DetNet Packet Loss and Delay Performance Measurement

draft-chen-detnet-loss-delay-00

Authors
Mach Chen
Andrew G. Malis
Motivation

• DetNet is defined to provide end-to-end bounded latency and extremely low packet 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 network performance evaluation.

• Passive performance measurement does not affect the behavior of the real DetNet service, and can provide more accurate measurement results than active PM.

• This document defines protocol mechanisms to support Passive PM for DetNet services.
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 received at the egress node B within a measurement interval, there needs a way to determine which packets belong to which measurement interval.

• The measurement interval number is calculated as the modulo of the sequence number 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 correlation 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 egress node;
    • The A_TxT[n] is the timestamp of the No. “no” packet when sent at the ingress node;
Embedded DM/LM Indication or Out-of-band 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 packet;
  - 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 be counted, or whether a packet should be timestamped (depends on implementation).
Lou’s Math on Sequence Number Space

<table>
<thead>
<tr>
<th>Bits Needed</th>
<th>64 BPkt</th>
<th>128 BPkt</th>
<th>256 BPkt</th>
<th>512 BPkt</th>
<th>1514 BPkt</th>
<th>4096 BPkt</th>
<th>9216 BPkt</th>
</tr>
</thead>
<tbody>
<tr>
<td>10M</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>1G</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>100G</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>22</td>
<td>20</td>
</tr>
<tr>
<td>400G</td>
<td>29</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>1T</td>
<td>30</td>
<td>30</td>
<td>29</td>
<td>28</td>
<td>26</td>
<td>25</td>
<td>24</td>
</tr>
</tbody>
</table>

- Given the packet size of 1.5K, 26 bits looks sufficient for all flows to hold 1 sec traffic.
  - 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 measurement
  - 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 opinions from the WG regarding to the DM/LM indication
  • Embedded or out-of-band?

• Solicit more reviews/comments, refine the draft accordingly.
Thanks