

Internet Engineering Task Force (IETF)
Request for Comments: 7607
Updates: [4271](#)
Category: Standards Track
ISSN: 2070-1721

W. Kumari
Google
R. Bush
Internet Initiative Japan
H. Schiller
Google
K. Patel
Cisco Systems
August 2015

Codification of AS 0 Processing

Abstract

This document updates [RFC 4271](#) and proscribes the use of Autonomous System (AS) 0 in the Border Gateway Protocol (BGP) OPEN, AS_PATH, AS4_PATH, AGGREGATOR, and AS4_AGGREGATOR attributes in the BGP UPDATE message.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in [Section 2 of RFC 5741](#).

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <http://www.rfc-editor.org/info/rfc7607>.

Copyright Notice

Copyright (c) 2015 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	2
1.1. Requirements Notation	2
2. Behavior	3
3. IANA Considerations	3
4. Security Considerations	3
5. References	4
5.1. Normative References	4
5.2. Informative References	4
Acknowledgements	4
Authors' Addresses	5

1. Introduction

Autonomous System 0 was listed in the IANA Autonomous System Number Registry as "Reserved - May be use [sic] to identify non-routed networks" ([IANA.AS_Numbers]).

[RFC6491] specifies that AS 0 in a Route Origin Attestation (ROA) is used to mark a prefix and all its more specific prefixes as not to be used in a routing context. This allows a resource holder to signal that a prefix (and the more specifics) should not be routed by publishing a ROA listing AS 0 as the only origin. To respond to this signal requires that BGP implementations not accept or propagate routes containing AS 0.

No clear statement that AS 0 was proscribed could be found in any BGP specification. This document corrects this omission, most importantly in the case of the AS_PATH. This represents an update to the error handling procedures given in Sections 6.2 and 6.3 of [RFC4271] by specifying the behavior in the presence of AS 0.

At least two implementations discard routes containing AS 0, and this document codifies this behavior.

1.1. Requirements Notation

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 [RFC2119].

2. Behavior

A BGP speaker MUST NOT originate or propagate a route with an AS number of zero in the AS_PATH, AS4_PATH, AGGREGATOR, or AS4_AGGREGATOR attributes.

An UPDATE message that contains the AS number of zero in the AS_PATH or AGGREGATOR attribute MUST be considered as malformed and be handled by the procedures specified in [RFC7606].

An UPDATE message that contains the AS number of zero in the AS4_PATH or AS4_AGGREGATOR attribute MUST be considered as malformed and be handled by the procedures specified in [RFC6793].

If a BGP speaker receives zero as the peer AS in an OPEN message, it MUST abort the connection and send a NOTIFICATION with Error Code "OPEN Message Error" and subcode "Bad Peer AS" (see [Section 6 of \[RFC4271\]](#)). A router MUST NOT initiate a connection claiming to be AS 0.

Authors of future protocol extensions that carry the Autonomous System number are encouraged to keep in mind that AS 0 is reserved and to provide clear direction on how to handle AS 0.

3. IANA Considerations

The IANA has updated the registry for "16-bit Autonomous System Numbers" so that the entry for AS 0 is simply "Reserved".

4. Security Considerations

By allowing a Resource Public Key Infrastructure (RPKI) resource holder to issue a ROA saying that AS 0 is the only valid origin for a route, we allow them to state that a particular address resource is not in use. By ensuring that all implementations that see AS 0 in a route ignore that route, we prevent a malicious party from announcing routes containing AS 0 in an attempt to hijack those resources.

In addition, by standardizing the behavior upon reception of an AS_PATH (or AS4_PATH) containing AS 0, this document makes the behavior better defined.

5. References

5.1. Normative References

- [IANA.AS_Numbers]
IANA, "Autonomous System (AS) Numbers",
<<http://www.iana.org/assignments/as-numbers>>.
- [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>>.
- [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, <<http://www.rfc-editor.org/info/rfc4271>>.
- [RFC6793] Vohra, Q. and E. Chen, "BGP Support for Four-Octet Autonomous System (AS) Number Space", RFC 6793, DOI 10.17487/RFC6793, December 2012, <<http://www.rfc-editor.org/info/rfc6793>>.
- [RFC7606] Chen, E., Ed., Scudder, J., Ed., Mohapatra, P., and K. Patel, "Revised Error Handling for BGP UPDATE Messages", RFC 7606, DOI 10.17487/RFC7606, July 2015, <<http://www.rfc-editor.org/info/rfc7606>>.

5.2. Informative References

- [RFC6491] Manderson, T., Vegoda, L., and S. Kent, "Resource Public Key Infrastructure (RPKI) Objects Issued by IANA", RFC 6491, DOI 10.17487/RFC6491, February 2012, <<http://www.rfc-editor.org/info/rfc6491>>.

Acknowledgements

The authors wish to thank Elwyn Davies, Enke Chen, Brian Dickson, Bruno Decraene, Robert Raszuk, Jakob Heitz, Danny McPherson, Chris Morrow, iLya, John Scudder, Jeff Tantsura, Daniel Ginsburg, and Susan Hares. Apologies to those we may have missed; it was not intentional.

Authors' Addresses

Warren Kumari
Google
1600 Amphitheatre Parkway
Mountain View, CA 94043
United States

Email: warren@kumari.net

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

Email: randy@psg.com

Heather Schiller
Google
1600 Amphitheatre Parkway
Mountain View, CA 94043
United States

Email: has@google.com

Keyur Patel
Cisco Systems
170 W. Tasman Drive
San Jose, CA 95134
United States

Email: keyupate@cisco.com