LSR Working Group                                          A. Wang
Internet-Draft                                       China Telecom
Intended status: Standards Track                             Z. Hu
Expires: November 17, 2022                     Huawei Technologies
                                                         A. Lindem
                                                     Cisco Systems
                                                         G. Mishra
                                                     Verizon Inc.
                                                            J. Sun
                                                   ZTE Corporation
                                                      May 16, 2022

                   **Advertisement of Stub Link Attributes**
                   **draft-wang-lsr-stub-link-attributes-04**

Abstract

   This document describes the mechanism that can be used to advertise
   the stub link attributes within the ISIS or OSPF domain.

Table of Contents

## 1.  Introduction

Stub links are used commonly within enterprise or service provider
networks.  One common use case is the inter-AS routing scenario where
there are no IGP adjacencies between the adjacent BGP domains.  Using
stub link on the inter-AS connections can ensure that prefixes
contained within a domain are only reachable within the domain itself
and are not advertised between domains which could result in
undesirable consequences.

For operators that have multiple ASes interconnect with each other
via the stub links, there is a requirement to obtain the inter-AS
topology information as described in
[I-D.ietf-idr-bgpls-inter-as-topology-ext].  If the router that uses
BGP-LS within one IGP domain can distinguish stub links from other
normal interfaces, it is then easy for the router to report these
stub links using BGP-LS to a centralized PCE controller.  The
controller can then pair the two endpoints of the stub link together
via the prefixes information (for numbered stub link) or other
attributes (for unnumbered stub link) associated with the stub link.

Stub links are also normally the boundary of one IGP domain, knowing
them can facilitate the operators to apply various policies on such

interfaces, for example, to secure their networks, or filtering the
incoming traffic with scrutiny.

But OSPF and ISIS have no capability to identify such stub links and
their associated attributes now.

This document defines the protocol extension for OSPFv2/v3 and ISIS
to indicate the stub links and their associated attributes.

## 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.  Consideration for Identifying Stub Link

OSPF[RFC5392] defines the Inter-AS-TE-v2 LSA and Inter-AS-TE-v3 LSA
to carry the TE information about inter-AS links.  ISIS[RFC5316]
defines the Inter-AS Reachability TLV to carry the TE information
about inter-AS links.  These LSAs and TLVs can be used to transfer
the information about the stub link which are located at the boundary
of one AS, but to accomplish the scenario that described in
[I-D.ietf-idr-bgpls-inter-as-topology-ext], every inter-AS link
should be configured with the Remote AS Number and IPv4/IPv6 Remote
ASBR ID.

And, if the inter-AS stub link is LAN type, every inter-AS link must
be configured with several Remote AS Numbers and IPv4/IPv6 Remote
ASBR ID pairs to achieve the accurate description of the inter-AS
connection.  Although the peers on the LAN share the same prefixes,
existing solutions doesn't utilize such information to form the
connection topology.

To solve the problems that raised by the solutions based on [RFC5392]
and [RFC5316], this document defines the Stub-Link TLV to identify
the stub link and transmit the associated attributes for OSPF and
ISIS respectively.

## 4.  Protocol Extension for Stub Link Attributes

The following sections define the protocol extension to indicate the
stub link and its associated attributes in OSPFv2/v3 and ISIS.

## 4.1.  OSPF Stub-Link TLV

   This document defines the OSPF Stub-Link TLV to describe stub link of
   a single router.  This Stub-Link TLV is only applicable to the Inter-
   AS-TE-v2 LSA and Inter-AS-TE-v3 LSA.  Inclusion in other LSAs MUST be
   ignored.

   The OSPF Stub-Link TLV which is under the IANA codepoint "Top Level
   Types in TE LSAs" has the following format:
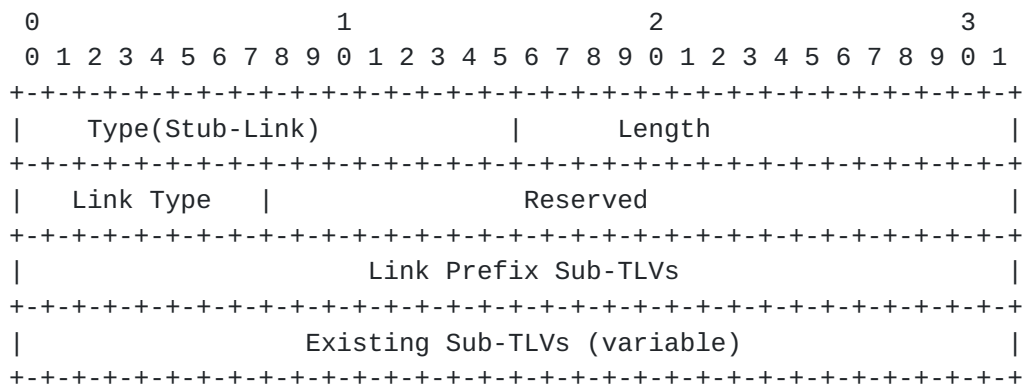
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type(Stub-Link)         |          Length                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Link Type   |                 Reserved                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Link Prefix Sub-TLVs                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  Existing Sub-TLVs (variable)               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
             Figure 1: OSPF Stub-Link TLV
```

   Type: The TLV type.  The value is 7(TBD) for OSPF Stub-Link

   Length: Variable, dependent on sub-TLVs

   Link Type: Define the type of the stub-link:

   o  0: Reserved

   o  1: Numbered Stub Link

   o  2: Unnumbered Stub Link

   o  3-255: For future extension

   Link Prefix Sub-TLV: The prefix of the stub-link.  It's format is
   defined in Section 4.3 and Section 4.4.

   Existing Sub-TLVs: Sub-TLV that defined within "Open Shortest Path
   First (OSPF) Traffic Engineering TLVs" for TE Link TLV(Value 2) can
   be included if necessary.

   If the stub-link is "Unnumbered Stub Link" type, then the "Remote AS
   number" , "IPv4 Remote ASBR ID", "IPv6 Remote ASBR ID" sub-TLV MUST
   be included to facilitate the pairing of inter-AS link.

If this TLV is advertised multiple times in the same Inter-AS-TE-v2/
v3 LSA, only the first instance of the TLV is used by receiving
OSPFv2/v3 routers.  This situation SHOULD be logged as an error.

If this TLV is advertised multiple times for the same link in
different Inter-AS-TE-v2/v3 LSA originated by the same OSPFrouter,
the OSPFStub-Link TLV in these LSAs with the smallest Opaque ID is
used by receiving OSPFrouters.  This situation may be logged as a
warning.

It is RECOMMENDED that OSPF routers advertising OSPF Stub-Link TLVs
in different OSPF Inter-AS-TE v2/v3 LSAs re-originate these LSAs in
ascending order of Opaque ID to minimize the disruption.

This document creates a registry for Stub-Link attributes in
Section 7.

## 4.2.  ISIS Stub-link TLV

This document defines the ISIS Stub-Link TLV to describes stub link
of a single router.

The ISIS Stub-Link TLV has the following format:
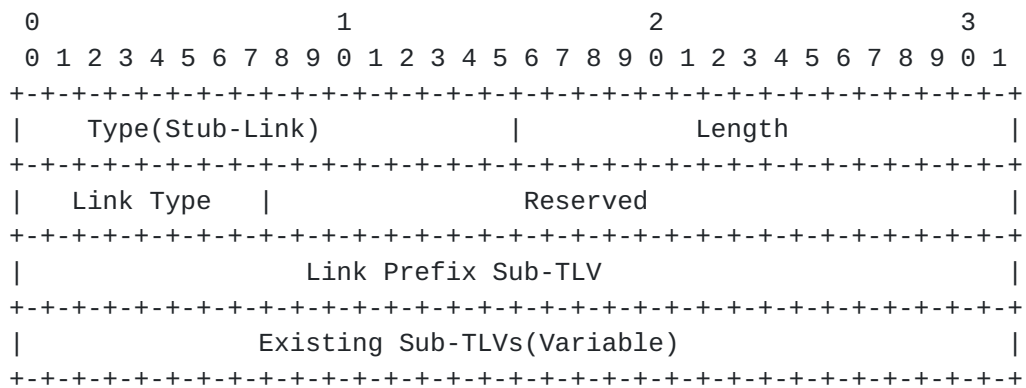
```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|    Type(Stub-Link)            |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Link Type   |              Reserved                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Link Prefix Sub-TLV                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               Existing Sub-TLVs(Variable)                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
                Figure 2: ISIS Stub-Link TLV

Type: ISIS TLV codepoint.  Value is 151 (TBD) for stub-link TLV.

Length: Variable, dependent on sub-TLVs

Link Type: Define the type of the stub-link:

o   0: Reserved

o   1: Numbered Stub Link

o   2: Unnumbered Stub Link

o  3-255: For future extension

Link Prefix Sub-TLV: The prefix of the stub-link.  It's format is
defined in Section 4.3 and Section 4.4.

Existing Sub-TLVs: Sub-TLVs that defined within "IS-IS Sub-TLVs for
TLVs Advertising Neighbor Information " can be included if necessary.

If the stub-link is "Unnumbered Stub Link" type, then the "Remote AS
number" , "IPv4 Remote ASBR ID", "IPv6 Remote ASBR ID" sub-TLV MUST
be included to facilitate the pairing of inter-AS link.

## 4.3.  IPv4 Prefix Sub-TLV

The IPv4 Prefix 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             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IPv4 Prefix                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
             Figure 3: IPv4 Prefix Sub-TLV
```

Type: IPv4 Prefix Sub-TLV codepoint.  Value is 25(TBD) for OSPFv2
(under "OSPFv2 Extended Link Sub-TLVs" )

30(TBD) for OSPFv3(under OSPFv3 Extended-LSA Sub-TLVs)

45(TBD) for IS-IS(under "IS-IS Sub-TLVs for TLVs Advertising Neighbor
Information")

Length: Netmask length value of the IPv4 Prefix.  Value should be in
2-32.

IPv4 Prefix: The value of 4-octet IPv4 Prefix address, the host part
should be zero.

## 4.4.  IPv6 Prefix Sub-TLV

The IPv6 Prefix 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             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IPv6 Prefix                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IPv6 Prefix                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IPv6 Prefix                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       IPv6 Prefix                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
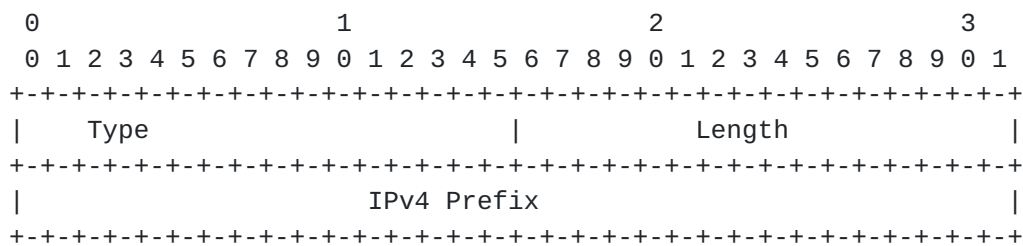                   Figure 4: IPv6 Prefix Sub-TLV

Type: IPv6 Prefix Sub-TLV codepoint.  Value is 31(TBD) for
OSPFv3.(under OSPFv3 Extended-LSA Sub-TLVs)

46(TBD) for IS-IS(under "IS-IS Sub-TLVs for TLVs Advertising Neighbor
Information")

Length: Netmask length value of the IPv6 Prefix.  Value should be in
2-128.

IPv6 Prefix: The value of 16-octet IPv6 Prefix address, the host part
should be zero.

## 5.  Application of the Stub Link attributes

For scenario that descried in
[I-D.ietf-idr-bgpls-inter-as-topology-ext], the prefixes information
associated with the stub link can be used to pair the two endpoints
of the stub link by the controller.  Such solution can apply in P2P,
Broadcast, P2MP, NBMA numbered stub link type.  For unnumbered Stub
link, the controller can use the associated Remote-AS, IPv4/IPv6
Remote Router ID to pair the two endpoints of the stub link.

## 6.  Security Considerations

Security concerns for ISIS are addressed in [RFC5304] and[RFC5310]

Security concern for OSPFv3 is addressed in [RFC4552]

Advertisement of the additional information defined in this document
introduces no new security concerns.

## 7.  IANA Considerations

   IANA is requested to the allocation in following registries:

```
+==============================+======+==========================+
| Registry                     | Type |        Meaning           |
+==============================+======+==========================+
|Top Level Types in TE LSAs    | 7    |OSPF Stub-Link TLV        |
+------------------------------+------+--------------------------+
|ISIS Top-Level TLV            | 151  |IS-IS Stub-Link TLV       |
+------------------------------+------+--------------------------+
|OSPFv2 Extended Link TLV      | 25   | IPv4 Prefix Sub-TLV      |
+------------------------------+------+--------------------------+
|OSPFv3 Extended-LSA Sub-TLVs  | 30   | IPv4 Prefix Sub-TLV      |
+------------------------------+------+--------------------------+
|OSPFv3 Extended-LSA Sub-TLVs  | 31   | IPv6 Prefix Sub-TLV      |
+------------------------------+------+--------------------------+
|IS-IS Sub-TLVs for TLVs       |      |                          |
|Advertising Neighbor Information | 45 | IPv4 Prefix Sub-TLV      |
+------------------------------+------+--------------------------+
|IS-IS Sub-TLVs for TLVs       |      |                          |
|Advertising Neighbor Information | 46 | IPv6 Prefix Sub-TLV      |
+------------------------------+------+--------------------------+
```
     Figure 5: IANA Allocation for newly defined TLVs and Sub-TLVs

## 8.  Acknowledgement

   Thanks Shunwan Zhang, Peter Psenak, Tony Li, Les Ginsberg, Dhruv
   Dhody, Jeff Tantsura and Robert Raszuk for their suggestions and
   comments on this idea.

## 9.  References

### 9.1.  Normative References

   [RFC2119]  Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <https://www.rfc-editor.org/info/rfc2119>.

   [RFC4552]  Gupta, M. and N. Melam, "Authentication/Confidentiality
              for OSPFv3", RFC 4552, DOI 10.17487/RFC4552, June 2006,
              <https://www.rfc-editor.org/info/rfc4552>.

   [RFC5304]  Li, T. and R. Atkinson, "IS-IS Cryptographic
              Authentication", RFC 5304, DOI 10.17487/RFC5304, October
              2008, <https://www.rfc-editor.org/info/rfc5304>.

[RFC5310]  Bhatia, M., Manral, V., Li, T., Atkinson, R., White, R., and M. Fanto, "IS-IS Generic Cryptographic Authentication", RFC 5310, DOI 10.17487/RFC5310, February 2009, <https://www.rfc-editor.org/info/rfc5310>.

[RFC5316]  Chen, M., Zhang, R., and X. Duan, "ISIS Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering", RFC 5316, DOI 10.17487/RFC5316, December 2008, <https://www.rfc-editor.org/info/rfc5316>.

[RFC5392]  Chen, M., Zhang, R., and X. Duan, "OSPF Extensions in Support of Inter-Autonomous System (AS) MPLS and GMPLS Traffic Engineering", RFC 5392, DOI 10.17487/RFC5392, January 2009, <https://www.rfc-editor.org/info/rfc5392>.

## 9.2.  Informative References

[I-D.ietf-idr-bgpls-inter-as-topology-ext]
           Wang, A., Chen, H., Talaulikar, K., and S. Zhuang, "BGP-LS Extension for Inter-AS Topology Retrieval", draft-ietf-idr-bgpls-inter-as-topology-ext-11 (work in progress), May 2022.

Authors' Addresses

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

Email: wangaj3@chinatelecom.cn


Zhibo Hu
Huawei Technologies
Huawei Bld., No.156 Beiqing Rd.
Beijing  100095
China

Email: huzhibo@huawei.com

Acee Lindem
Cisco Systems
No. 301 Midenhall Way
Cary  NC 27513
United States of America

Email: acee@cisco.com


Gyan S. Mishra
Verizon Inc.
13101 Columbia Pike
Silver Spring  MD 20904
United States of America

Email: gyan.s.mishra@verizon.com


Jinsong Sun
ZTE Corporation
No. 68, Ziijnhua Road
Nan Jing  210012
China

Email: sun.jinsong@zte.com.cn