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Advertisement of Dedicated Metric for Flexible Algorithm in IGP
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Abstract

This document proposes a method to advertise dedicated metric for Flex-Algorithm in IGP.

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1. Introduction

Flexible Algorithm (Flex-Algorithm) allows IGP to compute constraint-based paths. [RFC9350] specifies the usage of Flex-Algorithm in Segment Routing (SR) data planes - SR MPLS and SRv6. [RFC9350] extends the Flex-Algorithm for native IPv4 and IPv6 data planes.

However, links shared among multiple algorithms cannot be configured by different metrics, which may limit the flexibility of Flex-Algorithm.

This document proposes a method to advertise dedicated metric for Flex-Algorithm in IGP.

1.1. 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 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Problem Statement

Flex-Algorithm allows IGP to compute the best paths over a network based on user-defined constraints and metrics.

We use Figure 1 to illustrate the problem. In this scenario, all the IGP link metrics are 1.

Flex-Algorithm 128 are enabled on Node A, B, C and D. The topology used by Flex-Algorithm 128 is shown in Figure 2.

Another Flex-Algorithm 129 is also enabled on Node A, B, C and D. The metric-type of Flex-Algorithm 129 is the same with Flex-Algorithm 128. So the topology used by Flex-Algorithm 129 is the same as Figure 2.

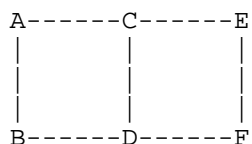


Figure 1

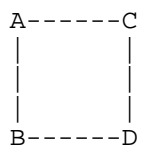


Figure 2

Assume that the traffics are from A to D. Since the metrics of A->B->D and A->C->D are equal, the traffics are forwarded along both of the two paths by ECMP load sharing.

The network operator expects to use link A->B->D as the primary path and link A->C->D as the backup path in Flex-Algorithm 128. Meanwhile, in Flex-Algorithm 129, the link A->C->D is expected to be the primary path and the link A->B->D is expected to be the backup path. So the traffics steered into Flex-Algorithm 128 and the traffics steered into Flex-Algorithm 129 can be carried by different paths separately. If a failure occurs on one path, the other path can still be used as protection.

However, it cannot be satisfied because Flex-Algorithm 128 and 129 use the same metrics in path computation.

If the metric-type of an algorithm is IGP Metric, the metrics advertised for links are used in path computation. For example, the default metric field of TLV-22 in IS-IS (The extended IS reachability TLV [RFC5305]). So Flex-Algorithm 128 and Flex-Algorithm 129 share the same link metrics with the default algorithm of normal SPF calculation.

If the metric-type of an algorithm is a kind of link attribute, such as Min Unidirectional Link Delay or Traffic Engineering Default Metric, the link attributes advertised in Application-Specific Link Attribute (ASLA) [RFC8919] [RFC8920] are used in path computation. So Flex-Algorithm 128 and Flex-Algorithm 129 also share the link attributes.

3. Dedicated Metric for Flexible Algorithm

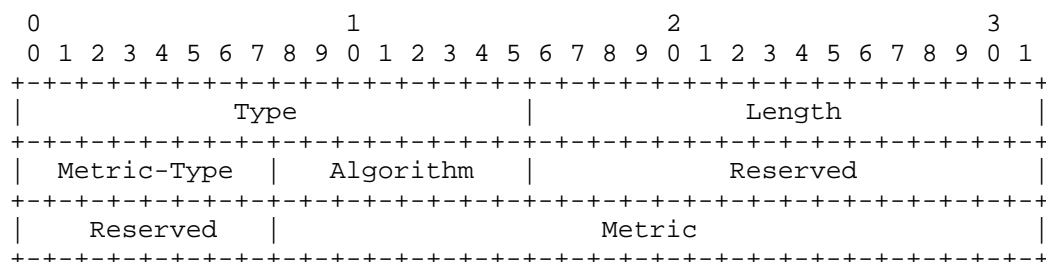
This document defines a new optional metric sub-TLV called the Flex-Algorithm-associated Generic Metric sub-TLV to advertise dedicated metric for Flex-Algorithm.

The format of Flex-Algorithm-associated Generic Metric sub-TLV in IS-IS is as the following:

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	2	3	4	5	6	7	8	9	0	1								
Type										Length										Metric-Type										Algorithm									
Reserved										Metric																													

- o Type: TBD.
- o Length: 6.
- o Metric-Type: A value from the IGP metric-type registry.
- o Algorithm: Associated algorithm from 1 to 255.
- o Metric: Metric value from 1 to 16,777,215.

The format of Flex-Algorithm-associated Generic Metric sub-TLV in OSPF is as the following:



o Type: TBD.

o Length: 8.

o Metric-Type: A value from the IGP metric-type registry.

o Algorithm: Associated algorithm from 1 to 255.

o Metric: Metric value from 1 to 16,777,215.

The Flex-Algorithm-associated Generic Metric sub-TLV is carried in the Application-Specific Link Attribute (ASLA) defined in [RFC8919] (IS-IS) and [RFC8920] (OSPF) which is advertised for Flex-Algorithm application with 'X' Application Identifier Bit. If the Metric-Type and Algorithm fields is consistent with the FAD of a Flex-Algorithm, that Flex-Algorithm should use the metric in the new defined sub-TLV during path calculation.

For example, in IS-IS, if the metric-type of a Flex-Algorithm is 0 (IGP-Metric) and the Flex-Algorithm-associated Generic Metric sub-TLV of the same metric-type is advertised in ASLA carried by TLV-22 (The extended IS reachability TLV [RFC5305]), the metric in the new defined sub-TLV, other than the default metric field in TLV-22, should be used by the associated Flex-Algorithm.

For another example, in OSPFv3, if the metric-type of a Flex-Algorithm is 2 (Traffic Engineering Default Metric) and the Flex-Algorithm-associated Generic Metric sub-TLV of the same metric-type is advertised in ASLA carried by OSPFv3 Router-Link TLV [RFC8362], the metric in the new defined sub-TLV should be used by the associated Flex-Algorithm, ignoring the TE Metric sub-tlv.

4. Security Considerations

TBD

5. IANA Considerations

Flex-Algorithm-associated Generic Metric sub-TLV (TBD)

6. References

6.1. Normative References

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