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OSPF Graceful Restart Enhancements
draft-basavaraj-ospf-graceful-restart-enhancements-00

Abstract

This document describes enhancements to the OSPF graceful restart procedures to improve routing convergence in some OSPF network deployments. This document updates RFC 3623 and RFC 5187.

Status of this Memo

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1 Introduction

This document describes the enhancements to the current Graceful restart OSPF procedure to improve routing convergence in certain OSPF network deployment scenarios. The goal is for both the restarting OSPF node and the helper OSPF node to terminate the OSPF graceful restart procedure faster and not wait for the grace period expiry in those network scenarios and hence improve the overall OSPF network convergence.

1.1 Terminology

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 [RFC2119].

2 Graceful Restart Enhancements

In this section we will describe couple of issues with OSPF Graceful Restart (GR) in some network deployment scenarios, and a proposal to enhance the OSPF GR procedure to achieve faster OSPF routing convergence in those scenarios.

2.1 Stub Link Network Scenarios

```
---------            ---------          ---------
|Router1|---Area 0----|Router2|---Area 1---|Router3|
---------            ---------          ---------
```

Figure1: OSPF topology with Graceful restart

As described in figure 1, Router2 is an area border router (ABR) with OSPF links in 2 areas. Furthermore. Router2 has formed full adjacencies only in Area 0. In Area 1, Router2 has an OSPF link enabled but Router2 couldn’t form any adjacency either because Router3 is down or Router3 does not have OSPF enabled. Hence, Router2 will only have a stub link in Area 1.

On restart, the ABR router Router2, having only a stub link in the Area 1, will never receive its pre-restart LSA in this area and will never form an adjacency, Router2 will have to wait for the grace period expiry leading to slower OSPF routing convergence.

For this we propose, if no OSPF control packets were received within the dead interval on a link in Area 1 as per the above network scenario, Router2 MUST mark the link as stub and MUST not wait for the grace period to form an adjacency on this link to successfully Exit GR.

2.2 Multiple Failure Scenarios

In scenarios where more than one router is restarting at the same time in the same OSPF area and StrictLSAChecking is disabled, restarting OSPF routers will end up waiting the entire grace interval to exit GR.

If the restarting routers receive a Grace Link State Advertisements (LSA) from another router in a given area after restart, and the helper routers receive grace LSAs from more than one router, this will indicate that there have been multiple failures. Therefore, the helper and restarting routers MUST terminate GR and avoid any unnecessary delay in OSPF routing convergence.

3 Security Considerations

This document does not introduce any additional security constraints.

4. IANA Considerations

None

5. References

5.1 Normative References

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

[RFC3623] Moy, J., Pillay-Esnault, P., and A. Lindem, "Graceful OSPF Restart", RFC 3623, November 2003.

[RFC5187] Pillay-Esnault, P., and A. Lindem, "OSPFv3 Graceful Restart", RFC 5187, June 2008.

5.2 Informative References

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

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ISIS Segment Routing Flexible Algorithm
draft-hegdeppsenak-isis-sr-flex-algo-02.txt

Abstract

IGP protocols traditionally compute best paths over the network based on the IGP metric assigned to the links. Many network deployments use RSVP-TE based or Segment Routing based Traffic Engineering to enforce traffic over a path that is computed using different metrics or constraints than the shortest IGP path. Various mechanisms are used to steer the traffic towards such traffic engineered paths. This document proposes a solution that allows IGPs themselves to compute constraint based paths over the network without the use of the above mentioned traffic engineering technologies.

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1. Introduction

IGP computed path based on the shortest IGP metric must often be replaced by traffic engineered path due to the traffic requirements which are not reflected in the IGP metric. Some networks engineer the IGP metric assignments in a way that the IGP Metric reflects the link bandwidth or delay. If, for example, the IGP metric is reflecting the bandwidth on the link and the application traffic is delay sensitive, the best IGP path may not reflect the best path from such application's perspective.

To overcome such IGP limitation, various sorts of traffic engineering has been deployed, including RSVP-TE or SR-TE, in which case the TE component is responsible for computing the path based on additional metrics and/or constraints. Such paths need to be installed in the forwarding and replace the original paths computed by IGPs. Tunnels are often used to represent the engineered paths and mechanisms like one described in [RFC3906] are used to replace the native IGP paths with such tunnel paths.

Segment Routing (SR) allows a flexible definition of end-to-end paths within IGP topologies by encoding paths as sequences of topological sub-paths, called segments. It also defines an algorithm that defines how the paths are computed. It also provides a way to associate Prefix-SID with an algorithm. This allows IGPs to compute paths based on various algorithms and cause traffic to be forwarded on such paths using the algorithm specific segments.

This document describes the IS-IS extension to support Segment Routing Flexible Algorithm on an MPLS data-plane.

1.1. Requirements notation

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].

2. Flexible Algorithm

Many possible constraints may be used to compute a path over a network. Some networks are deployed as multiple planes. A simple form of constraint may be to use a particular plane. A more sophisticated form of constraint can include some extended metric as described in [RFC7810]. Constraints which restrict paths to links with specific affinities or avoid links with specific affinities are also possible. Combinations of these are also possible.

To provide maximum flexibility we do not want to provide a strict mapping between the set of constraints and the algorithm that is associated with it. We want the mapping between the algorithm value and it’s meaning to be flexible and defined by the user. As far as all routers in the domain have the common understanding what the particular algorithm value represents, the computation for such algorithm is consistent and traffic is not subject to any looping.

Because the meaning of the algorithm is not defined by any standard, but is defined by the user, we call it Flex-Algorithm.

3. Flexible Algorithm Advertisement

[I-D.ietf-isis-segment-routing-extensions] defines an SR-Algorithm. This algorithm defines how the best path is computed by the IGP. Routers advertise the support for the algorithm as a node capability.

Prefix SIDs are also advertised with an algorithm value and as such are tightly coupled with the algorithm.

Existing advertisement of the SR-Algorithm is used for the Flex-Algorithm advertisements as defined in [I-D.ietf-isis-segment-routing-extensions].

SR-Algorithm is a one octet value. We propose to split the range of values as follows:

0-127 - standardised values assigned by IANA

128-255 - user defined values.

4. Flexible Algorithm Definition Advertisement

To guarantee the loop free forwarding for paths computed for a particular Flex-Algorithm, all routers in the flooding scope of the algorithm definition MUST agree on the definition of the Flex-Algorithm.

4.1. Flexible Algorithm Definition Sub-TLV

Flexible Algorithm Definition Sub-TLV (FAD Sub-TLV) is used to advertise the definition of the Flex-Algorithm.

FAD Sub-TLV is advertised as Sub-TLV of the IS-IS Router Capability TLV-242 that is defined in [RFC7981].

When the definition of the Flex Algorithm is advertised, it is applicable to all topologies supported on the receiving node.

FAD 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     |   Algorithm   |  Metric Type  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Alg. Type   |    Priority   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                          Sub-TLVs                             |
+                                                               +
|                            ...                                |

|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where:

Type: TBD1

Length: variable, dependent on the included Sub-TLVs

Algorithm: Flex-Algorithm number. Value between 128 and 255 inclusive.

Metric Type: Type of metric to be used during the calculation. Following values are defined:

0: IGP Metric

1: Min Unidirectional Link Delay as defined in [RFC7810].

2: TE default metric as defined in [RFC5305].

Algorithm Type: Single octet identifying the algorithm type used to compute paths for the Flex-Algoritm. Values are defined in "IGP Algorithm Types" registry defined under "Interior Gateway Protocol (IGP) Parameters" IANA registries.

Priority: Single octet that specifies the priority of the advertisement.

Sub-TLVs - optional sub-TLVs.

When the router is configured with the local definition of the Flex-Algorithm, the router MUST advertise its local definition in the FAD Sub-TLV. If the local definition of the Flex-Algorithm is not advertised, the inconsistency in the configuration of the Flex-Algorithm on various nodes cannot be detected and traffic routed based on a Flex-Algorithm path may loop permanently.

Every router, that is configured to support a particular Flex-Algorithm, MUST select the Flex-Algorithm definition based on the following rules:

From the received advertisements of the FAD, select the one(s) with the highest priority.

If there are multiple advertisements of the FAD with the same highest priority, select the one that is originated from the router with the highest Router ID. Router ID is required to be advertised in every Router Capability TLV [RFC7981].

If the router has a local definition of the Flex-Algorithm, compare it with the received FAD advertisements using the same rules as have been used to pick the best FAD advertisement, e.g., priority and Router ID.

A router that is not configured to support a particular Flex-Algorithm MUST ignore FAD Sub-TLVs advertisements for such Flex-Algorithm.

Having a deterministic way that always produces a valid Flex-Algorithm definition avoids conflicts and maximizes the availability of the forwarding for the traffic that is using the Flex-Algorithm paths.

Any change in the Flex-Algorithm definition may result in temporary disruption of traffic that is forwarded based on such Flex-Algorithm paths. The impact is similar to any other event that requires network wide convergence

The FAD Sub-TLV of the IS-IS Router Capability TLV-242 MUST be propagated throughout the level. It MAY be advertised across level boundaries, if the S-flag in the Router Capability TLV is set. The S-Flag SHOULD not be set by default unless local configuration policy on the originating router indicates domain wide flooding.

Flex-Algorithm definition is topology independent. A node which advertises support for a given Flex-Algorithm may support that Flex-Algorithm on any subset of the topologies it supports. Enabling of a supported Flex-Algorithm on a given topology is a matter of local configuration. For a given topology, if out of the set of nodes supporting that topology AND advertising support for a given Flex-Algorithm only a subset of the nodes actually compute/install Flex-Algorithm specific paths in the forwarding plane for that topology, some traffic intended for such topology/Flex-Algorithm could be dropped if forwarded to a node on which the Flex-Algorithm is not enabled on that topology.

4.2. Flexible Algorithm Exclude Admin Group Sub-TLV

The Flexible-Algorithm definition can specify 'colors' that are used by the operator to exclude links during the Flex-Algorithm path computation.

Flexible Algorithm Exclude Admin Group Sub-TLV (FAEAG Sub-TLV) is a Sub-TLV of the FAD Sub-TLV. 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type       |    Length     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Extended Admin Group                     |
+-                                                             -+
|                            ...                                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
where:

Type: 1

Length: variable, dependent on the size of the Extended Admin Group. MUST be a multiple of 4 octets.

Extended Administrative Group: Extended Administrative Group as defined in [RFC7308].

FAEAG Sub-TLV SHOULD only appear once in FAD Sub-TLV. If it appears more then once, FAD Sub-TLV MUST be ignored by the receiver.

4.3. Flexible Algorithm Include Admin Group Sub-TLVs

The Flexible-Algorithm definition can specify 'colors' that are used by the operator to include links during the Flex-Algorithm path computation.

The format of the include Sub-TLVs is identical to the format of the FAEAG Sub-TLV in Section 4.2.

Two forms of inclusion are available - include-any and include-all.

Flexible Algorithm Include-Any Admin Group Sub-TLV - Type 2.

Flexible Algorithm Include-All Admin Group Sub-TLV - Type 3.

Flexible Algorithm Include Admin Group Sub-TLVs SHOULD only appear once in FAD Sub-TLV. If any of these Sub-TLVs appear more then once, FAD Sub-TLV MUST be ignored by the receiver.

5. Calculation of Flexible Algorithm Paths

A router may compute path for multiple Flex-Algorithms.

A router MUST be configured to support Flex-Algorithm K before it can compute any path for Flex-Algorithm K.

A router MUST either be configured with a local definition of Flex-Algorithm K or receive the definition via the FAD Sub-TLV, as described in Section 4.1, before it can compute any path for Flex-Algorithm K.

When computing the path for Flex-Algorithm K, all nodes that do not advertise support for Flex-Algorithm K in SR-Algorithm Sub-TLV ([I-D.ietf-isis-segment-routing-extensions]), MUST be pruned from the topology.

When computing the path for Flex-Algorithm K, the metric that is part of the Flex-Algorithm definition (Section 4.1) MUST be used.

Various link include or exclude rules can be part of the Flex-Algorithm definition. These rules use Extended Administrative Groups (EAG) as defined in [RFC7308]. [RFC7308] uses term ’colors’ as a shorthand to refer to particular bits with an EAG. Link advertisement CAN also include EAG, which describe which color is set on the link.

Link advertisement CAN also include Administrative Group (AG) TLV ([RFC5305]). The coexistence of EAG and AG is described in the section 2.3.1 of [RFC7308].

Rules, in the order as specified below, MUST be used to prune link from the topology during the Flex-Algorithm computation.

For all links in the topology:

1. Check if any exclude rule is part of the Flex-Algorithm definition. If such exclude rule exists, check if any color that is part of the exclude rule is also set on the link. If such a color exist, the link MUST be pruned from the computation.

2. Check if any include-any rule is part of the Flex-Algorithm definition. if such include-any rule exists, check if any color that is part of the include-any rule is also set on the link. If

such color does not exist, the link MUST be pruned from the computation.

3. Check if any include-all rule is part of the Flex-Algorithm definition. If such include-all rule exists, check if all colors that are part of the include-all rule are also set on the link. If not all such colors are set on the link, the link MUST be pruned from the computation.

4. If the Flex-Algorithm definition uses other than IGP metric (Section 4.1), and such metric is not advertised for the particular link in a topology for which the computation is done, such link MUST be pruned from the computation. A metric of value 0 MUST NOT be assumed in such case.

Flex-Algorithm K path MUST be installed in the MPLS forwarding plane using the MPLS label that corresponds to the Prefix-SID that was advertised for algorithm K. If the Prefix SID for algorithm K is not known, the Flex-Algorithm K path to such prefix MUST NOT be installed in the MPLS forwarding plane.

Loop Free Alternate (LFA) paths for Flex-Algorithm K path MUST be computed using the same constraints as the calculation of the primary paths for Flex-Algorithm K. LFA path MUST only use Prefix-SIDs advertised specifically for algorithm K to enforce the traffic over such path. LFA path MUST NOT use Adjacency-SID that belong to the link that has been pruned from the computation.

If LFA protection is being used to protect Flex-Algorithm K paths, all routers in the area SHOULD advertise at least one Flex-Algorithm K specific Prefix-SID. These Prefix-SIDs are used to enforce traffic over the LFA computed backup path.

Flex-Algorithm paths MAY be used by other applications, that do not utilize MPLS forwarding plane. It is outside of the sope of this specification, how these application learn and use the Flex-Algorithm specific paths.

Any Shortest Path Tree calculation is limited to a single area. Same applies to Flex-Algorithm calculations. Given that the computing router may not have the visibility to the topology of remote areas, the Flex-Algorithm K path to an inter-area prefix will only be computed for the local area. The egress L1/L2 router will be selected based on the best path for the Flex-Algorithm K in the local area and such egress L1/L2 router will be responsible to compute the best Flex-Algorithm K path over the next area. This may produce end-to-end path, which is not the best from the Flex-Algorithm K perspective. If the best end-to-end path for Flex-Algorithm K needs to be used for inter-area destinations, paths for such destinations need to be computed by the entity that has the topological information about all areas.

6. Backward Compatibility

This extension brings no new backward compatibility issues.

7. Security Considerations

This extension adds no new security considerations.

8. IANA Considerations

This documents request allocation for the following ISIS TLVs and subTLVs.

8.1. Sub TLVs for Type 242

This document makes the following registrations in the "sub-TLVs for TLV 242" registry.

Type: TBD1 (suggested value 24).

Description: Flexible Algorithm Definition Sub-TLV.

Reference: This document (Section 4.1).

8.2. New Sub-Sub-TLV registry

This document creates the following Sub-TLV Registry:

Registry: Sub-TLVs for Flexible Algorithm Definition Sub-TLV

Registration Procedure: Expert review

Reference: This document (Section 4.1)

This document resisters following Sub-TLVs in the "Sub-TLVs for Flexible Algorithm Definition Sub-TLV" registry:

Type: 1

Description: Flexible Algorithm Exclude Admin Group Sub-TLV

Reference: This document (Section 4.2).

Type: 2

Description: Flexible Algorithm Include-Any Admin Group Sub-TLV

Reference: This document (Section 4.3).

Type: 3

Description: Flexible Algorithm Include-All Admin Group Sub-TLV

Reference: This document (Section 4.3).

8.2.1. Flexible Algorithm Definition TLV Metric Registry

This document creates the following Registry:

Registry: Flexible Algorithm Definition TLV Metric Registry

Registration Procedure: Expert review

Reference: This document (Section 4.1)

This document registers following values in the "Flexible Algorithm Definition TLV Metric Registry":

Type: TBD, suggested value 0

Description: IGP metric

Reference: This document (Section 4.1)

Type: TBD, suggested value 1

Description: Min Unidirectional Link Delay [RFC7810]

Reference: This document (Section 4.1)

Type: TBD, suggested value 2

Description: TE Default Metric [RFC5305]

Reference: This document (Section 4.1)

9. Acknowledgments

This draft, among other things, is also addressing the problem that the [I-D.gulkohegde-routing-planes-using-sr] was trying to solve. All authors of that draft agreed to join this draft.

Thanks to Les Ginsberg and Ketan Talaulikar for review and useful comments.

Thanks to Cengiz Halit for his review and feedback during initial phase of the solution definition.

10. References

10.1. Normative References

[I-D.ietf-isis-segment-routing-extensions]
Previdi, S., Ginsberg, L., Filsfils, C., Bashandy, A., Gredler, H., Litkowski, S., Decraene, B., and J. Tantsura, "IS-IS Extensions for Segment Routing", draft-ietf-isis-segment-routing-extensions-15 (work in progress), December 2017.

[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>.

[RFC5305] Li, T. and H. Smit, "IS-IS Extensions for Traffic Engineering", RFC 5305, DOI 10.17487/RFC5305, October 2008, <https://www.rfc-editor.org/info/rfc5305>.

[RFC7308] Osborne, E., "Extended Administrative Groups in MPLS Traffic Engineering (MPLS-TE)", RFC 7308, DOI 10.17487/RFC7308, July 2014, <https://www.rfc-editor.org/info/rfc7308>.

[RFC7810] Previdi, S., Ed., Giacalone, S., Ward, D., Drake, J., and Q. Wu, "IS-IS Traffic Engineering (TE) Metric Extensions", RFC 7810, DOI 10.17487/RFC7810, May 2016, <https://www.rfc-editor.org/info/rfc7810>.

[RFC7981] Ginsberg, L., Previdi, S., and M. Chen, "IS-IS Extensions for Advertising Router Information", RFC 7981, DOI 10.17487/RFC7981, October 2016, <https://www.rfc-editor.org/info/rfc7981>.

10.2. Informative References

[I-D.gulkohegde-routing-planes-using-sr]
Hegde, S. and a. arkadiy.gulko@thomsonreuters.com, "Separating Routing Planes using Segment Routing", draft-gulkohegde-routing-planes-using-sr-00 (work in progress), March 2017.

[RFC3906] Shen, N. and H. Smit, "Calculating Interior Gateway Protocol (IGP) Routes Over Traffic Engineering Tunnels", RFC 3906, DOI 10.17487/RFC3906, October 2004, <https://www.rfc-editor.org/info/rfc3906>.

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IS-IS TE Attributes per application
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Abstract

Existing traffic engineering related link attribute advertisements have been defined and are used in RSVP-TE deployments. In cases where multiple applications wish to make use of these link attributes the current advertisements do not support application specific values for a given attribute nor do they support indication of which applications are using the advertised value for a given link.

This draft introduces new link attribute advertisements which address both of these shortcomings. It also discusses backwards compatibility issues and how to minimize duplicate advertisements in the presence of routers which do not support the extensions defined in this document.

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.

Status of This Memo

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1. Introduction

Advertisement of link attributes by the Intermediate-System-to-Intermediate-System (IS-IS) protocol in support of traffic engineering (TE) was introduced by [RFC5305] and extended by [RFC5307], [RFC6119], and [RFC7810]. Use of these extensions has been associated with deployments supporting Traffic Engineering over Multiprotocol Label Switching (MPLS) in the presence of Resource Reservation Protocol (RSVP) - more succinctly referred to as RSVP-TE.

In recent years new applications have been introduced which have use cases for many of the link attributes historically used by RSVP-TE. Such applications include Segment Routing Traffic Engineering (SRTE) and Loop Free Alternates (LFA). This has introduced ambiguity in that if a deployment includes a mix of RSVP-TE support and SRTE support (for example) it is not possible to unambiguously indicate which advertisements are to be used by RSVP-TE and which advertisements are to be used by SRTE. If the topologies are fully congruent this may not be an issue, but any incongruence leads to ambiguity.

An additional issue arises in cases where both applications are supported on a link but the link attribute values associated with each application differ. Current advertisements do not support advertising application specific values for the same attribute on a specific link.

This document defines extensions which address these issues. Also, as evolution of use cases for link attributes can be expected to continue in the years to come, this document defines a solution which is easily extensible to the introduction of new applications and new use cases.

2. Requirements Discussion

As stated previously, evolution of use cases for link attributes can be expected to continue - so any discussion of existing use cases is limited to requirements which are known at the time of this writing. However, in order to determine the functionality required beyond what already exists in IS-IS, it is only necessary to discuss use cases which justify the key points identified in the introduction - which are:

1. Support for indicating which applications are using the link attribute advertisements on a link

2. Support for advertising application specific values for the same attribute on a link

[RFC7855] discusses use cases/requirements for SR. Included among these use cases is SRTE which is defined in [I-D.filsfils-spring-segment-routing-policy]. If both RSVP-TE and SRTE are deployed in a network, link attribute advertisements can be used by one or both of these applications. As there is no requirement for the link attributes advertised on a given link used by SRTE to be identical to the link attributes advertised on that same link used by RSVP-TE, there is a clear requirement to indicate independently which link attribute advertisements are to be used by each application.

As the number of applications which may wish to utilize link attributes may grow in the future, an additional requirement is that the extensions defined allow the association of additional applications to link attributes without altering the format of the advertisements or introducing new backwards compatibility issues.

Finally, there may still be many cases where a single attribute value can be shared among multiple applications, so the solution must minimize advertising duplicate link/attribute pairs whenever possible.

3. Legacy Advertisements

There are existing advertisements used in support of RSVP-TE. These advertisements include sub-TLVs for TLVs 22, 23, 141, 222, and 223 and TLVs for SRLG advertisement.

3.1. Legacy sub-TLVs

Sub-TLVs for TLVs 22, 23, 141, 222, and 223

```
Code Point/Attribute Name
--------------------------
 3 Administrative group (color)
 9 Maximum link bandwidth
10 Maximum reservable link bandwidth
11 Unreserved bandwidth
14 Extended Administrative Group
18 TE Default Metric
33 Unidirectional Link Delay
34 Min/Max Unidirectional Link Delay
35 Unidirectional Delay Variation
36 Unidirectional Link Loss
37 Unidirectional Residual Bandwidth
38 Unidirectional Available Bandwidth
39 Unidirectional Utilized Bandwidth
```

3.2. Legacy SRLG Advertisements

TLV 138 GMPLS-SRLG
  Supports links identified by IPv4 addresses and
  unnumbered links

TLV 139 IPv6 SRLG
  Supports links identified by IPv6 addresses

Note that [RFC6119] prohibits the use of TLV 139 when it is possible to use TLV 138.

4. Advertising Application Specific Link Attributes

Two new code points are defined in support of Application Specific Link Attribute Advertisements:

1) Application Specific Link Attributes sub-TLV for TLVs 22, 23, 141, 222, and 223

2)Application Specific Shared Risk Link Group (SRLG) TLV

In support of these new advertisements, an application bit mask is defined which identifies the application(s) associated with a given advertisement.

The following sections define the format of these new advertisements.

4.1. Application Identifier Bit Mask

Identification of the set of applications associated with link attribute advertisements utilizes two bit masks. One bit mask is for standard applications where the definition of each bit is defined in a new IANA controlled registry. A second bit mask is for non-standard User Defined Applications(UDAs).

The encoding defined below is used by both the Application Specific Link Attributes sub-TLV and the Application Specific SRLG TLV.

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|   SABML+F     |  1 octet
+-+-+-+-+-+-+-+-+
|   UDABML+F    |  1 octet
+-+-+-+-+-+-+-+-+
|   SABM         ...  0 - 127 octets
+-+-+-+-+-+-+-+-+
|   UDABM        ...  0 - 127 octets
+-+-+-+-+-+-+-+-+
```

SABML+F (1 octet)
    Standard Application Bit Mask Length/Flags

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|L|  SA-Length  |
+-+-+-+-+-+-+-+-+
```

L-flag: Applications listed (both Standard and User Defined) MUST use the legacy advertisements for the corresponding link found in TLVs 22, 23, 141, 222, and 223 or TLV 138 or TLV 139 as appropriate.

SA-Length: Indicates the length in octets (0-127) of the Bit Mask for Standard Applications.

UDABML+F (1 octet)
    User Defined Application Bit Mask Length/Flags

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|R| UDA-Length  |
+-+-+-+-+-+-+-+-+
```

R: Reserved. Transmitted as 0 and ignored on receipt

UDA-Length: Indicates the length in octets (0-127) of the Bit Mask for User Defined Applications.

SABM (variable length)
Standard Application Bit Mask

(SA-Length * 8) bits

This is omitted if SA-Length is 0.

```
 0 1 2 3 4 5 6 7 ...
+-+-+-+-+-+-+-+-+...
|R|S|F|X|       ...
+-+-+-+-+-+-+-+-+...
```

R-bit: RSVP-TE

S-bit: Segment Routing Traffic Engineering

F-bit: Loop Free Alternate

X-bit: Flex-Algo

UDABM (variable length)
User Defined Application Bit Mask

(UDA Length * 8) bits

```
 0 1 2 3 4 5 6 7 ...
+-+-+-+-+-+-+-+-+...
|               ...
+-+-+-+-+-+-+-+-+...
```

This is omitted if UDA-Length is 0.

NOTE: If both SA-length and UDA-Length are zero, then the attributes associated with this attribute identifier bit mask MAY be used by any Standard Application and any User Defined Application.

Standard Application Bits are defined/sent starting with Bit 0. Additional bit definitions that may be defined in the future SHOULD be assigned in ascending bit order so as to minimize the number of octets that will need to be transmitted. Undefined bits MUST be transmitted as 0 and MUST be ignored on receipt. Bits that are NOT transmitted MUST be treated as if they are set to 0 on receipt.

User Defined Application bits have no relationship to Standard Application bits and are NOT managed by IANA or any other standards body. It is recommended that bits are used starting with Bit 0 so as to minimize the number of octets required to advertise all UDAs.

4.2. Application Specific Link Attributes sub-TLV

A new sub-TLV for TLVs 22, 23, 141, 222, and 223 is defined which supports specification of the applications and application specific attribute values.

Type: 16 (suggested value - to be assigned by IANA)
Length: Variable (1 octet)
Value:

Application Bit Mask (as defined in Section 3.1)

Link Attribute sub-sub-TLVs - format matches the existing formats defined in [RFC5305] and [RFC7810]

When the L-flag is set in the Application Identifiers, all of the applications specified in the bit mask MUST use the link attribute sub-TLV advertisements listed in Section 3.1 for the corresponding link. Application specific link attribute sub-sub-TLVs for the corresponding link attributes MUST NOT be advertised for the set of applications specified in the Standard/User Application Bit Masks and all such advertisements MUST be ignored on receipt.

Multiple sub-TLVs for the same link MAY be advertised. When multiple sub-TLVs for the same link are advertised, they SHOULD advertise non-conflicting application/attribute pairs. A conflict exists when the same application is associated with two different values of the same link attribute for a given link. In cases where conflicting values for the same application/attribute/link are advertised all the conflicting values MUST be ignored.

For a given application, the setting of the L-flag MUST be the same in all sub-TLVs for a given link. In cases where this constraint is violated, the L-flag MUST be considered set for this application.

A new registry of sub-sub-TLVs is to be created by IANA which defines the link attribute sub-sub-TLV code points. A sub-sub-TLV is defined for each of the existing sub-TLVs listed in Section 3.1 except as noted below. The format of the sub-sub-TLVs matches the format of the corresponding legacy sub-TLV and IANA is requested to assign the legacy sub-TLV identifer to the corresponding sub-sub-TLV.

4.2.1. Special Considerations for Maximum Link Bandwidth

Maximum link bandwidth is an application independent attribute of the link. When advertised using the Application Specific Link Attributes sub-TLV, multiple values for the same link MUST NOT be advertised. This can be accomplished most efficiently by having a single advertisement for a given link where the Application Bit Mask identifies all the applications which are making use of the value for that link.

It is also possible to advertise the same value for a given link multiple times with disjoint sets of applications specified in the Application Bit Mask. This is less efficient but still valid.

If different values for Maximum Link Bandwidth for a given link are advertised, all values MUST be ignored.

4.2.2. Special Considerations for Unreserved Bandwidth

Unreserved bandwidth is an attribute specific to RSVP. When advertised using the Application Specific Link Attributes sub-TLV, bits other than the RSVP-TE(R-bit) MUST NOT be set in the Application Bit Mask. If an advertisement of Unreserved Bandwidth is received with bits other than the RSVP-TE bit set, the advertisement MUST be ignored.

4.3. Application Specific SRLG TLV

A new TLV is defined to advertise application specific SRLGs for a given link. Although similar in functionality to TLV 138 (defined by [RFC5307]) and TLV 139 (defined by [RFC6119], a single TLV provides support for IPv4, IPv6, and unnumbered identifiers for a link. Unlike TLVs 138/139, it utilizes sub-TLVs to encode the link identifiers in order to provide the flexible formatting required to support multiple link identifier types.

```
Type: 238 (Suggested value - to be assigned by IANA)
Length: Number of octets in the value field (1 octet)
Value:
  Neighbor System-ID + pseudo-node ID (7 octets)
  Application Bit Mask (as defined in Section 3.1)
  Length of sub-TLVs (1 octet)
  Link Identifier sub-TLVs (variable)
  0 or more SRLG Values (Each value is 4 octets)
```

The following Link Identifier sub-TLVs are defined. The type values are suggested and will be assigned by IANA - but as the formats are identical to existing sub-TLVs defined for TLVs 22, 23, 141, 222, and 223 the use of the suggested sub-TLV types is strongly encouraged.

Type	Description
4	Link Local/Remote Identifiers (see [RFC5307])
6	IPv4 interface address (see [RFC5305])
8	IPv4 neighbor address (see [RFC5305])
12	IPv6 Interface Address (see [RFC6119])
13	IPv6 Neighbor Address (see [RFC6119])

At least one set of link identifiers (IPv4, IPv6, or unnumbered) MUST be present. TLVs which do not meet this requirement MUST be ignored.

Multiple TLVs for the same link MAY be advertised.

When the L-flag is set in the Application Identifiers, SRLG values MUST NOT be included in the TLV. Any SRLG values which are advertised MUST be ignored. Based on the link identifiers advertised the corresponding legacy TLV (see Section 3.2) can be identified and the SRLG values advertised in the legacy TLV MUST be used by the set of applications specified in the Application Bit Mask.

For a given application, the setting of the L-flag MUST be the same in all TLVs for a given link. In cases where this constraint is violated, the L-flag MUST be considered set for this application.

5. Deployment Considerations

If link attributes are advertised associated with zero length application bit masks for both standard applications and user defined applications, then that set of link attributes MAY be used by any application. If support for a new application is introduced on any node in a network in the presence of such advertisements, these advertisements MAY be used by the new application. If this is not what is intended, then existing advertisements MUST be readvertised with an explicit set of applications specified before a new application is introduced.

6. Attribute Advertisements and Enablement

This document defines extensions to support the advertisement of application specific link attributes.

Whether the presence of link attribute advertisements for a given application indicates that the application is enabled on that link depends upon the application. Similarly, whether the absence of link attribute advertisements indicates that the application is not enabled depends upon the application.

In the case of RSVP-TE, the advertisement of application specific link attributes implies that RSVP is enabled on that link.

In the case of SRTE, advertisement of application specific link attributes does NOT indicate enablement of SRTE. The advertisements are only used to support constraints which may be applied when specifying an explicit path. SRTE is implicitly enabled on all links which are part of the Segment Routing enabled topology independent of the existence of link attribute advertisements

In the case of LFA, advertisement of application specific link attributes does NOT indicate enablement of LFA on that link. Enablement is controlled by local configuration.

In the case of Flex-Algo, advertisement of application specific link attributes does NOT indicate enablement of Flex-Algo. Rather the attributes are used to determine what links are included/excluded in the algorithm specific constrained SPF. This is fully specified in [I-D.hegdeppsenak-isis-sr-flex-algo].

If, in the future, additional standard applications are defined to use this mechanism, the specification defining this use MUST define the relationship between application specific link attribute advertisements and enablement for that application.

This document allows the advertisement of application specific link attributes with no application identifiers i.e., both the Standard Application Bit Mask and the User Defined Application Bit Mask are not present (See Section 4.1). This supports the use of the link attribute by any application. In the presence of an application where the advertisement of link attribute advertisements is used to infer the enablement of an application on that link (e.g., RSVP-TE), the absence of the application identifier leaves ambiguous whether that application is enabled on such a link. This needs to be considered when making use of the "any application" encoding.

7. Interoperability, Backwards Compatibility and Migration Concerns

Existing deployments of RSVP-TE utilize the legacy advertisements listed in Section 3. Routers which do not support the extensions defined in this document will only process legacy advertisements and are likely to infer that RSVP-TE is enabled on the links for which legacy advertisements exist. It is expected that deployments using the legacy advertisements will persist for a significant period of time - therefore deployments using the extensions defined in this document must be able to co-exist with use of the legacy advertisements by routers which do not support the extensions defined in this document. The following sub-sections discuss interoperability and backwards compatibility concerns for a number of deployment scenarios.

Note that in all cases the defined strategy can be employed on a per link basis.

7.1. RSVP-TE only deployments

In deployments where RSVP-TE is the only application utilizing link attribute advertisements, use of the the legacy advertisements can continue without change.

7.2. Multiple Applications: Common Attributes with RSVP-TE

In cases where multiple applications are utilizing a given link, one of the applications is RSVP-TE, and all link attributes for a given link are common to the set of applications utilizing that link, interoperability is achieved by using legacy advertisements and sending application specific advertisements with L-bit set and no link attribute values. This avoids duplication of link attribute advertisements.

7.3. Multiple Applications: All Attributes Not Shared w RSVP-TE

In cases where one or more applications other than RSVP-TE are utilizing a given link and one or more link attribute values are NOT shared with RSVP-TE, it is necessary to use application specific advertisements as defined in this document. Attributes for applications other than RSVP-TE MUST be advertised using application specific advertisements which have the L-bit clear. In cases where some link attributes are shared with RSVP-TE, this requires duplicate advertisements for those attributes.

The discussion in this section applies to cases where RSVP-TE is NOT using any advertised attributes on a link and to cases where RSVP-TE is using some link attribute advertisements on the link but some link attributes cannot be shared with RSVP-TE.

7.4. Deprecating legacy advertisements

The extensions defined in this document support RSVP-TE as one of the supported applications - so a long term goal for deployments would be to deprecate use of the legacy advertisements in support of RSVP-TE. This can be done in the following step-wise manner:

1)Upgrade all routers to support extensions in this document

2)Readvertise all legacy link attributes using application specific advertisements with L-bit clear and R-bit set.

3)Remove legacy advertisements

8. IANA Considerations

This document defines a new sub-TLV for TLVs 22, 23, 141, 222, and 223.

Type	Description	22	23	25	141	222	223
16	Application Specific Link Attributes	y	y	y(s)	y	y	y

This document defines one new TLV:

Type	Description	IIH	LSP	SNP	Purge
238	Application Specific SRLG	n	y	n	n

This document requests a new IANA registry be created to control the assignment of sub-sub-TLV codepoints for the Application Specific Link Attributes sub-TLV. The suggested name of the new registry is "sub-sub-TLV code points for application specific link attributes". The registration procedure is "Expert Review" as defined in [RFC8126]. The following assignments are made by this document:

Type	Description
0-2	Unassigned
3	Administrative group (color)
4-8	Unassigned
9	Maximum link bandwidth
10	Maximum reservable link bandwidth
11	Unreserved bandwidth
12-13	Unassigned
14	Extended Administrative Group
15-17	Unassigned
18	TE Default Metric
19-32	Unassigned
33	Unidirectional Link Delay
34	Min/Max Unidirectional Link Delay
35	Unidirectional Delay Variation
36	Unidirectional Link Loss
37	Unidirectional Residual Bandwidth
38	Unidirectional Available Bandwidth
39	Unidirectional Utilized Bandwidth
40-255	Unassigned

This document requests a new IANA registry be created, under the category of "Interior Gateway Protocol (IGP) Parameters", to control the assignment of application bit identifiers. The suggested name of the new registry is "Link Attribute Applications". The registration policy for this registry is "Standards Action" ([RFC8126] and [RFC7120]). The following assignments are made by this document:

Bit #	Name
0	RSVP-TE (R-bit)
1	Segment Routing Traffic Engineering (S-bit)
2	Loop Free Alternate (F-bit)
3	Flex Algorithm (X-bit)

This document requests a new IANA registry be created to control the assignment of sub-TLV types for the application specific SRLG TLV. The suggested name of the new registry is "Sub-TLVs for TLV 238". The registration procedure is "Expert Review" as defined in [RFC8126]. The following assignments are made by this document:

Value	Description
0-3	Unassigned
4	Link Local/Remote Identifiers (see [RFC5307])
5	Unassigned
6	IPv4 interface address (see [RFC5305])
7	Unassigned
8	IPv4 neighbor address (see [RFC5305])
9-11	Unassigned
12	IPv6 Interface Address (see [RFC6119])
13	IPv6 Neighbor Address (see [RFC6119])
14-255	Unassigned

9. Security Considerations

Security concerns for IS-IS are addressed in [ISO10589, [RFC5304], and [RFC5310].

10. Acknowledgements

The authors would like to thank Eric Rosen and Acee Lindem for their careful review and content suggestions.

11. References

11.1. 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>.

[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>.

[RFC5305] Li, T. and H. Smit, "IS-IS Extensions for Traffic Engineering", RFC 5305, DOI 10.17487/RFC5305, October 2008, <https://www.rfc-editor.org/info/rfc5305>.

[RFC5307] Kompella, K., Ed. and Y. Rekhter, Ed., "IS-IS Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", RFC 5307, DOI 10.17487/RFC5307, October 2008, <https://www.rfc-editor.org/info/rfc5307>.

[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>.

[RFC6119] Harrison, J., Berger, J., and M. Bartlett, "IPv6 Traffic Engineering in IS-IS", RFC 6119, DOI 10.17487/RFC6119, February 2011, <https://www.rfc-editor.org/info/rfc6119>.

[RFC7120] Cotton, M., "Early IANA Allocation of Standards Track Code Points", BCP 100, RFC 7120, DOI 10.17487/RFC7120, January 2014, <https://www.rfc-editor.org/info/rfc7120>.

[RFC7810] Previdi, S., Ed., Giacalone, S., Ward, D., Drake, J., and Q. Wu, "IS-IS Traffic Engineering (TE) Metric Extensions", RFC 7810, DOI 10.17487/RFC7810, May 2016, <https://www.rfc-editor.org/info/rfc7810>.

[RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 8126, DOI 10.17487/RFC8126, June 2017, <https://www.rfc-editor.org/info/rfc8126>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

11.2. Informative References

[I-D.filsfils-spring-segment-routing-policy]
Filsfils, C., Sivabalan, S., Hegde, S., daniel.voyer@bell.ca, d., Lin, S., bogdanov@google.com, b., Krol, P., Horneffer, M., Steinberg, D., Decraene, B., Litkowski, S., Mattes, P., Ali, Z., Talaulikar, K., Liste, J., Clad, F., and K. Raza, "Segment Routing Policy Architecture", draft-filsfils-spring-segment-routing-policy-06 (work in progress), May 2018.

[I-D.hegdeppsenak-isis-sr-flex-algo]
Psenak, P., Hegde, S., Filsfils, C., and A. Gulko, "ISIS Segment Routing Flexible Algorithm", draft-hegdeppsenak-isis-sr-flex-algo-02 (work in progress), February 2018.

[RFC7855] Previdi, S., Ed., Filsfils, C., Ed., Decraene, B., Litkowski, S., Horneffer, M., and R. Shakir, "Source Packet Routing in Networking (SPRING) Problem Statement and Requirements", RFC 7855, DOI 10.17487/RFC7855, May 2016, <https://www.rfc-editor.org/info/rfc7855>.

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                                                      P. Pillay-Esnault
                                                                  Huawei
                                                        November 4, 2018

OSPF LLS Extensions for Local Interface ID Advertisement
draft-ietf-ospf-lls-interface-id-09

Abstract

Every OSPF interface is assigned an identifier, Interface ID, which uniquely identifies the interface on the router. In some cases it is useful to know the assigned Interface ID on the remote side of the adjacency (Remote Interface ID).

This draft describes the extensions to OSPF link-local signalling (LLS) to advertise the Local Interface Identifier.

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 BCP14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

Table of Contents

1. Introduction

Every OSPF interface is assigned an Interface ID, which uniquely identifies the interface on the router. [RFC2328] uses this Interface ID in the Router-LSA Link Data for unnumbered links and uses the value of the MIB-II IfIndex [RFC2863]. [RFC4203] refers to these Interface IDs as the Link Local/Remote Identifiers and defines a way to advertise and use them for Generalized Multi-Protocol Label Switching (GMPLS) purposes. [RFC7684] defines a way to advertise Local/Remote Interface IDs in the OSPFv2 Extended Link LSA.

There is a known OSPFv2 protocol problem in verifying the bi-directional connectivity with parallel unnumbered links. If there are two parallel unnumbered links between a pair of routers and each link is only advertised from single direction, such two unidirectional parallel links could be considered as a valid single bidirectional link during the OSPF route computation on some other router. If each link is advertised with both its Local and Remote

Interface IDs, the advertisement of each link from both sides of adjacency can be verified by cross-checking the Local and Remote Interface IDs of both advertisements.

From the perspective of the advertising router, the Local Interface Identifier is a known value, however the Remote Interface Identifier needs to be learnt before it can be advertised. [RFC4203] suggests to use TE Link Local LSA [RFC3630] to communicate the Local Interface Identifier to neighbors on the link. Though such mechanism works, it has some drawbacks.

This draft proposes an extension to OSPF link-local signalling (LLS) [RFC5613] to advertise the Local Interface Identifier.

1.1. Interface ID Exchange using TE Opaque LSA

Usage of the Link Local TE Opaque LSA to propagate the Local Interface Identifier to the neighbors on the link is described in [RFC4203]. This mechanism has the following problems:

> LSAs can only be flooded over an existing adjacency that is in Exchange state or greater. The adjacency state machine progresses independently on each side of the adjacency and, as such, may reach the Full state on one side before the TE Link Opaque LSA arrives. The consequence is that link can be initially advertised without the Remote Interface Identifier. Later, when the TE Link Opaque LSA arrives, the link must be advertised again, this time with the valid Remote Interface Identifier. Implementations may choose to wait before advertising the link, but there is no guarantee that the neighbor will ever advertise the TE Link Opaque LSA with the Interface Identifier. In summary, the existing mechanism does not guarantee that the Remote Interface Identifier is known at the time the link is advertised.
>
> The TE Opaque LSA is defined for MPLS Traffic Engineering, but the knowledge of the Remote Interface Identifier is useful also for cases where MPLS TE is not used. One example is the mentioned lack of a valid 2-way connectivity check for parallel point-to-point links between OSPF routers.

2. Interface ID Exchange using OSPF LLS

To address the problems described earlier and to allow the Interface Identifier exchange to be part of the neighbor discovery process, we propose to extend OSPF link-local signalling to advertise the Local Interface Identifier in OSPF Hello and Database Description (DD) packets.

2.1. Local Interface Identifier TLV

The Local Interface Identifier TLV is a LLS TLV. It has 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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Local Interface Identifier                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where:

Type: TBD

Length: 4 octets

Local Interface Identifier: The value of the local Interface Identifier.

Local Interface Identifier TLV signalling using LLS is applicable to all OSPF interface types other than virtual links.

3. Backward Compatibility with RFC 4203

If the Local Interface ID signaling via Link Local TE Opaque LSA is supported in addition to the new LLS mechanism, implementations which support Local Interface ID signalling using LLS MUST prefer the Local Interface ID value received through LLS over the value received through the Link Local TE Opaque LSA if both are received from the same OSPF router.

Implementations which support Local Interface ID signalling via Link Local TE Opaque LSA MAY continue to do so to ensure backward compatibility. If they also support Local Interface ID signalling using LLS as described herein, they MUST signal the same Local Interface ID via both mechanisms.

During the rare conditions, when the Local Interface ID changes, a timing interval may exist, where the received values of the Local Interface ID advertised through LLS and Link Local TE Opaque LSA may differ. Such situation is temporary and received values via both mechanisms should become equal as soon as the next Hello and/or Link Local TE Opaque LSA is re-generated by the originator.

4. IANA Considerations

This specification allocates a single code point from the "Open Shortest Path First (OSPF) Link Local Signalling (LLS) - Type/Length/ Value Identifiers (TLV)" registry.

Following value is allocated:

o TBD - Local Interface Identifier TLV

5. Security Considerations

The security considerations for "OSPF Link-Local Signaling" [RFC5613] also apply to the Local Interface Identifier TLV described herein. The current usage of a neighbor's Local Interface Identifier is to disambiguate parallel links between OSPF routers. Hence, modification of the advertised Local Interface Identifier TLV may result in the wrong neighbor interface identifier being advertised in the OSPFv2 Extended Link LSA [RFC7684] and could prevent the link from being used. If authentication is being used in the OSPF routing domain [RFC5709], then the Cryptographic Authentication TLV [RFC5613] SHOULD also be used to protect that contents of the Link-Local Signaling (LLS) block.

Receiving a malformed LLS Interface Identifier TLV MUST NOT result in a hard router or OSPF process failure. The reception of malformed LLS TLVs or Sub-TLVs SHOULD be logged but such logging MUST be rate-limited to prevent Denial-of-Service (DoS) attacks.

The interface ID is assigned by the advertising OSPF router as a locally unique identifier and need not be unique in any broader context; it is not expected to contain any information about the device owner or traffic transiting the device, so there are no privacy oncerns associated with its advertisement.

6. Acknowledgments

Thanks to Tony Przygienda for his extensive review and useful comments.

7. References

7.1. 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>.

[RFC2328] Moy, J., "OSPF Version 2", STD 54, RFC 2328, DOI 10.17487/RFC2328, April 1998, <https://www.rfc-editor.org/info/rfc2328>.

[RFC3630] Katz, D., Kompella, K., and D. Yeung, "Traffic Engineering (TE) Extensions to OSPF Version 2", RFC 3630, DOI 10.17487/RFC3630, September 2003, <https://www.rfc-editor.org/info/rfc3630>.

[RFC4203] Kompella, K., Ed. and Y. Rekhter, Ed., "OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", RFC 4203, DOI 10.17487/RFC4203, October 2005, <https://www.rfc-editor.org/info/rfc4203>.

[RFC5613] Zinin, A., Roy, A., Nguyen, L., Friedman, B., and D. Yeung, "OSPF Link-Local Signaling", RFC 5613, DOI 10.17487/RFC5613, August 2009, <https://www.rfc-editor.org/info/rfc5613>.

[RFC7684] Psenak, P., Gredler, H., Shakir, R., Henderickx, W., Tantsura, J., and A. Lindem, "OSPFv2 Prefix/Link Attribute Advertisement", RFC 7684, DOI 10.17487/RFC7684, November 2015, <https://www.rfc-editor.org/info/rfc7684>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

7.2. Informative References

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, DOI 10.17487/RFC2863, June 2000, <https://www.rfc-editor.org/info/rfc2863>.

[RFC5709] Bhatia, M., Manral, V., Fanto, M., White, R., Barnes, M., Li, T., and R. Atkinson, "OSPFv2 HMAC-SHA Cryptographic Authentication", RFC 5709, DOI 10.17487/RFC5709, October 2009, <https://www.rfc-editor.org/info/rfc5709>.

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