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Error Handling for Optional Transitive BGP Attributes
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Abstract

According to the base BGP specification, a BGP speaker that receives an UPDATE message containing a malformed attribute is required to

reset the session over which the offending attribute was received. This behavior is undesirable in the case of optional transitive attributes. This document revises BGP's error-handling rules for optional transitive attributes, and provides guidelines for the authors of documents defining new optional transitive attributes. It also revises the error handling procedures for several existing optional transitive attributes.

1. Introduction

According to the base BGP specification [[RFC4271](#)], a BGP speaker that receives an UPDATE message containing a malformed attribute is required to reset the session over which the offending attribute was received. This behavior is undesirable in the case of optional transitive attributes whose Partial bit is set; the reason is that such attributes have been propagated without being checked by intermediate routers that do not recognize the attribute -- in effect the attributes have been tunneled, and when they do reach a router that recognizes and checks them, the session that is reset is not associated with the router that is at fault. This document revises BGP's error-handling rules for optional transitive attributes, and provides guidelines for the authors of documents defining new optional transitive attributes. It also revises the error handling procedures for several existing optional transitive attributes. Specifically, the error handling procedures of [[RFC4271](#)], [[RFC1997](#)], and [[RFC4360](#)] are revised.

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. Revision to Base Specification

[Section 6.3 of \[RFC4271\]](#) is revised as follows. The paragraphs related to "any recognized attribute" and "an optional attribute" do not apply to optional transitive attributes received with their Partial bit set. Instead, when such an attribute is determined to be malformed, the UPDATE message containing that attribute SHOULD be treated as though all contained prefixes had been withdrawn. Note that this option requires that the NLRI field and/or MP_REACH [[RFC4760](#)] attribute be successfully parsed. In the case of an optional transitive attribute which has no effect on route selection or installation, the malformed attribute MAY instead be discarded. An example of such an attribute is the AGGREGATOR attribute. In any

case, an error in an optional transitive attribute whose Partial bit is set MUST NOT be responded to by sending a NOTIFICATION message or resetting the BGP session.

A document which specifies an optional transitive attribute MUST provide specifics regarding what constitutes an error and how that error is to be handled.

Note that the revised error handling only applies when an individual optional transitive attribute is received with its Partial bit set and deemed to be erroneous. In the event that an UPDATE message is deemed to be malformed in any other way, for example if the Total Attribute Length is inconsistent with the message length, or if there is more than one attribute with a given type code, then the procedures of [[RFC4271](#)] continue to apply. This is likewise the case if an optional transitive attribute is received whose Partial bit is not set -- this is because the detected error can be imputed to the direct peer.

In the specific case of incorrect path attribute flag bits -- i.e., a path attribute that is known by its type code to be Optional and Transitive but whose flag bits are not set accordingly -- the behavior specified by [[RFC4271](#)] SHALL be followed. (Consider that in the case of such an error, the "tunneling" argument given above does not apply, by definition.)

3. Operational Considerations

Although the "treat as withdraw" error-handling behavior defined in [Section 2](#) makes every effort to preserve BGP's correctness, we note that if an UPDATE received on an IBGP session is subjected to this treatment, inconsistent routing within the affected Autonomous System may result. The consequences of inconsistent routing can include long-lived forwarding loops and black holes. While lamentable, this issue is expected to be rare in practice, and more importantly is seen as less problematic than the session-reset behavior it replaces.

Even if inconsistent routing does not arise, the "treat as withdraw" behavior can cause either complete unreachability or sub-optimal routing for the destinations whose prefixes are carried in the affected UPDATE message.

For any malformed attribute which is discarded instead of the containing UPDATE being treated as a withdraw as discussed in [Section 2](#), it is critical to consider the potential impact of doing so. In particular, if the attribute in question has or may have an effect on route selection or installation, the presumption is that

discarding it is unsafe, unless careful analysis proves otherwise. The analysis should take into account the tradeoff between preserving connectivity and potential side effects.

Because of these potential issues, a BGP speaker MUST provide debugging facilities to permit issues caused by malformed optional transitive attributes to be diagnosed. At a minimum, such facilities SHOULD include logging an error when such an attribute is detected.

4. Error Handling Procedures for Existing Optional Transitive Attributes

4.1. AGGREGATOR

The error handling of [\[RFC4271\]](#) is revised as follows:

The AGGREGATOR attribute SHALL be considered malformed if any of the following applies:

- o Its length is not 6 (if the peer that sent it is not AS4 capable [\[RFC4893\]](#)).
- o Its length is not 8 (if the peer that sent it is AS4 capable).
- o The AS number contained in the attribute is equal to zero.
- o The BGP identifier contained in the attribute is equal to zero.

If the attribute is malformed and its Partial bit is set, either the attribute MUST be discarded or the UPDATE containing it treated as a withdraw as discussed in [Section 2](#). If the attribute is malformed and its Partial bit is clear, the procedures of [\[RFC4271\]](#) MUST be followed with respect to an Optional Attribute Error.

4.2. Community

The error handling of [\[RFC1997\]](#) is revised as follows:

The Community attribute SHALL be considered malformed if its length is not a nonzero multiple of 4.

If the attribute is malformed and its Partial bit is set, the update containing it MUST be treated as a withdraw as discussed in [Section 2](#). If the attribute is malformed and its Partial bit is clear, the procedures of [\[RFC4271\]](#) MUST be followed with respect to an Optional Attribute Error.

4.3. Extended Community

The error handling of [[RFC4360](#)] is revised as follows:

The Extended Community attribute SHALL be considered malformed if its length is not a nonzero multiple of 8.

If the attribute is malformed and its Partial bit is set, the update containing it MUST be treated as a withdraw as discussed in [Section 2](#). If the attribute is malformed and its Partial bit is clear, the procedures of [[RFC4271](#)] MUST be followed with respect to an Optional Attribute Error.

Note that a BGP speaker MUST NOT treat an unrecognized Extended Community Type or Sub-Type as an error.

5. Security Considerations

This specification addresses the vulnerability of a BGP speaker to a potential attack whereby a distant attacker can generate a malformed optional transitive attribute that is not recognized by intervening routers (which thus propagate the attribute unchecked) but that causes session resets when it reaches routers that do recognize the given attribute type.

In other respects, this specification does not change BGP's security characteristics.

6. Acknowledgements

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7. IANA Considerations

This memo makes no request of IANA.

8. References

8.1. Normative References

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- [RFC4893] Vohra, Q. and E. Chen, "BGP Support for Four-octet AS Number Space", [RFC 4893](#), May 2007.

8.2. Informative References

- [RFC4760] Bates, T., Chandra, R., Katz, D., and Y. Rekhter, "Multiprotocol Extensions for BGP-4", [RFC 4760](#), January 2007.

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