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

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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>.

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## 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>>.

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## 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

