

Inter-Domain Routing
Internet-Draft
Intended status: Standards Track
Expires: 20 April 2026

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17 October 2025

Distribution of Service Metadata in BGP-LS
draft-ls-idr-bgp-ls-service-metadata-06

Abstract

In edge computing, a service may be deployed on multiple instances within one or more sites, called edge service. The edge service is associated with an ANYCAST address in the IP layer, and the route of it with potential service metadata will be distributed to the network. The Edge Service Metadata can be used by ingress routers to make path selections not only based on the routing cost but also the running environment of the edge services.

The service route with metadata can be collected by a PCE(Path Compute Element) or an analyzer for calculating the best path to the best site/instance. This draft describes a mechanism to collect information of the service routes and related service metadata in BGP-LS.

About This Document

This note is to be removed before publishing as an RFC.

The latest revision of this draft can be found at <https://VMatrix1900.github.io/draft-service-metadata-in-BGP-LS/draft-ls-idr-bgp-ls-service-metadata.html>. Status information for this document may be found at <https://datatracker.ietf.org/doc/draft-ls-idr-bgp-ls-service-metadata/>.

Discussion of this document takes place on the Inter-Domain Routing Working Group mailing list (<mailto:idr@ietf.org>), which is archived at <https://mailarchive.ietf.org/arch/browse/idr/>. Subscribe at <https://www.ietf.org/mailman/listinfo/idr/>.

Source for this draft and an issue tracker can be found at <https://github.com/VMatrix1900/draft-service-metadata-in-BGP-LS>.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

Many services deploy their service instances in multiple sites to get better response time and resource utilization. These sites are often geographically distributed to serve the user demand. For some services such as VR/AR and intelligent transportation, the QoE will depend on both the network metrics and the compute metrics. For example, if the nearest site is overloaded due to the demand fluctuation, then steering the user traffic to another light-loaded site may improve the QoE.

[I-D.ietf-idr-5g-edge-service-metadata] describes the BGP extension of distributing service route with network and computing-related metrics. The router connected to the site will receive the service routes and service metadata sent from devices inside the edge site, and then generate the corresponding routes and distribute them to ingress routers. However, the route with service metadata on the router connected to the site can be also collected by a central Controller for calculating the best path to the best site.

This document defines an extension of BGP-LS to carry the service metadata along with the service route. Using the service metadata and the service route, the controller can calculate the best site for the traffic, giving each user the best QoE.

1.1. Terminology

1.2. 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 Extension for Service in a Site

The goal of the BGP-LS extension is to collect information of the service prefix and metadata of the service, such as network metrics and compute metrics. A service is identified by a prefix, and this information is carried by the existing prefix NLRI TLV. Other information including service metadata is carried by attributes TLVs.

2.1. Prefix NLRI

A service is identified by a prefix, and the Prefix NLRI defined in the [RFC7752] is used to collect the prefix information of the service. The format of the Prefix NLRI is shown in Figure 1 for better understanding.

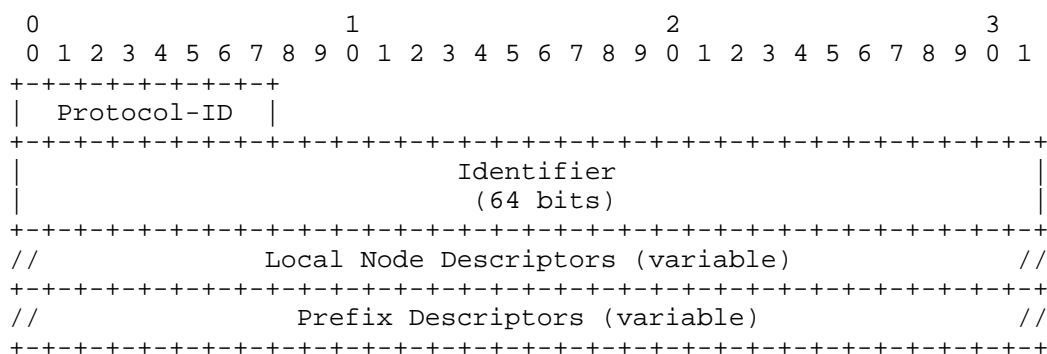


Figure 1: The IPv4/IPv6 Topology Prefix NLRI Format

Specifically, the service prefix is carried by the IP Reachability Information TLV(Figure 2) inside the Prefix Descriptor field. The Prefix Length field contains the length of the prefix in bits. The IP Prefix field contains the most significant octets of the prefix.

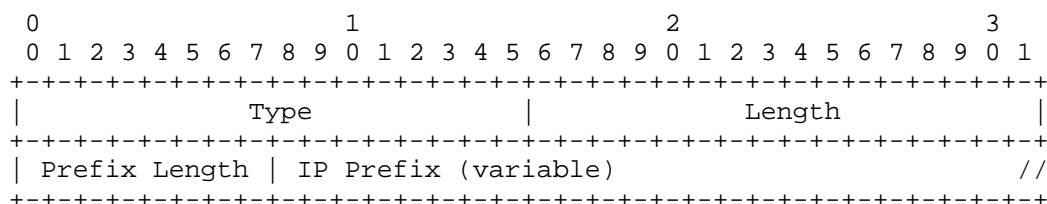


Figure 2: IP Reachability Information TLV Format

2.2. Attributes

The following three prefix attribute TLVs are used to carry the metadata of a service instance:

1. Metadata Path Attribute TLV carries the computing metric of the service instances such as site preference, site physical availability index, service delay prediction, service-oriented capability and service-oriented utilization defined in Section 4 of [I-D.ietf-idr-5g-edge-service-metadata].

2. Prefix SID TLV carries a Prefix SID associated with the edge site.
3. Color Attribute TLV carries the service requirement level information of the service

2.2.1. Metadata Path Attribute TLV

The Metadata Path Attribute TLV is an optional attribute to carry the Edge Service Metadata defined in the [I-D.ietf-idr-5g-edge-service-metadata]. It contains multiple sub-TLVs, with each sub-TLV containing a specific metric of the Edge Service Metadata. This document defines a new TLV in BGP-LS, which reuses the name and the format of Metadata Path Attribute TLV.

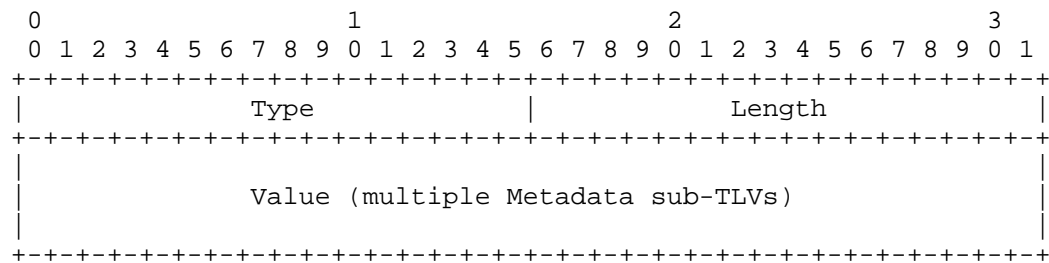


Figure 3: Metadata Path Attribute TLV format

- * Type: identify the Metadata Path Attribute, to be assigned by IANA.
- * Length: the total number of octets of the value field.
- * Value: contains multiple sub-TLVs. The name and format of sub-TLV is the same as [I-D.ietf-idr-5g-edge-service-metadata]

2.3. Prefix SID Attribute TLV

In some cases, there may be multiple sites connected to one Edge(egress) router through different interfaces. Generally, an overlay tunnel will be used between the ingress router and the egress for steering the traffic to the best site correctly. In SR-MPLS networks or SRv6 networks, a prefix SID is needed. For example, some SRv6 Endpoint Behaviors such as End.DX6, End.X can be encoded for each site so that the egress router can steer the traffic to the corresponding site. The Prefix SID TLV defined [RFC9085] can be used to collect this information.

The Prefix SID TLV is an optional TLV to carry the Prefix SID associated with the edge site. The TLV format is illustrated in Figure 4.

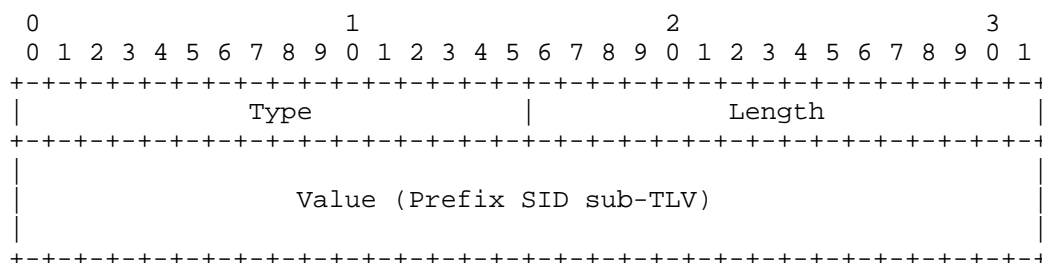


Figure 4: Prefix-SID TLV format

- * Type: 1158, identify the Prefix SID Attribute.
- * Length: the total number of octets of the value field.
- * Value: contains Prefix SID sub-TLV.

2.3.1. Color Attribute TLV

Color is used to indicate the service level. For example, different sites may have different levels of service capability which is taken into account by the controller when calculating the path to the egress router. More details can be added in the future revision.

The TLV format (shown in Figure 5) is similar to the BGP Color Extended Community defined in [RFC9012].

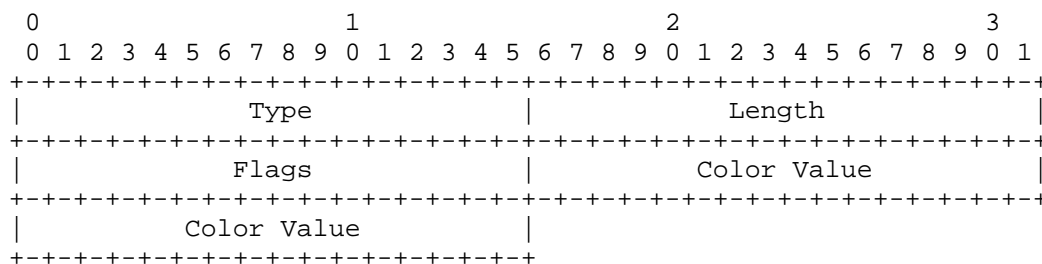


Figure 5: Color Attribute TLV format

- * Type: identify the Color Attribute, to be assigned by IANA.
- * Length: 6, length of Flags + Color Value.

- * Flags and Color are the same as defined in [RFC9012]. Color Value: 32 bit value of color.

3. Security Considerations

TBD

4. IANA Considerations

This document requires IANA to assign the following code points from the registry called "BGP-LS Node Descriptor, Link Descriptor, Prefix Descriptor, and Attribute TLVs":

Value	Description	Reference
TBD1	Metadata Path Attribute Type	Section 2.2.1
TBD2	Color Attribute Type	Section 2.3.1
TBD3	Site Preference Sub-Type	Section 2.2.1
TBD4	Site Physical Availability Index Sub-Type	Section 2.2.1
TBD5	Service Delay Prediction Index Sub-Type	Section 2.2.1
TBD6	Service-Oriented Capability Sub-Type	Section 2.2.1
TBD7	Service-Oriented Utilization Sub-Type	Section 2.2.1

Table 1

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6. Normative References

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Appendix A. Acknowledgements

The authors would like to thank Haibo Wang, Lili Wang, Jianwei Mao for their help.

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