IPv6 Application of the Alternate Marking Method
draft-fz-6man-ipv6-alt-mark-03

Abstract

   This document describes how the Alternate Marking Method can be used
   as the passive performance measurement tool in an IPv6 domain and
   reports implementation considerations. It proposes how to define a
   new Extension Header Option to encode alternate marking technique and
   also considers the Segment Routing Header TLV alternative.

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].

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1. Introduction

[RFC8321] and [I-D.ietf-ippm-multipoint-alt-mark] describe passive
performance measurement method, which can be used to measure packet
loss, latency and jitter on live traffic. Since this method is based
on marking consecutive batches of packets, the method often referred
as Alternate Marking Method.

This document defines how the alternate marking method can be used to
measure packet loss and delay metrics of IPv6. Consequently, the
SRv6 (Segment Routing over IPv6 data plane) application is also
discussed. Both Extension Header (EH) Option and Segment Routing
Header (SRH) TLV are considered here.

The format of the IPv6 addresses is defined in [RFC4291]. [RFC8200]
introduces the IPv6 Header Format, including the Extension Headers in
the base IPv6 Header and the availability of a 20-bit flow label. In
this respect, [I-D.fioccola-v6ops-ipv6-alt-mark] reported a summary
on the possible implementation options for the application of the
alternate marking method in an IPv6 domain. This document, starting
from the outcome of [I-D.fioccola-v6ops-ipv6-alt-mark], introduces a
new Option/TLV that can be encoded as EH Option or as SRH TLV.

[I-D.song-opsawg-ifit-framework] introduces the telemetry
architecture that can be considered as reference.

2. IPv6 application of the Alternate Marking

The application of the alternate marking requires a marking field.
As mentioned, several alternatives have been analysed in
[I-D.fioccola-v6ops-ipv6-alt-mark] (Extension Header, IPv6 Address,
Flow Label). Anyway the best choice would be the use of an Extension
Header(EH) Option or TLV.

A new Option/TLV can be defined for this scope. This approach
follows [RFC8200] that strongly recommended against creating new EHs
especially with hop by hop behaviour.

The document aims to be general for IPv6 data plane. A possibility
can be to use a Destination or a Hop-By-Hop(HBH) Extension
Header(EH). The assumption is that an EH with an alternate marking
measurement option can be defined. The router processing can be
easily optimized to handle this use case. For SRv6, SRH TLV (as
described in [I-D.ietf-6man-segment-routing-header]) can be a good
choice to encode the Data fields.

The main objective is to ensure enough space to implement and
optimize the deployment of the Alternate Marking method and the use
of a monitored flow identification field (FlowMonID), as introduced
in the next Section, goes in this direction.

The monitored flow identification can be required for some general
reasons:

   Firstly, it helps to reduce the per node configuration.
   Otherwise, each node needs to configure the ACLs for all the
   monitored flows. And, with Flow ID, there may be different
   granularity for flow definition.

   Secondly, it simplifies the counters handling, because hardware is
   hard to pull out and match the flow tuples defined by ACLs,
   especially in tunnels.

   Thirdly, it eases the data export encapsulation and correlation
   for the collectors.

Note that FlowMonID is different from the Flow Label field of the
IPv6 Header ([RFC8200]). Flow Label is used for application service,
like LB/ECMP and QoS. Instead, FlowMonID is only used to identify
the monitored flow. The reuse of flow label field for monitored flow
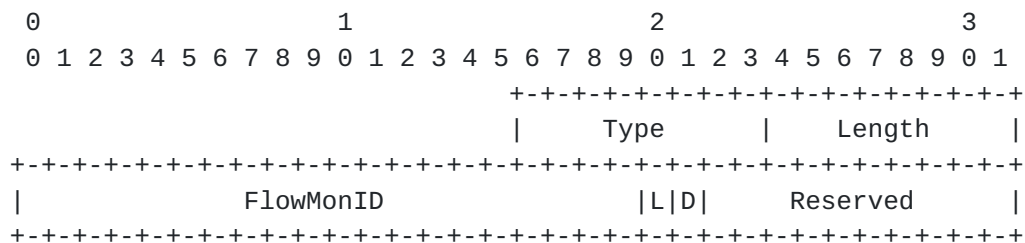identification is not considered since it may change the application

   intent and forwarding behaviour, so that the measurement does not
   align with the original traffic. Furthermore the flow label may be
   changed en route and this may also violate the measurement task.
   That is to explain the reason why we need to introduce FlowMonID for
   IPv6. Flow Label and FlowMonID within the same packet have different
   scope, identify different flows, different usage.

3. Definition of the AltMark Option/TLV

   The desired choice is to define a new Extension Header Option/TLV,
   and the data fields id dedicated for the alternate marking method and
   deployment considerations have inspired the layout.

3.1. Data Fields Format

   The following figure shows the data fields format for enhanced
   alternate marking EH Option/TLV. This AltMark data is expected to be
   encapsulated to specific encapsulation, e.g. the IPv6 Option or SRH
   TLV.

```
    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     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              FlowMonID               |L|D|     Reserved       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   where:

   o Type/Option Type: 8 bit identifier of the type of Option/TLV that
      needs to be allocated. Unrecognised Types MUST be ignored on
      receipt.

   o Length/Opt Data Len: The length of the length Data Fields of this
      Option/TLV in bytes.

   o FlowMonID: 20 bits unsigned integer. The FlowMon identifier field
      is to uniquely identify a monitored flow within the measurement
      domain. The field is set at the ingress node. The FlowMonID can
      be uniformly assigned by the central controller or algorithmically
      generated by the ingress node. The latter approach cannot
      guarantee the uniqueness of FlowMonID but it may be preferred for
      local or private network, where the conflict probability is small
      due to the large FlowMonID space.

   o L: Loss flag as defined in [RFC8321];

o D: Delay flag as defined in [RFC8321];

o Reserved: is reserved for further use. These bits MUST be set to
   zero.

4. AltMark: EH Option or SRH TLV

Using a new EH Option assumes that all routers in the domain support
this type of headers, but, beyond backward compatibility, the new
AltMark Option Layout seems the best way to implement the Alternate
Marking method.

It is important to highlight that the Option Layout can be used both
as Destination Option and as Hop-By-Hop Option depending on the Use
Cases. In general, it is needed to perform end-to-end or hop-by-hop
measurements, and the alternate marking methodology in [RFC8321]
allows, by definition, both end-to-end and hop-by-hop performance
measurements.

So, Hop-By-Hop Options Header or Destination Options Header can be
used based on the chosen type of performance measurement.

SRv6 is a subset of IPv6 and it is one type of routing header. Like
any other use case of IPv6, HBH and Destination options are useable
when SRv6 header is present. Because SRv6 is a routing header,
destination options before the routing header are processed by each
destination in the route list.

SRH TLV can also be used to encode the AltMark Data Fields for SRv6.
Furthermore the intermediated nodes that are not in the SID list may
consider the SRH as a green field, therefore they cannot support and
bypass or support and dig into the SRH TLV.

In summary, it is possible to list the alternative options:

   Destination Option => measurement only by node in Destination
   Address.

   Hop-By-Hop Option => every router on the path with feature
   enabled.

   SRH TLV => every node along the SR path.

   Destination Option + SRH => every node along the SR path.

Note that the SRH TLV and Destination Option + SRH can be considered
equivalent; so in this case it may be preferred the use of SRH TLV.

   In addition to the previous alternatives, for legacy network it is
   possible to mention a non-conventional application of SRH TLV and
   Destination Option for the hop-by-hop usage. [RFC8200] defines that
   the nodes along a path examine and process the Hop-by-Hop Options
   header only if HBH processing is explicitly configured. But, on the
   other hand, using SRH TLV or Destination Option for hop-by-hop action
   would cause worse performance than Hop-By-Hop. The only motivation
   for hiding the hop-by-hop options inside of destination options can
   be for compatibility reasons. Anyway this is not recommended.

5. Alternate Marking Method Operation

   [RFC8321] and [I-D.ietf-ippm-multipoint-alt-mark] describe in detail
   the methodology.

6. Security Considerations

   tbc

7. IANA Considerations

   The option type should be assigned in IANA's "Destination Options and
   Hop-by-Hop Options" registry. Also, the TLV type should be assigned
   from Segment Routing Header TLVs Registry.

8. Acknowledgements

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