DetNet Packet Loss and Delay Performance Measurement

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Authors

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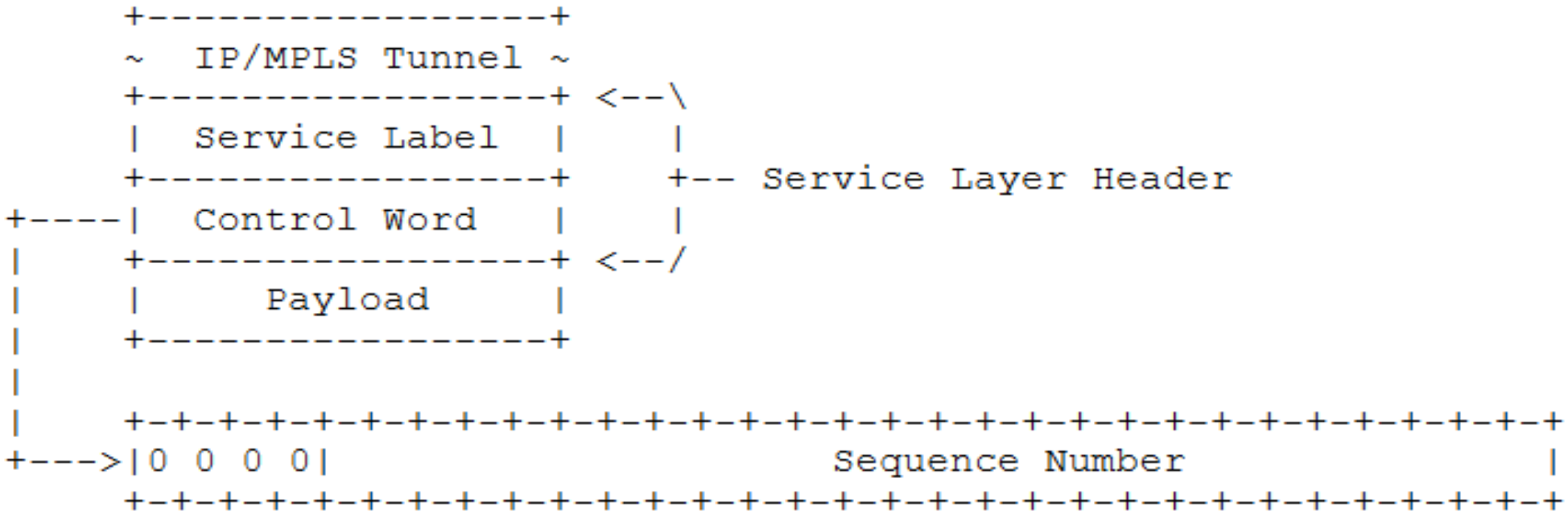
Motivation

- DetNet is defined to provide end-to-end bounded latency and extremely low pack et loss rates for critical flows.
- It's important to measure and monitor the packet loss rates and end-to-end delay and delay variation of a DetNet flow path, which allows evaluation of whether the Service Level Agreements (SLA) of the provided DetNet services are satisfied.
- These metrics are also useful in network/traffic planning, trouble shooting, and ne twork performance evaluation.
- Passive performance measurement does not affect the behavior of the real DetN et service, and can provide more accurate measurement results than active PM.
- This document defines protocol mechanisms to support Passive PM for DetNet s ervices.

d-CW based PM



- MPLS-based encapsulation introduces the DetNet service layer that makes it possible to implement Passive PM for DetNet services, where
  - The Service Label (S-Label) is used for flow identification
  - The Sequence Number in d-CW is used for packet counting/timestamping, and counts/timestamp correlation
  - No extra packets injected, the performance of the DetNet services will not be affected

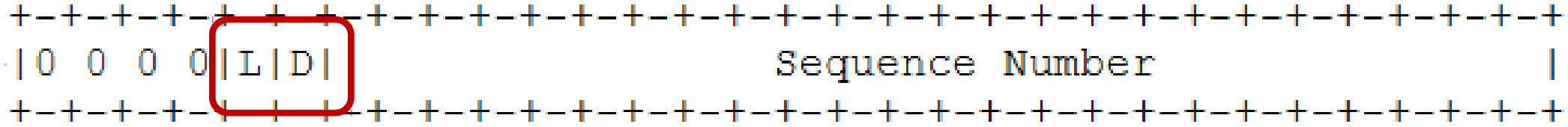
Loss Measurement

- To measure the number of packets transmitted at the ingress node but not receiv ed at the egress node B within a measurement interval, there needs a way to dete rmine which packets belong to which measurement interval.
- The measurement interval number is calculated as the modulo of the sequence n umber and a pre-configured constant.
  - Measurement Interval = "Sequence Number" mod "Pre-configured constant".
- Then:
  - Packet Loss[n] = A_TxP[n] - B_RxP[n], where:
  - The “n” is the measurement interval,
  - The A_TxP[n] is the number of packets transmitted at the ingress node;
  - The B_RxP[n] is the number of packets received at the egress node;
  - The A_TxPs and B_RxPs are communicated through RFC6374 LM message;

Delay Measurement

- Since each packet will carry a Sequence Number, it will be used for cor relation between the timestamps collected from the ingress node and the timestamps collected from the egress node;
- Then:
  - Packet Delay[n] = B_RxT[n] - A_TxT[n], where:
  - The “n” is the sequence number;
  - The B_RxT[n] is the timestamp of the No. “n” packet when received at the egr ess node;
  - The A_TxT[n] is the timestamp of the No. “no” packet when sent at the ingres s node;

Embedded DM/LM Indication or Out-of-b and Configuration/Signaling ?



- Embedded DM/LM indication
  - Allocate two bits (D bit and L bit) from the Sequence Number space, indicate whether LM and /or DM are enabled;
  - L bit: Loss Measurement Indicator, set at the ingress, notify the Measurement Points (MPs) to count this packet;
  - D bit: Delay Measurement Indicator, set at the ingress, notify the MPs to timestamp this pack et;
  - The D bit can be optional, the L bit is more desired;
- Alternative solutions (Out-of-band)
  - DetNet configuration model, or
  - PCEP extension, or
  - Command Line Interface (CLI).
  - The MPs may take more time and use more complex way to determine whether a packet should b e counted, or whether a packet should be timestamped (depends on implementation).

Lou's Math on Sequence Number Space

Bits Needed	64 BPkt	128 BPkt	256 BPkt	512 BPkt	1514 BPkt	4096 BPkt	9216 BPkt
10M	14	13	12	11	10	8	7
1G	21	20	19	18	16	15	14
100G	*27*	26	25	24	23	22	20
400G	*29*	*28*	*27*	26	25	24	22
1T	*30*	*30*	*29*	*28*	26	25	24

- Given the packet size of 1.5K, 26 bits looks sufficient for all flows to hold 1 sec tra ffic.
  - Considering large flow normally means large packets
- Can we squeeze out one or two bits for DetNet OAM?

Extensions to RFC6374

- New TLVs to RFC6374 LM and DM messages
  - Measurement Interval TLV
    - Carry the Measurement Interval in the LM message, when perform packet loss measure ment
  - DetNet control word TLV
    - Carry the d-CW in the DM message, when perform packet delay measurement
  - Service Label TLV
    - Can be carried in both LM and DM message, for identifying the measured DetNet flow.

Next Steps

- Ask opinons from the WG regarding to the DM/LM indication
  - Embedded or out-of-band?
- Solicit more reviews/comments, refine the draft accordingly.

Thanks