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Advanced BGP Monitoring Protocol (BMP) Statistics Types
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Abstract

RFC 7854 defines different BGP Monitoring Protocol (BMP) statistics message types to observe events that occur on a monitored router. This document defines new statistics type to monitor BMP Adj-RIB-In and Adj-RIB-Out Routing Information Bases (RIBs).

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

Section 4.8 of [RFC7854] defines a number of different BGP Monitoring Protocol (BMP) statistics types to observe major events that occur on a monitored router. Stats are either counters or gauges. Section 6.2 of [RFC8671] also defines several BMP statistics types for Adj-RIB-Out of a monitored router.

As BGP's application scenarios increase, the control granularity of BGP routing becomes increasingly refined, resulting in existing BMP statistics types no longer being able to adequately capture BGP routing behaviors. New BMP statistics types are needed to enable more refined BGP route monitoring and analysis, improving operational maintenance and troubleshooting capabilities.

This document defines new gauges for BMP statistics message. The format of the BMP statistics message remains same as defined in [RFC7854].

1.1. Requirements Language

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

2. Terminology

This document makes use of the following terms:

* 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."

* Pre-policy Adj-RIB-In: The result before applying the inbound policy to an Adj-RIB-In. Note that this differs from the pre-policy Adj-RIB-In concept specified in Section 2 of [RFC7854]. This specification explicitly distinguishes between these two Adj-RIB-In variants.

* Post-Policy Adj-RIB-In: As defined in Section 2 of [RFC7854]

* Adj-RIB-Out: As defined in Section 3 of [RFC8671]

* Pre-policy Adj-RIB-Out: As defined in Section 3 of [RFC8671]

* Post-policy Adj-RIB-Out: As defined in Section 3 of [RFC8671]

* Primary route: A route to a prefix that is considered the best route by the BGP decision process [RFC4271] and actively used for forwarding traffic to that prefix. For load balancing purposes, a prefix can have more than one primary route.

* Backup route: A backup route is also installed in the Loc-RIB, but it is not used until all primary routes become unreachable. Backup routes are used for fast convergence in the event of failures.

3. Statistics Definition

This section defines different statistics type for Adj-RIB-In and Adj-RIB-Out monitoring type.

3.1. Adj-RIB-In Statistics Definition

* Type = 18: (64-bit Gauge) Current number of routes in pre-policy Adj-RIB-In [RFC7854]. This gauge is similar to stats type 7 defined in [RFC7854] and makes it explicitly for the pre-policy Adj-RIB-In. When the monitoring station supports both type 7 and type 18, the monitored router MUST send only one of these types.

* Type = 19: (64-bit Gauge) Current number of routes in per-Address Family Identifier (AFI)/Subsequent Address Family Identifier (SAFI) pre-policy Adj-RIB-In. This gauge is similar to stats type 9 defined in Section 4.8 of [RFC7854] and makes it explicitly for the pre-policy Adj-RIB-In. When the monitoring station supports both type 9 and type 19, the monitored router MUST send only one of these types. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 20: (64-bit Gauge) Current number of routes in post-policy Adj-RIB-In [RFC7854].

* Type = 21: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-In. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 22: (64-bit Gauge) Current number of routes in per-AFI/SAFI rejected by inbound policy. This gauge is different from stats type 0 defined in Section 4.8 of [RFC7854]. The stats type 0 is a 32-counter which is a monotonically increasing number and doesn’t represent the current number of routes rejected by an inbound policy due to ongoing configuration changes. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 23: (64-bit Gauge) Current Number of routes in per-AFI/SAFI accepted by inbound policy. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge. Some implementations, or configurations in implementations, may discard routes that do not match policy and thus the accepted count (type 23) and the Adj-RIB-In counts (type 21) will be identical in such cases.

* Type = 24: (64-bit Gauge) Current Number of routes in per-AFI/SAFI selected as primary route. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 25: (64-bit Gauge) Current Number of routes in per-AFI/SAFI selected as a backup route. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 26: (64-bit Gauge) Current Number of routes in per-AFI/SAFI suppressed by configured route damping policy. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge. 'Suppressed' refers to a path which has been declared suppressed by the BGP Route Flap Damping mechanism as described in Section 2.2 of [RFC2439].

* Type = 27: (64-bit Gauge) Current Number of routes in per-AFI/SAFI marked as stale by Graceful Restart (GR) events. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge. 'Stale' refers to a path which has been declared stale by the BGP GR mechanism as described in Section 4.1 of [RFC4724].

* Type = 28: (64-bit Gauge) Current Number of routes in per-AFI/SAFI marked as stale by Long-Lived Graceful Restart (LLGR). The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge. 'Stale' refers to a path which has been declared stale by the BGP LLGR mechanism as described in Section 4.3 of [RFC9494].

* Type = 29: (64-bit Gauge) Current Number of routes left until reaching the received route threshold as defined in Section 6.7 of [RFC4271].

* Type = 30: (64-bit Gauge) Current Number of routes per-AFI/SAFI left until reaching the received route threshold following the model defined in Section 6.7 of [RFC4271]. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 31: (64-bit Gauge) Current Number of routes left until reaching a license-customized route threshold. This value is affected by whether a customized license exists, and when the customized license is installed.

* Type = 32: (64-bit Gauge) Current Number of routes in per-AFI/SAFI left until reaching a license-customized route threshold. This value is affected by whether a customized license exists for the relevant address family, and when the customized license is installed. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 33: (64-bit Gauge) Current number of routes rejected by exceeding the length threshold of AS PATH.

* Type = 34: (64-bit Gauge) Current number of routes in per-AFI/SAFI rejected by exceeding the length threshold of AS PATH. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 35: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-In invalidated through the Route Origin Authorization (ROA) of Resource Public Key Infrastructure (RPKI) [RFC6811]. This is total number of routes invalidated due to origin Autonomous System (AS) number mismatch and prefix length mismatch. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 36: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-In validated by verifying route origin AS number through the ROA of RPKI [RFC6811]. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 37: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-In not found by verifying route origin AS number through the ROA of RPKI [RFC6811]. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

3.2. Adj-RIB-Out Statistics Definition

* Type = 38: (64-bit Gauge) Current number of routes in per-AFI/SAFI rejected by outbound policy. These routes are active routes which otherwise would have been advertised in absence of outbound policy which rejected them. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 39: (64-bit Gauge) Current number of routes refused to be sent by exceeding the length threshold of AS-PATH.

* Type = 40: (64-bit Gauge) Current number of routes in per-AFI/SAFI refused to be sent by exceeding the length threshold of AS-PATH. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 41: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-Out invalidated through the ROA of RPKI [RFC6811]. This is total number of routes invalidated due to origin AS number mismatch and prefix length mismatch. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 42: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-Out validated by verifying route origin AS number through the ROA of RPKI [RFC6811]. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

* Type = 43: (64-bit Gauge) Current number of routes in per-AFI/SAFI post-policy Adj-RIB-Out not found by verifying route origin AS number through the ROA of RPKI [RFC6811]. The value is structured as: 2-byte AFI, 1-byte SAFI, followed by a 64-bit Gauge.

4. Summary

This section briefly lists the statistics defined in this document and outlines their scope of application, as shown in Table 1.

Type	Adj-RIB-In	Adj-RIB-Out	Loc-RIB
18	Y	N	N
19	Y	N	N
20	Y	N	N
21	Y	N	N
22	Y	N	N
23	Y	N	N
24	Y	N	Y
25	Y	N	Y
26	Y	N	Y
27	Y	N	Y
28	Y	N	Y
29	Y	N	N
30	Y	N	N
31	Y	N	Y
32	Y	N	Y
33	Y	N	N
34	Y	N	N
35	Y	N	N
36	Y	N	N
37	Y	N	N
38	N	Y	N
39	N	Y	N
40	N	Y	N
41	N	Y	N
42	N	Y	N
43	N	Y	N

Table 1: Scope of Application

5. Operational Considerations

This document defines new gauges for BMP statistics messages. The format of BMP statistics messages remains unchanged from [RFC7854]. Transmission scheduling and triggering mechanisms for new gauges are implementation-dependent. Implementations SHOULD determine appropriate report generation and delivery strategies, including configurable timing intervals and threshold values. The default configuration SHOULD disable reporting for new gauges, with implementations allowed to provide a configuration mechanism to enable them.

Some statistics are dependent on feature configurations, such as GR, LLGR, and RPKI, so the corresponding statistics are only sent when these features are enabled. This statistics include Type 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 39, 40, 41, 42, and 43.

Some statistics are also relevant for the Loc-RIB view [RFC9069], so they may apply to the Loc-RIB view after best-path selection is completed. This statistics include Type 24, 25, 26, 27, 28, 31, and 32.

Certain statistics may have logical relationships (e.g., per-AFI/SAFI counts summing to global totals). Implementations MAY perform consistency checks but MUST NOT assume strict dependencies (due to potential race conditions or partial failures). Discrepancies (e.g., sum(per-AFI/SAFI) != global count) SHOULD be logged as warnings but MUST NOT disrupt protocol operation.

Counters may reset due to session restart, manual clearance, or overflow. Implementations MUST track discontinuities and log this information.

Operators MAY consider rate-limiting statistic updates to minimize performance impact on control-plane processes. Operators SHOULD enable only necessary statistics to reduce memory and CPU overhead.

A BMP implementation MUST ignore unrecognized stat types upon receipt and MUST exclude unsupported stat types upon transmission.

6. Security Considerations

Procedures and protocol extensions defined in this document do not affect the BMP security model. All security and authentication mechanisms required by Section 11 of [RFC7854], Section 8 of [RFC8671], and Section 7 of [RFC9069] are also applicable to the gauges defined in this document. This document does not add any additional security considerations.

Monitored devices SHOULD be configured to implement rate-limited reporting of new gauges.

7. IANA Considerations

IANA has assigned the following new parameters in the BMP Statistics Types registry, part of the BMP parameters registry group (https://www.iana.org/assignments/bmp-parameters/bmp-parameters.xhtml).

This document requests IANA to update these entries as follows. Also, the document requests IANA to update the reference cited for the entries with the RFC number to be assigned to this document.

* Type = 18: Number of routes currently in pre-policy Adj-RIB-In.
* Type = 19: Number of routes currently in per-AFI/SAFI pre-policy Adj-RIB-In.
* Type = 20: Number of routes currently in post-policy Adj-RIB-In.
* Type = 21: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-In.
* Type = 22: Number of routes currently in per-AFI/SAFI rejected by inbound policy.
* Type = 23: Number of routes currently in per-AFI/SAFI accepted by inbound policy.
* Type = 24: Number of routes currently in per-AFI/SAFI selected as primary route.
* Type = 25: Number of routes currently in per-AFI/SAFI selected as a backup route.
* Type = 26: Number of routes currently in per-AFI/SAFI suppressed by configured route damping policy.
* Type = 27: Number of routes currently in per-AFI/SAFI marked as stale by GR events.
* Type = 28: Number of routes currently in per-AFI/SAFI marked as stale by LLGR.
* Type = 29: Number of routes currently left until reaching the received route threshold.

* Type = 30: Number of routes currently per-AFI/SAFI left until reaching the received route threshold.

* Type = 31: Number of routes currently left until reaching a license-customized route threshold.

* Type = 32: Number of routes currently in per-AFI/SAFI left until reaching a license-customized route threshold.

* Type = 33: Number of routes currently rejected due to exceeding the length threshold of AS-PATH.

* Type = 34: Number of routes currently in per-AFI/SAFI rejected due to exceeding the length threshold of AS-PATH.

* Type = 35: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-In invalidated after verifying route origin AS number through the ROA of RPKI.

* Type = 36: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-In validated after verifying route origin AS number through the ROA of RPKI.

* Type = 37: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-In not found after verifying route origin AS number through the ROA of RPKI.

* Type = 38: Number of routes currently in per-AFI/SAFI rejected by outbound policy.

* Type = 39: Number of routes currently refused to be sent by exceeding the length threshold of AS-PATH.

* Type = 40: Number of routes currently in per-AFI/SAFI refused to be sent by exceeding the length threshold of AS-PATH.

* Type = 41: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-Out invalidated after verifying route origin AS number through the ROA of RPKI.

* Type = 42: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-Out validated after verifying route origin AS number through the ROA of RPKI.

* Type = 43: Number of routes currently in per-AFI/SAFI post-policy Adj-RIB-Out not found after verifying route origin AS number through the ROA of RPKI.

8. Implementation Status

Note to the RFC Editor - remove this section before publication, as well as remove the reference to [RFC7942].

This section records the status of known implementations of the protocol defined by this specification at the time of posting of this Internet-Draft, and is based on a proposal described in [RFC7942]. The description of implementations in this section is intended to assist the IETF in its decision processes in progressing drafts to RFCs. Please note that the listing of any individual implementation here does not imply endorsement by the IETF. Furthermore, no effort has been spent to verify the information presented here that was supplied by IETF contributors. This is not intended as, and must not be construed to be, a catalog of available implementations or their features. Readers are advised to note that other implementations may exist.

According to [RFC7942], "this will allow reviewers and working groups to assign due consideration to documents that have the benefit of running code, which may serve as evidence of valuable experimentation and feedback that have made the implemented protocols more mature. It is up to the individual working groups to use this information as they see fit".

8.1. Juniper Networks

* Organization: Juniper Networks.
* Implementation:
* Description: Below RIB-IN statistics are implemented.
  - Type = 18.
  - Type = 19.
  - Type = 20.
  - Type = 21.
  - Type = 22.
  - Type = 23.
  - Type = 26.
  - Type = 27.

- Type = 28.
- Type = 35.
- Type = 36.
- Type = 37.

* Maturity Level: Demo
* Coverage:
* Version: Draft-05
* Licensing: N/A
* Implementation experience: Nothing specific.
* Contact: msri@juniper.net
* Last updated: January 20, 2025

8.2. New H3C Technologies

* Organization: New H3C Technologies.
* Implementation: H3C CR16000, CR19000 series routers implementation of New BMP Statistics Type.
* Description: Below New types have been implemented in above-mentioned New H3C Products (running Version 7.1.086 and above).
  - Type = 18.
  - Type = 19.
  - Type = 20.
  - Type = 21.
  - Type = 22.
  - Type = 23.
  - Type = 24.
  - Type = 25.

- Type = 29.
- Type = 30.
- Type = 31.
- Type = 32.
- Type = 33.
- Type = 34.
- Type = 35.
- Type = 36.
- Type = 37.
- Type = 38.
- Type = 39.
- Type = 40.

* Maturity Level: Demo
* Coverage:
* Version: Draft-05
* Licensing: N/A
* Implementation experience: Nothing specific.
* Contact: linchangwang.04414@h3c.com
* Last updated: January 20, 2025

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10.2. Informational References

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