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OSPFv2 Prefix/Link Attribute Advertisement
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Abstract

OSPFv2 requires functional extension beyond what can readily be done with the fixed-format Link State Advertisements (LSAs) as described in [RFC 2328](#). This document defines OSPF opaque LSAs based on Type-Length-Value (TLV) tuples that can be used to associate additional attributes with prefixes or links. Dependent on the application, these prefixes and links may or not be advertised in the fixed-format LSAs. The OSPF opaque LSAs are optional and fully backward compatible.

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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 prefixes or links. Dependent on the application, these prefixes and links may or not be advertised in the fixed-format LSAs. The OSPF opaque LSAs are optional and fully backward compatible. This is in contrast to the approach taken in OSPFv3 [[I-D.ietf-ospf-ospfv3-lsa-extend](#)] where the existing LSAs will be replaced by TLV-based extended LSAs.

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

This 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.

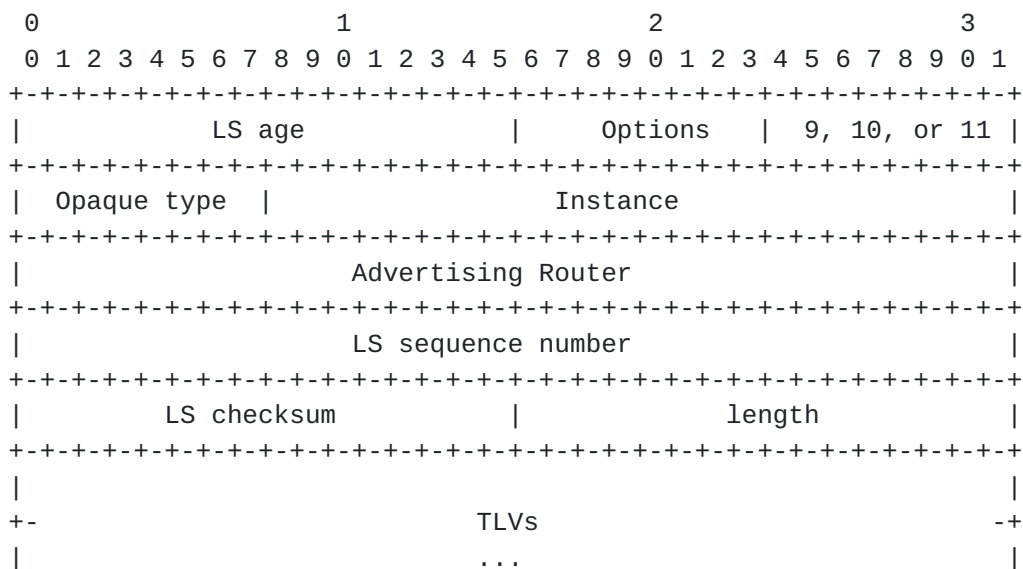
Thanks to Tony Przygienda for his review and comments.

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:



OSPFv2 Extended Prefix LSA

The opaque type used by OSPFv2 Extended Prefix Opaque LSA is 7.

The format of the TLVs within the body of the OSPFv2 Extended Prefix LSA is the same as the format used by the Traffic Engineering Extensions to OSPF [TE]. The variable TLV section consists of one or more nested Type/Length/Value (TLV) tuples. Nested TLVs are also referred to as sub-TLVs. The format of each TLV is:

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 an 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 - AS 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.

Flags: 1 octet field. The following flags are defined:

```

  0  1  2  3  4  5  6  7
+--+--+--+--+--+--+--+
|A|N| | | | | | |
+--+--+--+--+--+--+--+

```

where:

A-Flag: Attach flag. An ABR generating Extended Prefix TLV for inter-area prefix that is locally connected or attached in other connected area SHOULD set this flag.

N-Flag: Set when the prefix identifies the advertising router i.e., the prefix is a host prefix advertising a globally reachable address typically associated with a loopback address.

The advertising router MAY choose to NOT set this flag even when the above conditions are met. If the flag is set and the prefix length is NOT a host prefix then the flag MUST be ignored. The flag is preserved when OSPFv2 Extended Prefix Opaque LSA is propagated between areas.

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.

If this TLV is advertised multiple times for the same prefix in the same OSPFv2 Extended Prefix Opaque LSA, only the first instance is used by receiving OSPFv2 Routers. This situation SHOULD be logged as an error.

If this TLV is advertised multiple times for the same prefix in different OSPFv2 Extended Prefix Opaque LSAs originated by the same OSPF router, the OSPF advertising router is re-originating Extended Prefix Opaque LSAs for multiple prefixes and is most likely repacking Extended-Prefix-TLVs in Extended Prefix Opaque LSAs. In this case, the Extended-Prefix-TLV in the Extended Prefix Opaque LSA with the smallest Instance is used by receiving OSPFv2 Routers. This situation MAY be logged as a warning.

It is RECOMMENDED that OSPF routers advertising Extended-Prefix-TLVs in different Extended Prefix Opaque LSAs re-originate these LSAs in ascending order of Instance to minimize the disruption.

If this TLV is advertised multiple times for the same prefix in different OSPFv2 Extended Prefix Opaque LSAs originated by the different OSPF routers, the application using the information is required to determine which OSPFv2 Extended Prefix Opaque LSA is used. For example, the application could prefer the LSA providing the best path to the prefix.

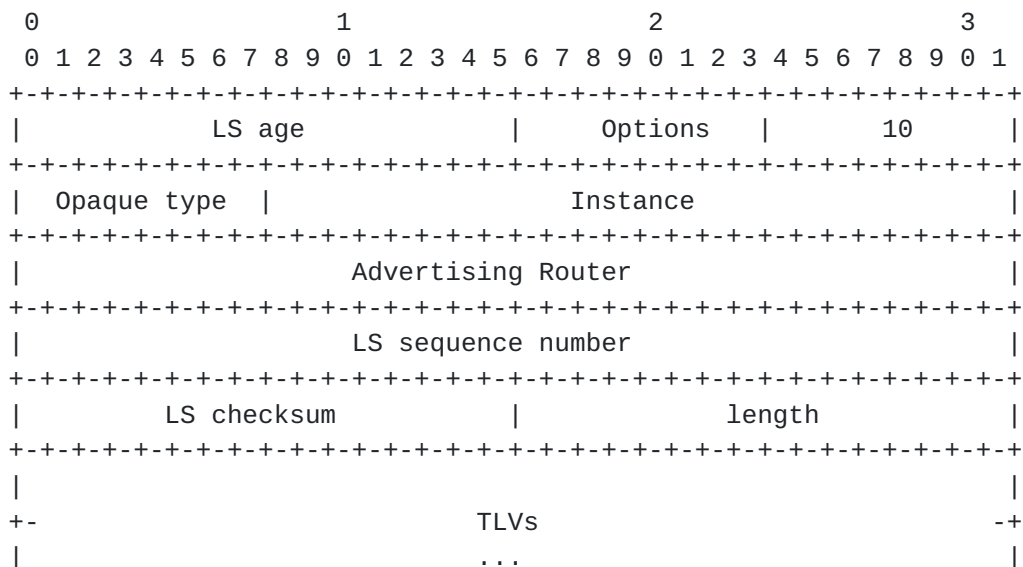
This document creates a registry for OSPF Extended Prefix sub-TLVs in [Section 6](#).

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:

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 that 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 Early Allocation [RFC7120]) - OSPFv2 Extended Prefix Opaque LSA
- o 8 (IANA Early Allocation [RFC7120]) - 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 33024-65535 are not to be assigned at this time. Before any assignments can be made in the 33024-65535 range, there MUST be an IETF specification that specifies IANA Considerations that covers the range being assigned.

6.2. OSPF Extended Prefix TLV Sub-TLV Registry

The OSPF Extended Link LSA sub-TLV registry 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 33024-65535 are not to be assigned at this time. Before any assignments can be made in the 33024-65535 range, there MUST be an IETF specification 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 33024-65535 are not to be assigned at this time. Before any assignments can be made in the 33024-65535 range, there MUST be an IETF specification 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:

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 33024-65535 are not to be assigned at this time. Before any assignments can be made in the 33024-65535 range, there MUST be an IETF specification that specifies IANA Considerations that covers the range being assigned.

7. References

7.1. Normative References

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