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BGP-LS Advertisement of Segment Routing Service Segments
draft-ietf-idr-bgp-ls-sr-service-segments-00

Abstract

Service functions are deployed as, physical or virtualized elements along with network nodes or on servers in data centers. Segment Routing (SR) brings in the concept of segments which can be topological or service instructions. Service segments are SR segments that are associated with service functions. SR Policies are used for the setup of paths for steering of traffic through service functions using their service segments.

BGP Link-State (BGP-LS) enables distribution of topology information from the network to a controller or an application in general so it can learn the network topology. This document specifies the extensions to BGP-LS for the advertisement of service functions along their associated service segments. The BGP-LS advertisement of service function information along with the network nodes that they are attached to, or associated with, enables controllers compute and setup service paths in the network.

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1. Introduction

Segments are introduced in the SR architecture [RFC8402]. Segment Routing based Service chaining is well described in [I-D.ietf-spring-sr-service-programming] with an example of network and services.

This document extend the example to add a Segment Routing Controller (SR-C) to the network, for the purpose of service discovery and SR policy [I-D.ietf-spring-segment-routing-policy] instantiation.

Consider the network represented in Figure 1 below where:

- A and B are two end hosts using IPv4.
- S1 is an SR-aware firewall Service.
- S2 is an SR-unaware DPI Service.

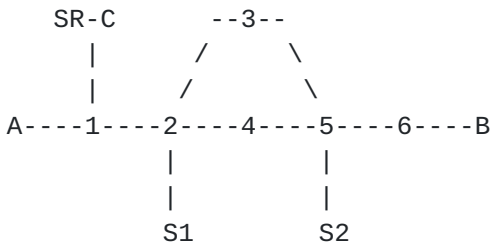

Figure 1: Network with Services

SR Controller (SR-C) is connected to Node 1, but may be attached to any node 1-6 in the network.

SR-C can receive BGP-LS updates to discover topology, and calculate constrained paths between nodes 1 and 6.

However, if SR-C is configured to compute a constrained path from 1 and 6, including a DPI service (i.e., S2) it is not yet possible due to the lack of service distribution. SR-C does not know where a DPI service is nor the SID for it. It does not know that S2 is a service it needs.

This document proposes an extension to BGP-LS for Service Chaining to distribute the service information to SR-C. There may be other alternate mechanisms to distribute service information to SR-C and

are outside the scope of this document. There are no extensions required in SR-TE Policy SAFI.

1.1. 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.

2. BGP-LS Extensions for Service Chaining

For an attached service, following data needs to be shared with SR-C:

- Service SID value (e.g. MPLS label or IPv6 address). Service SID MAY only be encoded as LOC:FUNCT, where LOC is the L most significant bits and FUNCT is the 128-L least significant bits[RFC8986]. ARGs bits, if any, MAY be set to 0 in the advertised service SID.

- Function Identifier (Static Proxy, Dynamic Proxy, Shared Memory Proxy, Masquerading Proxy, SR Aware Service etc.).

- Service Type (DPI, Firewall, Classifier, LB etc.).

- Traffic Type (IPv4 OR IPv6 OR Ethernet)

- Opaque Data (Such as brand and version, other extra information)

[I-D.ietf-spring-sr-service-programming] defines SR-aware and SR-unaware services. This document will reuse these definitions. Per [RFC7752] Node Attributes are ONLY associated with the Node NLRI. All non-VPN information SHALL be encoded using AFI 16388 / SAFI 71. VPN information SHALL be encoded using AFI 16388 / SAFI 72 with associated RTs.

This document introduces new TLVs for the SRv6 SID NLRI [I-D.ietf-idr-bgpls-srv6-ext] and SR-MPLS SID/Label TLV [RFC9085] to associate the Service SID value with Service-related Information using Service Chaining(SC) Sub-TLV.

SRv6 SID Information TLV [I-D.ietf-idr-bgpls-srv6-ext] encodes behavior along with associated SID Flags.

A Service Chaining (SC) TLV in Figure 2 is defined as:

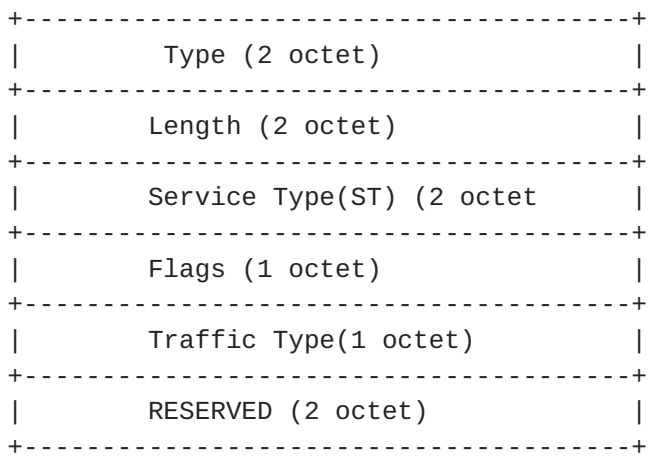

Figure 2: Service Chaining (SC) TLV

Where:

Type: 16 bit field. TBD

Length: 16 bit field. The total length of the value portion of the TLV.

Service Type(ST): 16bit field. Service Type: categorizes the Service: (such as "Firewall", "Classifier" etc.).

Flags: 8 bit field. Bits SHOULD be 0 on transmission and MUST be ignored on reception.

Traffic Type: 8 Bit field. A bit to identify if Service is IPv4 OR IPv6 OR L2 Ethernet Capable. Where:

Bit 0(LSB): Set to 1 if Service is IPv4 Capable

Bit 1: Set to 1 if Service is IPv6 Capable

Bit 2: Set to 1 if Service is Ethernet Capable

RESERVED: 16bit field. SHOULD be 0 on transmission and MUST be ignored on reception.

Service Type(ST) MUST be encoded as part of SC TLV.

There may be multiple instances of similar Services that need to be distinguished. For example, firewalls made by different vendors A and B may need to be identified differently because, while they have similar functionality, their behavior is not identical.

In order for the SDN Controller to identify the categories of Services and their associated SIDs, this section defines the BGP-LS extensions required to encode these characteristics and other relevant information about these Services.

Another Optional Opaque Metadata(OM) TLV of SRv6 SID NLRI may encode vendor specific information. Multiple of OM TLVs may be encoded.

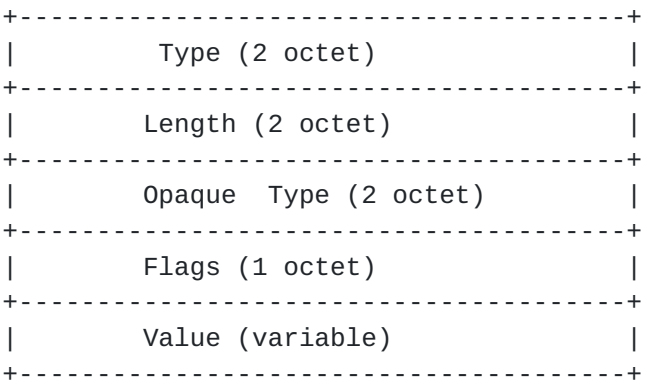

Figure 3: Opaque Metadata(OM) TLV

- Type: 16 bit field. TBD.
- Length: 16 bit field. The total length of the value portion of the TLV.
- Opaque Type: 8-bit field. Only publishers and consumers of the opaque data are supposed to understand the data.
- Flags: 8 bit field. Bits SHOULD be 0 on transmission and MUST be ignored on reception.
- Value: Variable Length. Based on the data being encoded and length is recorded in length field.

Opaque Metadata(OM) TLV defined in Figure 3 may encode propriety or Service Opaque information such as:

- Vendor specific Service Information.
- Traffic Limiting Information to particular Service Type.
- Opaque Information unique to the Service.
- Propriety Enterprise Service specific Information.

3. Illustration

In our SRv6 example above Figure 1, Node 5 is configured with an SRv6 dynamic proxy segments (End.AD) C5::AD:F2 for S2.

The BGP-LS advertisement MUST include SRv6 SID NLRI with SRv6 SID Information TLV in the BGP-LS Attribute:

- Service SID: C5::AD:F2 SID
- Endpoint Behavior: END.AD

The BGP-LS Attribute MUST contain a SC TLV with:

- Service Type: Deep Packet Inspection(DPI)
- Traffic Type: IPv4 Capable.

The BGP-LS Attribute MAY contain a OM TLV with:

- Opaque Type: Cisco DPI Version
- Value: 3.5

In our example in Figure 1, using BGP SR-TE SAFI Update [I-D.ietf-idr-segment-routing-te-policy], SR Controller computes the candidate path and pushes the Policy.

SRv6 encapsulation policy < CF1::, C3::, C5::AD:F2, C6::D4:B > is signaled to Node 1 which has mix of service and topological segments.

4. IANA Considerations

This document requests assigning code-points from the registry "BGP-LS Node Descriptor, Link Descriptor, Prefix Descriptor, and Attribute TLVs".

4.1. Service Type Table

IANA is request to create a new top-level registry called "Service Type Table (STT)". Valid values are in the range 0 to 65535. Values 0 and 65535 are to be marked "Reserved, not to be allocated".

Service Value(TBD)	Service	Reference	Date
32	Classifier	ref-to-set	date-to-set
33	Firewall	ref-to-set	date-to-set
34	Load Balancer	ref-to-set	date-to-set
35	DPI	ref-to-set	date-to-set

Figure 4

4.2. Segment routing function Identifier(SFI)

IANA is request to extend a top-level registry called "Segment Routing Function Identifier(SFI)" with new code points. This document extends the SFI values defined in [I-D.ietf-idr-bgpls-srv6-ext]. Details about the Service functions are defined in[I-D.ietf-spring-sr-service-programming].

Function	Function Identifier
Static Proxy	8
Dynamic Proxy	9
Shared Memory Proxy	10
Masquerading Proxy	11
SRv6 Aware Service	12

5. Manageability Considerations

This section is structured as recommended in[RFC5706]

6. Operational Considerations

6.1. Operations

Existing BGP and BGP-LS operational procedures apply. No additional operation procedures are defined in this document.

7. Security Considerations

Procedures and protocol extensions defined in this document do not affect the BGP security model. See the 'Security Considerations' section of [RFC4271] for a discussion of BGP security. Also refer to[RFC4272] and[RFC6952] for analysis of security issues for BGP.

8. Acknowledgements

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