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Signaling MSD (Maximum SID Depth) using OSPF
draft-ietf-ospf-segment-routing-msd-06

Abstract

This document proposes a way to signal Maximum SID Depth (MSD) supported by a node at node and/or link granularity by an OSPF Router. In a Segment Routing (SR) enabled network a centralized controller that programs SR tunnels needs to know the MSD supported by the head-end at node and/or link granularity to impose the SID stack of an appropriate depth. MSD is relevant to the head-end of a SR tunnel or Binding-SID anchor node where Binding-SID expansions might result in creation of a new SID stack. Here the term OSPF means both OSPFv2 and OSPFv3.

Status of This Memo

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1. Introduction

When Segment Routing tunnels are computed by a centralized controller, it is critical that the controller learns the MSD "Maximum SID Depth" of the node or link SR tunnel exits over, so the SID stack depth of a path computed doesn't exceed the number of SIDs the node is capable of imposing. This document describes how to use OSPF to signal the MSD of a node or link to a centralized controller.

PCEP SR extensions draft [I-D.ietf-pce-segment-routing] signals MSD in SR PCE Capability TLV and METRIC Object. However, if PCEP is not supported/configured on the head-end of a SR tunnel or a Binding-SID anchor node and controller does not participate in IGP routing, it has no way to learn the MSD of nodes and links which has been configured. BGP-LS [RFC7752] defines a way to expose topology and associated attributes and capabilities of the nodes in that topology to a centralized controller. MSD signaling by BGP-LS has been defined in [I-D.ietf-idr-bgp-ls-segment-routing-msd]. Typically, BGP-LS is configured on a small number of nodes, that do not

necessarily act as head-ends. In order, for BGP-LS to signal MSD for the all nodes and links in the network MSD is relevant, MSD capabilites SHOULD be distributed to every OSPF router in the network.

[I-D.ietf-ospf-mpls-elc] defines Readable Label Depth Capability (RLDC) that is used by a head-end to insert Entropy Label (EL) at appropriate depth, so it could be read by transit nodes. MSD in contrary signals ability to impose SID's stack of a particular depth.

MSD of type 1 (IANA Registry), called Base MSD is used to signal the total number of SIDs a node is capable of imposing, to be used by a path computation element/controller. In case, there are additional SIDs (e.g. service) that are to be imposed to the stack - this would be signaled with an another MSD type (TBD), no adjustment to the Base MSD should be made. In the future, new MSD types could be defined to signal additional capabilities: entropy labels, SIDs that can be imposed thru recirculation, or another dataplane e.g IPv6.

1.1. Conventions used in this document

1.1.1. Terminology

BGP-LS: Distribution of Link-State and TE Information using Border Gateway Protocol

OSPF: Open Shortest Path First

MSD: Maximum SID Depth

PCC: Path Computation Client

PCE: Path Computation Element

PCEP: Path Computation Element Protocol

SID: Segment Identifier

SR: Segment routing

1.2. Requirements Language

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. Terminology

This memo makes use of the terms defined in [RFC4970].

3. Node MSD TLV

A new TLV within the body of the OSPF RI Opaque LSA, called Node MSD TLV is defined to carry the provisioned SID depth of the router originating the RI LSA. Node MSD is the lowest MSD supported by the node.

```
  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               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |         Sub-Type and Value ...
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ...
```

Figure 1: Node MSD TLV

The Type (2 bytes) of this TLV has value of 12.

Length is variable (minimum of 2, multiple of 2 octets) and represents the total length of value field.

Value field consists of a 1 octet sub-type (IANA Registry) and 1 octet value.

Sub-Type 1 (IANA Section), MSD and the Value field contains maximum MSD of the router originating the RI LSA. Node Maximum MSD is a number in the range of 0-254. 0 represents lack of the ability to impose MSD stack of any depth; any other value represents that of the node. This value SHOULD represent the lowest value supported by node.

Other Sub-types other than defined above are reserved for future extensions.

This TLV is applicable to OSPFv2 and to OSPFv3 [RFC5838] and is optional. The scope of the advertisement is specific to the deployment.

4. Link MSD sub-TLV

A new sub-TLV called Link MSD sub-TLV is defined to carry the provisioned SID depth of the interface associated with the link.

```
     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                |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |         Sub-Type and Value ...
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+ ...
```

Figure 2: Link MSD Sub-TLV

The Type (2 bytes) of this TLV:

For OSPFv2, the Link level MSD value is advertised as an optional Sub-TLV of OSPFv2 Extended Link TLV as defined in [RFC7684], and has value of 6.

For OSPFv3, the Link level MSD value is advertised as an optional Sub-TLV of the Router-Link TLV as defined in [I-D.ietf-ospf-ospfv3-lsa-extend], and has value of 3 (Suggested value - to be assigned by IANA).

Length is variable and similar to what is defined in Section 3.

Value field consists of a 1 octet sub-type (IANA Registry) and 1 octet value.

Sub-Type 1 (IANA Section), MSD and the Value field contains Link MSD of the router originating the corresponding LSA as specified for OSPFv2 and OSPFv3. Link MSD is a number in the range of 0-254. 0 represents lack of the ability to impose MSD stack of any depth; any other value represents that of the particular link MSD value.

Other Sub-types other than defined above are reserved for future extensions.

5. Node MSD vs Link MSD conflict resolution

When both Node MSD and Link MSD are present, the value in the Link MSD MUST be used.

6. IANA Considerations

This document includes a request to IANA to allocate TLV type codes for the new TLV proposed in Section 3 of this document from OSPF Router Information (RI) TLVs Registry as defined by [RFC4970]. Also for link MSD, we request IANA to allocate new sub-TLV codes as proposed in Section 4 from OSPFv2 Extended Link Opaque LSAs Extended Link TLV registry and from Router-Link TLV defined in OSPFv3 Extend-LSA Sub-TLV registry.

This document also request IANA to create a new Sub-type registry as proposed in Section 3, Section 4.

Value	Name	Reference
0	Reserved	This document
1	Base MSD	This document
2-250	Unassigned	This document
251-254	Experimental	This document
255	Reserved	This document

Figure 3: MSD Sub-type Codepoints Registry

7. Security Considerations

This document describes a mechanism to signal Segment Routing MSD supported at node and/or link granularity through OSPF LSA's and does not introduce any new security issues.

8. Contributors

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9. Acknowledgements

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