IOAM Direct Exporting (DEX) Option Extensions for Incorporating the Alternate-Marking Method

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Motivation , Objective and Solution

Motivation and Objective

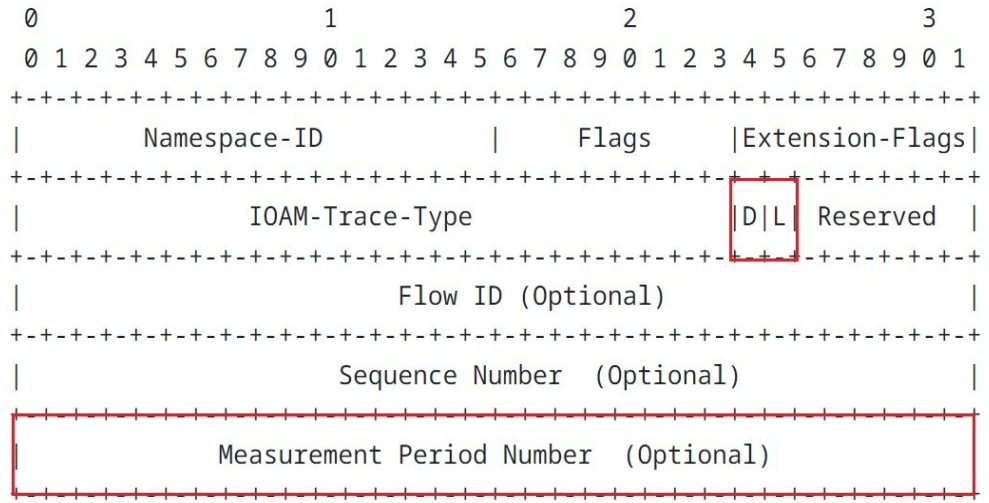
- The IOAM and Alternate-Marking Method are both the On-Path hybrid measurement methods， and it is necessary to unify the packet encapsulation format to reduce the complexity of the forwarding chip.
- IOAM Direct Export (DEX) Option [RFC9326] （postcard mode） have faced some problems in performance measurements such as packet loss , including more processing overhead and bandwidth, inaccurate measurement results and inconsistent measurement methodology, etc.
- This draft intends to augment IOAM's capabilities in performance measurement aspects by incorporating the Alternate-Marking Method.

Solution

- By extending DEX Option, defines the most significant 2 bits of the Reserved field (D, L) and MPN field .
- Employing 32 bits for Flow ID, which may be devided into two sub-fields: NodeID (assigned globely) and FlowMonID （assigned locally） , so it can be deployed in distributed way in case of centralized controller unavaillable.
- It can support the three IOAM operation modes: only IOAM trace monitoring; only performance measurement; hybrid.

Benefits

- Augment IOAM DEX Option's capabilities in performance measurement.
- Augment the Alternate-Marking Method in IPv6 (RFC9343) by extending 32-bit Flow ID, SN and MPN field.
- Only unique packet header encapsulation format is required for both IOAM trace monitoring and performance measurement such as packet loss, latency and jitter, thus simplifing the complexity of forwarding chips （like EVPN integrating L2/3 MPLS VPN).



IANA Consideration

– IOAM Option-Type: IOAM Extended DEX Option Type (TBA-type, suggested code point 5)

Motivation , Objective and Solution(cont)

the collision probability (CP) of Flow ID when deployed in distributed way

- 32-bit Flow ID is used for every source node
- N edge nodes (source nodes) in a large-scale operator network, and each source node can generate a unique Flow ID for every measured flow independently and randomly.
- Each node randomly generates M different Flow IDs.

32-bit Flow ID	N=100	N=100	N=200	N=200	N=200	N=200
	M=100	M=200	M=200	M=300	M=400	M=500
CP	0.0115	0.0453	0.1692	0.3410	0.5235	0.6860

When using 20-bit FlowMonID (RFC9343) and generating 10000 concurrent flows, CP will drastically rises to approximately 100%.

Why extend 32-bit Flow ID, SN and MPN field for the Alternate-Marking Method ?

- Compared to 20-bit FlowMonID, CP is significantly reduced in distributed way. On the other hand, 32-bit Flow ID can be split into two sub-fields (NodeID assigned globely and FlowMonID assigned locally), with sufficient space respectively.
- By employing MPN field, it is more simpler and accurate for an analyzer or collector to correlate loss measurement data belonging to the same measurement period from different nodes, especially in the case of milliseconds-level measurement block.
- By using SN and MPN fields together, multiple timestamps in different packets from different nodes belonging to the same measurement block can be identified in case of packets out of order, and it also can be used to identify which double-marked packet is lost. Compared to selecting a single double-marked packet for each batch, which may lead to a invalid delay result if this double-marked packet is lost, selecting multiple double-marked packets for each measurement batch provides a robust and accurate method for packet delay measurement (also the average delay can be obtained for every measurement period).

Next Steps

- Any comments or any suggestions?
- Request for WG adoption call