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Usage of BGP Large Communities
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Abstract

Examples and inspiration for operators for the use of BGP Large Communities.

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[1.](#) Introduction

BGP Large Communities [[RFC8092](#)] provide a mechanism to signal opaque information between Autonomous Systems. This document presents examples of how operators might utilise BGP Large Communities to achieve various goals. This document draws from experience of operational communities such as NANOG [[1](#)] and NLNOG [[2](#)].

[2.](#) The Design Overview

BGP Large Communities are composed of three 4-octet fields. The first is the Global Administrator (GA) field, whose value is the Autonomous System Number (ASN) of the Autonomous System (AS) that has defined the meaning of the remaining two 4-octet fields, known as "Local Data Part 1" and "Local Data Part 2". This document describes an approach where the "Local Data Part 1" field contains a function identifier and the "Local Data Part 2" contains a parameter value.

Using the canonical notation the above can be summarized as "ASN:Function:Parameter".

+-----+-----+	
RFC 8092	this document
+-----+-----+	
Global Administrator	ASN
Local Data Part 1	Function
Local Data Part 2	Parameter
+-----+-----+	

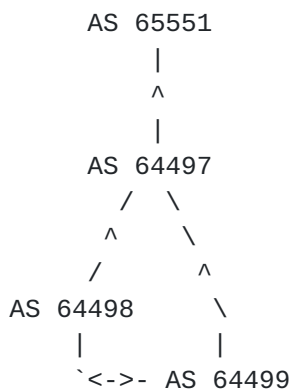
A mapping table on the usage of fields in BGP Large Communities between [[RFC8092](#)] and this document.

Table 1: Field mapping

In contemporary deployments of both BGP Communities [[RFC1997](#)] and BGP Large Communities, the function of a community can be divided into two categories:

- o Informational Communities
- o Action Communities

Throughout the document a topology of four Autonomous Systems is used to illustrate the usage of Communities in the following configuration:



AS 64497 obtains transit services from (is a customer of) AS 65551, a 32-bit ASN. AS 64497 provides transit services to both AS 64498 and AS 64499. AS 64498 and AS 64499 maintain a peering relationship in which they only exchange their customer routes.

The opaque nature of BGP Large Communities allows for rapid deployment of new features or changes to products. Operators are encouraged to publicly publish and maintain documentation of the

purpose of each BGP Large Community, both informational and action, that they support or are visible in BGP RIBs.

2.1. Informational Communities

Informational Communities are labels for attributes such as the origin of the route announcement, the nature of the relation with an EBGp neighbor or the intended propagation audience. Informational Communities can also assist in providing valuable information for day-to-day network operations such as debugging or capacity planning.

The Global Administrator field is set to the ASN which labels the routes with the Informational Communities. For example, AS 64497 might add a community with the GA 64497 to a route accepted from an IBGP or EBGp neighbor as a means of signaling that it was imported in a certain geographical region.

In general, the intended audiences of Informational Communities are downstream networks and the Global Administrator itself, but any Autonomous System could benefit from receiving these communities.

2.2. Action Communities

Action Communities are added as a label to request non-default treatment of a route within an AS. The operator of that AS defines routing policy which, based upon the communities, adjusts route attributes such as its propagation characteristics, the LOCAL_PREF (local preference), the next-hop, or the number of AS_PATH prepends to be added upon reception or propagation.

The Global Administrator field is set to the ASN which has defined the functionality of that BGP Large Community and is therefore the ASN that is expected to perform the action. For instance, AS 64499 might label a route with a BGP Large Community containing GA 64497 to request that AS 64497 perform a pre-defined action upon that route.

In general, the intended audience of Action Communities are transit providers taking action on behalf of a customer or the Global Administrator itself, but any AS could take action if they chose and any AS could add an action community with the GA of a non-adjacent ASN. However, note that an Action Community could also be informational. Its presence is an indicator that the GA may have performed the action and that an AS in the AS_PATH requested it.

3. Examples of Informational Communities

3.1. Location

An AS, AS 64497 in these examples, may inform other networks about the geographical region where AS 64497 imported a route by labeling it with BGP Large Communities following one of the following schemes or a combination thereof.

3.1.1. An ISO 3166-1 numeric function

AS 64497 could assign a value of 1 to the Function field to designate the content of the Parameter field as an ISO-3166-1 [\[3\]](#) numeric country identifier.

+-----+-----+	
BGP Large Community	Description
+-----+-----+	
64497:1:528	Route learned in the Netherlands
64497:1:392	Route learned in Japan
64497:1:840	Route learned in the United States of
	America
+-----+-----+	

Example documentation for Informational Communities deployed by AS 64497 to describe the location where a route was imported using ISO 3166-1 numeric identifiers.

Table 2: Information: ISO 3166-1

3.1.2. A UN M.49 Region function

AS 64497 could assign a value of 2 to the Function field to designate the content of the Parameter field as the M.49 numeric code published by the United Nations Statistics Division (UNSD) [\[4\]](#) for macro geographical (continental) regions, geographical sub-regions, or selected economic and other groupings.

+-----+-----+	
BGP Large Community	Description
+-----+-----+	
64497:2:2	Route learned in Africa
64497:2:9	Route learned in Oceania
64497:2:145	Route learned in Western Asia
64497:2:150	Route learned in Europe
+-----+-----+	

Example documentation for Informational Communities deployed by AS 64497 to describe the location where a route was imported using M.49 numeric codes published by the United Nations Statistics Division.

Table 3: Information: UNSD Regions

3.2. Relation Function

An AS, AS 64497 in this example, could assign a value of 3 to the Function field to designate the content of the Parameter field as a number indicating whether the route originated inside its own network or was learned externally, and if learned externally, it might simultaneously characterize the nature of the relation with that specific EBGp neighbor.

+-----+-----+	
BGP Large Community	Description
+-----+-----+	
64497:3:1	Route originated internally
64497:3:2	Route learned from a customer
64497:3:3	Route learned from a peering partner
64497:3:4	Route learned from a transit provider
+-----+-----+	

Example documentation for Informational Communities deployed by AS 64497 to describe the relation to the ASN from which the route was learned.

Table 4: Information: Relation

3.3. Combining Informational Communities

A route may be labeled with multiple Informational Communities. For example, a route learned in the Netherlands from a customer might be labeled with communities 64497:1:528, 64497:2:150 and 64497:3:2 at the same time.

4. Examples of Action Communities

4.1. Selective NO_EXPORT

As part of an agreement, often a commercial transit agreement, between AS 64497 and AS 64498, AS 64497 might expose BGP traffic engineering functions to AS 64498. One such BGP traffic engineering function could be selective NO_EXPORT, which is the selective filtering of a route learned from one AS, AS 64498, to certain EBGp neighbors of the GA, AS 64497.

4.1.1. ASN Based Selective NO_EXPORT

AS 64497 could assign a value of 4 to the Function field to designate the content of the Parameter field as a neighboring ASN to which a route should not be propagated.

+-----+-----+	
BGP Large Community	Description
+-----+-----+	
64497:4:64498	Do not export route to AS 64498
64497:4:64499	Do not export route to AS 64499
64497:4:65551	Do not export route to AS 65551
+-----+-----+	

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which selectively prevents the propagation of routes to the neighboring ASN specified in the Parameter field.

Table 5: Action: ASN NO_EXPORT

4.1.2. Location Based Selective NO_EXPORT

AS 64497 could assign a value of 5 to the Function field to designate the content of the Parameter field as an ISO 3166-1 numeric country identifier within which a labeled route is not propagated to EBGp neighbors. However this might not prevent one of those EBGp neighbors from learning that route in another country and thereby making it available in the country specified by the BGP Large Community.

BGP Large Community	Description
64497:5:528	Do not export to EBGp neighbors in the Netherlands
64497:5:392	Do not export to EBGp neighbors in Japan
64497:5:840	Do not export to EBGp neighbors in the United States of America

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which selectively prevents the propagation of routes to all EBGp neighbors in the geographical region specified in the Parameter field.

Table 6: Action: NO_EXPORT in Region

4.2. Selective AS_PATH Prepending

As part of an agreement between AS 64497 and AS 64498, AS 64497 might expose BGP traffic engineering functions to AS 64498. One such BGP traffic engineering function could be selective prepending of the AS_PATH with AS 64497 to certain certain EBGp neighbors of AS 64497.

4.2.1. ASN Based Selective AS_PATH Prepending

AS 64497 could assign a value of 6 to the Function field to designate the content of the Parameter field as a neighboring ASN to which prepending of the AS_PATH with AS 64497 is requested upon propagation of the route. Additional AS_PATH Prepending functions might also be defined to support multiples of prepending, that is two, three or more prepends of AS 64497.

BGP Large Community	Description
64497:6:64498	Prepend 64497 once on export to AS 64498
64497:6:64499	Prepend 64497 once on export to AS 64499
64497:6:65551	Prepend 64497 once on export to AS 65551

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which selectively prepends the AS_PATH with AS 64497 when propagating the route to the specified EBGp neighbor.

Table 7: Action: Prepend to ASN

4.2.2. Location Based Selective AS_PATH Prepending

AS 64497 could assign a value of 7 to the Function field to designate the content of the Parameter field as an ISO 3166-1 numeric country identifier to which the prepending of the AS_PATH with AS 64497 is requested upon propagation of the route to all EBGp neighbors in that region.

BGP Large Community	Description
64497:7:528	Prepend once to EBGp neighbors in the Netherlands
64497:7:392	Prepend once to EBGp neighbors in Japan
64497:7:840	Prepend once to EBGp neighbors in United States of America

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which selectively prepends the AS_PATH with AS 64497 when propagating the route to all EBGp neighbors in the geographical region specified in the Parameter field.

Table 8: Action: Prepend in Region

4.3. Manipulation of the LOCAL_PREF attribute

As part of an agreement between AS 64497 and AS 64498, AS 64497 might expose BGP traffic engineering functions to AS 64498. One such BGP traffic engineering function might allow AS 64498 to manipulate the value of the LOCAL_PREF attribute of routes learned from AS 64498 within AS 64497, even though the LOCAL_PREF attribute is non-transitive and therefore is not propagated to EBGp neighbors.

The LOCAL_PREF value of routes are locally significant within each Autonomous System and therefore are impossible to list in this document. Instead, the typical LOCAL_PREF values could be classified as a hierarchy and a BGP Large Community function exposed allowing an EBGp neighbor to affect the LOCAL_PREF value within the specified GA. The following non-exhaustive list defines the classes of routes in the order of descending LOCAL_PREF value and assigns a function identifier which could be used in the Function field of a BGP Large Community.

Function	Preference Class
8	Normal customer route.
9	Backup customer route.
10	Peering route.
11	Upstream transit route.
12	Fallback route, to be installed if no other path is available.

Table 9: Action: Preference Function Identifiers

4.3.1. Global Manipulation of LOCAL_PREF

AS 64497 could place one of the previously defined Preference Function Identifiers in the Function field and set the value 0 in the Parameter field to designate that the LOCAL_PREF associated with that function identifier should be applied for that route throughout the whole Autonomous System.

BGP Large Community	Description
64497:9:0	Assign LOCAL_PREF for a customer backup route
64497:10:0	Assign LOCAL_PREF for a peering route
64497:12:0	Assign LOCAL_PREF for a fallback route

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which allows a BGP neighbor to globally manipulate the LOCAL_PREF attribute for the route within AS 64497.

Table 10: Action: Global LOCAL_PREF Manipulation

4.3.2. Location Based Manipulation of LOCAL_PREF

AS 64497 could place one of the previously defined Preference Function Identifiers in the Function field and use an ISO 3166-1 numeric country identifier in the Parameter field to designate the geographical region within which the non-default LOCAL_PREF associated with that function identifier should be applied to the route. The value of the LOCAL_PREF attribute should not deviate from the default for that route class in any region not specified by one or more of these Action Communities.

BGP Large Community	Description
64497:9:528	Assign LOCAL_PREF for a customer backup route on BGP speakers in the Netherlands
64497:10:392	Assign LOCAL_PREF for a peering route on BGP speakers in Japan
64497:12:840	Assign LOCAL_PREF for a fallback route on BGP speakers in United States of America

Example documentation for Action Communities deployed by AS 64497 to expose a BGP traffic engineering function which allows a BGP neighbor to selectively manipulate the LOCAL_PREF attribute within AS 64497 in the geographical region specified in the Parameter field.

Table 11: Action: Regional LOCAL_PREF Manipulation

4.3.3. Note of Caution for LOCAL_PREF Functions

The LOCAL_PREF attribute strongly influences the BGP Decision Process, which in turn affects the scope of route propagation. Therefore, Operators should take special care when using Action Communities that decrease the LOCAL_PREF value, and therefore the degree of preference, to a value below that of another route class. Some of the unintended BGP states that might arise as a result of these traffic engineering decisions are described as "BGP Wedgies" in [\[RFC4264\]](#).

5. Security Considerations

Network operators should note the recommendations in [Section 11](#) of BGP Operations and Security [\[RFC7454\]](#).

6. IANA Considerations

None.

7. Acknowledgments

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8. References

8.1. Normative References

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- [RFC7454] Durand, J., Pepelnjak, I., and G. Doering, "BGP Operations and Security", [BCP 194](#), [RFC 7454](#), DOI 10.17487/RFC7454, February 2015, <<http://www.rfc-editor.org/info/rfc7454>>.
- [RFC8092] Heitz, J., Ed., Snijders, J., Ed., Patel, K., Bagdonas, I., and N. Hilliard, "BGP Large Communities Attribute", [RFC 8092](#), DOI 10.17487/RFC8092, February 2017, <<http://www.rfc-editor.org/info/rfc8092>>.

8.2. URIs

- [1] <http://nanog.net>
- [2] <http://nlhog.net>
- [3] <https://www.iso.org/iso-3166-country-codes.html>
- [4] <https://unstats.un.org/unsd/methodology/m49/>

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