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Acee Lindem
Naiming Shen
Redback Networks

Extensions to OSPF for Advertising Optional Route Attributes
[draft-lindem-ospf-route-attr-00.txt](#)

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Abstract

There are applications which require additional attributes to be advertised with an OSPF route. The existing OSPF LSA formats do not allow for backward compatible extension to advertise these attributes. This draft proposes an extension to OSPF for advertising additional attributes which will be associated with an OSPF route.

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](#) [[BCP-14](#)].

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1. Motivation

There are applications which require the advertisement of additional attributes associated with an OSPF route. Examples of such applications include:

- o Association of an administrative tag with an intra-area or inter-area route.
- o For Nexthop FRR [[NHOPFRR](#)], advertising the next hop of an inter-area route.
- o Indication that the route corresponds to a loopback interface.

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2. OSPF Route Attributes (RA) Opaque LSA

OSPF routers will optionally advertise additional route attributes (RA) in an area-scoped or AS-scoped opaque-LSA [[OPAQUE](#)]. The advertising OSPF router will originate an area-scoped (type 10) opaque LSA to associate additional attributes with a route advertised in a router-LSA (type 1), network-LSA (type 2), summary-LSAs (type 3 or type 4) or NSSA-LSA (type 7). An AS-scoped (type 11) Opaque-LSA will be originated to associate additional attributes with a route advertised in an AS-external-LSA (type 5).

For certain applications the additional route attributes may only need to be advertised to a adjacent neighbor, in this case a link-scoped (type 9) opaque LSA may be originated in place of an area-scoped (type 10) or AS-scoped (type 11) opaque LSA.

The Route Attributes LSA will have an Opaque type of 5 and a unique ID.

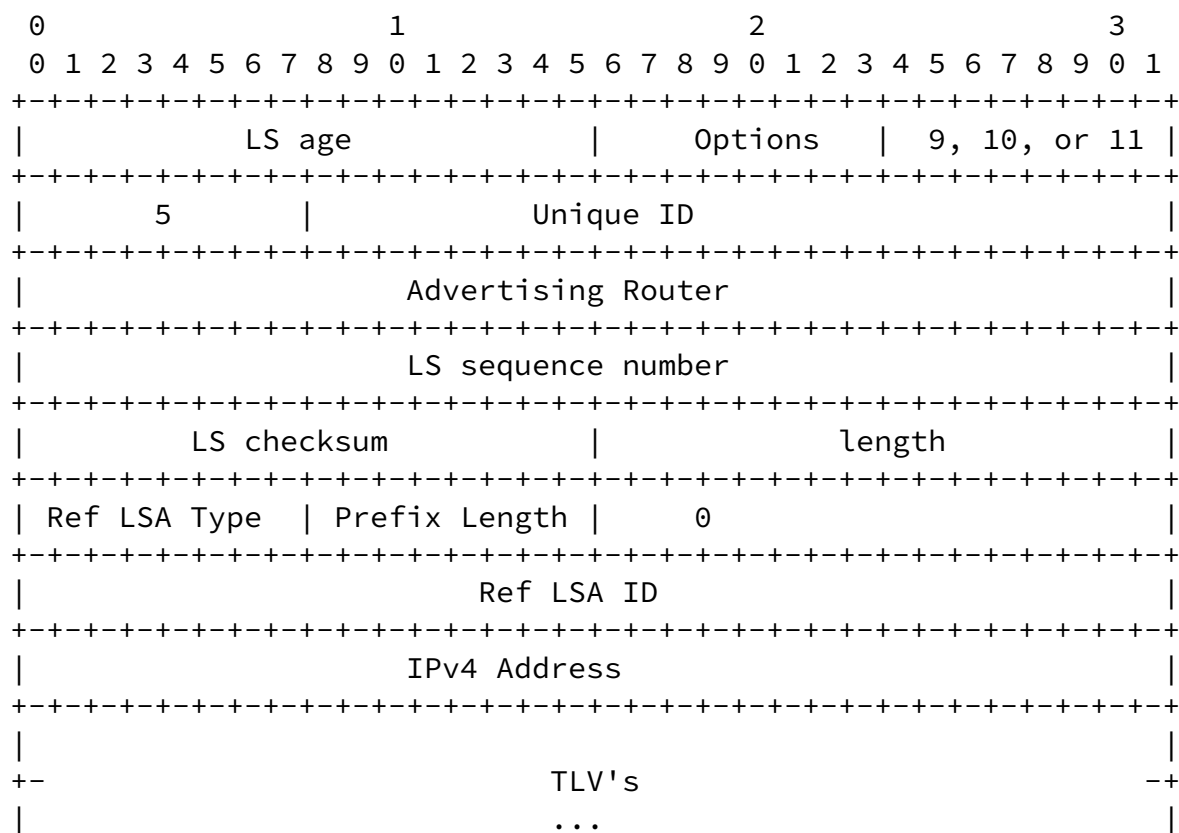


Figure 1. OSPF Route Attributes LSA

Reference LSA Type

The type for the LSA advertising the IPv4 prefix. The reference LSA type may be 1-5 or 7.

Prefix Length

The number of significant bits in the IPv4 address. For router routes, a length of 32 MUST be specified.

Reference LSA ID

The LSA ID for the LSA advertising the IPv4 prefix. The advertising router is not required to be respecified since an OSPF router may not use this LSA to associate additional attributes with LSAs that it does not originate.

IPv4 Address

The IPv4 address which requires association of additional attributes. For OSPF router routes advertised in Summary-ASBR LSAs, this will be the router ID.

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

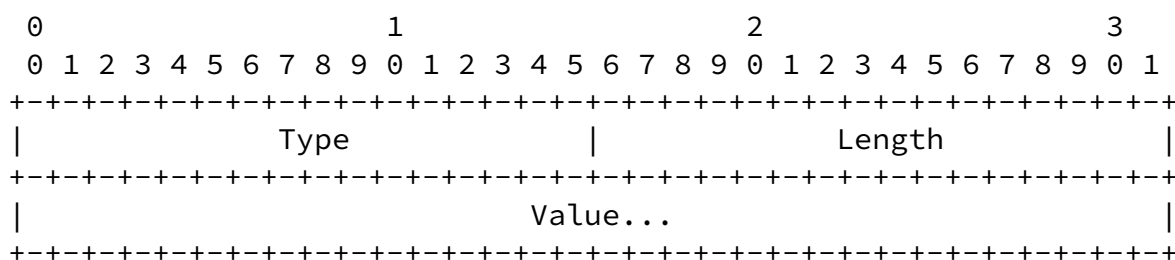


Figure 2. TLV Format

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 bytes of padding would be added to the end of the value portion of the TLV. Unrecognized types are ignored.

2.1 OSPF Route Tag TLV

The first defined TLV in the body of an RA opaque LSA is the Route Tag TLV. It allows one or more tags to be associated with a given OSPF routes. Its use is optional.

The format of the Route Tag TLV is as follows:

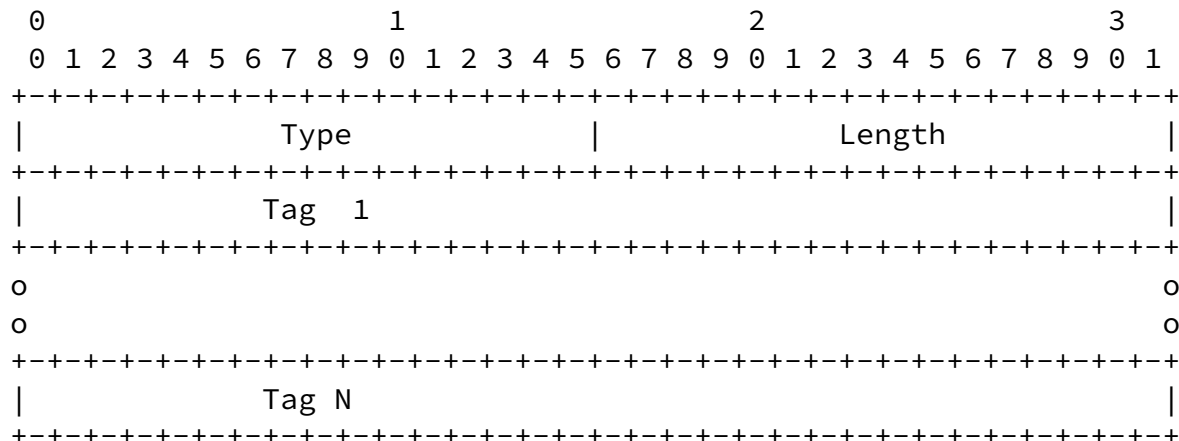


Figure 4. OSPF Router Capabilities TLV

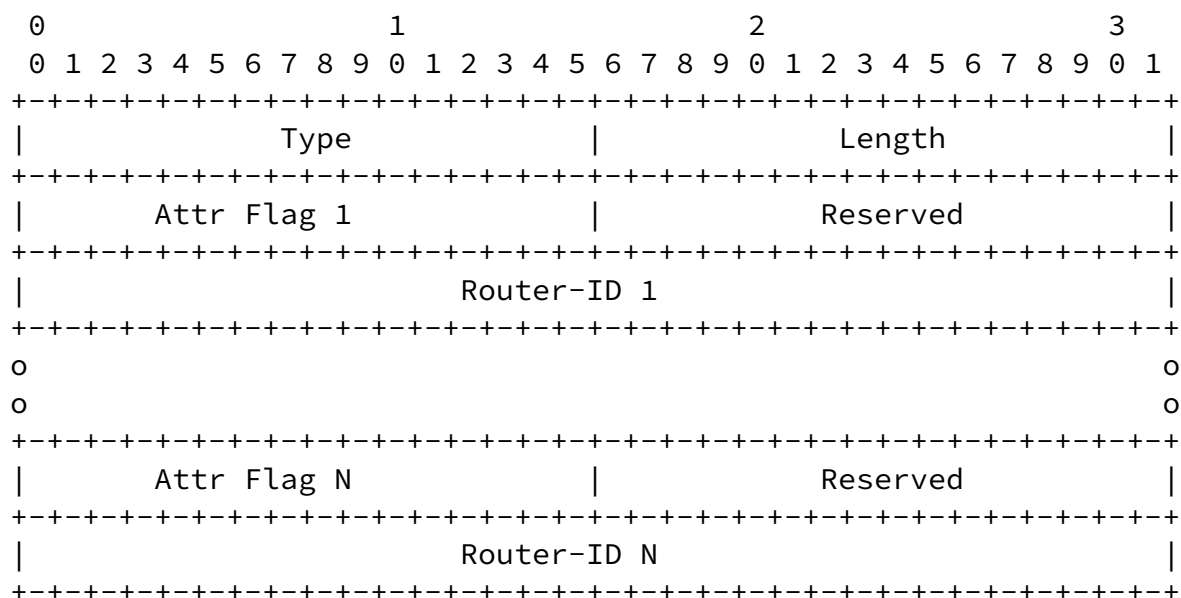
Type	A 16 bit field set to 1.
Length	A 16 bit field that indicates the length of the value portion in bytes. The value will be $N * 4$ where N is the number of advertised tags. The maximum number of tags that can be associated with a route is TBD.
Value	The value is comprised of one or more tags. The use of the tags is beyond the scope of this document but can be

used for applications such as marking a particular route for a specific action or preference.

[2.2](#) OSPF Inter-Area Route Attribute TLV

This Inter-Area Route Attribute TLV in RA opaque LSA is to allow the area border routers (ABRs) to advertise certain route attributes related to topology information in another area. For example, the ABR can advertise the nexthop OSPF node for an inter-area prefix. This can be used for Nexthop FRR of IP traffic in inter-area node protection case. Its use is optional.

The format of the Inter-area Route Attribute TLV is as follows:



Type	A 16 bit field set to 2.
Length	A 16 bit field that indicates the length of the value portion in bytes. The value will be $N * 8$ where N is the number of route attributes.
Value	The value is comprised of one or more route attributes.

It has an Attribute Flag field, a Reserved field and a Router-ID field.

Attribute Flag

This is an 16-bits field, currently defined:

```

  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|N|O|B|          Reserved          |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

Bits	Description
N	Nexthop Bit. If set, the router advertising this IP prefix with this TLV uses router specified in the Router-ID field as the nexthop node.
O	Origination Bit. If set, the router advertising this IP prefix with this TLV had learnt this prefix from the router specified in the Router-ID field.
B	Non-Best Path Bit. The N bit and B bit are mutually exclusive. If set, the ABR advertising this this TLV does not consider router specified in the Router-ID field to be on the IGP best path to reach the IP prefix.
Router-ID	This is a 32-bit number representing the router which can be used to forward traffic towards the destination for the prefixes.

The list may contain multiple (Attribute Flag, Router-ID) tuples to handle ECMP or non-ECMP cases.

If this TLV is being used in support of node protection, the RA opaque LSA containing the Nexthop attributes need only be flooded

using a link-scoped (type 9) LSA.

[3.](#) Operation of OSPF Routers Originating the RA Opaque LSA

OSPF routers originating an RA opaque LSA should directly correlate the existence with the reference LSA. In other words, the RA opaque LSA MUST only be originated when the referenced LSA has been originated and should purge (i.e., MaxAged) the RA opaque LSA when the referenced LSA is purged. Reorigination of either the referenced LSA or the RA opaque LSA do require reorigination of the other (unless of course, the underlying reason for the reorigination affects both).

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[4.](#) Operation of OSPF Routers

OSPF routers supporting the RA opaque LSA MUST find the reference LSA and associate the received LSA with the reference LSA. If the reference LSA is chosen as the best path during the SPF computation [[OSPF](#)] then the additional attributes in the RA opaque LSA will be associated with the route and handled in an application specific manner. In essence, the RA opaque LSA and the LSA it references are concatenated.

In the case of ECMP with more than one of the contributing LSAs having route attributes, the route will have a superset of optional route attributes. In the case of conflicting route attributes, the route will inherit the attributes the LSA with the highest advertising router ID.

[5.](#) Operation of OSPF Area Border Routers

OSPF Area Border Routers (ABRs) supporting RA opaque LSAs will be required to originate an RA opaque LSA whenever they propagate routes with additional attributes from one area to another. This implies that the ABR will:

1. Originate an RA area-scoped opaque LSA when it originates a summary LSA (type 3 or 4) for an intra-area or inter-area route with additional attributes.
2. Originate an RA AS-scoped opaque LSA when it originates an AS external LSA corresponding to a translated NSSA route with additional attributes.
3. Originate an RA area-scoped opaque LSA when it originates a summary LSA for an area range and policy dictates that the ABR should associate additional attributes with the area range.
4. Originate an RA AS-scoped opaque LSA when it originates an AS external LSA for an NSSA area range and policy dictates that the ABR should associate additional attributes with the NSSA area range.

[6.](#) OSPFv3 Route Attribute LSA

For OSPFv3 [[OSPFV3](#)], the OSPFv3 Route Attributes (RA) LSA will be similar to the OSPF opaque LSA. It will have it's own OSPFv3 LSA function code assigned by IANA. The U bit will always 1 and S1 and S2 bits will be the same as the referenced LSA type. Optionally, a link-scoped LSA may be originated when the route attributes need not be propagated beyond immediate neighbors.

```

      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
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|               LS age               |1|S|S|               TBD               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|               Link State ID               |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

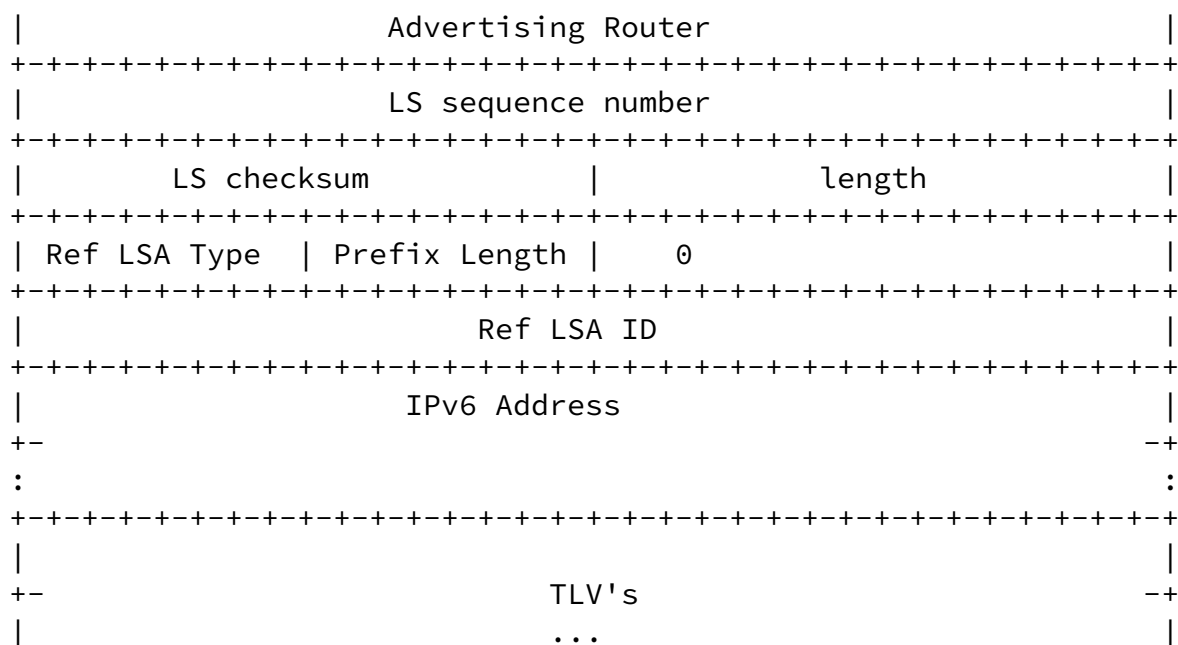


Figure 1. OSPF Route Attributes LSA

Reference LSA Type

The type for the LSA advertising the IPv6 prefix. The reference LSA type may be 0x2001-0x2005, 0x2007, 0x2009, or 0x0008.

Prefix Length

The number of significant bits in the IPv6 address. For router routes, a length of 32 MUST be specified.

Reference LSA ID

The LSA ID for the LSA advertising the IPv6 prefix. The advertising router is not required to be respecified since an OSPFv3 router may not use this LSA to associate additional attributes with LSAs that it does not originate.

IPv6 Address

The IPv6 address which requires association of additional attributes. IPv6 Address Prefix is an encoding of the prefix itself as an even multiple of 32-bit words, padding with zero bits as necessary; this encoding consumes $(\text{Prefix Length} + 31) / 32$ 32-bit words. For OSPFv3 router routes advertised in Inter-Area-Router-LSAs, this will be the router ID.

[6.1](#) Operation of OSPFv3 Area Border Routers

OSPFv3 Area Border Routers (ABRs) supporting RA LSAs will be required to originate an RA LSA whenever they propagate routes with additional attributes from one area to another. The rules documented in [Section 5](#) apply to Inter-Area-Prefix-LSAs, Inter-Area-Router-LSAs, and NSSA LSAs.

[6.2](#) Operation of OSPFv3 Designated Routers

Operation of OSPFv3 Routers acting as a DR is similar to OSPFv3 ABRs in that they will propagate route attributes associated with the prefixes advertised in the intra-area-prefix-LSA referencing the DR's network LSA.

[7](#). Security Consideration

This memo does not create any new security issues for the OSPF protocol. Security considerations for the base OSPF protocol are covered in [\[OSPF\]](#). Security considerations for OSPFv3 are covered in [\[OSPFV3\]](#).

[8](#). Acknowledgments

TBD.

[9](#). IANA Considerations

A new OSPF opaque LSA type and OSPFv3 LSA function code will need to be assigned by IANA. Additionally, IANA will need to have registries for the Route attributes LSA TLV's. The TLV assignee will be responsible for allocation of any sub-TLV's for the IANA assigned TLV. All TLV's and sub-TLV's will be subject to OSPF WG review.

10. References

Normative References

- [OSPF] Moy, J., "OSPF Version 2", [RFC 2328](#), April 1998.
- [OSPFV3] Colton, R., J. Moy, and D. Ferguson, "OSPF for IPv6", [RFC 2740](#), December 1999.
- [OPAQUE] Coltun, R., "The OSPF Opaque LSA Option", [RFC 2370](#), July 1998.
- [NHOPFRR] Shen, N., and P. Pan, "Nexthop Fast ReRoute for IP and MPLS", [draft-shen-nhop-fastreroute-00.txt](#), Work In Progress.
- [BCP-14] Bradner, S., "Keywords for use in RFCs to Indicate Requirement Level", [BCP 14](#), [RFC 2119](#), March 1997.

Informative References

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

11. Author Information

Acee Lindem
Redback Networks
[102](#) Carric Bend Court
Cary, NC 27519
e-mail: acee@redback.com

Naiming Shen
Redback Networks
[350](#) Holger Way
San Jose, CA 95134
e-mail: naiming@redback.com

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