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BMP Extension for Path Status TLV

draft-ietf-grow-bmp-path-marking-tlv-02

Abstract

The BGP Monitoring Protocol (BMP) provides an interface for obtaining

BGP Path information. BGP Path Information is conveyed within BMP

Route Monitoring (RM) messages. This document proposes an extension

to BMP to convey the status of a path after being processed by the

BGP process. This extension makes use of the TLV mechanim described

in draft-ietf-grow-bmp-tlv [I-D.ietf-grow-bmp-tlv] and

draft-ietf-grow-bmp-tlv-ebit [I-D.ietf-grow-bmp-tlv-ebit].

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 RFC 2119 [RFC2119] RFC 8174 [RFC8174] when, and only when, they

appear in all capitals, as shown here.

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1. Introduction

For a given prefix, multiple paths with different path status, e.g.,

the "best-path", "back-up path", "invalid", and so on, may co-exist

in the BGP RIBs after being processed by the BGP decision process.

The path status information is currently not carried in the BGP

Update Message RFC4271 [RFC4271] or in the BMP Update Message RFC7854

[RFC7854].

External systems can use the path status for various applications.

The path status is commonly used by operators when performing

troubleshooting or verify redundancy. Having such status stored in a centralized system

enables the development of tools that facilitate this process.

Optimization systems can include the path status in their process,

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and use the status as a validation source (since it can compare

the calculated state to the actual outcome of the network, such as

primary and backup path). As a final example, path status

information can complement other centralized sources of data, for

example, flow collectors.

This document defines a so-called Path Status TLV to convey the BGP

path status to the BMP server. The BMP Path Status TLV is carried in

the BMP Route Monitoring (RM) Message.

2. Path Status TLV

This document defines two types of Path Status TLVs: IANA-

registered Path Status TLV and Enterprise-specific

Path Status TLV.

2.1. IANA-registered Path Status TLV

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

+-------------------------------+-------------------------------+

|E| Type (15 bits) | Length (2 octets) |

+---------------------------------------------------------------+

| Index (2 octets) |

+-------------------------------+-------------------------------+

| Path Status (4 octets) |

+---------------------------------------------------------------+

| Reason Code (2 octets, optional) |

+---------------------------------------------------------------+

Figure 2: Encoding of IANA-Registered Path Status TLV

\* E bit: For an IANA-registered TLV, the E bit MUST be set to 0

[I-D.ietf-grow-bmp-tlv-ebit].

\* Type = TBD2 (15 Bits): indicates that it is the IANA-registered

Path Status TLV.

\* Length (2 Octets): indicates the length of the value field of the

Path Status TLV. The value field further consists of the Path-

Status field and Reason Code field.

\* Index (2 Octets): indicates the prefix that this TLV is

describing. Please see [I-D.ietf-grow-bmp-tlv] for details of the

use of the index field to associate the path marking content with

one or more NLRIs.

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\* Path Status (4 Octets): indicates the path status of the BGP

Update PDU encapsulated in the RM Message. Currently 10 types of

path status are defined, as shown in Table 1. All zeros are

reserved.

\* Reason Code (2 Octets, optional): indicates the reason of the path

status indicated in the Path Status field. The reason code field

is optional. If no reason code is carried, this field is empty.

If a reason code is carried, the reason code is indicated by a

2-byte value, which is defined in Table 2.

+------------+-----------------------------+

| Value | Path type |

+------------------------------------------+

| 0x00000001 | Invalid |

| 0x00000002 | Best |

| 0x00000004 | Non-selected |

| 0x00000008 | Primary |

| 0x00000010 | Backup |

| 0x00000020 | Non-installed |

| 0x00000040 | Best-external |

| 0x00000080 | Add-Path |

| 0x00000100 | Filtered in inbound policy |

| 0x00000200 | Filtered in outbound policy |

| 0x00000400 | Invalid ROV |

| 0x00000800 | Stale |

| 0x00001000 | Suppressed |

+------------+-----------------------------+

Table 1: IANA-Registered Path Type

Figure 1

The Path Status field contains a bitmap where each bit encodes a

specific role of the path. Multiple bits may be set when multiple

path status applies to a path.

\* The best-path is defined in RFC4271 [RFC4271] and the best-

external path is defined in draft-ietf-idr-best-external

[I-D.ietf-idr-best-external].

\* An invalid path is a route that does not enter the BGP decision

process.

\* A non-selected path is a route that is not selected in the BGP

decision process. Back-up routes are considered non-selected,

while the best and ECMP routes are not considered as non-selected.

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\* A primary path is a recursive or non-recursive path whose nexthop

resolution ends with an adjacency draft-ietf-rtgwg-bgp-pic

[I-D.ietf-rtgwg-bgp-pic]. A prefix can have more than one primary

path when multipath is configured

draft-lapukhov-bgp-ecmp-considerations

[I-D.lapukhov-bgp-ecmp-considerations]. A best-path is also

considered as a primary path.

\* A backup path is also installed in the RIB, but it is not used

until some or all primary paths become unreachable. Backup paths

are used for fast convergence in the event of primary path failures.

\* A non-installed path refers to the route that is not installed

into the IP routing table.

\* For the advertisement of multiple paths for the same address

prefix without the new paths implicitly replacing any previous

ones, the add-path status is applied [RFC7911].

\* Stale refers to a path which has been declared stale by the BGP

Graceful Restart mechanism as described in Section 4.1 of

[RFC4724].

\* Suppressed refers to a path which has been declared suppressed by

the BGP Route Flap Damping mechanism as described in Section 2.2

of [RFC2439].

The path status TLV does not force a BMP client to send any of these

paths. It just provides a method to mark the paths that are

available with their status.

+----------+-----------------------------------------------------+

| Value | Reason code |

+----------------------------------------------------------------+

| [0x0001] | invalid for AS loop |

| [0x0002] | invalid for unresolvable nexthop |

| [0x0003] | not preferred for Local preference |

| [0x0004] | not preferred for AS Path Length |

| [0x0005] | not preferred for origin |

| [0x0006] | not preferred for MED |

| [0x0007] | not preferred for peer type |

| [0x0008] | not preferred for IGP cost |

| [0x0009] | not preferred for router ID |

| [0x000A] | not preferred for peer address |

| [0x000B] | not preferred for AIGP |

+----------+-----------------------------------------------------+

Table 2: IANA-Registered Reason Code

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Figure 2

2.2. Enterprise-specific Path Status TLV

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1

+-------------------------------+-------------------------------+

|E| Type (15 bits) | Length (2 octets) |

+-------------------------------+-------------------------------+

| PEN number (4 octets) |

+---------------------------------------------------------------+

| Index (2 octets) |

+---------------------------------------------------------------+

| Path Status (4 octets) |

+---------------------------------------------------------------+

| Reason Code (2 octets, optional) |

+---------------------------------------------------------------+

Figure 3: Encoding of Enterprise-specific Path Status TLV

\* E bit: For an Enterprise-specific TLV, the E bit MUST be set to 1

[I-D.ietf-grow-bmp-tlv-ebit].

\* Type = 1 (15 Bits): indicates that it's the Enterprise-specific

Path Status TLV.

\* Length (2 Octets): indicates the length of the value field of the

Path Status TLV. The value field further consists of the Path-

Status field and Reason Code field.

\* Index (2 Octets): indicates the prefix that this TLV is

describing. The index is the encapsulation order, starting from

0, of the prefix in the BGP Update PDU.

\* PEN Number (4 octets): indicates the IANA enterprise number IANA-

PEN.

\* Path Status (4 Octets): indicates the enterprise-specific path

status. The format is to be determined with respect to each PEN number.

\* Reason Code (2 octets, optional): indicates the reasons/

explanations of the path status indicated in the Path Status

field. The format is to be determined with respect to each PEN number.

3. Implementation notes

The BMP path marking TLV remains optional within BMP implementations.

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An implementation of the BMP path marking TLV may not fully support

marking of all status defined in table Figure 1 or any future

extensions. Similarly, an implementation may choose to support the

inclusion of the reason code (for which support is also optional),

without necessarily incorporating any of the reason codes defined in

table Figure 2 or future extensions.

This document refrains from defining mechanisms for signaling the

status or reason codes an implementation supports. This could be

established through external means (e.g. documentation) or

potentially addressed in a subsequent document.

The remainder of this section encompasses additional points related

to the implementation of the BMP Path marking TLV.

3.1. Configuration of BMP path marking

Implementations supporting the BMP path marking TLV SHOULD provide an

option for enabling or disabling the Path Marking TLV over BMP

sessions. Furthermore, the configuration options for this TLV SHOULD

provide the means to enable and disable the transmission of reason

codes, if the reason code are supported by the implementation.

3.2. Paths with no markings

Some BGP routes might not require any type of status or reasons. For

example, an unfiltered path obtained via the Adj-RIB-IN may fall

under this category since there is really nothing to mark for that

path. We suggest a couple of approaches for signaling that a path

has no markings: (1) An implicit form of marking, achieved by

abstaining from appending any BMP marking TLV pointing toward the

route. (2) Alternatively, an explicit marking of the packet through a

TLV containing no marked status and no associated reason code.

3.3. Significance of status and origin RIBs

This document refrains from imposing any implementation to mark

specific status from specific RIBs. We recognize the diversity among

implementations; some might be able to mark some status over one RIB

while other do it on others. For instance, some might be able to

mark Adj-RIB-in filtered routes when obtained from the Adj-RIB-IN

pre-policy, while other could do it only from the Adj-RIB-IN post-policy. To

remove ambiguities in implementations, we recommend the meaning of

status (and reason codes) to not depend on the origin RIB of a route.

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3.4. Enterprise-specific status and reasons

Implementations introducing their own status and reason codes are

advised to adhere to [I-D.ietf-grow-bmp-tlv-ebit] and use ebit and

vendor specific status and reasons. Additionally, we recommend all

implementations to provide comprehensive documentation for these

codes.

For scenarios where a path state combines a standard status with an

enterprise-specific reason code (or vice versa), the following

alternatives are presented:

\* Replication of the standard definitions within the enterprise-

specific space, thus permitting direct marking within the same

packet using the ebit.

\* Assigning two TLVs to the same path(s): one containing the

standard part and another housing the vendor-specific part.

3.5. Multiple TLVs assigned to the same route.

We advocate for the employment of TLV grouping wherever feasible.

The inclusion of all marking information within a single message is

recommended, except on the case described in Section 3.4. In

situations where multiple TLVs are associated with a single route,

all markings will be applicable to that route.

3.6. Reason Code Applicability

Reason codes starting with 'invalid' are most likely to be applied to path type 'Invalid'. Describing the reason why they are invalid. Where reason codes starting with 'not preferred' are most likely being used with path types which are not 'Best'. For example reason codes 'not preferred for AS Path Length' or 'not preferred for Local preference' are likely applied to path type 'Backup' to describe why they are considered 'Backup' and not 'Best'.

4. Acknowledgments

We would like to thank Jeff Haas and Maxence Younsi for their

valuable comments.

5. IANA Considerations

This document requests that IANA assign the following new parameters

to the BMP parameters name space.

Type = TBD1 (15 Bits): indicates that it is the IANA-registered Path

Status TLV.

6. Security Considerations

It is not believed that this document adds any additional security

considerations.

7. Normative References

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