BGP Large Communities Attribute
RFC 8092

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A Brief History of BGP Communities

• BGP Communities Attribute (**RFC 1997**, August 1996)
  – Designed to simplify Internet routing policies
  – Encodes a 32-bit value displayed as “16-bit ASN:16-bit value”
  – Broad support in BGP implementations, and widely deployed by network operators for Internet routing
  – For example: 2914:420 2914:1206 2914:2203 2914:3200

• BGP Extended Communities Attribute (**RFC 4360**, February 2006)
  – Adds label, value and longer range displayed as “8/16-bit type:48/56-bit value”
  – Useful for L3VPNs, fewer implementations available
  – Slow adoption rate
  – Cannot see the forest for the trees (**RFC 7153**)
What Network Operators Use

RFC 1997 style communities, as they have been used for the past 20 years
Widely documented in training material, operations procedures, policy documentation
Required in RFPs and documented in contracts

Sources: https://www.us.ntt.net/support/policy/routing.cfm (AS 2914), https://onestep.net/communities/

2017-03-23 CEE Peering Days 2017, Ljubljana
Along Came a Problem

• We knew we’d run out of 16-bit ASNs eventually
• 32-bit ASN work started in January 2001
  – RFC 4893 in May 2007
  – RFC 6793 in December 2012
• RIRs started allocating 32-bit ASNs by request in 2007
• No distinction between 16-bit and 32-bit ASNs now
  – Widely used as edge and transit ASNs
• However, you can’t fit a 32-bit value into a 16-bit field
  – Can’t use native 32-bit ASNs at all
  – 32-bit ASN owners use private ASNs in communities or some other kludge
  – Creates namespace collisions between ASNs
BGP Large Communities Attribute

Abstract

This document describes the Large BGP Communities attribute, an extension to BGP-4. This attribute provides a mechanism to signal opaque information within separate namespaces to aid in routing management. The attribute is suitable for use with all Autonomous System Numbers including four-octet Autonomous System Numbers.
Related Work for 32-Bit ASNs in Communities

• 4-Octet AS Specific BGP Extended Community ([RFC 5668](http://www.rfc-editor.org/rfc/rfc5668), October 2009)
  – RFC 4360 style extended community for 32-bit ASNs displayed as “32-bit ASN:16-bit value”
  – Perceived as a micro optimization
• Flexible BGP Communities ([draft-lange-flexible-bgp-communities](http://tools.ietf.org/html/draft-lange-flexible-bgp-communities))
  – December 2002 – August 2010
  – BGP peer community grouping, 32-bit ASNs, plus other stuff
  – No consensus or implementations
  – July 2010 – March 2017, was Wide BGP Communities Attribute
  – Complementary and comprehensive solution
  – Generalized BGP peer community grouping, 32-bit ASNs, plus other stuff
  – No consensus or implementations, needs time to develop
• No Internet routing communities solution for almost 10 years

IETF Support for BGP Large Communities

• Overwhelming interest on the IDR mailing list
  – Network operators
  – Implementers

• Hundreds of messages and counting on the Working Group adoption thread
Like RFC 1997 Communities, but Larger
Design Goals

• Simply “larger”, that’s it...
  – No added complexity or functionality
  – Extend RFC 1997 communities for 32-bit ASNs
  – Signal an action without losing information about either the origin or the target

• Broadly deployable solution that is available quickly
  – Transitive

• Flexibility for network operators to define their own communities
  – Opaque, may be ignored

• A unique namespace for all 16-bit and 32-bit ASNs
  – Parity and fairness as everyone now can use their globally unique ASN
  – No namespace collisions between ASNs

• Easy to implement
• Easy to adopt
• Easy to remember and tell each other on the phone
  – Canonical representation
  – Especially in an international community with many different languages
Things That are “Out of Scope”

• No RFC 1997 to BGP Large Communities mapping
  – Out of scope because routing policies differ widely between network operators
• No TLV or header
  – Just use BGP Path Attributes code 32 (0x20)
  – Purposely kept simple to meet the specific use requirements
• No well-known communities
  – Not needed, since RFC 1997 well-known communities like “no-advertize”, “no–export”, “blackhole”, etc. can still be used
Encoding and Usage

- BGP Large Communities are encoded as a 96-bit quantity and displayed as “32-bit ASN:32-bit value:32-bit value”
- Canonical representation is $Me:$Action:$You
- Working on an RFC 1998 style draft-ietf-grow-large-communities-usage I-D with examples

Autonomous System Number (Me)
Operator-Defined Value (Action)
Operator-Defined Value (You)
## BGP Large Community Examples

<table>
<thead>
<tr>
<th>RFC 1997 (Current)</th>
<th>BGP Large Communities</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>65400:peer-as</td>
<td>2914:65400:peer-as</td>
<td>Do not Advertise to peer-as in North America (NTT)</td>
</tr>
<tr>
<td>43760:peer-as</td>
<td>43760:1:peer-as</td>
<td>Announce a prefix to a certain peer (INEX)</td>
</tr>
<tr>
<td>0:43760</td>
<td>43760:0:peer-as</td>
<td>Prevent announcement of a prefix to a certain peer (INEX)</td>
</tr>
<tr>
<td>65520:nnn</td>
<td>2914:65520:nnn</td>
<td>Lower Local Preference in Country nnn (NTT)</td>
</tr>
<tr>
<td>2914:410</td>
<td>2914:400:10</td>
<td>Route Received From a Peering Partner (NTT)</td>
</tr>
<tr>
<td>2914:420</td>
<td>2914:400:20</td>
<td>Route Received From a Customer (NTT)</td>
</tr>
</tbody>
</table>

- No namespace collisions or use of reserved ASNs
- Enables operators to use 32-bit ASNs in $Me and $You values
## Major Milestones Towards an RFC Standard

<table>
<thead>
<tr>
<th>Date</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2, 2016</td>
<td>Published draft-heitz-idr-large-community-03</td>
</tr>
<tr>
<td>September 6, 2016</td>
<td>Requested IDR WG Adoption</td>
</tr>
<tr>
<td>September 24, 2016</td>
<td>IDR Working Group Adoption of draft-ietf-idr-large-community-00</td>
</tr>
<tr>
<td>September 29, 2016</td>
<td>Early IANA BGP Path Attributes Code (30) Allocation</td>
</tr>
<tr>
<td>October 11, 2016</td>
<td>BGP Large Communities Beacon Prefixes Announced</td>
</tr>
<tr>
<td>October 17, 2016</td>
<td>Start of IDR Working Group Last Call</td>
</tr>
<tr>
<td>October 26, 2016</td>
<td>Early IANA BGP Path Attributes Code (32) Allocation</td>
</tr>
<tr>
<td>November 2, 2016</td>
<td>Start of IETF Last Call and IESG Review</td>
</tr>
<tr>
<td>December 1, 2016</td>
<td>Start of IESG Last Call</td>
</tr>
<tr>
<td>December 18, 2016</td>
<td>IESG Ballot Issued</td>
</tr>
<tr>
<td>January 5, 2017</td>
<td>IESG Approved Revision -12 for RFC Publication</td>
</tr>
<tr>
<td><strong>February 16, 2017</strong></td>
<td><strong>RFC 8092 “BGP Large Communities Attribute” Published</strong></td>
</tr>
</tbody>
</table>
RFC 8092

“BGP Large Communities Attribute” Published!

• Idea progressed rapidly from inception in March 2016
• First I-D in September 2016 to RFC publication on February 16, 2017 in just seven months
• Final standard, plus a number of implementation and tools developed as well
• Network operators can test and deploy the new technology now

Cake and photo courtesy of the NTT Communications NOC.

2017-03-23
Timeline Overview

IETF
Consensus Building, Progression from I-D to RFC, Publication
Done!

Months/Years

Implementers
Feature Design, Implementation, Testing, Documentation, Shipping
In Progress

Days/Months

Network Operators
Evangelism, Training, Preparation, Testing, Deployment
In Progress

Weeks/Months

18 Months

12 Months
# BGP Speaker Implementation Status

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Software</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arista</td>
<td>EOS</td>
<td>Planned</td>
<td>Feature Requested BUG169446</td>
</tr>
<tr>
<td>Cisco</td>
<td>IOS XR</td>
<td>✔️ Done!</td>
<td>Beta (perhaps in 6.3.2 for real?)</td>
</tr>
<tr>
<td>cz.nic</td>
<td>BIRD</td>
<td>✔️ Done!</td>
<td>BIRD 1.6.3 (<a href="http://largebgpcommunities.net/implementations/">commit</a>)</td>
</tr>
<tr>
<td>ExaBGP</td>
<td>ExaBGP</td>
<td>✔️ Done!</td>
<td>PR482</td>
</tr>
<tr>
<td>FreeRangeRouting</td>
<td>frr</td>
<td>✔️ Done!</td>
<td>Issue 46 (<a href="http://largebgpcommunities.net/implementations/">Commit</a>)</td>
</tr>
<tr>
<td>nop.nu</td>
<td>freeRouter</td>
<td>✔️ Done!</td>
<td></td>
</tr>
<tr>
<td>Juniper</td>
<td>Junos OS</td>
<td>Planned</td>
<td>Second Half 2017 (perhaps 17.3R1?)</td>
</tr>
<tr>
<td>MikroTik</td>
<td>RouterOS</td>
<td>Won’t Implement Until RFC</td>
<td>Feature Requested 2016090522001073</td>
</tr>
<tr>
<td>Nokia</td>
<td>SR OS</td>
<td>Planned</td>
<td>Third Quarter 2017</td>
</tr>
<tr>
<td>OpenBSD</td>
<td>OpenBGPD</td>
<td>✔️ Done!</td>
<td>OpenBSD 6.1 (<a href="http://largebgpcommunities.net/implementations/">commit</a>)</td>
</tr>
<tr>
<td>OSRG</td>
<td>GoBGP</td>
<td>✔️ Done!</td>
<td>PR1094</td>
</tr>
<tr>
<td>rtbrick</td>
<td>Fullstack</td>
<td>✔️ Done!</td>
<td>FullStack 17.1</td>
</tr>
<tr>
<td>Quagga</td>
<td>Quagga</td>
<td>✔️ Done!</td>
<td>Quagga 1.2.0 875</td>
</tr>
<tr>
<td>Ubiquiti Networks</td>
<td>EdgeOS</td>
<td>Planned</td>
<td>Internal Enhancement Requested</td>
</tr>
<tr>
<td>VyOS</td>
<td>VyOS</td>
<td>Requested</td>
<td>Feature Requested T143</td>
</tr>
</tbody>
</table>

Visit [http://largebgpcommunities.net/implementations/](http://largebgpcommunities.net/implementations/) for the latest status
### Tools and Ecosystem Implementation Status

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Software</th>
<th>Status</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>DE-CIX</td>
<td>pbgpP</td>
<td>✓ Done!</td>
<td>PR16</td>
</tr>
<tr>
<td>FreeBSD</td>
<td>tcpdump</td>
<td>✓ Done!</td>
<td>PR213423</td>
</tr>
<tr>
<td>Marco d’Itri</td>
<td>zebra-dump-parser</td>
<td>✓ Done!</td>
<td>PR3</td>
</tr>
<tr>
<td>OpenBSD</td>
<td>tcpdump</td>
<td>✓ Done!</td>
<td>OpenBSD 6.1 (&lt;a href=&quot;patch&quot;&gt;patch&lt;/a&gt;)</td>
</tr>
<tr>
<td>pmacct.net</td>
<td>pmacct</td>
<td>✓ Done!</td>
<td>PR61</td>
</tr>
<tr>
<td>RIPE NCC</td>
<td>bgpdump</td>
<td>✓ Done!</td>
<td>Issue 41 (&lt;a href=&quot;commit&quot;&gt;commit&lt;/a&gt;)</td>
</tr>
<tr>
<td>tcpdump.org</td>
<td>tcpdump</td>
<td>✓ Done!</td>
<td>PR543 (&lt;a href=&quot;commit&quot;&gt;commit&lt;/a&gt;)</td>
</tr>
<tr>
<td>Yoshiyuki Yamauchi</td>
<td>mrtparse</td>
<td>✓ Done!</td>
<td>PR13</td>
</tr>
<tr>
<td>Wireshark</td>
<td>Dissector</td>
<td>✓ Done!</td>
<td>18172 (&lt;a href=&quot;patch&quot;&gt;patch&lt;/a&gt;)</td>
</tr>
</tbody>
</table>

Visit <a href="http://largebgpcommunities.net/implementations/">http://largebgpcommunities.net/implementations/</a> for the Latest Status
BGP Large Communities Beacon Prefixes

- The following prefixes are announced with AS path 2914_15562$
  - 192.147.168.0/24 (looking glass)
  - 2001:67c:208c::/48 (looking glass)
  - BGP Large Community: 15562:1:1
BGP Implementer To Do List

• Add support for BGP Path Attributes code 32 (0x20) to BGP
  – Optional CLI command to enable
• Extend your routing policies
  – Set and match
  – Regular expressions
• Extend your show commands
  – Including the debug commands and packet dump output
• Update your documentation
• Update your training material
• Educate your technical staff
Network Operator To Do List

• The entire network ecosystem needs to support BGP Large Communities in order to provision, deploy and troubleshoot
• Ask your routing vendors and implementers for software support
• Update your tools and provisioning software
• Extend your routing policies, and openly publish this information
• Train your technical staff

Image sources: https://www.sunet.se/blogg/all-i-want-for-christmas-is-large-bgp-communities/
“All i want for christmas is … Large BGP Communities” by Fredrik "Hugge" Korsbäck
Questions?

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Visit http://LargeBGPCommunities.net/ for the Latest Info
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