Advertising a Router's Local Addresses
in OSPF Traffic Engineering (TE) Extensions

Abstract

   OSPF Traffic Engineering (TE) extensions are used to advertise TE
   Link State Advertisements (LSAs) containing information about TE-
   enabled links. The only addresses belonging to a router that are
   advertised in TE LSAs are the local addresses corresponding to TE-
   enabled links, and the local address corresponding to the Router ID.

   In order to allow other routers in a network to compute Multiprotocol
   Label Switching (MPLS) Traffic Engineered Label Switched Paths (TE
   LSPs) to a given router's local addresses, those addresses must also
   be advertised by OSPF TE.

   This document describes procedures that enhance OSPF TE to advertise
   a router's local addresses.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
   (IETF). It represents the consensus of the IETF community. It has
   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 5741.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc5786.

Table of Contents

1. Introduction

1.1. Motivation

   In some cases, it is desirable to set up constrained shortest path
   first (CSPF) computed Multiprotocol Label Switching (MPLS) Traffic
   Engineered Label Switched Paths (TE LSPs) to local addresses of a
   router that are not currently advertised in the TE LSAs, i.e.,
   loopback and non-TE interface addresses.

   For instance, in a network carrying VPN and non-VPN traffic, it is
   often desirable to use different MPLS TE LSPs for the VPN traffic and
   the non-VPN traffic. In this case, one loopback address may be used
   as the BGP next-hop for VPN traffic while another may be used as the
   BGP next-hop for non-VPN traffic. It is also possible that different
   BGP sessions are used for VPN and non-VPN services. Hence, two
   separate MPLS TE LSPs are desirable -- one to each loopback address.

   However, current routers in an OSPF network can only use CSPF to
   compute MPLS TE LSPs to the router ID or the local addresses of a
   remote router's TE-enabled links. This restriction arises because
   OSPF TE extensions [RFC3630, RFC5329] only advertise the router ID
   and the local addresses of TE-enabled links of a given router. Other
   routers in the network can populate their traffic engineering
   database (TED) with these local addresses belonging to the
   advertising router. However, they cannot populate the TED with the
   advertising router's other local addresses, i.e., loopback and non-TE
   interface addresses. OSPFv2 stub links in the router LSA [RFC2328]
   provide stub reachability information to the router but are not
   sufficient to learn all the local addresses of a router. In
   particular for a subnetted point-to-point (P2P) interface the stub,
   link ID is the subnet address. While for a non-subnetted interface,
   the stub link ID is the neighbor address. Intra-prefix LSAs in
   OSPFv3 [RFC5340] are also not sufficient to learn the local
   addresses.

   For the above reasons, this document defines an enhancement to OSPF
   TE extensions to advertise the local addresses of a node.

2. Specification of Requirements

   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. Rejected Potential Solution

   A potential solution would be to advertise a TE link TLV for each
   local address, possibly with a new link type. However, this is
   inefficient since the only meaningful information is the address.
   Furthermore, this would require implementations to process these TE
   link TLVs differently from others; for example, the TE metric is
   normally considered a mandatory sub-TLV, but would have no meaning
   for a local address.

4. Solution

   The solution is to advertise the local addresses of a router in a new
   OSPF TE LSA Node Attribute TLV. It is anticipated that the Node
   Attribute TLV will also prove more generally useful.

4.1. Node Attribute TLV

   The Node Attribute TLV carries the attributes associated with a
   router. The TLV type is 5 and the length is variable. It contains
   one or more sub-TLVs. This document defines the following sub-TLVs:

      1. Node IPv4 Local Address sub-TLV
      2. Node IPv6 Local Address sub-TLV

   The Node IPv4 Local Address sub-TLV has a type of 1 and contains one
   or more local IPv4 addresses. It 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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              1                |             Length             |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   | Prefix Len 1  |         IPv4 Prefix 1                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |Prefix 1 cont. |                                              :
   +-+-+-+-+-+-+-+-+                                              ~
   :                            .                                :
   ~                            .                +-+-+-+-+-+-+-+-+
   :                            .                | Prefix Len n  |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        IPv4 Prefix n                         |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   Each local IPv4 address is encoded as a <Prefix Length, Prefix>
   tuple. Prefix Length is encoded in 1 byte. It is the number of bits
   in the Address and can be at most 32. Prefix is an IPv4 address
   prefix and is encoded in 4 bytes with zero bits as necessary.

The Node IPv4 Local Address sub-TLV length is in octets. It is the
sum of the lengths of all n IPv4 Address encodings in the sub-TLV,
where n is the number of local addresses included in the sub-TLV.
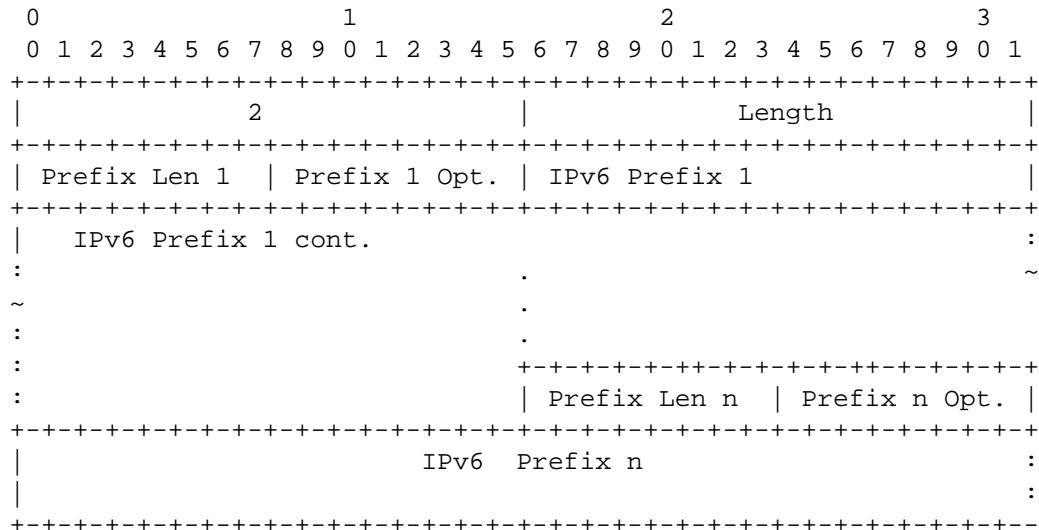
The Node IPv6 Local Address sub-TLV has a type of 2 and contains one
or more local IPv6 addresses. It has the following format:

```
     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
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |              2                |              Length           |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    | Prefix Len 1  | Prefix 1 Opt. | IPv6 Prefix 1                |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |    IPv6 Prefix 1 cont.                                        :
    :                                 .                            ~
    ~                                 .
    :                                 .
    :                                 +-+-+-+-+-++-+-+-+-+-++-+-+-+-+-+
    :                                 | Prefix Len n  | Prefix n Opt. |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                      IPv6  Prefix n                          :
    |                                                             :
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+--
```

Each local IPv6 address is encoded using the procedures in [RFC5340].
Each IPv6 address MUST be represented by a combination of three
fields: PrefixLength, PrefixOptions, and Address Prefix.
PrefixLength is the length in bits of the prefix and is an 8-bit
field. PrefixOptions is an 8-bit field describing various
capabilities associated with the prefix [RFC5340]. 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
(PrefixLength + 31) / 32) 32-bit words.

The Node IPv6 Local Address sub-TLV length is in octets. It is the
sum of the lengths of all n IPv6 Address encodings in the sub-TLV,
where n is the number of local addresses included in the sub-TLV.

4.2. Operation

A router announces one or more local addresses in the Node Attribute
TLV. The local addresses that can be learned from TE LSAs, i.e.,
router address and TE interface addresses SHOULD NOT be advertised in
the node local address sub-TLV. The local addresses advertised will
depend on the local configuration of the advertising router. The
default behavior MAY be to advertise all the loopback interface
addresses.

The Node Attribute TLV MUST NOT appear in more than one TE LSA
originated by a router. Furthermore, such an LSA MUST NOT include
more than one Node Attribute TLV. A Node Attribute TLV MUST NOT
carry more than one Node IPv4 Local Address sub-TLV. A Node
Attribute TLV MUST NOT carry more than one Node IPv6 Local Address
sub-TLV.

5. Security Considerations

This document does not introduce any further security issues other
than those discussed in [RFC3630] and [RFC5329].

6. IANA Considerations

IANA has assigned the Node Attribute TLV (value 5) type from the
range 3-32767 as specified in [RFC3630], from the top level types in
TE LSAs registry maintained by IANA at http://www.iana.org.

IANA has created and now maintains the registry for the sub-TLVs of
the Node Attribute TLV. Value 1 is reserved for Node IPv4 Local
Address sub-TLV and value 2 for Node IPv6 Local Address sub-TLV.

The guidelines for the assignment of types for sub-TLVs of the Node
Attribute TLV are as follows:

   o Types in the range 3-32767 are to be assigned via Standards
      Action.

   o Types in the range 32768-32777 are for experimental use; these
      will not be registered with IANA, and MUST NOT be mentioned by
      RFCs.

   o Types in the range 32778-65535 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. Acknowledgements

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Lindem, Venkata Naidu, Dimitri Papadimitriou, and Adrian Farrel for
their comments.

8. References

8.1. Normative References

   [RFC2328] Moy, J., "OSPF Version 2", STD 54, RFC 2328, April 1998.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC3630] Katz, D., Kompella, K., and D. Yeung, "Traffic Engineering
              (TE) Extensions to OSPF Version 2", RFC 3630, September
              2003.

   [RFC5340] Coltun, R., Ferguson, D., Moy, J., and A. Lindem, "OSPF
              for IPv6", RFC 5340, July 2008.

8.2. Informative References

   [RFC5329] Ishiguro, K., Manral, V., Davey, A., and A. Lindem, Ed.,
              "Traffic Engineering Extensions to OSPF Version 3", RFC
              5329, September 2008.

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