LSR Working Group   A. Wang
Internet-Draft   China Telecom
Intended status: Standards Track   A. Lindem
Expires: September 9, 2021   Cisco Systems
                                                         J. Dong
                                             Huawei Technologies
                                                       P. Psenak
                                                   K. Talaulikar
                                                   Cisco Systems
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OSPF Prefix Originator Extensions
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Abstract

   This document defines OSPF extensions to include information
   associated with the node originating a prefix along with the prefix
   advertisement.

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   provisions of BCP 78 and BCP 79.

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   This Internet-Draft will expire on September 9, 2021.

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1. Introduction

   Prefix attributes are advertised in OSPFv2 [RFC2328] using the
   Extended Prefix Opaque Link State Advertisement (LSA) [RFC7684] and
   in OSPFv3 [RFC5340] using the various Extended Prefix LSA types
   [RFC8362].

   The identification of the originating router for a prefix in OSPF
   varies by the type of the prefix and is currently not always
   possible. For intra-area prefixes, the originating router is
   identified by the Advertising Router field of the area-scoped LSA
   used for those prefix advertisements. However, for the inter-area
   prefixes advertised by the Area Border Router (ABR), the Advertising
   Router field of their area-scoped LSAs is set to the ABR itself and
   the information about the router originating the prefix advertisement
   is lost in this process of prefix propagation across areas. For
   Autonomous System (AS) external prefixes, the originating router may
   be considered as the Autonomous System Border Router (ASBR) and is
   identified by the Advertising Router field of the AS-scoped LSA used.
   However, the actual originating router for the prefix may be a remote
   router outside the OSPF domain. Similarly, when an ABR performs
   translation of Not-So-Stubby Area (NSSA) [RFC3101] LSAs to AS-
   external LSAs, the information associated with the NSSA ASBR (or the
   router outside the OSPF domain) is not conveyed across the OSPF
   domain.

While typically the originator of information in OSPF is identified
by its OSPF Router ID, it does not necessarily represent a reachable
address for the router. The IPv4/IPv6 Router Address as defined in
[RFC3630] and [RFC5329] for OSPFv2 and OSPFv3 respectively provide an
address to reach that router.

The primary use case for the extensions proposed in this document is
to be able to identify the originator of a prefix in the network. In
cases where multiple prefixes are advertised by a given router, it is
also useful to be able to associate all these prefixes with a single
router even when prefixes are advertised outside of the area in which
they originated. It also helps to determine when the same prefix is
being originated by multiple routers across areas.

This document proposes extensions to the OSPF protocol for inclusion
of information associated with the router originating the prefix
along with the prefix advertisement. These extensions do not change
the core OSPF route computation functionality. They provide useful
information for topology analysis and traffic engineering, especially
on a controller when this information is advertised as an attribute
of the prefixes via mechanisms such as Border Gateway Protocol Link-
State (BGP-LS) [RFC7752] [I-D.ietf-idr-bgp-ls-segment-routing-ext].

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in BCP
14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

2. Protocol Extensions

This document defines the Prefix Source Router-ID and the Prefix
Originator Sub-TLVs for inclusion of the Router ID and a reachable
address information for the router originating the prefix as a prefix
attribute.

2.1. Prefix Source Router-ID Sub-TLV

For OSPFv2, the Prefix Source Router-ID Sub-TLV is an optional Sub-
TLV of the OSPFv2 Extended Prefix TLV [RFC7684]. For OSPFv3, the
Prefix Source Router-ID Sub-TLV is an optional Sub-TLV of the Intra-
Area-Prefix TLV, Inter-Area-Prefix TLV, and External-Prefix TLV
[RFC8362] when originating either an IPv4 [RFC5838] or an IPv6 prefix
advertisement.

The Prefix Source Router-ID Sub-TLV has the following format:

```
    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
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |              Type             |             Length            |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                        OSPF Router ID                         |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

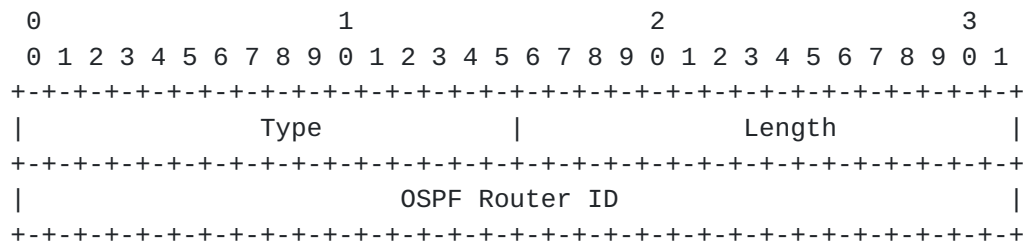   Figure 1: Prefix Source Router-ID Sub-TLV Format

   Where:

   o Type: 4 for OSPFv2 and 27 for OSPFv3

   o Length: 4

   o OSPF Router ID : the OSPF Router ID of the OSPF router that
      originated the prefix advertisement in the OSPF domain.

   The parent TLV of a prefix advertisement MAY include more than one
   Prefix Source Router-ID sub-TLV, one corresponding to each of the
   Equal-Cost Multi-Path (ECMP) nodes that originated the given prefix.

   For intra-area prefix advertisements, the Prefix Source Router-ID
   Sub-TLV MUST be considered invalid and ignored if it is not the same
   as Advertising Router ID for the prefix advertisement.

   A received Prefix Source Router-ID Sub-TLV with OSPF Router ID set to
   0 MUST be considered invalid and ignored. Additionally, reception of
   such Sub-TLV SHOULD be logged as an error (subject to rate-limiting).

2.2. Prefix Originator Sub-TLV

   For OSPFv2, the Prefix Originator Sub-TLV is an optional Sub-TLV of
   the OSPFv2 Extended Prefix TLV [RFC7684]. For OSPFv3, the Prefix
   Originator Sub-TLV is an optional Sub-TLV of the Intra-Area-Prefix
   TLV, Inter-Area-Prefix TLV, and External-Prefix TLV [RFC8362] when
   originating either an IPv4 [RFC5838] or an IPv6 prefix advertisement.

   The Prefix Originator Sub-TLV has the following format:

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |             Type              |             Length            |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |             Router Address (4 or 16 octets)                   |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

         Figure 2: Prefix Originator Sub-TLV Format

   Where:

o Type: TBD1 for OSPFv2 and TBD2 for OSPFv3

o Length: 4 or 16

o Router Address: A reachable IPv4 or IPv6 router address for the
   router that originated the IPv4 or IPv6 prefix advertisement
   respectively. Such an address would be semantically equivalent to
   what may be advertised in the OSPFv2 Router Address TLV [RFC3630]
   or in the OSPFv3 Router IPv6 Address TLV [RFC5329].

A prefix advertisement MAY include more than one Prefix Originator
sub-TLV, one corresponding to each of the Equal-Cost Multi-Path
(ECMP) nodes that originated the given prefix.

A received Prefix Originator Sub-TLV that has an invalid length (i.e.
not consistent with the prefix's address family) or a Router Address
containing an invalid IPv4 or IPv6 address (dependent on address
family of the associated prefix) MUST be considered invalid and
ignored. Additionally, reception of such Sub-TLV SHOULD be logged as
an error (subject to rate-limiting).

3. Elements of Procedure

This section describes the procedure for advertisement of the Prefix
Source Router-ID and Prefix Originator Sub-TLVs along with the prefix
advertisement.

The OSPF Router ID of the Prefix Source Router-ID is set to the OSPF
Router ID of the node originating the prefix in the OSPF domain.

If the originating node is advertising an OSPFv2 Router Address TLV
[RFC3630] or an OSPFv3 Router IPv6 Address TLV [RFC5329], then the
same address SHOULD be used in the Router Address field of the Prefix
Originator Sub-TLV. When the originating node is not advertising
such an address, implementations MAY support mechanisms to determine
a reachable address (e.g., advertised with the N-flag set [RFC7684]

   or N-bit set [RFC8362] and either matching the OSPF Router ID or the
   highest IP address) belonging to the originating node to set in the
   Router Address field.

   Implementations MAY support the selection of specific prefixes for
   which the originating node information needs to be included with
   their prefix advertisements.

   When an ABR generates inter-area prefix advertisements into its non-
   backbone areas corresponding to an inter-area prefix advertisement
   from the backbone area, the only way to determine the originating
   node information is based on the Prefix Source Router-ID and Prefix
   Originator Sub-TLVs present in the inter-area prefix advertisement
   originated into the backbone area by an ABR from another non-backbone
   area. The ABR performs its prefix calculation to determine the set
   of nodes that contribute to the best prefix reachability. It MUST
   use the prefix originator information only from this set of nodes.
   The ABR MUST NOT include the Prefix Source Router-ID or the Prefix
   Originator Sub-TLVs when it is unable to determine the information of
   the best originating node.

   Implementations MAY provide control on ABRs to selectively disable
   the propagation of the originating node information across area
   boundaries.

   Implementations may support the propagation of the originating node
   information along with a redistributed prefix into the OSPF domain
   from another routing domain. The details of such mechanisms are
   outside the scope of this document. Such implementations may also
   provide control on whether the Router Address in the Prefix
   Originator Sub-TLV is set as the ABSR node address or as the address
   of the actual node outside the OSPF domain that owns the prefix.

   When translating the NSSA prefix advertisements [RFC3101] to the AS
   external prefix advertisements, the NSSA ABR, follows the same
   procedures as an ABR generating inter-area prefix advertisements for
   the propagation of the originating node information.

4. Security Considerations

   Since this document extends the OSPFv2 Extended Prefix LSA, the
   security considerations for [RFC7684] are applicable. Similarly,
   since this document extends the OSPFv3 E-Intra-Area-Prefix-LSA, E-
   Inter-Area-Prefix-LSA, E-AS-External LSA and E-NSSA-LSA, the security
   considerations for [RFC8362] are applicable. The new sub-TLVs
   introduced in this document are optional and do not affect the OSPF
   route computation and therefore do not affect the security aspects of
   OSPF protocol operations.

5. IANA Considerations

   This document requests IANA for the allocation of the codepoints from
   the "OSPFv2 Extended Prefix TLV Sub-TLVs" registry under the "Open
   Shortest Path First v2 (OSPFv2) Parameters" registry.

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Code  |              Description         |   IANA Allocation   |
| Point |                                  |        Status       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   4   |  Prefix Source Router-ID Sub-TLV | early allocation done |
|  TBD1 |    Prefix Originator Sub-TLV     |        pending      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Figure 3: Codepoints in OSPFv2 Extended Prefix TLV Sub-TLVs

   This document requests IANA for the allocation of the codepoints from
   the "OSPFv3 Extended Prefix TLV Sub-TLVs" registry under the "Open
   Shortest Path First v3 (OSPFv3) Parameters" registry.

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Code  |              Description         |   IANA Allocation   |
| Point |                                  |        Status       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  27   |  Prefix Source Router-ID Sub-TLV | early allocation done |
|  TBD2 |    Prefix Originator Sub-TLV     |        pending      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Figure 4: Codepoints in OSPFv3 Extended-LSA Sub-TLVs

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Authors' Addresses

   Aijun Wang
   China Telecom
   Beiqijia Town, Changping District
   Beijing 102209
   China

   Email: wangaj3@chinatelecom.cn

   Acee Lindem
   Cisco Systems
   301 Midenhall Way
   Cary, NC 27513
   USA

   Email: acee@cisco.com

   Jie Dong
   Huawei Technologies
   Beijing
   China

   Email: jie.dong@huawei.com

   Peter Psenak
   Cisco Systems
   Pribinova Street 10
   Bratislava, Eurovea Centre, Central 3 81109
   Slovakia

   Email: ppsenak@cisco.com

   Ketan Talaulikar
   Cisco Systems
   India

   Email: ketant@cisco.com