Large BGP Communities

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A Brief History of BGP Communities

  – 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](https://tools.ietf.org/html/rfc4360), February 2006)
  – Adds label, value, longer range
  – Useful for L3VPNs, fewer implementations available
  – Slow adoption rate
  – Cannot see the forest for the trees ([RFC 7153](https://tools.ietf.org/html/rfc7153))
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/

October 27, 2016
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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

32-bit ASNs in a 16-bit Field
Large BGP Communities

draft-ietf-idr-large-community-05

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 in four-octet ASNs.
Related Work for 32-Bit ASNs in Communities

- **4-Octet AS Specific BGP Extended Community** *(RFC 5668, October 2009)*
  - RFC 4360 style extended community for 32-bit ASNs
  - Perceived as a micro optimization
- **Flexible BGP Communities** *(draft-lange-flexible-bgp-communities)*
  - December 2002 – August 2010
  - BGP peer community grouping, 32-bit ASNs, plus other stuff
  - No consensus or implementations
- **Wide BGP Communities Attribute** *(draft-ietf-idr-wide-bgp-communities)*
  - July 2010 – September 2016
  - 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 Large BGP Communities

• Overwhelming interest on the IDR mailing list
  – Network operators
  – Implementers
• Hundreds of messages and counting on the Working Group adoption thread

Working Group adoption thread: https://mailarchive.ietf.org/arch/search/?email_list=idr&gbt=1&index=vEa3744YRI5pj8bUB_i54Uay-fE

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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 Large BGP 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

- Large BGP 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
## Large BGP Community Examples

<table>
<thead>
<tr>
<th>RFC 1997 (Current)</th>
<th>Large BGP 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>0:peer-as</td>
<td>6667:0:peer-as</td>
<td>Do not Announce to Route Server peer-as (AMS-IX)</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 us 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 1, 2016</td>
<td>Published draft-ietf-idr-large-community-01</td>
</tr>
<tr>
<td>October 8, 2016</td>
<td>Published draft-ietf-idr-large-community-02</td>
</tr>
<tr>
<td>October 11, 2016</td>
<td>Large BGP Communities Beacon Prefixes Announced</td>
</tr>
<tr>
<td>October 16, 2016</td>
<td>Published draft-ietf-idr-large-community-03</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>
</tbody>
</table>
Timeline Overview

IETF
Consensus Building, Progression from I-D to RFC, Publication
Months/Years
∞

Implementers
Feature Design, Implementation, Testing, Documentation, Shipping
Days/Months
18 Months

Network Operators
Evangelism, Training, Preparation, Testing, Deployment
Weeks/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>Engineering Release</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><a href="http://largebgpcommunities.net/implementations/">PR482</a></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></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><a href="http://largebgpcommunities.net/implementations/">PR1094</a></td>
</tr>
<tr>
<td>rtbrick</td>
<td>Fullstack</td>
<td>Planned</td>
<td>ETA: <a href="http://largebgpcommunities.net/implementations/">December 2016</a></td>
</tr>
<tr>
<td>Quagga</td>
<td>Quagga</td>
<td>In progress</td>
<td>Feature Requested 875 – patch will be submitted soon</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

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## 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>FreeBSD</td>
<td>tcpdump</td>
<td>✔️ Done!</td>
<td>PR213423</td>
</tr>
<tr>
<td>pmacct.net</td>
<td>pmacct</td>
<td>✔️ Done!</td>
<td>PR61</td>
</tr>
<tr>
<td>OpenBSD</td>
<td>tcpdump</td>
<td>✔️ Done!</td>
<td>OpenBSD 6.1 (patch)</td>
</tr>
<tr>
<td>tcpdump.org</td>
<td>tcpdump</td>
<td>✔️ Done!</td>
<td>PR543 (commit)</td>
</tr>
<tr>
<td>Wireshark</td>
<td>Dissector</td>
<td>✔️ Done!</td>
<td>18172 (patch)</td>
</tr>
</tbody>
</table>

Visit [http://largebgpcommunities.net/implementations/](http://largebgpcommunities.net/implementations/) for the Latest Status
Large BGP 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)
  - Large BGP Community: 15562:1:1

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Cisco IOS Output (Without Large BGP Communities Support)

```
route-views>sh ip bgp 192.147.168.0
BGP routing table entry for 192.147.168.0/24, version 98399100
Paths: (39 available, best #30, table default)
  Not advertised to any peer
  Refresh Epoch 1
  701 2914 15562
  137.39.3.55 from 137.39.3.55 (137.39.3.55)
  Origin IGP, localpref 100, valid, external
  unknown transitive attribute: flag 0xE0 type 0x20 length 0xC
    value 0000 3CCA 0000 0001 0000 0001
  rx pathid: 0, tx pathid: 0
```

BIRD Output (With Large BGP Communities Support)

```
COLOCLUE1 11:06:17 from 94.142.247.3] (100/-) [AS15562i]
  Type: BGP unicast univ
  BGP.origin: IGP
  BGP.as_path: 8283 2914 15562
  BGP.next_hop: 94.142.247.3
  BGP.med: 0
  BGP.local_pref: 100
  BGP.community: (2914,410) (2914,1206) (2914,2203) (8283,1)
  BGP.large_community: (15562, 1, 1)
```
BGP Implementer To Do List

- Add support for BGP Path Attributes code 30, 31, 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 Large BGP 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
Questions?

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

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