Global Routing Operations
Internet-Draft
Updates: 7854 (if approved)
Intended status: Standards Track
Expires: September 3, 2018

T. Evens
S. Bayraktar
Cisco Systems
P. Lucente
NTT Communications
P. Mi
Tencent
S. Zhuang
Huawei

March 2, 2018

Support for Adj-RIB-Out in BGP Monitoring Protocol (BMP)
draft-ietf-grow-bmp-adj-rib-out-01

Abstract

The BGP Monitoring Protocol (BMP) defines access to only the Adj-RIB-In Routing Information Bases (RIBs). This document updates the BGP Monitoring Protocol (BMP) RFC 7854 by adding access to the Adj-RIB-Out RIBs. It adds a new flag to the peer header to distinguish Adj-RIB-In and Adj-RIB-Out.

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 September 3, 2018.

Copyright Notice

Table of Contents

1. Introduction

BGP Monitoring Protocol (BMP) defines monitoring of the received (e.g. Adj-RIB-In) Routing Information Bases (RIBs) per peer. The Adj-RIB-In pre-policy conveys to a BMP receiver all RIB data before any policy has been applied. The Adj-RIB-In post-policy conveys to a BMP receiver all RIB data after policy filters and/or modifications have been applied. An example of pre-policy verses post-policy is when an inbound policy applies attribute modification or filters. Pre-policy would contain information prior to the inbound policy changes or filters of data. Post policy would convey the changed data or would not contain the filtered data.

Monitoring the received updates that the router received before any policy has been applied is the primary level of monitoring for most use-cases. Inbound policy validation and auditing is the primary use-case for enabling post-policy monitoring.

In order for a BMP receiver to receive any BGP data, the BMP sender (e.g. router) needs to have an established BGP peering session and actively be receiving updates for an Adj-RIB-In.

Being able to only monitor the Adj-RIB-In puts a restriction on what data is available to BMP receivers via BMP senders (e.g. routers). This is an issue when the receiving end of the BGP peer is not enabled for BMP or when it is not accessible for administrative reasons. For example, a service provider advertises prefixes to a customer, but the service provider cannot see what it advertises via BMP. Asking the customer to enable BMP and monitoring of the Adj-RIB- In is not feasible.

This document updates BGP Monitoring Protocol (BMP) RFC 7854 [RFC7854] peer header by adding a new flag to distinguish Adj-RIB-In verses Adj-RIB-Out.

Adding Adj-RIB-Out enables the ability for a BMP sender to send to a BMP receiver what it advertises to BGP peers, which can be used for outbound policy validation and to monitor RIBs that were advertised.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Definitions

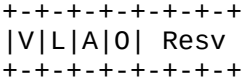
- Adj-RIB-Out: As defined in [RFC4271], "The Adj-RIBs-Out contains the routes for advertisement to specific peers by means of the local speaker’s UPDATE messages."

- Pre-Policy Adj-RIB-Out: The result before applying the outbound policy to an Adj-RIB-Out. This normally would match what is in the local RIB.

- Post-Policy Adj-RIB-Out: The result of applying outbound policy to an Adj-RIB-Out. This MUST be what is actually sent to the peer.

4. Per-Peer Header

The per-peer header has the same structure and flags as defined in section 4.2 [RFC7854] with the following O flag addition:



- o The O flag indicates Adj-RIB-In if set to 0 and Adj-RIB-Out if set to 1.

The existing flags are defined in section 4.2 [RFC7854] and the remaining bits are reserved for future use. They SHOULD be transmitted as 0 and their values MUST be ignored on receipt.

5. Adj-RIB-Out

5.1. Post-Policy

The primary use-case in monitoring Adj-RIB-Out is to monitor the updates transmitted to the BGP peer after outbound policy has been applied. These updates reflect the result after modifications and filters have been applied (e.g. Adj-RIB-Out Post-Policy). Some attributes are set when the BGP message is transmitted, such as next-hop. Adj-RIB-Out Post-Policy MUST convey what is actually transmitted to the peer, next-hop and any attribute set during transmission should also be set and transmitted to the BMP receiver.

The L flag MUST be set to 1 to indicate post-policy.

5.2. Pre-Policy

As with Adj-RIB-In policy validation, there are use-cases that pre-policy Adj-RIB-Out is used to validate and audit outbound policies. For example, a comparison between pre-policy and post-policy can be used to validate the outbound policy.

Depending on BGP peering session type (IBGP, IBGP route reflector client, EBGP) the candidate routes that make up the Pre-Policy Adj-RIB-Out do not contain all local-rib routes. Pre-Policy Adj-RIB-Out conveys only routes that are available based on the peering type. Post-Policy represents the filtered/changed routes from the available routes.

Some attributes are set only during transmission of the BGP message, e.g. Post-Policy. It is common that next-hop may be null, loopback,

or similar during this phase. All mandatory attributes, such as next-hop, MUST be either ZERO or have an empty length if they are unknown at the Pre-Policy phase. The BMP receiver will treat zero or empty mandatory attributes as self originated.

The L flag MUST be set to 0 to indicate pre-policy.

6. BMP Messages

Many BMP messages have a per-peer header but some are not applicable to Adj-RIB-In or Adj-RIB-Out monitoring. Unless otherwise defined, the O flag should be set to 0 in the per-peer header in BMP messages.

6.1. Route Monitoring and Route Mirroring

The O flag MUST be set accordingly to indicate if the route monitor or route mirroring message conveys Adj-RIB-In or Adj-RIB-Out.

6.2. Statistics Report

Statistics report message has Stat Type field to indicate the statistic carried in the Stat Data field. Statistics report messages are not specific to Adj-RIB-In or Adj-RIB-Out and MUST have the O flag set to zero. The O flag SHOULD be ignored by the BMP receiver.

The following new statistic types are added:

- Stat Type = TBD: (64-bit Gauge) Number of routes in Adj-RIBs-Out Pre-Policy.

- Stat Type = TBD: (64-bit Gauge) Number of routes in Adj-RIBs-Out Post-Policy.

- Stat Type = TBD: Number of routes in per-AFI/SAFI Adj-RIB-Out Pre-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

- Stat Type = TBD: Number of routes in per-AFI/SAFI Adj-RIB-Out Post-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

6.3. Peer Down and Up Notifications

PEER UP and DOWN notifications convey BGP peering session state to BMP receivers. The state is independent of whether or not route monitoring or route mirroring messages will be sent for Adj-RIB-In,

Adj-RIB-Out, or both. BMP receiver implementations SHOULD ignore the O flag in PEER UP and DOWN notifications. BMP receiver implementations MUST use the per-peer header O flag in route monitoring and mirroring messages in order to identify if the message is for Adj-RIB-In or Adj-RIB-Out.

6.3.1. Peer Up Information

The following peer UP information TLV types are added:

- Type = TBD: Admin Label. The Information field contains a free-form UTF-8 string whose length is given by the Information Length field. The value is administratively assigned. There is no requirement to terminate the string with null or any other character.

  Multiple admin labels can be included in the Peer UP. When multiple admin labels are included the BMP receiver MUST preserve the order.

  The TLV is optional.

7. Other Considerations

7.1. Peer and Update Groups

Peer and update groups are used to group updates shared by many peers. This is a level of efficiency in the implementation, not a true representation of what is conveyed to a peer in either Pre-Policy or Post-Policy.

One of the use-cases to monitor Adj-RIB-Out Post-Policy is to validate and continually ensure the egress updates match what is expected. For example, wholesale peers should never have routes with community X:Y sent to them. In this use-case, there maybe hundreds of wholesale peers but a single peer could have represented the group.

A single peer could be used to represent a group. From a BMP perspective, this should be simple to include a group name in the PEER UP, but it is more complex than that. BGP implementations have evolved to provide comprehensive and structured policy grouping, such as session, afi/safi, and template based group policy inheritances.

This level of structure and inheritance of polices does not provide a simple peer group name or ID, such as wholesale peer.

Instead of requiring a group name to be used, a new administrative label informational TLV (Section 6.3.1) is added to the Peer UP message. These labels have administrative scope relevance. For example, labels "type=wholesale" and "region=west" could be used to monitor expected policies.

Configuration and assignment of labels to peers is BGP implementation specific.

8. Security Considerations

It is not believed that this document adds any additional security considerations.

9. IANA Considerations

This document requests that IANA assign the following new parameters to the BMP parameters name space [1].

9.1. BMP Peer Flags

This document defines the following new per-peer header flags (Section 4):

- Flag 3 as O flag: The O flag indicates Adj-RIB-In if set to 0 and Adj-RIB-Out if set to 1.

9.2. BMP Statistics Types

This document defines four new statistic types for statistics reporting (Section 6.2):

- Stat Type = TBD: (64-bit Gauge) Number of routes in Adj-RIBs-Out Pre-Policy.

- Stat Type = TBD: (64-bit Gauge) Number of routes in Adj-RIBs-Out Post-Policy.

- Stat Type = TBD: Number of routes in per-AFI/SAFI Adj-RIB-Out Pre-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

- Stat Type = TBD: Number of routes in per-AFI/SAFI Adj-RIB-Out Post-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

9.3. Peer UP Information TLV

This document defines the following new BMP PEER UP informational message TLV types (Section 6.3.1):

- Type = TBD: Admin Label. The Information field contains a free-form UTF-8 string whose length is given by the Information Length field. The value is administratively given by the Information Length field. The value is administratively assigned. There is no requirement to terminate the string with null or any other character.

10. References

10.1. Normative References

[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>.

[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>.

[RFC7854] Scudder, J., Ed., Fernando, R., and S. Stuart, "BGP Monitoring Protocol (BMP)", RFC 7854, DOI 10.17487/RFC7854, June 2016, <https://www.rfc-editor.org/info/rfc7854>.

10.2. URIs

[1] https://www.iana.org/assignments/bmp-parameters/bmp-parameters.xhtml

Acknowledgements

The authors would like to thank John Scudder for his valuable input.

Contributors

Manish Bhardwaj
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: manbhard@cisco.com

Xianyuzheng
Tencent
Tencent Building, Kejizhongyi Avenue,
Hi-techPark, Nanshan District,Shenzhen 518057, P.R.China

Weiguo
Tencent
Tencent Building, Kejizhongyi Avenue,
Hi-techPark, Nanshan District,Shenzhen 518057, P.R.China

Shugang cheng
H3C

Authors' Addresses

Tim Evens
Cisco Systems
2901 Third Avenue, Suite 600
Seattle, WA 98121
USA

Email: tievens@cisco.com

Serpil Bayraktar
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: serpil@cisco.com

Paolo Lucente
NTT Communications
Siriusdreef 70-72
Hoofddorp, WT 2132
NL

Email: paolo@ntt.net

Penghui Mi
Tencent
Tengyun Building,Tower A ,No. 397 Tianlin Road
Shanghai 200233
China

Email: kevinmi@tencent.com

Shunwan Zhuang
Huawei
Huawei Bld., No.156 Beiqing Rd.
Beijing 100095
China

Email: zhuangshunwan@huawei.com

Global Routing Operations
Internet-Draft
Updates: 7854 (if approved)
Intended status: Standards Track
Expires: February 6, 2020

T. Evens
S. Bayraktar
Cisco Systems
P. Lucente
NTT Communications
P. Mi
Tencent
S. Zhuang
Huawei

August 5, 2019

Support for Adj-RIB-Out in BGP Monitoring Protocol (BMP)
draft-ietf-grow-bmp-adj-rib-out-07

Abstract

The BGP Monitoring Protocol (BMP) defines access to only the Adj-RIB-In Routing Information Bases (RIBs). This document updates the BGP Monitoring Protocol (BMP) RFC 7854 by adding access to the Adj-RIB-Out RIBs. It adds a new flag to the peer header to distinguish Adj-RIB-In and Adj-RIB-Out.

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 February 6, 2020.

Table of Contents

1. Introduction

BGP Monitoring Protocol (BMP) defines monitoring of the received (e.g., Adj-RIB-In) Routing Information Bases (RIBs) per peer. The Adj-RIB-In pre-policy conveys to a BMP receiver all RIB data before any policy has been applied. The Adj-RIB-In post-policy conveys to a BMP receiver all RIB data after policy filters and/or modifications have been applied. An example of pre-policy versus post-policy is when an inbound policy applies attribute modification or filters. Pre-policy would contain information prior to the inbound policy changes or filters of data. Post policy would convey the changed data or would not contain the filtered data.

Monitoring the received updates that the router received before any policy has been applied is the primary level of monitoring for most use-cases. Inbound policy validation and auditing is the primary use-case for enabling post-policy monitoring.

In order for a BMP receiver to receive any BGP data, the BMP sender (e.g., router) needs to have an established BGP peering session and actively be receiving updates for an Adj-RIB-In.

Being able to only monitor the Adj-RIB-In puts a restriction on what data is available to BMP receivers via BMP senders (e.g., routers). This is an issue when the receiving end of the BGP peer is not enabled for BMP or when it is not accessible for administrative reasons. For example, a service provider advertises prefixes to a customer, but the service provider cannot see what it advertises via BMP. Asking the customer to enable BMP and monitoring of the Adj-RIB-In is not feasible.

BGP Monitoring Protocol (BMP) RFC 7854 [RFC7854] only defines Adj-RIB-In being sent to BMP receivers. This document updates the per-peer header in section 4.2 of [RFC7854] by adding a new flag to distinguish Adj-RIB-In versus Adj-RIB-Out. BMP senders use the new flag to send either Adj-RIB-In or Adj-RIB-Out.

Adding Adj-RIB-Out provides the ability for a BMP sender to send to BMP receivers what it advertises to BGP peers, which can be used for outbound policy validation and to monitor routes that were advertised.

2. Terminology

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 RFC 2119 [RFC2119] RFC 8174 [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Definitions

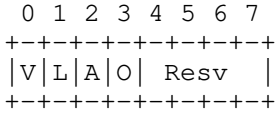
- Adj-RIB-Out: As defined in [RFC4271], "The Adj-RIBs-Out contains the routes for advertisement to specific peers by means of the local speaker's UPDATE messages."

- Pre-Policy Adj-RIB-Out: The result before applying the outbound policy to an Adj-RIB-Out. This normally would match what is in the local RIB.

- Post-Policy Adj-RIB-Out: The result of applying outbound policy to an Adj-RIB-Out. This MUST convey to the BMP receiver what is actually transmitted to the peer.

4. Per-Peer Header

The per-peer header has the same structure and flags as defined in section 4.2 of [RFC7854] with the following O flag addition:



- The O flag indicates Adj-RIB-In if set to 0 and Adj-RIB-Out if set to 1.

The existing flags are defined in section 4.2 of [RFC7854] and the remaining bits are reserved for future use. They MUST be transmitted as 0 and their values MUST be ignored on receipt.

When the O flag is set to 1, the following fields in the Per-Peer Header are redefined:

- Peer Address: The remote IP address associated with the TCP session over which the encapsulated PDU is sent.

- Peer AS: The Autonomous System number of the peer to which the encapsulated PDU is sent.

- Peer BGP ID: The BGP Identifier of the peer to which the encapsulated PDU is sent.

- Timestamp: The time when the encapsulated routes were advertised (one may also think of this as the time when they were installed in the Adj-RIB-Out), expressed in seconds and microseconds since midnight (zero hour), January 1, 1970 (UTC). If zero, the time is unavailable. Precision of the timestamp is implementation-dependent.

5. Adj-RIB-Out

5.1. Post-Policy

The primary use-case in monitoring Adj-RIB-Out is to monitor the updates transmitted to a BGP peer after outbound policy has been applied. These updates reflect the result after modifications and filters have been applied (e.g., Adj-RIB-Out Post-Policy). Some

attributes are set when the BGP message is transmitted, such as next-hop. Adj-RIB-Out Post-Policy MUST convey to the BMP receiver what is actually transmitted to the peer.

The L flag MUST be set to 1 to indicate post-policy.

5.2. Pre-Policy

Similarly to Adj-RIB-In policy validation, pre-policy Adj-RIB-Out can be used to validate and audit outbound policies. For example, a comparison between pre-policy and post-policy can be used to validate the outbound policy.

Depending on BGP peering session type (IBGP, IBGP route reflector client, EBGP, BGP confederations, Route Server Client) the candidate routes that make up the Pre-Policy Adj-RIB-Out do not contain all local-rib routes. Pre-Policy Adj-RIB-Out conveys only routes that are available based on the peering type. Post-Policy represents the filtered/changed routes from the available routes.

Some attributes are set only during transmission of the BGP message, i.e., Post-Policy. It is common that next-hop may be null, loopback, or similar during pre-policy phase. All mandatory attributes, such as next-hop, MUST be either ZERO or have an empty length if they are unknown at the Pre-Policy phase completion. The BMP receiver will treat zero or empty mandatory attributes as self-originated.

The L flag MUST be set to 0 to indicate pre-policy.

6. BMP Messages

Many BMP messages have a per-peer header but some are not applicable to Adj-RIB-In or Adj-RIB-Out monitoring, such as peer up and down notifications. Unless otherwise defined, the O flag should be set to 0 in the per-peer header in BMP messages.

6.1. Route Monitoring and Route Mirroring

The O flag MUST be set accordingly to indicate if the route monitor or route mirroring message conveys Adj-RIB-In or Adj-RIB-Out.

6.2. Statistics Report

The Statistics report message has a Stat Type field to indicate the statistic carried in the Stat Data field. Statistics report messages are not specific to Adj-RIB-In or Adj-RIB-Out and MUST have the O flag set to zero. The O flag SHOULD be ignored by the BMP receiver.

The following new statistic types are added:

- Stat Type = 14: (64-bit Gauge) Number of routes in Adj-RIBs-Out Pre-Policy.

- Stat Type = 15: (64-bit Gauge) Number of routes in Adj-RIBs-Out Post-Policy.

- Stat Type = 16: Number of routes in per-AFI/SAFI Adj-RIB-Out Pre-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

- Stat Type = 17: Number of routes in per-AFI/SAFI Adj-RIB-Out Post-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

6.3. Peer Down and Up Notifications

Peer Up and Down notifications convey BGP peering session state to BMP receivers. The state is independent of whether or not route monitoring or route mirroring messages will be sent for Adj-RIB-In, Adj-RIB-Out, or both. BMP receiver implementations SHOULD ignore the O flag in Peer Up and Down notifications.

6.3.1. Peer Up Information

The following Peer Up message Information TLV type is added:

- Type = 4: Admin Label. The Information field contains a free-form UTF-8 string whose byte length is given by the Information Length field. The value is administratively assigned. There is no requirement to terminate the string with null or any other character.

  Multiple admin labels can be included in the Peer Up notification. When multiple admin labels are included the BMP receiver MUST preserve their order.

  The TLV is optional.

7. Other Considerations

7.1. Peer and Update Groups

Peer and update groups are used to group updates shared by many peers. This is a level of efficiency in implementations, not a true representation of what is conveyed to a peer in either Pre-Policy or Post-Policy.

One of the use-cases to monitor Adj-RIB-Out Post-Policy is to validate and continually ensure the egress updates match what is expected. For example, wholesale peers should never have routes with community X:Y sent to them. In this use-case, there may be hundreds of wholesale peers but a single peer could have represented the group.

From a BMP perspective, this should be simple to include a group name in the Peer Up, but it is more complex than that. BGP implementations have evolved to provide comprehensive and structured policy grouping, such as session, AFI/SAFI, and template-based based group policy inheritances.

This level of structure and inheritance of polices does not provide a simple peer group name or ID, such as wholesale peer.

Instead of requiring a group name to be used, a new administrative label informational TLV (Section 6.3.1) is added to the Peer Up message. These labels have administrative scope relevance. For example, labels "type=wholesale" and "region=west" could be used to monitor expected policies.

Configuration and assignment of labels to peers is BGP implementation specific.

8. Security Considerations

The same considerations as in section 11 of [RFC7854] apply to this document. Implementations of this protocol SHOULD require to establish sessions with authorized and trusted monitoring devices. It is also believed that this document does not add any additional security considerations.

9. IANA Considerations

This document requests that IANA assign the following new parameters to the BMP parameters name space [1].

9.1. BMP Peer Flags

This document defines the following per-peer header flags (Section 4):

- Flag 3 as O flag: The O flag indicates Adj-RIB-In if set to 0 and Adj-RIB-Out if set to 1.

9.2. BMP Statistics Types

This document defines four statistic types for statistics reporting (Section 6.2):

- Stat Type = 14: (64-bit Gauge) Number of routes in Adj-RIBs-Out Pre-Policy.

- Stat Type = 15: (64-bit Gauge) Number of routes in Adj-RIBs-Out Post-Policy.

- Stat Type = 16: Number of routes in per-AFI/SAFI Adj-RIB-Out Pre-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

- Stat Type = 17: Number of routes in per-AFI/SAFI Adj-RIB-Out Post-Policy. The value is structured as: 2-byte Address Family Identifier (AFI), 1-byte Subsequent Address Family Identifier (SAFI), followed by a 64-bit Gauge.

9.3. Peer Up Information TLV

This document defines the following BMP Peer Up Information TLV types (Section 6.3.1):

- Type = 4: Admin Label. The Information field contains a free-form UTF-8 string whose byte length is given by the Information Length field. The value is administratively assigned. There is no requirement to terminate the string with null or any other character.

  Multiple admin labels can be included in the Peer Up notification. When multiple admin labels are included the BMP receiver MUST preserve their order.

  The TLV is optional.

10. References

10.1. Normative References

[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>.

[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>.

[RFC7854] Scudder, J., Ed., Fernando, R., and S. Stuart, "BGP Monitoring Protocol (BMP)", RFC 7854, DOI 10.17487/RFC7854, June 2016, <https://www.rfc-editor.org/info/rfc7854>.

[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>.

10.2. URIs

[1] https://www.iana.org/assignments/bmp-parameters/bmp-parameters.xhtml

Acknowledgements

The authors would like to thank John Scudder and Mukul Srivastava for their valuable input.

Contributors

Manish Bhardwaj
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: manbhard@cisco.com

Xianyuzheng
Tencent
Tencent Building, Kejizhongyi Avenue,
Hi-techPark, Nanshan District,Shenzhen 518057, P.R.China

Weiguo
Tencent
Tencent Building, Kejizhongyi Avenue,
Hi-techPark, Nanshan District,Shenzhen 518057, P.R.China

Shugang cheng
H3C

Authors' Addresses

Tim Evens
Cisco Systems
2901 Third Avenue, Suite 600
Seattle, WA 98121
USA

Email: tievens@cisco.com

Serpil Bayraktar
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: serpil@cisco.com

Paolo Lucente
NTT Communications
Siriusdreef 70-72
Hoofddorp, WT 2132
NL

Email: paolo@ntt.net

Penghui Mi
Tencent
Tengyun Building,Tower A ,No. 397 Tianlin Road
Shanghai 200233
China

Email: kevinmi@tencent.com

Shunwan Zhuang
Huawei
Huawei Bld., No.156 Beiqing Rd.
Beijing 100095
China

Email: zhuangshunwan@huawei.com

Global Routing Operations
Internet-Draft
Updates: 7854 (if approved)
Intended status: Standards Track
Expires: August 27, 2018

T. Evens
S. Bayraktar
M. Bhardwaj
Cisco Systems
P. Lucente
NTT Communications

February 23, 2018

Support for Local RIB in BGP Monitoring Protocol (BMP)
draft-ietf-grow-bmp-local-rib-01

Abstract

The BGP Monitoring Protocol (BMP) defines access to the Adj-RIB-In and locally originated routes (e.g. routes distributed into BGP from protocols such as static) but not access to the BGP instance Loc-RIB. This document updates the BGP Monitoring Protocol (BMP) RFC 7854 by adding access to the BGP instance Local-RIB, as defined in RFC 4271 the routes that have been selected by the local BGP speaker's Decision Process. These are the routes over all peers, locally originated, and after best-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 August 27, 2018.

Copyright Notice

Table of Contents

1. Introduction

The BGP Monitoring Protocol (BMP) suggests that locally originated routes are locally sourced routes, such as redistributed or otherwise added routes to the BGP instance by the local router. It does not specify routes that are in the BGP instance Loc-RIB, such as routes after best-path selection.

Figure 1 shows the flow of received routes from one or more BGP peers into the Loc-RIB.

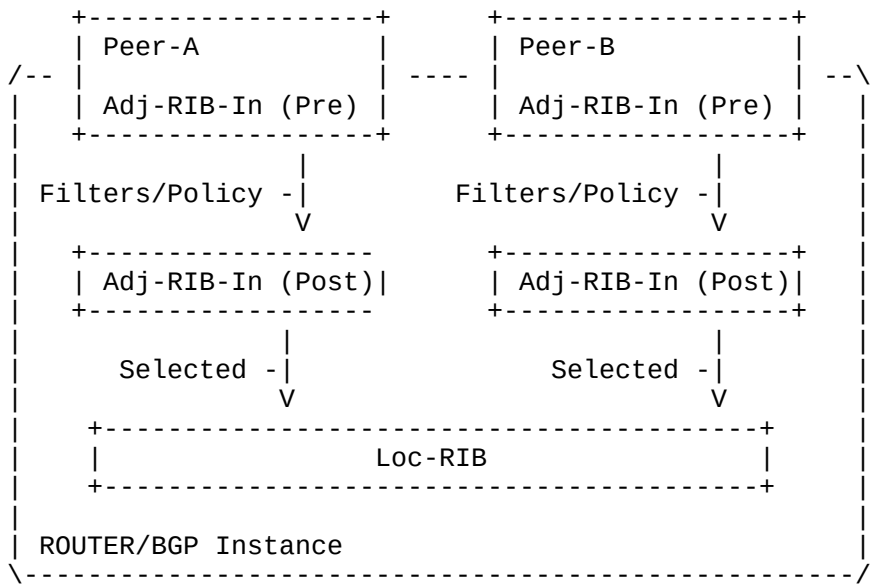


Figure 1: BGP peering Adj-RIBs-In into Loc-RIB

As shown in Figure 2, Locally originated follows a similar flow where the redistributed or otherwise originated routes get installed into the Loc-RIB based on the decision process selection.

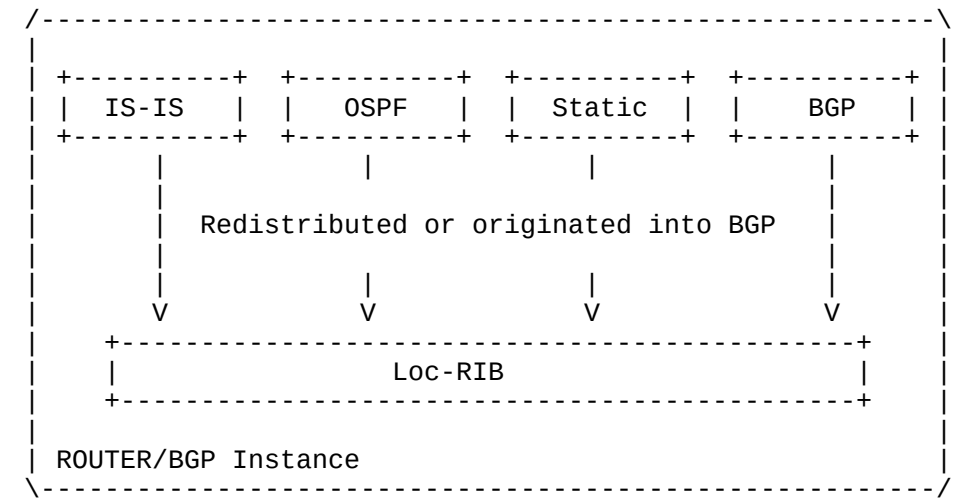


Figure 2: Locally Originated into Loc-RIB

BGP instance Loc-RIB usually provides a similar, if not exact, forwarding information base (FIB) view of the routes from BGP that the router will use. The following are some use-cases for Loc-RIB access:

- Adj-RIBs-In Post-Policy may still contain hundreds of thousands of routes per-peer but only a handful are selected and installed in the Loc-RIB as part of the best-path selection. Some monitoring applications, such as ones that need only to correlate flow records to Loc-RIB entries, only need to collect and monitor the routes that are actually selected and used.

  Requiring the applications to collect all Adj-RIB-In Post-Policy data forces the applications to receive a potentially large unwanted data set and to perform the BGP decision process selection, which includes having access to the IGP next-hop metrics. While it is possible to obtain the IGP topology information using BGP-LS, it requires the application to implement SPF and possibly CSPF based on additional policies. This is overly complex for such a simple application that only needed to have access to the Loc-RIB.

- It is common to see frequent changes over many BGP peers, but those changes do not always result in the router’s Loc-RIB changing. The change in the Loc-RIB can have a direct impact on the forwarding state. It can greatly reduce time to troubleshoot and resolve issues if operators had the history of Loc-RIB changes. For example, a performance issue might have been seen

for only a duration of 5 minutes. Post troubleshooting this issue without Loc-RIB history hides any decision based routing changes that might have happened during those five minutes.

- o Operators may wish to validate the impact of policies applied to Adj-RIB-In by analyzing the final decision made by the router when installing into the Loc-RIB. For example, in order to validate if multi-path prefixes are installed as expected for all advertising peers, the Adj-RIB-In Post-Policy and Loc-RIB needs to be compared. This is only possible if the Loc-RIB is available. Monitoring the Adj-RIB-In for this router from another router to derive the Loc-RIB is likely to not show same installed prefixes. For example, the received Adj-RIB-In will be different if add-paths is not enabled or if maximum number of equal paths are different from Loc-RIB to routes advertised.

This document adds Loc-RIB to the BGP Monitoring Protocol and replaces Section 8.2 [RFC7854] Locally Originated Routes.

1.1. Current Method to Monitor Loc-RIB

Loc-RIB is used to build Adj-RIB-Out when advertising routes to a peer. It is therefore possible to derive the Loc-RIB of a router by monitoring the Adj-RIB-In Pre-Policy from another router. At scale this becomes overly complex and error prone.

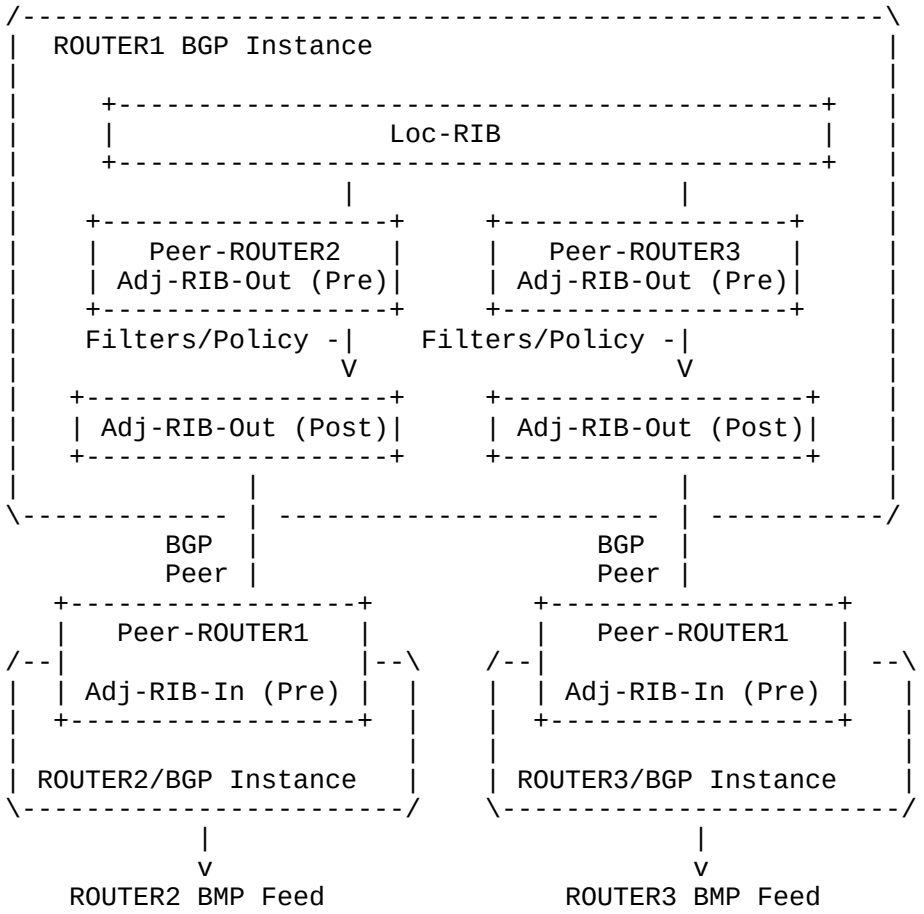


Figure 3: Current method to monitor Loc-RIB

The setup needed to monitor the Loc-RIB of a router requires another router with a peering session to the target router that is to be monitored. As shown in Figure 3, the target router Loc-RIB is advertised via Adj-RIB-Out to the BMP router over a standard BGP peering session. The BMP router then forwards Adj-RIB-In Pre-Policy to the BMP receiver.

The current method introduces the need for additional resources:

- Requires at least two routers when only one router was to be monitored.

- Requires additional BGP peering to collect the received updates when peering may have not even been required in the first place. For example, VRF's with no peers, redistributed bgp-ls with no peers, segment routing egress peer engineering where no peers have link-state address family enabled.

Complexities introduced with current method in order to derive (e.g. correlate) peer to router Loc-RIB:

- Adj-RIB-Out received as Adj-RIB-In from another router may have a policy applied that filters, generates aggregates, suppresses more specifics, manipulates attributes, or filters routes. Not only does this invalidate the Loc-RIB view, it adds complexity when multiple BMP routers may have peering sessions to the same router. The BMP receiver user is left with the error prone task of identifying which peering session is the best representative of the Loc-RIB.

- BGP peering is designed to work between administrative domains and therefore does not need to include internal system level information of each peering router (e.g. the system name or version information). In order to derive a Loc-RIB to a router, the router name or other system information is needed. The BMP receiver and user are forced to do some type of correlation using what information is available in the peering session (e.g. peering addresses, ASNs, and BGP-ID's). This leads to error prone correlations.

- The BGP-ID's and session addresses to router correlation requires additional data, such as router inventory. This additional data provides the BMP receiver the ability to map and correlate the BGP-ID's and/or session addresses, but requires the BMP receiver to somehow obtain this data outside of BMP. How this data is obtained and the accuracy of the data directly effects the integrity of the correlation.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Definitions

- Adj-RIB-In: As defined in [RFC4271], "The Adj-RIBs-In contains unprocessed routing information that has been advertised to the local BGP speaker by its peers." This is also referred to as the pre-policy Adj-RIB-In in this document.

- Adj-RIB-Out: As defined in [RFC4271], "The Adj-RIBs-Out contains the routes for advertisement to specific peers by means of the local speaker's UPDATE messages."

- Loc-RIB: As defined in [RFC4271], "The Loc-RIB contains the routes that have been selected by the local BGP speaker's Decision Process." It is further defined that the routes selected include locally originated and routes from all peers.

- Pre-Policy Adj-RIB-Out: The result before applying the outbound policy to an Adj-RIB-Out. This normally represents a similar view of the Loc-RIB but may contain additional routes based on BGP peering configuration.

- Post-Policy Adj-RIB-Out: The result of applying outbound policy to an Adj-RIB-Out. This MUST be what is actually sent to the peer.

4. Per-Peer Header

4.1. Peer Type

A new peer type is defined for Loc-RIB to distinguish that it represents Loc-RIB with or without RD and local instances. Section 4.2 [RFC7854] defines a Local Instance Peer type, which is for the case of non-RD peers that have an instance identifier.

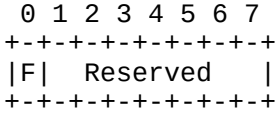
This document defines the following new peer type:

- Peer Type = TBD: Loc-RIB Instance Peer

4.2. Peer Flags

In section 4.2 [RFC7854], the "locally sourced routes" comment under the L flag description is removed. Locally sourced routes MUST be conveyed using the Loc-RIB instance peer type.

The per-peer header flags for Loc-RIB Instance Peer type are defined as follows:



- The F flag indicates that the Loc-RIB is filtered. This indicates that the Loc-RIB does not represent the complete routing table.

The remaining bits are reserved for future use. They SHOULD be transmitted as 0 and their values MUST be ignored on receipt.

5. Loc-RIB Monitoring

Loc-RIB contains all routes from BGP peers as well as any and all routes redistributed or otherwise locally originated. In this context, only the BGP instance Loc-RIB is included. Routes from other routing protocols that have not been redistributed, originated by or into BGP, or received via Adj-RIB-In are not considered.

Loc-RIB in this context does not attempt to maintain a pre-policy and post-policy representation. Loc-RIB is the selected and used routes, which is equivalent to post-policy.

For example, VRF "Blue" imports several targets but filters out specific routes. The end result of VRF "Blue" Loc-RIB is conveyed. Even though the import is filtered, the result is complete for VRF "Blue" Loc-RIB. The F flag is not set in this case since the Loc-RIB is complete and not filtered to the BMP receiver.

5.1. Per-Peer Header

All peer messages that include a per-peer header MUST use the following values:

- Peer Type: Set to TBD to indicate Loc-RIB Instance Peer.
- Peer Distinguisher: Zero filled if the Loc-RIB represents the global instance. Otherwise set to the route distinguisher or unique locally defined value of the particular instance the Loc-RIB belongs to.
- Peer Address: Zero-filled. Remote peer address is not applicable. The V flag is not applicable with Local-RIB Instance peer type considering addresses are zero-filed.
- Peer AS: Set to the BGP instance global or default ASN value.
- Peer BGP ID: Set to the BGP instance global or RD (e.g. VRF) specific router-id.

5.2. Peer UP Notification

Peer UP notifications follow section 4.10 [RFC7854] with the following clarifications:

- Local Address: Zero-filled, local address is not applicable.

- Local Port: Set to 0, local port is not applicable.

- Remote Port: Set to 0, remote port is not applicable.

- Sent OPEN Message: This is a fabricated BGP OPEN message. Capabilities MUST include 4-octet ASN and all necessary capabilities to represent the Loc-RIB route monitoring messages. Only include capabilities if they will be used for Loc-RIB monitoring messages. For example, if add-paths is enabled for IPv6 and Loc-RIB contains additional paths, the add-paths capability should be included for IPv6. In the case of add-paths, the capability intent of advertise, receive or both can be ignored since the presence of the capability indicates enough that add-paths will be used for IPv6.

- Received OPEN Message: Repeat of the same Sent Open Message. The duplication allows the BMP receiver to use existing parsing.

5.2.1. Peer UP Information

The following peer UP information TLV types are added:

- Type = TBD: VRF/Table Name. The Information field contains an ASCII string whose value MUST be equal to the value of the VRF or table name (e.g. RD instance name) being conveyed. The string size MUST be within the range of 1 to 255 bytes.

  The VRF/Table Name TLV is optionally included. For consistency, it is RECOMMENDED that the VRF/Table Name always be included. The default value of "global" SHOULD be used for the default Loc-RIB instance with a zero-filled distinguisher. If the TLV is included, then it SHOULD also be included in the Peer Down notification.

5.3. Peer Down Notification

Peer down notification SHOULD follow the section 4.9 [RFC7854] reason 2.

The VRF/Table Name informational TLV SHOULD be included if it was in the Peer UP.

5.4. Route Monitoring

Route Monitoring messages are used for initial synchronization of the Loc-RIB. They are also used to convey incremental Loc-RIB changes.

As defined in section 4.3 [RFC7854], "Following the common BMP header and per-peer header is a BGP Update PDU."

5.4.1. ASN Encoding

Loc-RIB route monitor messages MUST use 4-byte ASN encoding as indicated in PEER UP sent OPEN message (Section 5.2) capability.

5.4.2. Granularity

State compression and throttling SHOULD be used by a BMP sender to reduce the amount of route monitoring messages that are transmitted to BMP receivers. With state compression, only the final resultant updates are sent.

For example, prefix 10.0.0.0/8 is updated in the Loc-RIB 5 times within 1 second. State compression of BMP route monitor messages results in only the final change being transmitted. The other 4 changes are suppressed because they fall within the compression interval. If no compression was being used, all 5 updates would have been transmitted.

A BMP receiver SHOULD expect that Loc-RIB route monitoring granularity can be different by BMP sender implementation.

5.5. Route Mirroring

Route mirroring is not applicable to Loc-RIB.

5.6. Statistics Report

Not all Stat Types are relevant to Loc-RIB. The Stat Types that are relevant are listed below:

- Stat Type = 8: (64-bit Gauge) Number of routes in Loc-RIB.
- Stat Type = 10: Number of routes in per-AFI/SAFI Loc-RIB. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

6. Other Considerations

6.1. Loc-RIB Implementation

There are several methods to implement Loc-RIB efficiently. In all methods, the implementation emulates a peer with Peer UP and DOWN messages to convey capabilities as well as Route Monitor messages to

convey Loc-RIB. In this sense, the peer that conveys the Loc-RIB is a local router emulated peer.

6.1.1. Multiple Loc-RIB Peers

There MUST be multiple emulated peers for each Loc-RIB instance, such as with VRF's. The BMP receiver identifies the Loc-RIB's by the peer header distinguisher and BGP ID. The BMP receiver uses the VRF/ Table Name from the PEER UP information to associate a name to the Loc-RIB.

In some implementations, it might be required to have more than one emulated peer for Loc-RIB to convey different address families for the same Loc-RIB. In this case, the peer distinguisher and BGP ID should be the same since it represents the same Loc-RIB instance. Each emulated peer instance MUST send a PEER UP with the OPEN message indicating the address family capabilities. A BMP receiver MUST process these capabilities to know which peer belongs to which address family.

6.1.2. Filtering Loc-RIB to BMP Receivers

There maybe be use-cases where BMP receivers should only receive specific routes from Loc-RIB. For example, IPv4 unicast routes may include IBGP, EBGP, and IGP but only routes from EBGP should be sent to the BMP receiver. Alternatively, it may be that only IBGP and EBGP that should be sent and IGP redistributed routes should be excluded. In these cases where the Loc-RIB is filtered, the F flag is set to 1 to indicate to the BMP receiver that the Loc-RIB is filtered.

7. Security Considerations

It is not believed that this document adds any additional security considerations.

8. IANA Considerations

This document requests that IANA assign the following new parameters to the BMP parameters name space [1].

8.1. BMP Peer Type

This document defines a new peer type (Section 4.1):

- Peer Type = TBD: Loc-RIB Instance Peer

8.2. BMP Peer Flags

This document defines a new flag (Section 4.2) and proposes that peer flags are specific to the peer type:

- The F flag indicates that the Loc-RIB is filtered. This indicates that the Loc-RIB does not represent the complete routing table.

8.3. Peer UP Information TLV

This document defines the following new BMP PEER UP informational message TLV types (Section 5.2.1):

- Type = TBD: VRF/Table Name. The Information field contains an ASCII string whose value MUST be equal to the value of the VRF or table name (e.g. RD instance name) being conveyed. The string size MUST be within the range of 1 to 255 bytes.

9. References

9.1. Normative References

[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>.

[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>.

[RFC7854] Scudder, J., Ed., Fernando, R., and S. Stuart, "BGP Monitoring Protocol (BMP)", RFC 7854, DOI 10.17487/RFC7854, June 2016, <https://www.rfc-editor.org/info/rfc7854>.

9.2. URIs

[1] https://www.iana.org/assignments/bmp-parameters/bmp-parameters.xhtml

Acknowledgements

The authors would like to thank John Scudder for his valuable input.

Authors' Addresses

Tim Evens
Cisco Systems
2901 Third Avenue, Suite 600
Seattle, WA 98121
USA

Email: tievens@cisco.com

Serpil Bayraktar
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: serpil@cisco.com

Manish Bhardwaj
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
USA

Email: manbhard@cisco.com

Paolo Lucente
NTT Communications
Siriusdreef 70-72
Hoofddorp, WT 2132
NL

Email: paolo@ntt.net

Global Routing Operations
Internet-Draft
Updates: 7854 (if approved)
Intended status: Standards Track
Expires: 20 May 2021

T. Evens
S. Bayraktar
M. Bhardwaj
Cisco Systems
P. Lucente
NTT Communications

16 November 2020

Support for Local RIB in BGP Monitoring Protocol (BMP)
draft-ietf-grow-bmp-local-rib-08

Abstract

The BGP Monitoring Protocol (BMP) defines access to various Routing Information Bases (RIBs). This document updates BMP (RFC 7854) by adding access to the Local Routing Information Base (Loc-RIB), as defined in RFC 4271. The Loc-RIB contains the routes that have been selected by the local BGP speaker's Decision Process.

Table of Contents

1. Introduction

This document defines a mechanism to monitor the BGP Loc-RIB state of remote BGP instances without the need to establish BGP peering sessions. BMP [RFC7854] does not define a method to send the BGP instance Loc-RIB. It does define in section 8.2 of [RFC7854] locally originated routes, but these routes are defined as the routes originated into BGP. For example, locally sourced routes that are redistributed.

Figure 1 shows the flow of received routes from one or more BGP peers into the Loc-RIB.

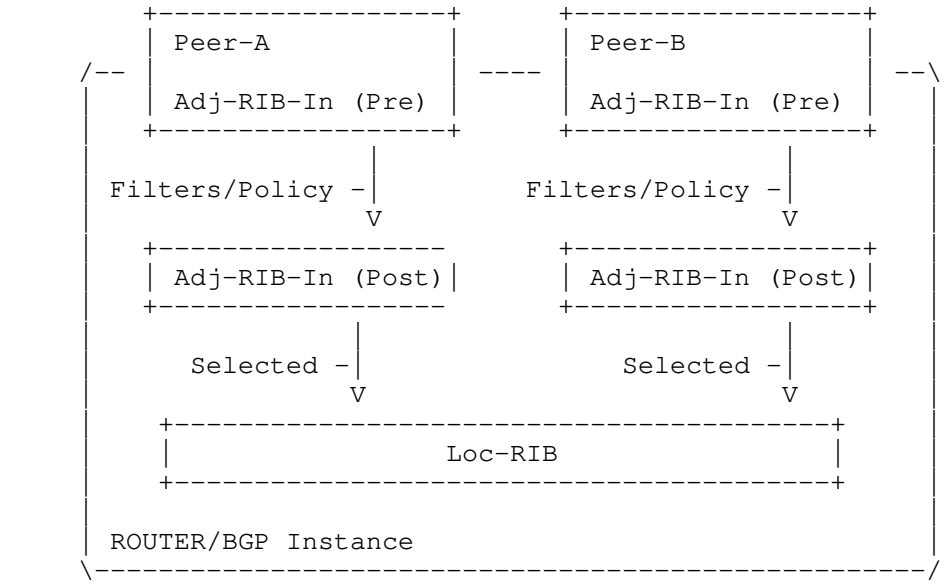


Figure 1: BGP peering Adj-RIBs-In into Loc-RIB

As shown in Figure 2, Locally originated section 9.4 of [RFC4271] follows a similar flow where the redistributed or otherwise originated routes get installed into the Loc-RIB based on the decision process selection.

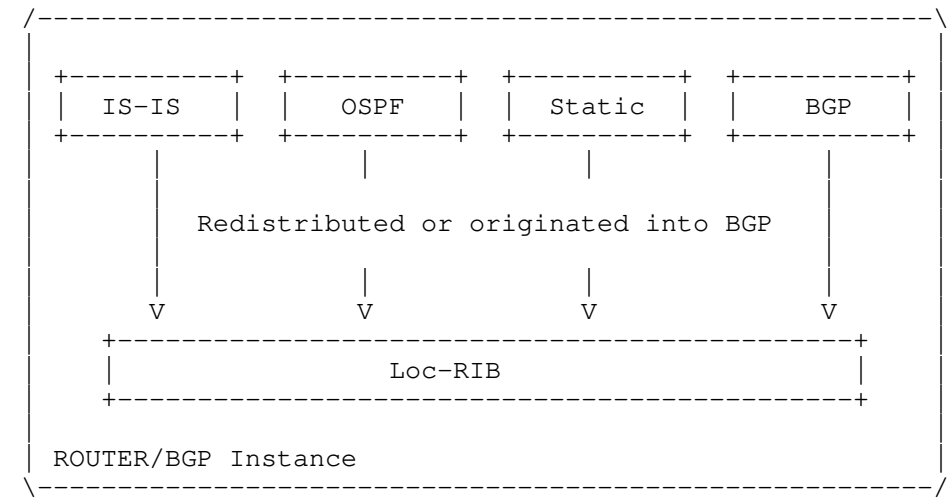


Figure 2: Locally Originated into Loc-RIB

The following are some use-cases for Loc-RIB access:

* The Adj-RIB-In for a given peer Post-Policy may contain hundreds of thousands of routes, with only a handful of routes selected and installed in the Loc-RIB after best-path selection. Some monitoring applications, such as ones that need only to correlate flow records to Loc-RIB entries, only need to collect and monitor the routes that are actually selected and used.

  Requiring the applications to collect all Adj-RIB-In Post-Policy data forces the applications to receive a potentially large unwanted data set and to perform the BGP decision process selection, which includes having access to the IGP next-hop metrics. While it is possible to obtain the IGP topology information using BGP-LS, it requires the application to implement SPF and possibly CSPF based on additional policies. This is overly complex for such a simple application that only needed to have access to the Loc-RIB.

* It is common to see frequent changes over many BGP peers, but those changes do not always result in the router's Loc-RIB changing. The change in the Loc-RIB can have a direct impact on the forwarding state. It can greatly reduce time to troubleshoot and resolve issues if operators had the history of Loc-RIB changes. For example, a performance issue might have been seen for only a duration of 5 minutes. Post troubleshooting this issue without Loc-RIB history hides any decision based routing changes that might have happened during those five minutes.

* Operators may wish to validate the impact of policies applied to Adj-RIB-In by analyzing the final decision made by the router when installing into the Loc-RIB. For example, in order to validate if multi-path prefixes are installed as expected for all advertising peers, the Adj-RIB-In Post-Policy and Loc-RIB needs to be compared. This is only possible if the Loc-RIB is available. Monitoring the Adj-RIB-In for this router from another router to derive the Loc-RIB is likely to not show same installed prefixes. For example, the received Adj-RIB-In will be different if add-paths is not enabled or if maximum number of equal paths are different from Loc-RIB to routes advertised.

This document adds Loc-RIB to the BGP Monitoring Protocol and replaces Section 8.2 of [RFC7854] Locally Originated Routes.

1.1. Alternative Method to Monitor Loc-RIB

Loc-RIB is used to build Adj-RIB-Out when advertising routes to a peer. It is therefore possible to derive the Loc-RIB of a router by monitoring the Adj-RIB-In Pre-Policy from another router. At scale this becomes overly complex and error prone.

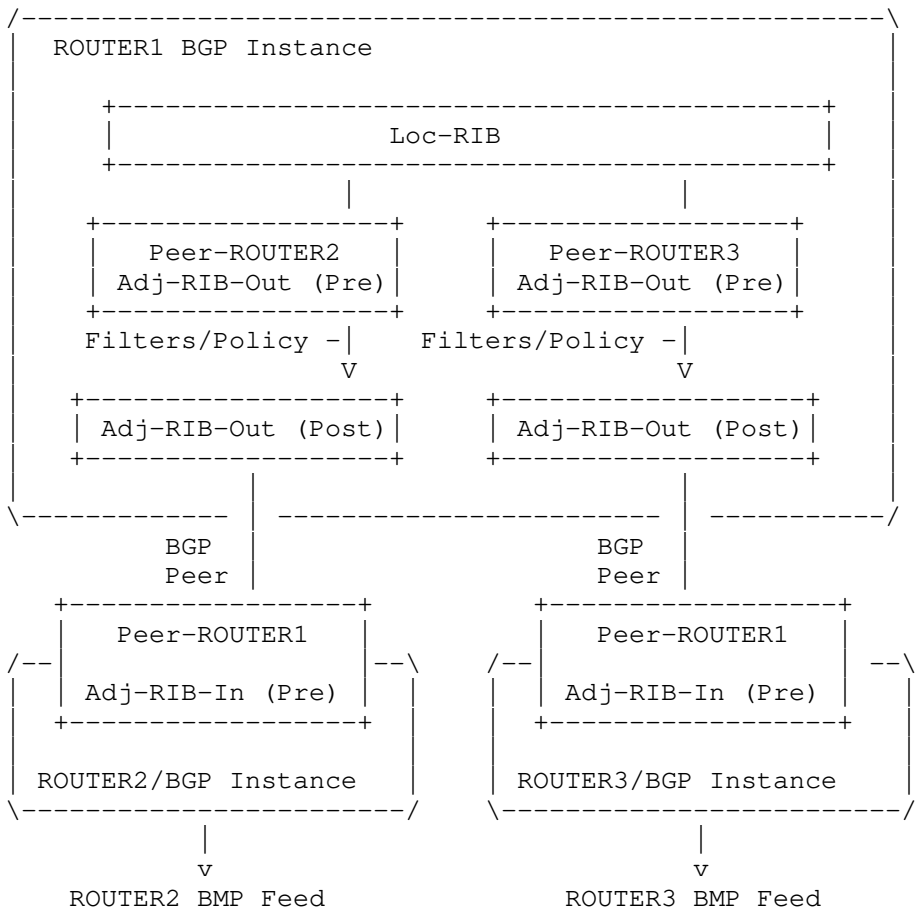


Figure 3: Alternative method to monitor Loc-RIB

The setup needed to monitor the Loc-RIB of a router requires another router with a peering session to the target router that is to be monitored. As shown in Figure 3, the target router Loc-RIB is advertised via Adj-RIB-Out to the BMP router over a standard BGP peering session. The BMP router then forwards Adj-RIB-In Pre-Policy to the BMP receiver.

The current method introduces the need for additional resources:

* Requires at least two routers when only one router was to be monitored.

* Requires additional BGP peering to collect the received updates when peering may have not even been required in the first place. For example, VRFs with no peers, redistributed BGP-LS with no peers, segment routing egress peer engineering where no peers have link-state address family enabled.

Complexities introduced with current method in order to derive (e.g. correlate) peer to router Loc-RIB:

* Adj-RIB-Out received as Adj-RIB-In from another router may have a policy applied that filters, generates aggregates, suppresses more specifics, manipulates attributes, or filters routes. Not only does this invalidate the Loc-RIB view, it adds complexity when multiple BMP routers may have peering sessions to the same router. The BMP receiver user is left with the error prone task of identifying which peering session is the best representative of the Loc-RIB.

* BGP peering is designed to work between administrative domains and therefore does not need to include internal system level information of each peering router (e.g. the system name or version information). In order to derive a Loc-RIB to a router, the router name or other system information is needed. The BMP receiver and user are forced to do some type of correlation using what information is available in the peering session (e.g. peering addresses, ASNs, and BGP-IDs). This leads to error prone correlations.

* The BGP-IDs and session addresses to router correlation requires additional data, such as router inventory. This additional data provides the BMP receiver the ability to map and correlate the BGP-IDs and/or session addresses, but requires the BMP receiver to somehow obtain this data outside of BMP. How this data is obtained and the accuracy of the data directly effects the integrity of the correlation.

2. Terminology

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 RFC 2119 [RFC2119] RFC 8174 [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Definitions

* BGP Instance: it refers to an instance of an instance of BGP-4 [RFC4271] and considerations in section 8.1 of [RFC7854] do apply to it.

* Adj-RIB-In: As defined in [RFC4271], "The Adj-RIBs-In contains unprocessed routing information that has been advertised to the local BGP speaker by its peers." This is also referred to as the pre-policy Adj-RIB-In in this document.

* Adj-RIB-Out: As defined in [RFC4271], "The Adj-RIBs-Out contains the routes for advertisement to specific peers by means of the local speaker's UPDATE messages."

* Loc-RIB: As defined in section 9.4 of [RFC4271], "The Loc-RIB contains the routes that have been selected by the local BGP speaker's Decision Process." Note that the Loc-RIB state as monitored through BMP might also contain routes imported from other routing protocols such as an IGP, or local static routes.

* Pre-Policy Adj-RIB-Out: The result before applying the outbound policy to an Adj-RIB-Out. This normally represents a similar view of the Loc-RIB but may contain additional routes based on BGP peering configuration.

* Post-Policy Adj-RIB-Out: The result of applying outbound policy to an Adj-RIB-Out. This MUST be what is actually sent to the peer.

4. Per-Peer Header

4.1. Peer Type

A new peer type is defined for Loc-RIB to distinguish that it represents Loc-RIB with or without RD and local instances. Section 4.2 of [RFC7854] defines a Local Instance Peer type, which is for the case of non-RD peers that have an instance identifier.

This document defines the following new peer type:

* Peer Type = 3: Loc-RIB Instance Peer

4.2. Peer Flags

In section 4.2 of [RFC7854], the "locally sourced routes" comment under the L flag description is removed. Locally sourced routes MUST be conveyed using the Loc-RIB instance peer type.

The per-peer header flags for Loc-RIB Instance Peer type are defined as follows:

* The F flag indicates that the Loc-RIB is filtered. This MUST be set when only a subset of Loc-RIB routes is sent to the BMP collector.

  The remaining bits are reserved for future use. They MUST be transmitted as 0 and their values MUST be ignored on receipt.

5. Loc-RIB Monitoring

The Loc-RIB contains all routes selected by the BGP protocol Decision Process section 9.1 of [RFC4271]. These routes include those learned from BGP peers via its Adj-RIBs-In post-policy, as well as routes learned by other means section 9.4 of [RFC4271]. Examples of these include redistribution of routes from other protocols into BGP or otherwise locally originated (ie. aggregate routes).

As mentioned in Section 4.2 a subset of Loc-RIB routes MAY be sent to a BMP collector by setting the F flag.

5.1. Per-Peer Header

All peer messages that include a per-peer header MUST use the following values:

* Peer Type: Set to 3 to indicate Loc-RIB Instance Peer.

* Peer Distinguisher: Zero filled if the Loc-RIB represents the global instance. Otherwise set to the route distinguisher or unique locally defined value of the particular instance the Loc-RIB belongs to.

* Peer Address: Zero-filled. Remote peer address is not applicable. The V flag is not applicable with Loc-RIB Instance peer type considering addresses are zero-filed.

* Peer AS: Set to the BGP instance global or default ASN value.

* Peer BGP ID: Set to the BGP instance global or RD (e.g. VRF) specific router-id section 1.1 of [RFC7854].

* Timestamp: The time when the encapsulated routes were installed in The Loc-RIB, expressed in seconds and microseconds since midnight (zero hour), January 1, 1970 (UTC). If zero, the time is unavailable. Precision of the timestamp is implementation-dependent.

5.2. Peer UP Notification

Peer UP notifications follow section 4.10 of [RFC7854] with the following clarifications:

* Local Address: Zero-filled, local address is not applicable.

* Local Port: Set to 0, local port is not applicable.

* Remote Port: Set to 0, remote port is not applicable.

* Sent OPEN Message: This is a fabricated BGP OPEN message. Capabilities MUST include 4-octet ASN and all necessary capabilities to represent the Loc-RIB route monitoring messages. Only include capabilities if they will be used for Loc-RIB monitoring messages. For example, if add-paths is enabled for IPv6 and Loc-RIB contains additional paths, the add-paths capability should be included for IPv6. In the case of add-paths, the capability intent of advertise, receive or both can be ignored since the presence of the capability indicates enough that add-paths will be used for IPv6.

* Received OPEN Message: Repeat of the same Sent Open Message. The duplication allows the BMP receiver to use existing parsing.

5.2.1. Peer UP Information

The following Peer UP information TLV type is added:

* Type = 3: VRF/Table Name. The Information field contains a UTF-8 string whose value MUST be equal to the value of the VRF or table name (e.g. RD instance name) being conveyed. The string size MUST be within the range of 1 to 255 bytes.

  The VRF/Table Name TLV is optionally included. For consistency, it is RECOMMENDED that the VRF/Table Name always be included. The default value of "global" MUST be used for the default Loc-RIB instance with a zero-filled distinguisher. If the TLV is included, then it MUST also be included in the Peer Down notification.

Multiple TLVs of the same type can be repeated as part of the same message, for example to convey a filtered view of a VRF. A BMP receiver should append multiple TLVs of the same type to a set in order to support alternate or additional names for the same peer. If multiple strings are included, their ordering MUST be preserved when they are reported.

5.3. Peer Down Notification

Peer down notification MUST use reason code TBD3. Following the reason is data in TLV format. The following peer Down information TLV type is defined:

* Type = 3: VRF/Table Name. The Information field contains a UTF-8 string whose value MUST be equal to the value of the VRF or table name (e.g. RD instance name) being conveyed. The string size MUST be within the range of 1 to 255 bytes. The VRF/Table Name informational TLV MUST be included if it was in the Peer UP.

5.4. Route Monitoring

Route Monitoring messages are used for initial synchronization of the Loc-RIB. They are also used to convey incremental Loc-RIB changes.

As defined in section 4.3 of [RFC7854], "Following the common BMP header and per-peer header is a BGP Update PDU."

5.4.1. ASN Encoding

Loc-RIB route monitor messages MUST use 4-byte ASN encoding as indicated in PEER UP sent OPEN message (Section 5.2) capability.

5.4.2. Granularity

State compression and throttling SHOULD be used by a BMP sender to reduce the amount of route monitoring messages that are transmitted to BMP receivers. With state compression, only the final resultant updates are sent.

For example, prefix 10.0.0.0/8 is updated in the Loc-RIB 5 times within 1 second. State compression of BMP route monitor messages results in only the final change being transmitted. The other 4 changes are suppressed because they fall within the compression interval. If no compression was being used, all 5 updates would have been transmitted.

A BMP receiver should expect that Loc-RIB route monitoring granularity can be different by BMP sender implementation.

5.5. Route Mirroring

Route mirroring is not applicable to Loc-RIB and Route Mirroring messages SHOULD be ignored.

5.6. Statistics Report

Not all Stat Types are relevant to Loc-RIB. The Stat Types that are relevant are listed below:

* Stat Type = 8: (64-bit Gauge) Number of routes in Loc-RIB.

* Stat Type = 10: Number of routes in per-AFI/SAFI Loc-RIB. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

6. Other Considerations

6.1. Loc-RIB Implementation

There are several methods for a BGP speaker to implement Loc-RIB efficiently. In all methods, the implementation emulates a peer with Peer UP and DOWN messages to convey capabilities as well as Route Monitor messages to convey Loc-RIB. In this sense, the peer that conveys the Loc-RIB is a local router emulated peer.

6.1.1. Multiple Loc-RIB Peers

There MUST be multiple emulated peers for each Loc-RIB instance, such as with VRFs. The BMP receiver identifies the Loc-RIB by the peer header distinguisher and BGP ID. The BMP receiver uses the VRF/ Table Name from the PEER UP information to associate a name to the Loc-RIB.

In some implementations, it might be required to have more than one emulated peer for Loc-RIB to convey different address families for the same Loc-RIB. In this case, the peer distinguisher and BGP ID should be the same since it represents the same Loc-RIB instance. Each emulated peer instance MUST send a PEER UP with the OPEN message indicating the address family capabilities. A BMP receiver MUST process these capabilities to know which peer belongs to which address family.

6.1.2. Filtering Loc-RIB to BMP Receivers

There maybe be use-cases where BMP receivers should only receive specific routes from Loc-RIB. For example, IPv4 unicast routes may include IBGP, EBGP, and IGP but only routes from EBGP should be sent to the BMP receiver. Alternatively, it may be that only IBGP and EBGP that should be sent and IGP redistributed routes should be excluded. In these cases where the Loc-RIB is filtered, the F flag is set to 1 to indicate to the BMP receiver that the Loc-RIB is filtered. If multiple filters are associated to the same Loc-RIB, a Table Name MUST be used in order to allow a BMP receiver to make the right associations.

6.1.3. Changes to existing BMP sessions

In case of any change that results in the alteration of behaviour of an existing BMP session, ie. changes to filtering and table names, the session MUST be bounced with a Peer DOWN/Peer UP sequence.

7. Security Considerations

The same considerations as in section 11 of [RFC7854] apply to this document. Implementations of this protocol SHOULD require to establish sessions with authorized and trusted monitoring devices. It is also believed that this document does not add any additional security considerations.

8. IANA Considerations

This document requests that IANA assign the following new parameters to the BMP parameters name space (https://www.iana.org/assignments/bmp-parameters/bmp-parameters.xhtml).

8.1. BMP Peer Type

This document defines a new peer type (Section 4.1):

* Peer Type = 3: Loc-RIB Instance Peer

8.2. BMP Peer Flags

This document defines a new flag (Section 4.2) and proposes that peer flags are specific to the peer type:

* The F flag indicates that the Loc-RIB is filtered. This indicates that the Loc-RIB does not represent the complete routing table.

8.3. Peer UP Information TLV

This document defines the following new BMP PEER UP informational message TLV types (Section 5.2.1):

* Type = 3: VRF/Table Name. The Information field contains a UTF-8 string whose value MUST be equal to the value of the VRF or table name (e.g. RD instance name) being conveyed. The string size MUST be within the range of 1 to 255 bytes.

8.4. Peer Down Reason code

This document defines the following new BMP Peer Down reason code (Section 5.3):

* Type = TBD3: Local system closed, TLV data follows.

9. Normative References

[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>.

[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>.

[RFC7854] Scudder, J., Ed., Fernando, R., and S. Stuart, "BGP Monitoring Protocol (BMP)", RFC 7854, DOI 10.17487/RFC7854, June 2016, <https://www.rfc-editor.org/info/rfc7854>.

[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>.

Acknowledgements

The authors would like to thank John Scudder, Jeff Haas and Mukul Srivastava for their valuable input.

Authors' Addresses

Tim Evens
Cisco Systems
2901 Third Avenue, Suite 600

Seattle, WA 98121
United States of America

Email: tievens@cisco.com

Serpil Bayraktar
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
United States of America

Email: serpil@cisco.com

Manish Bhardwaj
Cisco Systems
3700 Cisco Way
San Jose, CA 95134
United States of America

Email: manbhard@cisco.com

Paolo Lucente
NTT Communications
Siriusdreef 70-72
2132 Hoofddorp
Netherlands

Email: paolo@ntt.net

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: August 31, 2018

J. Borkenhagen
AT&T
R. Bush
Internet Initiative Japan
R. Bonica
Juniper Networks
S. Bayraktar
Cisco Systems
February 27, 2018

Well-Known Community Policy Behavior
draft-ymbk-grow-wkc-behavior-00

Abstract

Well-Known BGP Communities are manipulated inconsistently by current implementations. This results in difficulties for operators. It is recommended that removal policies be applied consistently to Well-Known Communities.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [RFC2119] only when they appear in all upper case. They may also appear in lower or mixed case as English words, without normative meaning.

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 August 31, 2018.

Table of Contents

1. Introduction

The BGP Communities Attribute was specified in [RFC1997] which introduced the concept of Well-Known Communities. In hindsight, it did not prescribe as fully as it should have how Well-Known Communities may be manipulated by policies applied by operators. Currently, implementations differ in this regard, and these differences can result in inconsistent behaviors that operators find difficult to identify and resolve.

This document describes the current behavioral differences in order to assist operators in generating consistent community-manipulation policies in a multi-vendor environment, and to prevent the introduction of additional divergence in implementations.

2. Manipulation of Communities by Policy

[RFC1997] says:

"A BGP speaker receiving a route with the COMMUNITIES path attribute may modify this attribute according to the local policy."

One common operational need is to add or remove one or more communities to the current set. Another common need is to replace all received communities with a new set as defined by policy. All BGP policy implementations we know of provide syntax to "set" a community that operators use to mean "remove any/all communities present on the update received from the neighbor, and apply this set of communities instead."

3. Community Manipulation Policy Differences

Vendor implementations differ in the treatment of certain Well-Known communities when modified using the syntax to "set" the community. Some replace all communities including the Well-Known ones with the new set, while others replace all non-Well-Known Communities but do not modify any Well-Known Communities that are present.

These differences result in what would appear to be identical policy configurations having very different results on different platforms.

4. Documentation of Vendor Implementations

In Juniper Networks' JunOS, "community set" removes all received communities, Well-Known or otherwise.

In Cisco Systems' IOS-XR, "set community" removes all received communities except for the following:

Numeric	Common Name
0:0	internet
65535:0	graceful-shutdown
65535:1	accept-own rfc7611
65535:65281	NO_EXPORT
65535:65282	NO_ADVERTISE
65535:65283	NO_EXPORT_SUBCONFED (or local-AS)

Communities not removed by Cisco IOS/XR

Table 1

IOS-XR does allow Well-Known communities to be removed one at a time by explicit policy; for example, "delete community accept-own". Operators are advised to consult IOS-XR documentation and/or Cisco Systems support for full details.

4.1. Note on an Inconsistency

The IANA publishes a list of Well-Known Communities [IANA-WKS].

IOS-XR's set of well-known communities that "set community" will not overwrite diverges from IANA's list. Quite a few well-known communities from IANA's list do not receive special treatment in IOS-XR, and at least one specific community on IOS-XR's special treatment list (internet == 0:0) is not really on IANA's list -- it's taken from the "Reserved" range [0x00000000-0x0000FFFF].

This merely notes an inconsistency. It is not a plea to 'protect' the entire IANA list from "set community."

5. Note for Those Writing RFCs for New Community-Like Attributes

Care should be taken when establishing new [RFC1997]-like attributes (large communities, wide communities, etc) to avoid repeating this mistake.

6. Action Items

Unfortunately, it would be operationally disruptive for vendors to change their current implementations.

Vendors SHOULD share the behavior of their implementations for inclusion in this document, especially if their behavior differs from the examples described.

For new well-known communities specified (after this draft), vendors MUST treat "community set" command to mean "remove all other communities, Well-Known or otherwise."

7. Security Considerations

Surprising defaults and/or undocumented behaviors are not good for security. This document attepts to remedy that.

8. IANA Considerations

This document has no IANA Considerations other than to be aware that any future Well-Known Communities will be subject to the policy treatment described here.

9. Normative References

[IANA-WKS] "IANA Well-Known Comunities", <https://www.iana.org/assignments/bgp-well-known-communities/bgp-well-known-communities.xhtml>.

[RFC1997] Chandra, R., Traina, P., and T. Li, "BGP Communities Attribute", RFC 1997, DOI 10.17487/RFC1997, August 1996, <http://www.rfc-editor.org/info/rfc1997>.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

Authors' Addresses

Jay Borkenhagen
AT&T
200 Laurel Avenue South
Middletown, NJ 07748
United States of America

Email: jayb@att.net

Randy Bush
Internet Initiative Japan
5147 Crystal Springs
Bainbridge Island, WA 98110
United States of America

Email: randy@psg.com

Ron Bonica
Juniper Networks
2251 Corporate Park Drive
Herndon, VA 20171
US

Email: rbonica@juniper.net

Serpil Bayraktar
Cisco Systems
170 W. Tasman Drive
San Jose, CA 95134
United States of America

Email: serpil@cisco.com

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: December 23, 2018

J. Borkenhagen
AT&T
R. Bush
Internet Initiative Japan
R. Bonica
Juniper Networks
S. Bayraktar
Cisco Systems
June 21, 2018

Well-Known Community Policy Behavior
draft-ymbk-grow-wkc-behavior-03

Abstract

Well-Known BGP Communities are manipulated inconsistently by current implementations. This results in difficulties for operators. It is recommended that removal policies be applied consistently to Well-Known Communities.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [RFC2119] only when they appear in all upper case. They may also appear in lower or mixed case as English words, without normative meaning.

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 December 23, 2018.

Table of Contents

1. Introduction

The BGP Communities Attribute was specified in [RFC1997] which introduced the concept of Well-Known Communities. In hindsight, it did not prescribe as fully as it should have how Well-Known Communities may be manipulated by policies applied by operators. Currently, implementations differ in this regard, and these differences can result in inconsistent behaviors that operators find difficult to identify and resolve.

This document describes the current behavioral differences in order to assist operators in generating consistent community-manipulation policies in a multi-vendor environment, and to prevent the introduction of additional divergence in implementations.

2. Manipulation of Communities by Policy

[RFC1997] says:

"A BGP speaker receiving a route with the COMMUNITIES path attribute may modify this attribute according to the local policy."

A basic operational need is to add or remove one or more communities to the received set. Another common need is to replace all received communities with a new set. To simplify the second case, most BGP policy implementations provide syntax to "set" community that operators use to mean "remove any/all communities present on the update received from the neighbor, and apply this set of communities instead."

Some operators prefer to write explicit policy to delete unwanted communities rather than using "set;" i.e. using a "delete community *:*" and then "add community x:y ..." configuration statements in an attempt to replace all received communities. The same community manipulation policy differences described in the following section exist in both "set" and "delete community *:*" syntax. For simplicity, the remainder of this document refers only to the "set" behaviors.

3. Community Manipulation Policy Differences

Vendor implementations differ in the treatment of certain Well-Known communities when modified using the syntax to "set" the community. Some replace all communities including the Well-Known ones with the new set, while others replace all non-Well-Known Communities but do not modify any Well-Known Communities that are present.

These differences result in what would appear to be identical policy configurations having very different results on different platforms.

4. Documentation of Vendor Implementations

In Juniper Networks' JunOS, "community set" removes all received communities, Well-Known or otherwise.

In Cisco Systems' IOS-XR, "set community" removes all received communities except for the following:

Numeric	Common Name
0:0	internet
65535:0	graceful-shutdown
65535:1	accept-own rfc7611
65535:65281	NO_EXPORT
65535:65282	NO_ADVERTISE
65535:65283	NO_EXPORT_SUBCONFED (or local-AS)

Communities not removed by Cisco IOS/XR

Table 1

IOS-XR does allow Well-Known communities to be removed one at a time by explicit policy; for example, "delete community accept-own". Operators are advised to consult IOS-XR documentation and/or Cisco Systems support for full details.

On Brocade NetIron: "set community X" removes all communities and sets X.

In Huawei's VRP product, "community set" removes all received communities, well-Known or otherwise.

In OpenBSD's OpenBGPD, "set community" does not remove any communities, well-Known or otherwise.

4.1. Note on an Inconsistency

The IANA publishes a list of Well-Known Communities [IANA-WKS].

IOS-XR's set of well-known communities that "set community" will not overwrite diverges from IANA's list. Quite a few well-known communities from IANA's list do not receive special treatment in IOS-XR, and at least one specific community on IOS-XR's special treatment list (internet == 0:0) is not really on IANA's list -- it's taken from the "Reserved" range [0x00000000-0x0000FFFF].

This merely notes an inconsistency. It is not a plea to 'protect' the entire IANA list from "set community."

5. Note for Those Writing RFCs for New Community-Like Attributes

Care should be taken when establishing new [RFC1997]-like attributes (large communities, wide communities, etc) to avoid repeating this mistake.

6. Action Items

Unfortunately, it would be operationally disruptive for vendors to change their current implementations.

Vendors SHOULD share the behavior of their implementations for inclusion in this document, especially if their behavior differs from the examples described.

For new well-known communities specified (after this draft), vendors MUST treat "community set" command to mean "remove all other communities, Well-Known or otherwise."

7. Security Considerations

Surprising defaults and/or undocumented behaviors are not good for security. This document attepts to remedy that.

8. IANA Considerations

This document has no IANA Considerations other than to be aware that any future Well-Known Communities will be subject to the policy treatment described here.

9. Acknowledgements

The authors thank Martijn Schmidt for his contribution, Qin Wu for the Huawei data point.

10. Normative References

[IANA-WKS] "IANA Well-Known Comunities", <https://www.iana.org/assignments/bgp-well-known-communities/bgp-well-known-communities.xhtml>.

[RFC1997] Chandra, R., Traina, P., and T. Li, "BGP Communities Attribute", RFC 1997, DOI 10.17487/RFC1997, August 1996, <http://www.rfc-editor.org/info/rfc1997>.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

Authors' Addresses

Jay Borkenhagen
AT&T
200 Laurel Avenue South
Middletown, NJ 07748
United States of America

Email: jayb@att.com

Randy Bush
Internet Initiative Japan
5147 Crystal Springs
Bainbridge Island, WA 98110
United States of America

Email: randy@psg.com

Ron Bonica
Juniper Networks
2251 Corporate Park Drive
Herndon, VA 20171
US

Email: rbonica@juniper.net

Serpil Bayraktar
Cisco Systems
170 W. Tasman Drive
San Jose, CA 95134
United States of America

Email: serpil@cisco.com