

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: November 19, 2017

K. Patel
Arrcus, Inc.
J. Uttaro
ATT
B. Decraene
Orange
W. Henderickx
Alcatel Lucent
J. Haas
Juniper Networks
May 18, 2017

Constrain Attribute announcement within BGP
draft-ietf-idr-bgp-attribute-announcement-01.txt

Abstract

[RFC4271] defines four different categories of BGP Path attributes. The different Path attribute categories can be identified by the attribute flag values. These flags help identify if an attribute is optional or well-known, Transitive or non-Transitive, Partial, or of an Extended length type. BGP attribute announcement depends on whether an attribute is a well-known or optional, and whether an attribute is a transitive or non-transitive. BGP implementations MUST recognize all well-known attributes. The well-known attributes are always Transitive. It is not required for BGP implementations to recognise all the Optional attributes. The Optional attributes could be Transitive or Non-Transitive. BGP implementations MUST store and forward any Unknown Optional Transitive attributes and ignore and drop any Unknown Optional Non-Transitive attributes.

Currently, there is no way to confine the scope of Path attributes within a given Autonomous System (AS) or a given BGP member-AS in Confederation. This draft defines attribute extensions that help confine the scope of Optional attributes within a given AS or a given BGP member-AS in Confederation

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1. Introduction

[RFC4271] defines four different categories of BGP Path attributes. The different Path attribute categories can be identified by the attribute flag values. These flags help identify if an attribute is optional or well-known, Transitive or non-Transitive, Partial, or of an Extended length type. BGP attribute announcement depends on whether an attribute is a well-known or optional, and whether an attribute is a transitive or non-transitive. BGP implementations MUST recognize all well-known attributes. The well-known attributes are always Transitive. It is not required for BGP implementations to recognise all the Optional attributes. The Optional attributes could be Transitive or Non-Transitive. BGP implementations MUST store and forward any Unknown Optional Transitive attributes and ignore and drop any Unknown Optional Non-Transitive attributes.

Optional Transitive attributes help foster partial deployments of newer BGP features. Alternatively, Optional Non-Transitive attributes are drop by BGP speakers that do not recognise the attribute. The optional attributes in their current definition do not provide any automated attribute level filtering to control the scope of announcements within a given AS or a BGP member-AS in Confederation. Scoped announcements of attributes may be needed in certain scenarios. Announcing attributes beyond their intended scope MAY result in breakage of functionalities or leaking of any undesired information.

This draft defines new attribute extensions that help confine the scope of Path attributes; in particular Optional attributes within a given Autonomous System or a given BGP member-AS in confederation or a given Administrative domain. Note that "BGP Member-AS in Confederation" and "Member-AS" are used entirely interchangeably throughout this document.

As part of new attribute extensions, this draft defines a new attribute format to incorporate the scoping information. The new attribute format applies to all the new attribute types that will be defined moving forward. The newly defined attribute scoping is specifically for newer attributes that explicitly state their use of such scoping bits. These newly defined attributes would be either an Optional transitive attributes (recognized and unrecognized) or any recognized optional non-transitive attributes. For any well-known attributes or unrecognized optional non-transitive attributes, the standard rules mentioned in [[RFC4271](#)] applies.

1.1. Requirements Language

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](#)].

2. Path Attribute Format

[RFC4271] defines path attribute format as a triple [attribute type, attribute length, attribute value] of a variable length. The attribute value field is of a variable length. This draft augments the path attribute value field and reserves first four bytes of path attribute value field as path attribute extended flags field. All the path attributes carrying extended flags field will have a minimum attribute length of 4 bytes. The augmented path attribute format applies to all the current undefined attributes types (30-39, 41-127, 129-254). Any attribute specific data follows the path attribute extended flags field.

3. Extended Path Attribute Flags

[RFC4271] defines four type of BGP Path attributes using the attribute Flags field as follows:

Path Attribute flags:

```

  0 1 2 3 4 5 6 7
+-+--+--+--+--+
|O|T|P|E|  R  |   (R = MUST Be Zero)
+-+--+--+--+--+

```

O Optional or a Well-known as defined in [[RFC4271](#)]

T Transitive or Non-Transitive as defined in [[RFC4271](#)]

P Partial as defined in [[RFC4271](#)]

E Extended Length type as defined in [[RFC4271](#)]

This draft introduces new Flags field known as Extended Path Attribute Flags. The Extended Path Attribute Flags field is defined as first 4 bytes of the Path Attribute's value field. This draft introduces three new Extended Path Attributes flags as follows:

Path Attribute flags:

```

      0             1             2             3
      0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7 0 1 2 3 4 5 6 7
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                                     R                                     |C|A|
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

(R = MUST Be Zero)

- A AS Wide Scope
- C Member-AS in Confederation Scope
- M Multi-AS Scope

The first least significant bit ("A") is defined as the AS Wide Scope bit, which is used to indicate that an optional attribute cannot be announced outside a given AS boundary. When set, the given optional attribute MUST be filtered by the sending BGP speaker at an AS boundary. If the "A" bit is set then the "O" bit defined in BGP Path Attribute Flag field MUST be set. Otherwise a BGP speaker MUST consider an attribute as an error and malformed.

The second least significant bit ("C") is defined as the Member-AS Scope bit, which is used to indicate that an optional attribute cannot be announced outside a given Member-AS boundary. When set, the given optional attribute MUST be filtered by the sending BGP speaker at a Member-AS boundary. If the "C" bit is set then the "O" bit defined in BGP Path Attribute Flag field MUST be set. Otherwise a BGP speaker MUST consider an attribute as an error and malformed. "C" bit SHOULD only be set when an Autonomous System is configured as a BGP Confederation. A BGP speaker MUST not transmit an attribute with "C" bit set to peers that are not members of the local confederation. Otherwise a BGP speaker MUST consider an attribute as an error and malformed.

Both the first and the second most least significant bit together is defined as the Multiple AS Scope within a Single Administration. When both the first and the second bits are set, optional attribute can be traversed across multiple AS and filtered by the sending BGP speaker at the Administration boundary.

The handling of malformed attributes SHOULD follow the procedures mentioned in [[RFC7606](#)]. For any malformed attribute that is handled

by the "attribute discard" instead of the "treat-as-withdraw" approach, it is critical to consider the potential impact. In particular, if the attribute has an impact on the route selection or installation process, then the presumption is that "attribute discard" is unsafe and "treat-as-withdraw" procedure SHOULD be considered. Otherwise, "attribute discard" procedure SHOULD be used.

4. Operation

When originating a well-known Path attribute, a BGP speaker MUST set both the AS Wide Scope and Member-AS Scope bit to 0. When originating an optional Path attribute, a BGP speaker SHOULD use and set AS Wide Scope bit if it wants to restrict the announcement within a AS. Similarly, when originating an optional Path attribute, a BGP speaker SHOULD use and set Member-AS Scope bit if it wants to restrict the announcement with a Member-AS. When originating an optional Path attribute, a BGP speaker SHOULD use and set both Member-AS Scope bit and AS Wide Scope bit if it wants to restrict the announcement within a single administration composed of multiple ASes.

When a BGP speaker receives or originates a route that includes any well-known Path attribute with either a AS Wide Scope bit set or a Member-AS Scope bit set then it SHOULD consider the attribute as malformed. The handling of malformed attributes SHOULD follow the procedures mentioned in [[RFC7606](#)].

When a BGP speaker receives or originates a route that includes an optional Path attribute with a AS Wide Scope bit set and a Member-AS Scope bit cleared, it MUST remove that Path attribute when announcing the route to any of its EBGp speakers. To deal with partial deployments it is suggested that a BGP speaker SHOULD quietly ignore and not pass along to other BGP peers any Path attribute received from its EBGp peers with a AS Wide Scope bit set and a Member-AS Scope bit cleared unless configured explicitly using a policy.

When a BGP speaker receives or originates a route that includes an optional Path attribute with a Member-AS Scope bit set and a AS Wide Scope bit cleared, it MUST remove that Path attribute when announcing the route to any of its BGP speakers outside its Member-AS. To deal with partial deployments it is suggested that a BGP speaker SHOULD quietly ignore and not pass along to other BGP peers any Path attribute received from its BGP peers with a Member-AS Scope bit set and a AS Wide Scope bit cleared unless configured explicitly as a policy.

When a BGP speaker receives or originates a route with an optional path attribute that has both, the AS Wide Scope bit set and the

Member-AS Scope bit set, it MUST announce it to all its EBGp peers within its administrative domain. Such an attribute MUST be filtered when the attribute is announced outside its administrative domain. The BGP peering boundaries for an administrative domain is a matter of a policy and is set by the operators.

Any implementation that supports the extensions defined in this draft MUST support the Enhanced Error handling defined in [[RFC7606](#)]. Enhanced Error handling allows any error condition that MAY occur during the parsing and processing of new attribute flags to be treated according to the procedures of [[RFC7606](#)]. Furthermore, it is assumed that the BGP network is enabled with Enhanced Error Handling feature. This allows BGP speakers not implementing the draft extensions to apply the procedures of [[RFC7606](#)].

5. IANA Considerations

This draft define a new path attribute format for all undefined attribute types. We request IANA to record the use of new path attribute format for the following undefined attribute types (30-39, 41-127, 129-254).

This draft defines two new Extended Path attribute flags. We request IANA to create a new registry for BGP Extended Path Attribute Flags under BGP Path attributes as follows:

Under "Border Gateway Protocol (BGP) Parameters" registry, "BGP Extended Path Attributes Flags" Reference: [draft-keyupate-idr-bgp-attribute-annoucement-01](#) Registration Procedures as follows:

Bit Value (LSB)	Type	Reference
1	AS Wide Scope	Current Draft
2	Member-AS in Confederation	Current Draft

6. Security Considerations

This extension to BGP does not change the underlying security issues inherent in the existing [[RFC4724](#)] and [[RFC4271](#)].

6.1. Acknowledgements

The authors would like to thank John Scudder, Jakob Heitz, Shyam Seturam, Juan Alcaide and Acee Lindem for the review and comments.

7. References

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Authors' Addresses

Keyur Patel
Arrcus, Inc.

Email: keyur@arrcus.com

James Uttaro
ATT
200 S. Laurel Ave
Middletown, NJ 07748
USA

Email: uttaro@att.com

Bruno Decraene
Orange

Email: bruno.decraene@orange.com

Wim Henderickx
Alcatel Lucent
Copernicuslaan 50
Antwerp 2018
Belgium

Email: wim.henderickx@alcatel-lucent.com

Jeff Haas
Juniper Networks
1194 N. Mathilda Ave.
Sunnyvale, CA 94089
USA

Email: jhaas@juniper.net

