

5 - external

7 - NSSA external

Prefix Length

Length in of the prefix in bits.

AF

Address family for the prefix. Currently, the only supported value is 0 for IPv4 unicast.

Address Prefix

The prefix itself encoded as an even multiple of 32-bit words, padded with zeroed bits as necessary. This encoding consumes $((\text{PrefixLength} + 31) / 32)$ 32-bit words. The default route is represented by a prefix of length 0.

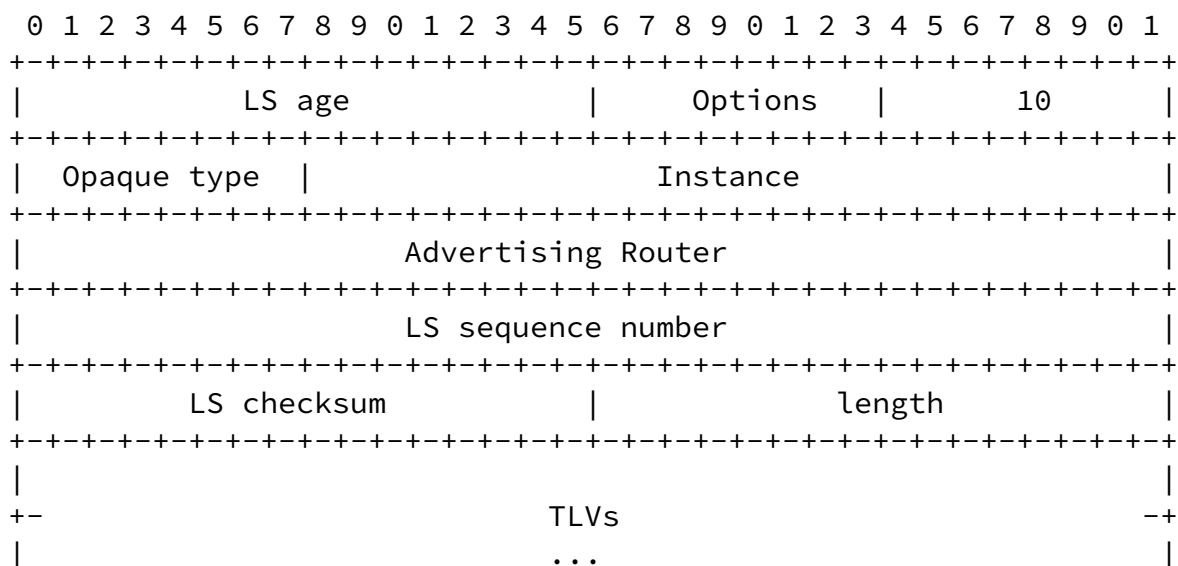
This document creates a registry for OSPF Extended Prefix sub-TLVs in [Section 6](#).

[3](#). OSPFv2 Extended Link Opaque LSA

The OSPFv2 Extended Link Opaque LSA will be used to advertise additional link attributes. Opaque LSAs are described in [\[OPAQUE\]](#).

The OSPFv2 Extended Link Opaque LSA has an area flooding scope. Multiple OSPFv2 Extended Link Opaque LSAs can be advertised by a single router in an area.

The format of the OSPFv2 Extended Link Opaque LSA is as follows:



OSPFv2 Extended Link LSA

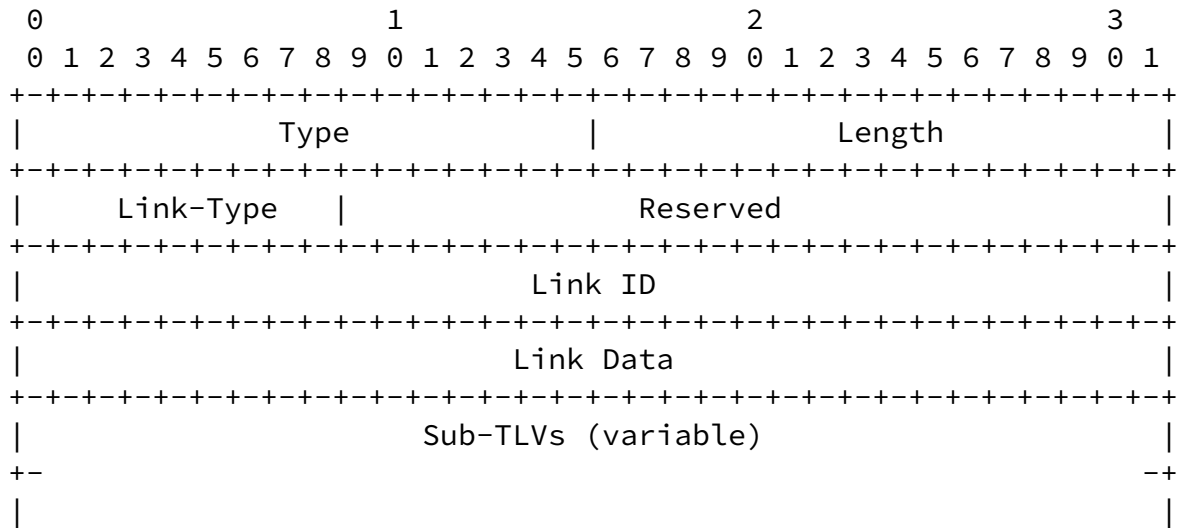
The Opaque type used by OSPFv2 Extended Link Opaque LSA is 8.

The format of the TLVs within the body of the OSPFv2 Extended Prefix LSA is the same as [Section 2](#).

3.1. OSPFv2 Extended Link TLV

OSPFv2 Extended Link TLV is used in order to advertise various attributes of the link. It describes a single link and is constructed of a set of Sub-TLVs. There are no ordering requirements for the Sub-TLVs. Only one Extended Link TLV SHALL be advertised in each Extended Link Opaque LSA, allowing for fine granularity changes in the topology.

The Extended Link TLV has following format:



OSPFv2 Extended Link TLV

Type

The TLV type. Suggested value is 1.

Length

Variable dependent on sub-TLVs.

Link-Type

Link-Type is defined in section A.4.2 of [\[OSPFV2\]](#).

Link-ID

Link-ID is defined in section A.4.2 of [\[OSPFV2\]](#).

Link Data

Link-Data is defined in section A.4.2 of [\[OSPFV2\]](#).

This document creates a registry for OSPF Extended Link sub-TLVs in [Section 6](#).

4. Backward Compatibility

Since opaque OSPFv2 LSAs are optional and backward compatible [\[OPAQUE\]](#), the extensions described herein is fully backward compatible. However, future OSPFv2 extensions utilizing these extensions must address backward compatibility of the corresponding functionality.

[5.](#) Security Considerations

In general, new LSAs defined in this document are subject to the same security concerns as those described in [[OSPFV2](#)]. Additionally, implementations must assure that malformed TLV and Sub-TLV permutations do not result in errors which cause hard OSPF failures.

[6.](#) IANA Considerations

This specification updates the Opaque Link-State Advertisements (LSA) Option Types with the following values:

- o 7 (IANA Preallocated) - OSPFv2 Extended Prefix Opaque LSA
- o 8 (IANA preallocated) - OSPFv2 Extended Link Opaque LSA

This specification also creates four new registries:

- o OSPF Extended Prefix LSA TLVs
- o OSPF Extended Prefix TLV Sub-TLVs
- o OSPF Extended Link LSA TLVs
- o OSPF Extended Link TLV Sub-TLVs

[6.1.](#) OSPF Extended Prefix LSA TLV Registry

The OSPF Extend Prefix LSA TLV registry will define top-level TLVs for Extended Prefix LSAs and should be placed in the existing OSPF IANA registry. New values can be allocated via IETF Consensus or IESG Approval.

The following initial values are allocated:

- o 0 - Reserved
- o 1 - OSPF Extended Prefix TLV

Types in the range 32768-33023 are for experimental use; these will not be registered with IANA, and MUST NOT be mentioned by RFCs.

Types in the range 33023-65535 are not to be assigned at this time. Before any assignments can be made in this range, there MUST be a Standards Track RFC that specifies IANA Considerations that covers the range being assigned.

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[6.2.](#) OSPF Extended Prefix TLV Sub-TLV Registry

The OSPF Extended Link LSA sub-TLV registry will define will define sub-TLVs at any level of nesting for Extended Link LSAs and should be placed in the existing OSPF IANA registry. New values can be allocated via IETF Consensus or IESG Approval.

The following initial values are allocated:

- o 0 - Reserved

Types in the range 32768-33023 are for experimental use; these will not be registered with IANA, and MUST NOT be mentioned by RFCs.

Types in the range 33023-65535 are not to be assigned at this time. Before any assignments can be made in this range, there MUST be a Standards Track RFC that specifies IANA Considerations that covers the range being assigned.

[6.3.](#) OSPF Extended Link LSA TLV Registry

The OSPF Extend Link LSA TLV registry will define top-level TLVs for Extended Link LSAs and should be placed in the existing OSPF IANA registry. New values can be allocated via IETF Consensus or IESG Approval.

Following initial values are allocated:

- o 0 - Reserved
- o 1 - OSPFv2 Extended Link TLV

Types in the range 32768–33023 are for experimental use; these will not be registered with IANA, and MUST NOT be mentioned by RFCs.

Types in the range 33023–65535 are not to be assigned at this time. Before any assignments can be made in this range, there MUST be a Standards Track RFC that specifies IANA Considerations that covers the range being assigned.

[6.4.](#) OSPF Extended Link TLV Sub-TLV Registry

The OSPF Extended Link sub-TLV registry will define will define sub-TLVs at any level of nesting for Extended Link LSAs and should be placed in the existing OSPF IANA registry. New values can be allocated via IETF Consensus or IESG Approval.

The following initial values are allocated:

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- o 0 - Reserved

Types in the range 32768–33023 are for experimental use; these will not be registered with IANA, and MUST NOT be mentioned by RFCs. Types in the range 33023–65535 are not to be assigned at this time. Before any assignments can be made in this range, there MUST be a Standards Track RFC that specifies IANA Considerations that covers the range being assigned.

[7.](#) References

[7.1.](#) Normative References

- [OPAQUE] Berger, L., Bryskin, I., Zinin, A., and R. Coltun, "The OSPF Opaque LSA Option", [RFC 5250](#), July 2008.
- [OSPFV2] Moy, J., "OSPF Version 2", [RFC 2328](#), April 1998.
- [RFC-KEYWORDS] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [RFC 2119](#), March 1997.
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[7.2.](#) Informative References

[OSPFV3-LSA-EXTEND]

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