Abstract

This document defines new BGP - Link State (BGP-LS) TLVs in order to carry the IGP Traffic Engineering Metric Extensions defined in the IS-IS and OSPF protocols.

Status of This Memo

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1. Introduction

BGP - Link State (BGP-LS) [RFC7752] defines Network Layer Reachability Information (NLRI) and attributes in order to carry link-state information. New BGP-LS Link Attribute TLVs are required in order to carry the Traffic Engineering Metric Extensions defined in [RFC8570] and [RFC7471].

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2. Link Attribute TLVs for TE Metric Extensions

The following new Link Attribute TLVs are defined:

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<tr>
<th>TLV Code Point</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1114</td>
<td>Unidirectional Link Delay</td>
</tr>
<tr>
<td>1115</td>
<td>Min/Max Unidirectional Link Delay</td>
</tr>
<tr>
<td>1116</td>
<td>Unidirectional Delay Variation</td>
</tr>
<tr>
<td>1117</td>
<td>Unidirectional Link Loss</td>
</tr>
<tr>
<td>1118</td>
<td>Unidirectional Residual Bandwidth</td>
</tr>
<tr>
<td>1119</td>
<td>Unidirectional Available Bandwidth</td>
</tr>
<tr>
<td>1120</td>
<td>Unidirectional Utilized Bandwidth</td>
</tr>
</tbody>
</table>

TLV formats are described in detail in the following subsections. TLV formats follow the rules defined in [RFC7752].

2.1. Unidirectional Link Delay TLV

This TLV advertises the average link delay between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
0                   1                   2                   3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Type                        |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|A|  RESERVED   |                   Delay                       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1

where:

Type:  1114
Length:  4
2.2. Min/Max Unidirectional Link Delay TLV

This TLV advertises the minimum and maximum delay values between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Type                        |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|A| RESERVED    |                   Min Delay                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   RESERVED    |                   Max Delay                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2

where:

Type: 1115

Length: 8

2.3. Unidirectional Delay Variation TLV

This TLV advertises the average link delay variation between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|   Type                        |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  RESERVED     |               Delay Variation                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3

where:

Type: 1116

Length: 4
2.4. Unidirectional Link Loss TLV

This TLV advertises the loss (as a packet percentage) between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
|   Type                        |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
|A|  RESERVED   |                  Link Loss                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```

Figure 4

where:

Type: 1117

Length: 4

2.5. Unidirectional Residual Bandwidth TLV

This TLV advertises the residual bandwidth between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
|   Type                        |           Length              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
|                          Residual Bandwidth                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
```

Figure 5

where:

Type: 1118

Length: 4
2.6. Unidirectional Available Bandwidth TLV

This TLV advertises the available bandwidth between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----------------------------------------------+---+
| Type                                          | Length |
+-----------------------------------------------+---+
| +-------------------------------+-------------------------+---+
| | Available Bandwidth            |                         |   |
+-------------------------------+-------------------------+---+
```

Figure 6

where:

Type: 1119

Length: 4

2.7. Unidirectional Utilized Bandwidth TLV

This TLV advertises the bandwidth utilization between two directly connected IGP link-state neighbors. The semantics and values of the fields in the TLV are described in [RFC8570] and [RFC7471].

```
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-----------------------------------------------+---+
| Type                                          | Length |
+-----------------------------------------------+---+
| +-------------------------------+-------------------------+---+
| | Utilized Bandwidth             |                         |   |
+-------------------------------+-------------------------+---+
```

Figure 7

where:

Type: 1120

Length: 4
2.8. Mappings to IGP Source Sub-TLVs

This section documents the mappings between the Link Attribute TLVs defined in this document and the corresponding advertisements sourced by the IGPs.

For OSPFv2 and OSPFv3, the advertisements are defined in [RFC7471]. For IS-IS, the advertisements are defined in [RFC8570].

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>IS-IS Sub-TLV</th>
<th>OSPFv2/OSPFv3 Sub-TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidirectional Link Delay</td>
<td>33</td>
<td>27</td>
</tr>
<tr>
<td>Min/Max Unidirectional Link Delay</td>
<td>34</td>
<td>28</td>
</tr>
<tr>
<td>Unidirectional Delay Variation</td>
<td>35</td>
<td>29</td>
</tr>
<tr>
<td>Unidirectional Link Loss</td>
<td>36</td>
<td>30</td>
</tr>
<tr>
<td>Unidirectional Residual Bandwidth</td>
<td>37</td>
<td>31</td>
</tr>
<tr>
<td>Unidirectional Available Bandwidth</td>
<td>38</td>
<td>32</td>
</tr>
<tr>
<td>Unidirectional Utilized Bandwidth</td>
<td>39</td>
<td>33</td>
</tr>
</tbody>
</table>

Figure 8

3. Security Considerations

Procedures and protocol extensions defined in this document do not affect the BGP security model. See the "Security Considerations" section of [RFC4271] for a discussion of BGP security. Also, refer to [RFC4272] and [RFC6952] for analyses of security issues for BGP. Security considerations for acquiring and distributing BGP-LS information are discussed in [RFC7752].

The TLVs introduced in this document are used to propagate the Traffic Engineering Metric Extensions defined in [RFC8570] and [RFC7471]. These TLVs represent the state and resource availability of the IGP link. It is assumed that the IGP instances originating these TLVs will support all the required security and authentication mechanisms (as described in [RFC8570] and [RFC7471]) in order to prevent any security issues when propagating the TLVs into BGP-LS.
The advertisement of the link attribute information defined in this document presents no additional risk beyond that associated with the existing link attribute information already supported in [RFC7752].

4. IANA Considerations

IANA has made assignments in the "BGP-LS Node Descriptor, Link Descriptor, Prefix Descriptor, and Attribute TLVs" registry for the new Link Attribute TLVs as listed below:

<table>
<thead>
<tr>
<th>TLV Code Point</th>
<th>Description</th>
</tr>
</thead>
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</tr>
<tr>
<td>1120</td>
<td>Unidirectional Utilized Bandwidth</td>
</tr>
</tbody>
</table>

5. References

5.1. Normative References


5.2. Informative References


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