BGP Signaling For AS3320

IP-TRANSIT / IP-TRANSIT LIGHT

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Contents

1. Introduction

This document lists the communites used in the BGP protocol of Deutsche Telekom AG and is derived from a machine readable version that is also used in its Router configuration system TROPOS.

Community Names and Representations

Communities are identified by a name that is easier to memorize for humans than numbers and follows a certain structure that gives hints about its meaning.

Communities are always unique by a numeric representation, either in 32 bits or 96 bits or both. These are the actual bit values used in the BGP protocol for exchange between routers. A 32 bit value is necessary for the legacy community feature in BGP (here-in also named *small community* or *SC*), while the 96 bit value is used in the new *Large Communities* (*LC*) feature (rfc8092).

This bit representation is also called an *encoding*, resp. *small encoding* and *large encoding*. The bit values are written in the standard textual representation as either `XXX:YYY`, where `XXX` and `YYY` are the decimal values of the upper and lower 16 bit words without leading zeroes. Similarly, large encodings follow the pattern `AAAA:BBBB:CCCC` where each part is the decimal encoding of a 32 bit value.

Community Classes

Community classes group supported communities which share same semantics and differ at most in some specifics. it makes sense to define a *Community Class* for all of these communities and use the common prefix for the internal names of all members of this group.

For example, the small communities `65010:64500` and `65010:64502` both prevent exports of a route, the former to AS64500 peers, the latter to AS64502 ones.
All communities dealing with restricting route export based on various criteria share the same prefix on their internal name (`req.no-export.to.`) and they are described together in one subchapter.

A community class defines its members by specifying how its members are structured, eventually with the help of parameters. For example, see class Region of Import:

```
Small Encoding       "3320:20" region "0"
Parameter Rules      region ::= Type: Region
```

The parameter values may be definied separately as reusable type as seen here and used by several community classes. They also specify their encoding and default values. These types will be listed in the appendix.

Large Communities Structure

Large community (LC) encodings are written as 3 unsigned 32 bit values in decimal notation. Leading zeroes are omitted. Numbers are separated by a colon ':'. This format is used for matching in router configurations, e.g. when specifying regular expressions. Therefore it makes sense to define the large encodings via that string representation, analog to the small communities.

The 1st integer is always the AS number of the entity defining a community, e.g. the owner. If the community has a target AS (e.g. the one it applies to), it will be specified in the 3rd number. If no AS is a community parameter, the 3rd number will be set to `0`.

The 2nd number will be used to define the *type* of community and list parameters for the community that are not AS. The starting digit of this number specifies the community type. Currently only the large community encodings of type 2 are available for communication with systems outside the DTAG network.

- 2: *req* (request) community (interpreted at ingress)

2. DTAG Communities

At Deutsche Telekom AG (DTAG) specifically, BGP Communities are used in the following way.

2.1. Signaling Communities

Customer networks connected to Deutsche Telekom's AS3320 Internet backbone with BGP-based routing can signal requests for specific treatment of their routes by setting BGP communities as defined in this chapter.

2.1.1. Restrict Route Propagation

Description

Customer networks may use these communities to restrict propagation of their routes from AS3320 to other Tier-1 providers; please consider using the well-known community NOPEER where appropriate.

The request can be defined by explicitly naming a peer AS to be excluded when exporting.
For 16 bit ASNs either SC encoding or LC encoding may be set on a route, for 32 bit ASNs only LC encodings are possible to use.

The parameters *neighbor* and *targetAS* are mutually exclusive. For LC encodings exactly one value must be specified, the other one must be set to zero.

Examples

Small Encoding	Large Encoding	Description	Internal Name
65010:65001	3320:2501:0	Don't export to peers	req.no-export.to.peer
65010:64500	3320:2500:64500	Don't export to AS64500	req.no-export.to.AS64500
	3320:2500:65550	Don't export to AS65550	req.no-export.to.AS65550

Small Encoding: `"65010:"` (*neighbor* | *targetAS*)

Large Encoding: `"3320:250"` *neighbor* `":"` *targetAS*

Parameter Rules: targetAS ::= [Type: AS]

neighbor ::= [Type: PeerSet]

Parameter

neighbor	Small Encoding	Large Encoding
Pattern	6500N	N

2.1.2. Request Announcement

Description

Used to signal a request to DTAG to explicitly re-export a route.

The request can be defined by explicitly naming a peer AS to be included when exporting.
For 16 bit ASNs either SC encoding or LC encoding may be set on a route, for 32 bit ASNs only LC encodings are possible to use.

The parameters *neighbor* and *targetAS* are mutually exclusive. For LC encodings exactly one value must be specified, the other one must be set to zero.

Examples

Small Encoding	Large Encoding	Description	Internal Name
65011:65001	3320:2511:0	Export to any peer	req.announce.to.peer
65011:64500	3320:2510:64500	Export to AS64500	req.announce.to.AS64500
	3320:2510:65550	Export to AS65550	req.announce.to.AS65550

Small Encoding `"65011:"` (*neighbor* | *targetAS*)

Large Encoding `"3320:251"` *neighbor* `":"` *targetAS*

Parameter Rules targetAS ::= Type: AS

neighbor ::= Type: PeerSet

Parameter

neighbor	Small Encoding	Large Encoding
Pattern	6500N	N

2.1.3. AS Path Prepending

Description	AS path prepending is a common way of making routes less attractive (as AS path length is usually one of the BGP path selection criteria). Customer networks may use these communities to selectively request from AS3320 insertion of extra copies of the AS number 3320 when propagating their routes to any of its neighbors. Extension of the AS path can be requested by one or two extra AS numbers (resulting in AS paths seen by neighbor ASs with two or three times 3320). The request can be defined by explicitly naming a neighbor AS. For 16 bit ASNs either SC encoding or LC encoding may be set on a route, for 32 bit ASNs only LC encodings are possible to use. The parameters *neighbor* and *targetAS* are mutually exclusive. For LC encodings exactly one value must be specified, the other one must be set to zero.

Examples

Small Encoding	Large Encoding	Description	Internal Name
65012:65001	3320:252201:0	Prepend twice when exporting to peers	req.prepend.to.peer
65012:65004	3320:252204:0	Prepend twice when exporting to customers	req.prepend.to.customer
65012:64500	3320:252200:64500	Prepend twice when exporting to AS64500	req.prepend.to.AS64500
65013:65001	3320:252301:0	Prepend 3 times when exporting to peers	req.prepend.to.peer.3x
65013:65004	3320:252304:0	Prepend 3 times when exporting to customers	req.prepend.to.customer.3x
65013:64500	3320:252300:64500	Prepend 3 times when exporting to AS64500	req.prepend.to.AS64500.3x
	3320:252300:65550	Prepend 3 times when exporting to AS65550	req.prepend.to.AS65550.3x
65012:65005	3320:252205:0	Prepend twice when exporting to peers and customers	req.prepend.to.peer+customer
65112:65001	3320:252211:0	Prepend twice when exporting to peers within EU	req.prepend.in.eu.to.peer
65122:65004	3320:252224:0	Prepend twice when exporting to customers within North America	req.prepend.in.na.to.customer
65133:64500	3320:252330:64500	Prepend 3 times when exporting to AS64500 within PACRIM	req.prepend.in.pacrim.to.AS64500.3x

Small Encoding `"65"` *region n* `":"` (*neighbors* | *targetAS*)

Large Encoding `"3320:252"` *n region neighbors* `":"` *targetAS*

Parameter Rules

region ::= Type: Region

targetAS ::= Type: AS

neighbors ::= Type: NeighborSet

n ::= "2" | "3"

Parameter

region	Small Encoding	Large Encoding
Pattern	1N	N

In SC encodings the region parameter value of `01` requests the AS Path prepending without regional restrictions.
In LC encodings the region parameter value of `0` requests the AS Path prepending without regional restrictions.

Parameter

neighbors	Small Encoding	Large Encoding
Pattern	6500N	N

Parameter

n	Small Encoding	Large Encoding
2	2	2
3	3	3

2.2. Signaling Communities by Agreement

Customer networks connected to Deutsche Telekom's AS3320 Internet backbone with BGP-based routing can signal requests for specific treatment of their routes by setting BGP communities as defined in this chapter.

Note: Using these communities requires the feature to be explicitely requested and configured via sales contact person or mail to: peering-ops@telekom.de .

2.2.1. Blackholing Service

Description

RTBH enables the signaling of prefixes towards AS3320, that will lead to discarding all traffic to the particular address space within our backbone. Announcement of prefixes up to /32 (IPv4) and /128 (IPv6) is possible in terms of precise selection if traffic towards a range or specific host should be discarded.

Values

Small Encoding	Description	Internal Name
65000:0	Request Blackholing	req.blackhole.standard

2.2.2. Local Preference - Route Priority

Description

Used to signal a request for setting the local preference at DTAG ingress to a particular value.
AS3320 assigns a standard local preference value of 100. There are options to statically set lower or higher priorities.

- *10*, *50* or *70*: The request will be honored if any Local Preference option is configured for the BGP connection.
- *100*: Can be used to explicitly request standard routing priority within AS3320, in case of adjusted presets.
- *150*: Raising priority will be honored only for authorized routes.

Values

Small Encoding	Description	Internal Name
65001:10	Reduce local preference to 10	req.local-pref.10
65001:50	Reduce local preference to 50	req.local-pref.50
65001:70	Reduce local preference to 70	req.local-pref.70
65001:100	Explicitely set local preference to DTAG default	req.local-pref.100
65001:150	Increase local preference to 150	req.local-pref.150

2.3. Informational Communities

Customer networks connected to Deutsche Telekom's AS3320 Internet backbone with BGP-based routing receive routes with additional classification signaled by BGP community attributes as defined in this chapter.

2.3.1. Country of Import

Description

Used to externally signal the country in which DTAG imported a route. These country codes are defined as 'a2' codes in ISO 3166, see appendix (page 22).

Note: Please keep in mind that the region of import does not denote the country of a prefix. It relates to the location where AS3320 has learnt the prefix via BGP.

Examples

Small Encoding	Description	Internal Name
3320:1276	Imported in Germany	tag.origin.country.de
3320:1840	Imported in USA	tag.origin.country.US
3320:1826	Imported in UK	tag.origin.country.gb

Small Encoding `"3320:1"` *country*

Parameter Rules country ::= Type: CC

2.3.2. Region of Import

Description

Used to externally signal the region in which DTAG imported a route.

Note: Please keep in mind that the region of import does not necessarily match with the origin of a prefix. It relates to the location where AS3320 has learnt the prefix via BGP.

Examples

Small Encoding	Description	Internal Name
3320:2010	Imported in Europe	tag.origin.region.eu
3320:2020	Imported in North America	tag.origin.region.na
3320:2030	Imported in Pacific Rim	tag.origin.region.pacrim

Small Encoding `"3320:20"` *region* `"0"`

Parameter Rules region ::= Type: Region

2.3.3. Origin Type

Description	Used to externally signal the neighbor class of the AS from whom DTAG imported a route.
Examples	see table below
Small Encoding	`"3320:90"` *type* `"0"`
Parameter Rules	type ::= Type: Neighbor

Small Encoding	Description	Internal Name
3320:9010	Imported from customer	tag.origin.type.customer
3320:9020	Imported from peer	tag.origin.type.peer

3. IANA Communities

The communities defined by RFCs and and registred at the Internet Assigned Numbers Authority (IANA) are commonly called *well known communities* (WKC).

The official list of defined well known communities is maintained by IANA, and made available at http://www.iana.org/assignments/bgp-well-known-communities.
The WKC GRACEFUL_SHUTDOWN is defined in RFC8326, the community NOPEER is defined in RFC3765.

3.1. Community Classes

3.1.1. Well-Known Communities

Description

The WKC NOPEER is supported by AS3320. Customer networks can use this community to restrict propagation of their route. Use of this community as described in the defining RFC is encouraged.

The WKC GRACEFUL_SHUTDOWN is supported by AS3320. Customer networks can use this community to throttle traffic on BGP connections to be shut down. Use of this community as described in the defining RFC is encouraged.

The 3 WKCs NO_EXPORT, NO_ADVERTISE and NO_EXPORT_SUBCONFED are used internally within AS3320. Routes tagged with any of them are **not** accepted to avoid potential conflicts.

Values

Small Encoding	Description	Internal Name
65535:0	GRACEFUL_SHUTDOWN	iana:wkc.graceful-shutdown
65535:65281	NO_EXPORT	iana:wkc.no-export
65535:65282	NO_ADVERTISE	iana:wkc.no-advertise
65535:65283	NO_EXPORT_SUBCONFED	iana:wkc.local-as
65535:65284	NOPEER	iana:wkc.no-peer

4. BGP Features Available by Agreement

Deutsche Telekom implements various services and options in its BGP routing (transit services) that are only avaliable upon request. They require an individual agreement and specific configuration on the AS3320 BGP routers.

Using these features requires explicit request via sales contact person or mail to: peering-ops@telekom.de .

4.1. MED

By default, AS3320 accepts and honors MED announced by customer networks.

4.2. Default Route

AS3320 can announce the default route only or additionally to the full BGP table.

4.3. MD5 protection of eBGP sessions

In general, AS3320 expects to negotiate a MD5 key for each neighbor AS to protect all eBGP sessions. AS3320 proposes a MD5 key in each case.

4.4. Maximum Prefix Limit

During provision, AS3320 sets a maximum prefix limit considering the actual analysis of the expected prefix announcements from the customer. Upon request, this limit can be changed by the provisioning team at any time.

If major changes are planned within the customer's network, an early request to raise the prefix limit to a save limit is necessary!

4.5. Loopback Peering

Loopback peering is possible for load sharing over multiple parallel circuits between a single pair of border gateways.

4.6. Multi-Path

Multi-path is possible for load sharing over multiple parallel circuits between a single pair of border gateways.

4.7. LACP

LACP is possible for load sharing over multiple parallel circuits between a single pair of border gateways.

5. Disclaimer

Unless said otherwise, the information provided in this document has been prepared to the best of our knowledge and is for informational purposes only.
Any binding commitments shall be subject to a written agreement.

6. Appendix: Type Definitions

6.1. Complex Types

6.1.1. Type AS

Abstract	An AS number, such as 'AS3320'.
Internal Name	`"AS"` *number*
Description	A unsigned 32 bit number of an Autonomous System as first standardized in RFC 1771 and further defined by RFC 1930 for 16 bit values. Due to the growth of the internet, AS numbers have been extended to 32 bit in RFC 4893. When used in Communities, the small community encodings only allow for the older 16 bit values. Therefore, a community name such as 'req.no-export.to.AS12345678' will only have an encoding as large community, even though the community class is defined for small communities as well.
Used in	Request Announcement (page 8), Restrict Route Propagation (page 7), AS Path Prepending (page 9)

6.1.2. Type Neighbor

Abstract	A type of neighbor.
Internal Name	`( "customer" | "peer" )`
Description	A type of BGP neighbor. The following neighbor types are defined: 'customer' and 'peer'.

Value

Internal Name	Small Encoding	Large Encoding
customer	1	1
peer	2	2

Used in Origin Type (page 15)

6.1.3. Type NeighborSet

Abstract	A combination of neighbor types.
Internal Name	*token* [{ "+" *token* }]
Description	A combintation of BGP neighbors. The following neighbor types are defined: 'customer' and 'peer'. Combinations are concatenated with a '+', as in 'peer+customer'.

Value

Internal Name	Small Encoding	Large Encoding
peer	1	1
customer	4	4
all	7	7

Used in AS Path Prepending (page 9)

6.1.4. Type PeerSet

Abstract	A combination of 'peer' or 'all'.
Internal Name	*token* [{ "+" *token* }]
Description	A combintation of BGP neighbors. The following neighbor types are defined: 'peer' and 'all'.

Value

Internal Name	Small Encoding	Large Encoding
peer	1	1
all	7	7

Used in Request Announcement (page 8), Restrict Route Propagation (page 7)

6.1.5. Type Region

Abstract: A region on the globe.

Internal Name: `( "eu" | "na" | "pacrim" | "sa" )`

Description: A region of the earth. The following regions are currently defined:

- eu (Europe)
- na (North America)
- pacrim (Pacific Rim)
- sa (South America)

Value:

Internal Name	Small Encoding	Large Encoding
eu	1	1
na	2	2
pacrim	3	3
sa	4	4

Used in: AS Path Prepending (page 9), Region of Import (page 14)

6.2. Simple Types

6.2.1. Type CC

Abstract: A 2 letter country code, such as 'UK'.

Description: These country codes are defined as 'a2' codes in ISO 3166. See appendix for the list of country code definitions.

Used in: Country of Import (page 14)

7. Appendix: ISO 3166 Country Codes

Country	A2	A3	Number
Austria	AT	AUT	040
Belgium	BE	BEL	056
Bulgaria	BG	BGR	100
Croatia	HR	HRV	191
Denmark	DK	DNK	208
Czech Republic	CZ	CZE	203
France	FR	FRA	250
Germany	DE	DEU	276
Greece	GR	GRC	300
Italy	IT	ITA	380
Hungary	HU	HUN	348
Luxembourg	LU	LUX	442
Netherlands (the)	NL	NLD	528
North Macedonia	MK	MKD	807
Montenegro	ME	MNE	499
Poland	PL	POL	616
Romania	RO	ROU	642
Slovakia	SK	SVK	703
Spain	ES	ESP	724
Sweden	SE	SWE	752
Switzerland	CH	CHE	756
United Kingdom of Great Britain and Northern Ireland (the)	GB	GBR	826
Canada	CA	CAN	124
Brazil	BR	BRA	076
United States of America (the)	US	USA	840
Singapore	SG	SGP	702
Hong Kong	HK	HKG	344