

IDR  
Internet-Draft  
Intended status: Standards Track  
Expires: July 27, 2022

S. Sangli  
S. Hegde  
R. Das  
Juniper Networks Inc.  
B. Decraene  
Orange  
January 23, 2022

Generic Metric for the AIGP attribute  
draft-ssangli-idr-bgp-generic-metric-aigp-02

## Abstract

This document defines extensions to the AIGP attribute to carry Generic Metric sub-types. This is applicable when multiple domains exchange BGP routing information. The extension will aid in intent-based end-to-end path selection.

## Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on July 27, 2022.

## Copyright Notice

Copyright (c) 2022 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in [Section 4.e](#) of

the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">2.</a>	Requirements Language . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Multiple Metric types . . . . .	<a href="#">4</a>
<a href="#">4.</a>	Issues with <a href="#">RFC7311</a> . . . . .	<a href="#">4</a>
<a href="#">5.</a>	Generic Metric TLV . . . . .	<a href="#">5</a>
<a href="#">6.</a>	Usage of Generic-Metric TLV . . . . .	<a href="#">6</a>
<a href="#">7.</a>	Updates to Decision Procedure . . . . .	<a href="#">7</a>
<a href="#">8.</a>	Use-case: Different Metrics across Domains . . . . .	<a href="#">8</a>
<a href="#">9.</a>	Deployment Considerations . . . . .	<a href="#">9</a>
<a href="#">10.</a>	Contiguity Compliance . . . . .	<a href="#">10</a>
<a href="#">11.</a>	Backward Compatibility . . . . .	<a href="#">10</a>
<a href="#">12.</a>	Security Considerations . . . . .	<a href="#">10</a>
<a href="#">13.</a>	IANA Considerations . . . . .	<a href="#">11</a>
<a href="#">14.</a>	Acknowledgements . . . . .	<a href="#">11</a>
<a href="#">15.</a>	References . . . . .	<a href="#">11</a>
<a href="#">15.1.</a>	Normative References . . . . .	<a href="#">11</a>
<a href="#">15.2.</a>	Informative References . . . . .	<a href="#">12</a>
	Authors' Addresses . . . . .	<a href="#">13</a>

## [1.](#) Introduction

Large Networks belonging to an enterprise may consist of nodes in the order of thousands and may span across multiple IGP domains where each domain can run separate IGPs or levels/areas. BGP may be used to interconnect such IGP domains, with one or more IGP domains within an Autonomous System. The enterprise network can have multiple Autonomous Systems and BGP may be employed to provide connectivity between these domains. Furthermore, BGP can be used to provide routing over a large number of such independent administrative domains.

The traffic types have evolved over years and operators have resorted to defining different metric types within a IGP domain (ISIS or OSPF) for IGP path computation. An operator may want to create an end-to-end path that satisfy certain intent. The intent could be to create end-to-end path that minimizes one of the metric-types. Some metrics can be assigned administratively by an operator and they are described in the base ISIS, OSPF specifications. Other metrics, for

example, are the Traffic Engineering Default Metric defined in [\[RFC5305\]](#) and [\[RFC3630\]](#) , Min Unidirectional delay metric defined in [\[RFC8570\]](#) and [\[RFC7471\]](#) . There may be other metrics such as jitter, reliability, fiscal cost, etc. that an operator may wish to express

as the cost of a link. The procedures mentioned in the above specifications describe the IGP path computation within IGP domains.

With the advent of 5G applications and Network Slicing applications, an operator may wish to provision end-to-end paths across multiple domains to cater to traffic constraints. This is also known as intent-based inter-domain routing and there are certain architectures being developed as described in [\[I-D.hegde-spring-seamless-sr-architecture\]](#) and [\[I-D.dskc-bess-bgp-car-problem-statement\]](#) . The Classful Transport Planes as described in [\[I-D.kaliraj-idr-bgp-classful-transport-planes\]](#) and Color-Based Routing as described in [\[I-D.dskc-bess-bgp-car\]](#) describe how end-to-end intent-based paths can be established. The proposal described in this document can be used in conjunction with such architectures.

When multiple domains are interconnected via BGP, protocol extensions for advertising best-external path and/or ADSPATH as described in [\[RFC7911\]](#) are employed to take advantage of network connectivity thus providing alternate paths. The Color-Based Routing and Classful Transport Planes routing proposals describe approaches that result in alternate paths for reaching one destination. During the BGP best path computation, the step(e) as per [section 9.1.2.2 of \[RFC4271\]](#) , the interior cost of a route as determined via the IGP metric value can be used to break the tie. In a network spanning multiple IGP domains, the AIGP TLV encoded within the AIGP attribute described in [\[RFC7311\]](#) can be used to compute the AIGP-enhanced interior cost to be used in the decision process for selecting the best path as documented in [section 2 of \[RFC7311\]](#) . The [\[RFC7311\]](#) specifies how AIGP TLV can carry the accumulated IGP metric value.

There is a need to synchronize the metric-type values carried between IGP and BGP in order to avoid operational overhead of translation between them. The existing AIGP TLV carries a TLV type and metric-value where TLV type does not map to IGP metric-types defined in the IGP metric-type registry. Hence there is a need to provide a generic

metric template to embed the IGP metric-type values within the AIGP attribute. This document extends the AIGP attribute for carrying Generic-Metric TLV and the well-defined sub metric types. This document also provides procedures for handling Generic-Metric during the BGP best path computation.

## 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.

## 3. Multiple Metric types

Consider the network as shown in Figure 1. The network has multiple domains. Each domain runs a separate IGP instance. Within each domain iBGP sessions are established between the PE routers. eBGP sessions are established between the Border Routers across domains. An operator wishes to compute end-to-end path optimized for a metric-type delay. Each domain will be enabled to compute the IGP paths based on metric-type delay. Such values should also be propagated to the adjacent domains for effective end-to-end path computation.

-----IBGP-----EBGP-----IBGP-----EBGP-----IBGP----- | | | | | | +-----

Figure 1: WAN Network

The AIGP TLV in the AIGP attribute as specified in [[RFC7311](#)] supports the IGP default metric. If all domains use IGP cost as the metric, then one can compute the end-to-end path with shortest IGP cost. However if an operator wishes to compute the end-to-end path with metric other than IGP cost, we need additional extensions to the AIGP attribute for carry the metric-types and metric values.

The [[I-D.ietf-lsr-flex-algo-bw-con](#)] proposes a generic metric type that can embed multiple metric types within it. It supports both standard metric-types and user-defined metric-types. This document leverages the generic-metric draft and proposes extensions to the

AIGP attribute to carry Generic Metric TLV as specified below.

#### 4. Issues with [RFC7311](#)

The following procedures are not clearly described in [[RFC7311](#)] .

- o The [section 3](#) describes "When an AIGP attribute is created, it SHOULD contain no more than one AIGP TLV. However, if it contains more than one AIGP TLV, only the first one is used as described in Sections [3.4](#) and [4](#). In the remainder of this document, we will use the term value of the AIGP TLV to mean the value of the first AIGP TLV in the AIGP attribute. Any other AIGP TLVs in the AIGP attribute MUST be passed along unchanged if the AIGP attribute is passed along."
- o ....One MUST interpret that more than one TLV of a particular type (i.e. AIGP TLV metric-type 1) can be present in the update and only the first occurrence MUST be analysed. All other TLVs (type 2

or type 3 etc.) MUST be passed along unchanged if AIGP attribute is passed along.

- o The [section 3.2](#) describes "Note that an AIGP attribute MUST NOT be considered to be malformed because it contains more than one TLV of a given type or because it contains TLVs of unknown types."
- o ....One MUST interpret that opaque TLVs (TLVs with type 2 or type 3 for example) MUST be passed along if ADVERTISE\_AIGP\_ATTRIBUTE has been enabled to a neighbor.
- o [Section 3.3](#) describes "The AIGP attribute MUST NOT be sent on any BGP session for which AIGP\_SESSION is disabled."
- o ....While maintaining the non-transitivity is important, it is also important to provide accumulated cost end-to-end across domains. If there are more than one TLVs in the AIGP attribute, it becomes important to define the behavior of which TLV gets updated and sent across domains.
- o The rules for route redistribution is not clearly described.

- o ....When a BGP route is redistributed, should AIGP metric-value be used directly as the cost in IGP or should there be a policy to modify AIGP metric-value before redistributing the route into IGP. It is important to define the behavior of route redistribution metric conversion when redistribution occurs on multiple domains along the path.

## 5. Generic Metric TLV

This document proposes a new TLV : Generic-Metric TLV in the AIGP attribute. This will carry the metric type and metric value used in the network. The format is shown below.

0 1 2 3 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 2 +-+--

Figure 2: Generic-Metric TLV

Generic-Metric TLV Type (1 octet): Code point to be assigned by IANA

Generic-Metric TLV Length (2 octets): 12

Generic-Metric TLV Value (9 octets): 2 sub-fields as shown below:

1. metric-type (1 octet): Value from IGP metric-type registry.

2. metric-value (8 octets): Value range (0 - 0xffffffffffffffff)

## 6. Usage of Generic-Metric TLV

1. When a BGP speaker wishes to generate AIGP attribute with Generic-Metric TLV for a prefix, it MUST perform the following procedures.

- \* The procedures specified in [\[RFC7311\] section 3.4](#) should be followed that describes creation of attribute, modifications by the originator and non-originator of the route.
- \* Repeated metric changes may cause large number of BGP updates

to get generated and be propagated throughout the network. In order to avoid that, a configurable threshold is defined. If the difference between the new metric-value and the advertised metric-value is less than the configured threshold, the update MAY be suppressed. If the new metric-value is above the configured threshold, a new BGP update containing the new metric-value SHOULD be advertised.

- \* If the domain uses a metric type other than IGP cost for the IGP path computation, the BGP speaker MAY add Generic-Metric TLV to the AIGP attribute before advertising to a neighboring BGP speaker.
  - \* The metric-type sub-field in the Generic-Metric TLV will carry the value indicating the type of the metric as specified in the IGP metric-type registry.
  - \* The value of the metric or cost to reach the prefix being advertised will be encoded in the metric-value sub-field. This is the cost or the distance to the destination prefix from the advertising BGP speaker which sets itself as the next hop as described in [section 3.4 of \[RFC7311\]](#) .
  - \* Procedures for defining the cost to reach a next hop for various metric-types is outside the scope of this document.
2. When a BGP speaker wishes to send a BGP update attaching the AIGP attribute, it must validate if that session has been enabled for sending the AIGP attribute as per procedures mentioned in [\[RFC7311\]](#) .

3. When a BGP speaker receives a BGP update that has a route to T with next hop N and has the AIGP attribute with Generic-Metric TLV it MUST perform the following procedures.

- \* It must validate if that session has been enabled to receive the AIGP attribute as per rules mentioned in [\[RFC7311\]](#) .

- \* If the BGP speaker does not recognize the Generic-Metric TLV or type of metric encoded in metric-type subfield of the TLV, then the BGP speaker will ignore the Generic-Metric TLV and follow the BGP decision procedure as specified in [\[RFC7311\]](#) .
- \* If the metric-type of the path used for resolving the next hop N matches with the metric-type of Generic-Metric TLV of the AIGP attribute, then the metric-value sub-field MUST be used in the AIGP-enhanced interior cost computation as specified in the next section.
- \* If the metric-type of the path used for resolving the next hop N does not match with the metric-type of Generic-Metric TLV of the AIGP attribute, then the BGP speaker may normalize cost of the path used for resolving the next hop. A policy may be used to provide the metric normalization.

## [7.](#) Updates to Decision Procedure

This section follows the approach as laid out in [\[RFC7311\]](#) to select the best path when the route has AIGP attribute with Generic-Metric TLV. The domain that the router R belongs to, has enabled metric-types different from IGP cost. The following describes procedures in addition to general procedure described in [section 4 of \[RFC7311\]](#) .

When R receives a route T with next hop N and the AIGP attribute with Generic-Metric TLV, and the metric-type sub-field matches with the type of the metric of the path used for resolving the next hop N, the AIGP-enhanced interior cost should be computed as below.

Let  $m$  be the cost to reach the next hop N that IGP uses for its path computation as described in [\[RFC7311\]](#) .

If the type of the metric of the path used for resolving the next hop N does not match the metric-type sub-field of the Generic-Metric TLV, the cost of the path to reach next hop N may be normalized. The normalized metric value can be zero, maximum metric value or scaled up (multiple of a positive number).

Let  $m$  be the normalized value of the cost to reach the next hop N



that IGP uses for its path computation as described in [RFC7311] .

The AIGP-enhanced interior cost computation as described below will be used in the decision process as described in [RFC7311] .

Let A be the value of the value of the metric-value sub-field of the Generic-Metric TLV.

The AIGP-enhanced interior cost will be A+m as described in [RFC7311] .

A path with Generic-Metric TLV and a path with AIGP TLV cannot be compared. To enable end-to-end path selection based on intent, the path with Generic-Metric TLV MUST be chosen over path with AIGP TLV. The implementation should allow a local policy to specify the preference.

A path with Generic-Metric TLV of metric-type 'a' cannot be compared with a path with Generic-Metric TLV of metric-type 'b'. The path with lower metric-type MUST be chosen as best between two paths with Generic-Metric TLV.

#### 8. Use-case: Different Metrics across Domains

+-----+ | Domain2 | | | .....+ASBR21 ASBR22+.... . | | . +-----+

Figure 3: Different metric across network

Each domain is a separate Autonomous System. Within each domain, ASBR and PE form iBGP peering. The IGP within each domain uses domain specific metric. Domain3 and Domain4 use delay as the metric while Domain1 and Domain2 use IGP cost as the metric. ASBRs across domains form eBGP peering. The use-case is to find delay-based end-to-end path from Domain1 to Domain4.

This can be achieved by the advertising router to add the AIGP attribute with metric type 1 that represents delay metric. In the above network diagram, ASBR41 (and ASBR42) will advertise prefix PE2-loopback with Generic-Metric TLV with delay as metric-type. The metric-value sub-field of the Generic-Metric TLV will represent the cost to reach PE2's loopback end-point from the advertising router as they will do next hop self.

In Domain3, when ASRB32 advertises the prefix PE2-loopback within the local domain, it may add cost to the metric-value, the value representing the delay introduced by the DMZ link between ASRB32 to ASBR42. When ASRBR31 advertises the prefix PE2-loopback, it will perform the following procedures.

1. Compute the delay  $d$  of the path to reach ASBR32 from which it has chosen the best path.
2. Add the above  $d$  value to the metric-value sub-field of the Generic-Metric TLV.

In Domain2 however, the local metric type IGP cost. The ASBR22 may follow the procedure similar to ASBR32 and add the delay value corresponding to the DMZ link between ASBR22 and ASBR41 before advertising the path internally in Domain2. When ASBR21 computes the AIGP-enhanced interior cost, as mentioned before, it may normalize the igp cost to reach ASBR22 and may add the normalized value to the delay-metric. In the above network example, the delay cost from ASBR21 to ASBR22 is negligible and hence delay-metric value will be unchanged.

The procedures for AIGP-enhanced interior cost computation at ASBR11 (and ASBR12) will follow DMZ delay computation procedure described above. PE1 will have two paths to reach PE2-loopback: P1 via ASBR11 (and domain2) and P2 via ASBR12 (and domain3), each having respective AIGP-enhanced interior cost representing end-to-end delay. The BGP decision process described in [Section 7](#) will result in delay optimized end-to-end path for PE2-loopback on PE1 that can be used to resolve the service prefixes.

## [9.](#) Deployment Considerations

It can be noted that a domain may normalize the metric-value of the metric-type of the path used to resolve next hop to the metric-type present in the Generic-Metric TLV. The idea is to propagate the cost of reaching the prefix through the domain while maintaining the metric-type chosen by the originating router and domain. The normalization of metric types to the one carried in the AIGP attribute can be done via policy. Definition of such policies and how they can be enforced is outside the scope of this document. In topologies where there is a common router between adjacent domains that do iBGP peering, the Border router can provide the normalization.

It is important to maintain the property of IGP cost to a destination decrease as one gets closer to the destination. The AIGP-enhanced interior cost should not be allowed to decrease through the metric normalization. When adjacent domains use different metric types, the ASBR that connects two domains is better suited to pass on the metric values by setting itself as next hop.

All routers of a domain MUST compute the AIGP-enhanced interior cost as described above to be used during decision process. Within a

domain, if one router R1 applies AIGP-enhanced interior cost while R2 does not, it may lead to routing loop unless some sort of tunnelling technology viz MPLS, SRv6, IP, etc. is adopted to reach the next hop. In a network where any tunnelling technology is used, one can incrementally deploy the Generic-Metric functionality. In a network without any tunnelling technology, it is recommended that all routers MUST support Generic-Metric based AIGP-enhanced interior cost computation.

The contiguity of the AIGP domain across multiple IGP or AS domains is important to maintain end-to-end path of a certain intent. A router that does not recognize Generic-Metric TLV, may add AIGP TLV and pass on the BGP route with just AIGP TLV. This results in AIGP attribute having both TLVs. The router making decision only on Generic-Metric TLV may chose sub-optimal paths.

In certain networks, routes may be redistributed between BGP and IGP, usually controlled via a policy. When a route is propagated across domains, a router should use AIGP metric-value of Generic-Metric TLV, optionally modified via the local policy as the IGP cost during route redistribution in to IGP. The local policy should apply metric normalization or translation based on metric-type of Generic-Metric TLV and the metric-type adopted in the IGP.

## 10. Contiguity Compliance

AIGP attribute is optional and non-transitive, however new TLV might not be interpreted and/or updated by routers along the path. For computing the end-to-end path based on an intent, it is essential to maintain contiguity of AIGP domain for the metric-type. The mechanism will be addressed in the future version of this document.

## 11. Backward Compatibility

When a BGP speaker receives an update with the AIGP attribute it may have Generic-Metric TLV. If the BGP speaker understands the AIGP attribute but does not understand the Generic-Metric TLV, it will process the AIGP attribute as per [\[RFC7311\]](#) . However when it needs to advertise the prefix to its peers it will pass on the AIGP

attribute with all the TLVs including the unknown Generic-Metric TLV as per [\[RFC7311\]](#) . If a BGP speaker does not understand the Generic-Metric TLV, it may chose sub-optimal BGP path.

## [12.](#) Security Considerations

This document does not introduce any new security considerations beyond those already specified in [\[RFC4271\]](#) , [\[RFC7311\]](#) .

Sangli, et al.

Expires July 27, 2022

[Page 10]

---

Internet-Draft

Generic Metric for AIGP attribute

January 2022

## [13.](#) IANA Considerations

IANA is requested to assign a code point for Generic Metric TLV. The metric-type field refers to the IGP metric-type registry defined in [\[I-D.ietf-lsr-flex-algo-bw-con\]](#)

## [14.](#) Acknowledgements

The authors would like to thank John Scudder, Jeff Haas, Robert Raszuk, and Kaliraj Vairavakkalai for careful review and suggestions.

## [15.](#) References

### [15.1.](#) Normative References

[I-D.dskc-bess-bgp-car]

Rao, D., Agrawal, S., Filsfils, C., Talaulikar, K., Steinberg, D., Jalil, L., Su, Y., Decraene, B., Guichard, J., Patel, K., and H. Wang, "BGP Color-Aware Routing (CAR)", [draft-dskc-bess-bgp-car-03](#) (work in progress), October 2021.

[I-D.dskc-bess-bgp-car-problem-statement]

Rao, D., Agrawal, S., Filsfils, C., Talaulikar, K., Decraene, B., Steinberg, D., Jalil, L., Guichard, J., Patel, K., and W. Henderickx, "BGP Color-Aware Routing Problem Statement", [draft-dskc-bess-bgp-car-problem-statement-04](#) (work in progress), November 2021.

[I-D.hegde-spring-seamless-sr-architecture]

Hegde, S., Bowers, C., Xu, X., Gulko, A., Bogdanov, A., Uttaro, J., Jalil, L., Khaddam, M., and A. Alston,

"Seamless Segment Routing Architecture", [draft-hegde-spring-seamless-sr-architecture-00](#) (work in progress), February 2021.

[I-D.ietf-lsr-flex-algo-bw-con]

Hegde, S., J, W. B. A., Shetty, R., Decraene, B., Psenak, P., and T. Li, "Flexible Algorithms: Bandwidth, Delay, Metrics and Constraints", [draft-ietf-lsr-flex-algo-bw-con-01](#) (work in progress), July 2021.

[I-D.kaliraj-idr-bgp-classful-transport-planes]

Vairavakkalai, K., Venkataraman, N., Rajagopalan, B., Mishra, G., Khaddam, M., Xu, X., Szarecki, R. J., and D. J. Gowda, "BGP Classful Transport Planes", [draft-kaliraj-idr-bgp-classful-transport-planes-13](#) (work in progress), January 2022.

Sangli, et al.

Expires July 27, 2022

[Page 11]

---

Internet-Draft

Generic Metric for AIGP attribute

January 2022

[RFC0791] Postel, J., "Internet Protocol", STD 5, [RFC 791](#), DOI 10.17487/RFC0791, September 1981, <<https://www.rfc-editor.org/info/rfc791>>.

[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>>.

[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>>.

[RFC8200] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", STD 86, [RFC 8200](#), DOI 10.17487/RFC8200, July 2017, <<https://www.rfc-editor.org/info/rfc8200>>.

## [15.2](#). Informative References

[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>>.

- [RFC4271] Rekhter, Y., Ed., Li, T., Ed., and S. Hares, Ed., "A Border Gateway Protocol 4 (BGP-4)", [RFC 4271](#), DOI 10.17487/RFC4271, January 2006, <<https://www.rfc-editor.org/info/rfc4271>>.
- [RFC4364] Rosen, E. and Y. Rekhter, "BGP/MPLS IP Virtual Private Networks (VPNs)", [RFC 4364](#), DOI 10.17487/RFC4364, February 2006, <<https://www.rfc-editor.org/info/rfc4364>>.
- [RFC4659] De Clercq, J., Ooms, D., Carugi, M., and F. Le Faucheur, "BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN", [RFC 4659](#), DOI 10.17487/RFC4659, September 2006, <<https://www.rfc-editor.org/info/rfc4659>>.
- [RFC4760] Bates, T., Chandra, R., Katz, D., and Y. Rekhter, "Multiprotocol Extensions for BGP-4", [RFC 4760](#), DOI 10.17487/RFC4760, January 2007, <<https://www.rfc-editor.org/info/rfc4760>>.
- [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>>.

- [RFC7311] Mohapatra, P., Fernando, R., Rosen, E., and J. Uttaro, "The Accumulated IGP Metric Attribute for BGP", [RFC 7311](#), DOI 10.17487/RFC7311, August 2014, <<https://www.rfc-editor.org/info/rfc7311>>.
- [RFC7471] Giacalone, S., Ward, D., Drake, J., Atlas, A., and S. Previdi, "OSPF Traffic Engineering (TE) Metric Extensions", [RFC 7471](#), DOI 10.17487/RFC7471, March 2015, <<https://www.rfc-editor.org/info/rfc7471>>.
- [RFC7911] Walton, D., Retana, A., Chen, E., and J. Scudder, "Advertisement of Multiple Paths in BGP", [RFC 7911](#), DOI 10.17487/RFC7911, July 2016, <<https://www.rfc-editor.org/info/rfc7911>>.
- [RFC8277] Rosen, E., "Using BGP to Bind MPLS Labels to Address Prefixes", [RFC 8277](#), DOI 10.17487/RFC8277, October 2017, <<https://www.rfc-editor.org/info/rfc8277>>.

[RFC8570] Ginsberg, L., Ed., Previdi, S., Ed., Giacalone, S., Ward, D., Drake, J., and Q. Wu, "IS-IS Traffic Engineering (TE) Metric Extensions", [RFC 8570](https://www.rfc-editor.org/info/rfc8570), DOI 10.17487/RFC8570, March 2019, <<https://www.rfc-editor.org/info/rfc8570>>.

#### Authors' Addresses

Srihari Sangli  
Juniper Networks Inc.  
Exora Business Park  
Bangalore, KA 560103  
India

Email: [ssangli@juniper.net](mailto:ssangli@juniper.net)

Shraddha Hegde  
Juniper Networks Inc.  
Exora Business Park  
Bangalore, KA 560103  
India

Email: [shraddha@juniper.net](mailto:shraddha@juniper.net)

Sangli, et al.

Expires July 27, 2022

[Page 13]

---

Internet-Draft

Generic Metric for AIGP attribute

January 2022

Reshma Das  
Juniper Networks Inc.  
1133 Innovation Way  
Sunnyvale, CA 94089  
USA

Email: [dreshma@juniper.net](mailto:dreshma@juniper.net)

Bruno Decraene  
Orange

France

Email: [bruno.decraene@orange.com](mailto:bruno.decraene@orange.com)