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   **Performance Measurement (PM) with Alternate Marking Method in Service
                    Function Chaining (SFC) Domain
                     draft-mirsky-sfc-pmamm-04**

Abstract

   This document describes how the alternate marking method be used as
   the passive performance measurement method in a Service Function
   Chaining (SFC) domain.

Status of This Memo

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1. Introduction

[RFC7665] introduced architecture of a Service Function Chain (SFC)
in the network and defined its components as classifier, Service
Function Forwarder (SFF), and Service Function (SF). [RFC8321]
describes passive performance measurement method, which can be used
to measure packet loss, latency, and jitter on live traffic. Because
this method is based on marking consecutive batches of packets the
method often referred to as Alternate Marking Method (AMM).

This document defines how the alternate marking method can be used to
measure packet loss and delay metrics of a service flow over e2e or
any segment of the SFC.

2. Conventions used in this document

2.1. Terminology

MM: Marking Method

OAM: Operations, Administration and Maintenance

SFC: Service Function Chain

SF: Service Function

SFF: Service Function Forwarder

SFP: Service Function Path

NSH: Network Service Header

2.2. 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.

3. Mark Field in NSH Base Header

[RFC8300] defines the format of the Network Service Header (NSH).

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |Ver|O|R|    TTL    |   Length  | M |R|R|MD Type|     Proto     |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
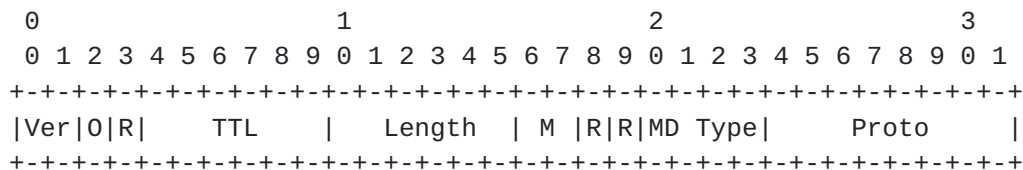
Figure 1: NSH Base format

This document defines the two-bit long field, referred to as Mark
field (M in Figure 1, as part of NSH Base and designated for the
alternate marking performance measurement method [RFC8321]. The Mark
field MUST NOT be used in defining forwarding and/or quality of
service treatment of an SFC packet. The Mark field MUST be used only
for the performance measurement of data traffic in the SFC layer.
Because the setting of the field to any value does not affect
forwarding and/or quality of service treatment of a packet, the
alternate marking method in SFC layer can be viewed as a real example
of passive performance measurement method.

Figure 2 displays the format of the Mark field.

```
 0
 0   1
+-+-+-+-+
| L | D |
+-+-+-+-+
```

Figure 2: Mark field format

   where:

   o L- Loss flag;

   o D - Delay flag.

4. Theory of Operation

   The marking method can be successfully used in the SFC. Without
   limiting any generality consider SFC presented in Figure 3. Any
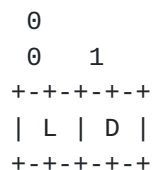   combination of markings, Loss and/or Delay, can be applied to a
   service flow by any component of the SFC at either ingress or egress
   point to perform node, link, segment or end-to-end measurement to
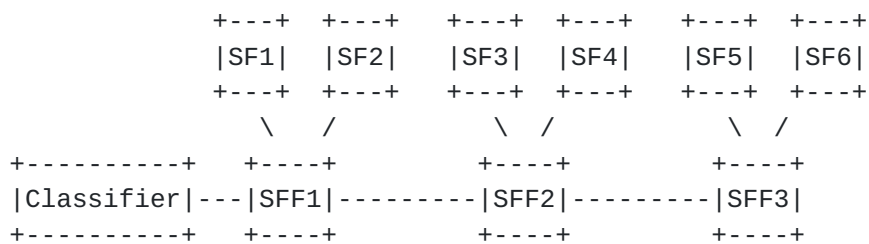   detect performance degradation defect and localize it efficiently.

```
            +---+  +---+    +---+  +---+    +---+  +---+
            |SF1|  |SF2|    |SF3|  |SF4|    |SF5|  |SF6|
            +---+  +---+    +---+  +---+    +---+  +---+
               \   /          \   /           \   /
   +----------+   +----+          +----+          +----+
   |Classifier|---|SFF1|---------|SFF2|---------|SFF3|
   +----------+   +----+          +----+          +----+
```

                       Figure 3: SFC network

   Using the marking method a component of the SFC creates distinct sub-
   flows in the particular service traffic over SFC. Each sub-flow
   consists of consecutive blocks that are unambiguously recognizable by
   a monitoring point at any component of the SFC and can be measured to
   calculate packet loss and/or packet delay metrics.

4.1. Single Mark Enabled Measurement

   As explained in the [RFC8321], marking can be applied to delineate
   blocks of packets based either on the equal number of packets in a
   block or based on an the same time interval. The latter method
   offers better control as it allows better account for capabilities of
   downstream nodes to report statistics related to batches of packets
   and, at the same time, time resolution that affects defect detection
   interval.

   If the Single Mark measurement used, then the Delay flag Figure 2
   MUST be set to zero on transmit and ignored on reception by
   monitoring point.

The Loss flag is used to create alternate flows to measure the packet
loss by switching the value of the Loss flag every N-th packet or at
specified time intervals. Delay metrics MAY be calculated with the
alternate flow using any of the following methods:

o First/Last Packet Delay calculation: whenever the marking, i.e.,
   the value of Loss flag, changes a component of the SFC can store
   the timestamp of the first/last packet of the block. The
   timestamp can be compared with the timestamp of the packet that
   arrived in the same order through a monitoring point at a
   downstream component of the SFC to compute packet delay. Because
   timestamps collected based on order of arrival, this method is
   sensitive to packet loss and re-ordering of packets

o Average Packet Delay calculation: an average delay is calculated
   by considering the average arrival time of the packets within a
   single block. A component of the SFC may collect timestamps for
   each packet received within a single block. Average of the
   timestamp is the sum of all the timestamps divided by the total
   number of packets received. Then the difference between averages
   calculated at two monitoring points is the average packet delay on
   that segment. This method is robust to out of order packets and
   also to packet loss (only a small error is introduced). This
   method only provides a single metric for the duration of the
   block, and it doesn't give the minimum and maximum delay values.
   Highly optimized implementation of the method can reduce the
   duration of the block and thus overcome the limitation.

4.2. Double Mark Enabled Measurement

Double Mark method allows measurement of minimum and maximum delays
for the monitored flow, but it requires more nodal and network
resources. If the Double Mark method used, then the Loss flag MUST
be used to create the alternate flow, i.e., mark larger batches of
packets. The Delay flag MUST be used to denote single packets to
measure delay jitter.

The first marking (Loss flag alternation) is needed for packet loss
and also for average delay measurement. The second marking (Delay
flag is put to one) creates a new set of marked packets that are
fully identified over the SFC, so that a component can store the
timestamps of these packets; these timestamps can be compared with
the timestamps of the same packets on another element of the SFC to
compute packet delay values for each packet. The number of
measurements can be easily increased by changing the frequency of the
second marking. But the rate of the second marking must be not too
high to avoid out of order issues. This method supports the
calculation of not only the average delay but also the minimum and

   maximum delay values and, in broader terms, to know more about the
   statistic distribution of delay values.

4.3. Residence Time Measurement with the Alternate Marking Method

   Residence time is the variable part of the propagation delay that a
   packet experiences while traversing a network, e.g., SFC. Residence
   Time over an SFC is the sum of the nodal residence times, i.e.,
   periods that the packet spent in each of SFFs that compose the SFC.
   The nodal residence time in SFC itself is the sum of sub-nodal
   residence times that the packet spent in each of SFs that are part of
   the given SFC and are mapped to the SFF. The residence time and
   deviation of the residence time metrics may include any combination
   of minimum, maximum, values over measurement period, as well as mean,
   median, percentile. These metrics may be used to evaluate the
   performance of the SFC and its elements before and during its
   operation.

   Use of the specially marked packets simplifies residence time
   measurement and correlation of the measured metrics over the SFC end-
   to-end. For example, the alternate marking method may be used as
   described in Section 4.2 to identify packets in the data flow to be
   used to measure the residence time. The nodal and sub-nodal
   residence time metrics can be locally calculated and then collected
   using either in-band or out-band OAM mechanisms.

5. IANA Considerations

5.1. Mark Field in NSH Base Header

   This document requests IANA to allocate Mark field as two bits-long
   field from NSH Base Header Reserved Bits [RFC8300].

   This document requests IANA to register values of the Mark field of
   NSH as the following:

   +--------------+---------+--------------------------+---------------+
   | Bit Position | Marking | Description | Reference |
   +--------------+---------+--------------------------+---------------+
   | 0 | S | Single Mark Measurement | This document |
   | 1 | D | Double Mark Measurement | This document |
   +--------------+---------+--------------------------+---------------+

                      Table 1: Mark field of SFC NSH

6. Security Considerations

   This document lists the OAM requirement for SFC domain and does not
   raise any security concerns or issues in addition to ones common to
   networking and SFC.

7. Acknowledgment

   TBD

8. References

8.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <https://www.rfc-editor.org/info/rfc2119>.

   [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC
              2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174,
              May 2017, <https://www.rfc-editor.org/info/rfc8174>.

   [RFC8300] Quinn, P., Ed., Elzur, U., Ed., and C. Pignataro, Ed.,
              "Network Service Header (NSH)", RFC 8300,
              DOI 10.17487/RFC8300, January 2018,
              <https://www.rfc-editor.org/info/rfc8300>.

8.2. Informative References

   [RFC7665] Halpern, J., Ed. and C. Pignataro, Ed., "Service Function
              Chaining (SFC) Architecture", RFC 7665,
              DOI 10.17487/RFC7665, October 2015,
              <https://www.rfc-editor.org/info/rfc7665>.

   [RFC8321] Fioccola, G., Ed., Capello, A., Cociglio, M., Castaldelli,
              L., Chen, M., Zheng, L., Mirsky, G., and T. Mizrahi,
              "Alternate-Marking Method for Passive and Hybrid
              Performance Monitoring", RFC 8321, DOI 10.17487/RFC8321,
              January 2018, <https://www.rfc-editor.org/info/rfc8321>.

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