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BGP Maximum Prefix Limits
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Abstract

This document describes mechanisms to limit the negative impact of route leaks [[RFC7908](#)] and/or resource exhaustion in BGP [[RFC4271](#)] implementations.

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.

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[1.](#) Introduction

This document describes mechanisms to reduce the negative impact of certain types of misconfigurations and/or resource exhaustions in BGP [[RFC4271](#)] operations. While [[RFC4271](#)] already described a method to tear down BGP sessions when certain thresholds are exceeded, some nuances in this specification were missing resulting in inconsistencies between BGP implementations. In addition to clarifying "inbound maximum prefix limits", this document also introduces a specification for "outbound maximum prefix limits".

[2.](#) Inbound Maximum Prefix Limits

An operator MAY configure a BGP speaker to terminate its BGP session with a neighbor when the number of address prefixes received from that neighbor exceeds a locally configured upper limit. The BGP

speaker then MUST send the neighbor a NOTIFICATION message with the Error Code Cease and the Error Subcode "Threshold reached: Maximum Number of Prefixes Received", and MAY support other actions. Reporting when thresholds have been exceeded is an implementation specific consideration, but SHOULD include methods such as Syslog

[[RFC5424](#)]. Inbound Maximum Prefix Limits can be applied in two distinct places in the conceptual model: before or after the application of routing policy.

[2.1.](#) Type A: Pre-Policy Inbound Maximum Prefix Limits

The Adj-RIBs-In stores routing information learned from inbound UPDATE messages that were received from another BGP speaker [Section 3.2 \[RFC4271\]](#). The Type A pre-policy limit uses the number of NLRIs per Address Family Identifier (AFI) per Subsequent Address Family Identifier (SAFI) as input into its threshold comparisons. For example, when an operator configures the Type A pre-policy limit for IPv4 Unicast to be 50 on a given EBGP session, and the other BGP speaker announces its 51st IPv4 Unicast NLRI, the session MUST be terminated.

Type A pre-policy limits are particularly useful to help dampen the effects of full table route leaks and memory exhaustion when the implementation stores rejected routes.

[2.2.](#) Type B: Post-Policy Inbound Maximum Prefix Limits

[RFC4271](#) describes a Policy Information Base (PIB) that contains local policies that can be applied to the information in the Routing Information Base (RIB). The Type B post-policy limit uses the number of NLRIs per Address Family Identifier (AFI) per Subsequent Address Family Identifier (SAFI), after application of the Import Policy as input into its threshold comparisons. For example, when an operator configures the Type B post-policy limit for IPv4 Unicast to be 50 on a given EBGP session, and the other BGP speaker announces a hundred IPv4 Unicast routes of which none are accepted as a result of the local import policy (and thus not considered for the Loc-RIB by the local BGP speaker), the session is not terminated.

Type B post-policy limits are useful to help prevent FIB exhaustion and prevent accidental BGP session teardown due to prefixes not

accepted by policy anyway.

3. Outbound Maximum Prefix Limits

An operator MAY configure a BGP speaker to terminate its BGP session with a neighbor when the number of address prefixes to be advertised to that neighbor exceeds a locally configured upper limit. The BGP speaker then MUST send the neighbor a NOTIFICATION message with the Error Code Cease and the Error Subcode "Threshold reached: Maximum Number of Prefixes Send", and MAY support other actions. Reporting when thresholds have been exceeded is an implementation specific

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consideration, but SHOULD include methods such as Syslog [[RFC5424](#)]. By definition, Outbound Maximum Prefix Limits are Post-Policy.

The Adj-RIBs-Out stores information selected by the local BGP speaker for advertisement to its neighbors. The routing information stored in the Adj-RIBs-Out will be carried in the local BGP speaker's UPDATE messages and advertised to its neighbors [Section 3.2 \[RFC4271\]](#). The Outbound Maximum Prefix Limit uses the number of NLRIs per Address Family Identifier (AFI) per Subsequent Address Family Identifier (SAFI), after application of the Export Policy, as input into its threshold comparisons. For example, when an operator configures the Outbound Maximum Prefix Limit for IPv4 Unicast to be 50 on a given EBGp session, and were about to announce its 51st IPv4 Unicast NLRI to the other BGP speaker as a result of the local export policy, the session MUST be terminated.

Outbound Maximum Prefix Limits are useful to help dampen the negative effects of a misconfiguration in local policy. In many cases, it would be more desirable to tear down a BGP session rather than causing or propagating a route leak.

4. Considerations for Operations with Multi-Protocol BGP

5. Considerations for soft thresholds

describe soft and hard limits (warning vs teardown)

6. Security Considerations

Maximum Prefix Limits are an essential tool for routing operations and SHOULD be used to increase stability.

7. IANA Considerations

This memo requests that IANA updates the name of subcode "Maximum Number of Prefixes Reached" to "Threshold exceeded: Maximum Number of Prefixes Received" in the "Cease NOTIFICATION message subcodes" registry under the "Border Gateway Protocol (BGP) Parameters" group.

This memo requests that IANA assigns a new subcode named "Threshold exceeded: Maximum Number of Prefixes Send" in the "Cease NOTIFICATION message subcodes" registry under the "Border Gateway Protocol (BGP) Parameters" group.

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8. Acknowledgments

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9. Implementation status - RFC EDITOR: REMOVE BEFORE PUBLICATION

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.

The below table provides an overview (as of the moment of writing) of which vendors have produced implementation of inbound or outbound maximum prefix limits. Each table cell shows the applicable configuration keywords if the vendor implemented the feature.

| Vendor | Type A Pre-Policy | Type B Post-Policy | Outbound |
|------------------|-------------------|--|----------|
| Cisco IOS XR | | maximum-prefix | |
| Cisco IOS XE | | maximum-prefix | |
| Juniper Junos OS | prefix-limit | accepted-prefix-limit, or prefix-limit combined with 'keep none' | |

| | | | |
|---------------------|--|-----------------------------------|--------------|
| Nokia SR OS | prefix-limit | | |
| NIC.CZ BIRD | 'import keep filtered' combined with 'receive limit' | 'import limit' or 'receive limit' | export limit |
| OpenBSD OpenBGPD | max-prefix | | |
| Arista EOS | maximum-routes | maximum-accepted-routes | |
| Huawei VRPv5 | peer route-limit | | |
| Huawei VRPv8 | peer route-limit | peer route-limit accept-prefix | |

First presented by Snijders at [\[RIPE77\]](#)

Table 1: Maximum prefix limits capabilities per implementation

[10.](#) Appendix: Implementation Guidance

1) make it clear who does what: if A sends too many prefixes to B A should see "ABC" in log B should see "DEF" in log to make it clear which of the two parties does what 2) recommended by default automatically restart after between 15 and 30 minutes

[11.](#) References

[11.1.](#) 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>>.

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11.2. Informative References

- [RFC5424] Gerhards, R., "The Syslog Protocol", [RFC 5424](#), DOI 10.17487/RFC5424, March 2009, <<https://www.rfc-editor.org/info/rfc5424>>.
- [RFC7908] Sriram, K., Montgomery, D., McPherson, D., Osterweil, E., and B. Dickson, "Problem Definition and Classification of BGP Route Leaks", [RFC 7908](#), DOI 10.17487/RFC7908, June 2016, <<https://www.rfc-editor.org/info/rfc7908>>.
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