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# OSPF Extensions for Broadcast Inter-AS TE Link

## Abstract

   This document presents extensions to the Open Shortest Path First
   (OSPF) for advertising broadcast inter-AS Traffic Engineering (TE)
   links.

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## 1.  Introduction

Connections among different Autonomous Systems (ASes) may be point-to-point (P2P) links and broadcast links. For a P2P inter-AS TE link, RFC 5392 defines a new Opaque LSA, the Inter-AS-TE-v2 LSA, for advertising the OSPFv2 link; and a new OSPFv3 LS type, Inter-AS-TE-v3 LSA, for advertising the OSPFv3 link.

Both the Inter-AS-TE-v2 LSA and Inter-AS-TE-v3 LSA contain one top level TLV:

**2 -**  Link TLV

The Link TLV describes a single link and includes a set of sub-TLVs.

The Link ID sub-TLV defined in RFC 3630 MUST NOT be used in the Link TLV of an Inter-AS-TE-v2 LSA, and the Neighbor ID sub-TLV defined in RFC 5329 MUST NOT be used in the Link TLV of an Inter-AS-TE-v3 LSA.

Instead, the remote ASBR is identified by the inclusion of Remote AS Number sub-TLV and IPv4/IPv6 Remote ASBR ID sub-TLV, which is defined in RFC 5392.

For a P2P inter-AS link, the information about its remote ASBR for replacing its link ID may be configured. For a broadcast inter-AS link, its link ID is the interface IP address of the designated router (DR) of the link in OSPF. Since no OSPF runs over any broadcast inter-AS link, no DR or backup DR (BDR) is selected. It is hard to configure a replacement for DR and BDR.

This document presents extensions to OSPF for advertising broadcast
inter-AS TE links through defining a new sub-TLV for a broadcast
link without configuring any replacement for DR and BDR on the link.

## 2.  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 [RFC2119].

## 3.  Information on Inter-AS TE Link

For a broadcast link connecting multiple ASBRs in a number of ASes,
on each of the ASBRs X, the following information about the link may
be obtained:

1)  Link Type: Multi-access
2)  Local IP address with mask length
3)  Traffic engineering metric
4)  Maximum bandwidth
5)  Maximum reservable bandwidth
6)  Unreserved bandwidth
7)  Administrative group
8)  SRLG


No remote IP address or link ID (i.e., DR's interface address) may
be obtained.

## 4.  Extensions to OSPF

## 4.1.  sub-TLVs

Two new sub-TLVs are defined. One is for local IPv4 address with
mask length; and the other is for local IPv6 address with mask
length.

The format of the sub-TLV for a local IPv4 address with mask length
is shown 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Type (stTBD1)         |             Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    IPv4 Address (4 bytes)                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Mask Length  |
+-+-+-+-+-+-+-+-+-+
```

The IPv4 Address indicates the local IPv4 address of a link. The
Mask Length indicates the length of the IPv4 address mask.

The format of the sub-TLV for a local IPv6 address with mask length
is illustrated below.

```
 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 (stTBD2)         |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      IPv6 Address (16 bytes)                  |
~                                                               ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Mask Length  |
+-+-+-+-+-+-+-+-+
```
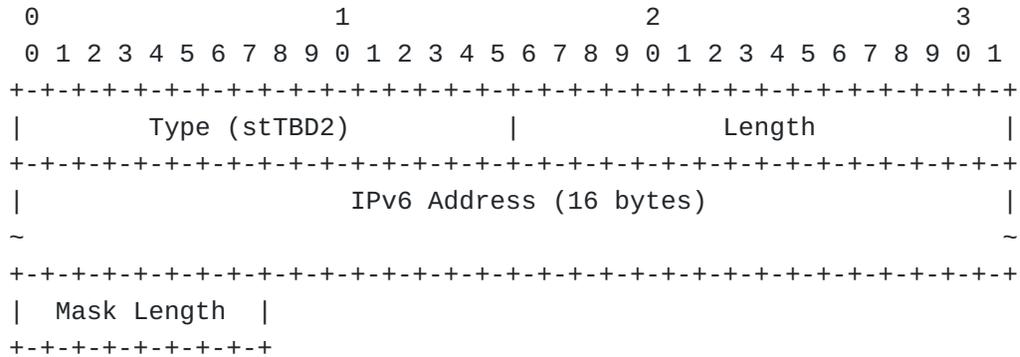
The IPv6 Address indicates the local IPv6 address of a link. The
Mask Length indicates the length of the IPv6 address mask.

## 4.2.  Procedures

### 4.2.1.  OSPF Router Procedure

For a broadcast inter-AS link connecting to multiple ASBRs, each of
the ASBRs as an OSPF router advertises an LSA (Inter-AS-TE-v2 LSA
for OSPFv2 or Inter-AS-TE-v3 LSA for OSPFv3) with a link TLV
containing sub-TLVs for the information such as 1) 10 8) on the
broadcast link described in Section 3.

When TE is enabled on an inter-AS link and the link is up, the ASBR
SHOULD advertise this link using the normal procedures for OSPF-TE.
When either the link is down or TE is disabled on the link, the ASBR
SHOULD withdraw the advertisement. When there are changes to the TE
parameters for the link (for example, when the available bandwidth
changes), the ASBR SHOULD re-advertise the link but MUST take
precautions against excessive re-advertisements.

### 4.2.2.  Super Node Procedure

Suppose that there is a super node, which just receives LSAs from
each of ASes (or domains) through a passive OSPF adjacency between
the super node and an ASBR or ABR in the AS or domain.

For a new broadcast link connecting multiple routers with no link ID
configured, when the super node receives an LSA containing the link
attached to router X, it stores the link from X into its TED. It
finds the link's remote end P using the link's local IP address with
network mask. P is a Pseudo node identified by the local IP address

of the DR selected from the routers connected to the link. After finding P, it associates the link attached to X with P and the link connected to P with X. If P is not found, a new Pseudo node P is created. The super node associates the link attached to X with P and the link attached to P with X. This creates a bidirectional connection between X and P.

The first router and second router from which the super node receives an LSA containing the link are selected as the DR and BDR respectively. After the DR is down, the BDR node becomes the DR and the router other than the DR with the largest (or smallest) local IP address connecting to the link is selected as the BDR.

When the old DR is down and the BDR becomes the new DR, the super node updates its TED through removing the link between each of routers X and old P (the Pseudo node corresponding to the old DR) and adding a link between each of routers X (still connecting to the broadcast link) and new P (the Pseudo node corresponding to the new DR).

## 5.  Security Considerations

The mechanism described in this document does not raise any new security issues for the OSPF protocols.

## 6.  IANA Considerations

This section specifies requests for IANA allocation.

## 7.  Acknowledgement

The authors would like to thank all for their valuable comments on this draft.

## 8.  References

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