Use case: MPLS path monitoring

Monitoring MPLS paths

- network topology (the implementation detects and stacks LDP signaled Labels)
- the MPLS path monitoring packets remain in data plane
- a single PMS is able to address all LSPs of a domain, a PMS allows arbitrary path combinations
- Example task shown here: PMS based data plane failure detection between LER i and LER j.

In general, all MPLS LSPs of a domain can be monitored this way.
Measurement Topology (extract)

case one: IPPM and PMS comparison of RT Delay measurement:

▶ PerfMA 1 ↔ PerfMA 3 (reference)
▶ PMS ↔ LER 3

case two: LER 2 ↔ LER 3 measurements:

▶ LER 2 ↔ LER 3 = PMS →
LER 1 → LER 2 → LER 3 →
LER 2 → LER 1 → PMS →
PMS ↔ LER 2
▶ LER 3 ↔ LER 2 in analogy by subtracting PMS ↔ LER 3

Rüdiger Geib, Raik Leipnitz (SPRING WG) PMS implementation report July 2016 2 / 5
Measurement Results and Evaluation

- measurement: 288 mean RT Delay values each calculated of 10 singleton samples (8 hours measurement)
- Anderson-Darling-K-Sample (ADK) is successful ($\leq 1.993$, RFC 6576) after adjustment of the mean / median
- high precision of the values
- no network emulator inserted
- LER 2 $\leftrightarrow$ LER 3 two calculation methods result in mean / median values differing by 10 $\mu$s

<table>
<thead>
<tr>
<th>Test metric</th>
<th>PERFAS+</th>
<th>PMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>minimum [$\mu$s]</td>
<td>691.5</td>
<td>695.5</td>
</tr>
<tr>
<td>maximum [$\mu$s]</td>
<td>701</td>
<td>704.5</td>
</tr>
<tr>
<td>mean [$\mu$s]</td>
<td>695.4</td>
<td>699.6</td>
</tr>
<tr>
<td>median [$\mu$s]</td>
<td>695.5</td>
<td>699.5</td>
</tr>
<tr>
<td>standard deviation [$\mu$s]</td>
<td>1.4</td>
<td>1.7</td>
</tr>
<tr>
<td>ADK-value</td>
<td>278.445</td>
<td></td>
</tr>
<tr>
<td>ADK-value (adj. of mean)</td>
<td>1.701</td>
<td></td>
</tr>
<tr>
<td>ADK-value (adj. of median)</td>
<td>1.982</td>
<td></td>
</tr>
</tbody>
</table>

Table: PERFAS+ and PMS OWD measurement results for path LER 1 to LER 2 and ADK test results
IP-address variation

- identical routing paths for all measurements, no Equal-cost multi-path routing
- 11 mean round-trip delay values of 10 singletons per measurement, collected at different times of a day
- only IP-addresses varied, MPLS-stack kept the same
- PMS connected to two different LER “one” and “two”
- difference in mean values of 19.5 $\mu$s and 14.4 $\mu$s, RTD a.b.c.0 is always smaller than that of a.b.c.32

<table>
<thead>
<tr>
<th>Interface IP-address</th>
<th>mean [\mu s]</th>
<th>median [\mu s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>one / a.b.c.0</td>
<td>1413.2</td>
<td>1412</td>
</tr>
<tr>
<td>one / a.b.c.32</td>
<td>1432.7</td>
<td>1433</td>
</tr>
<tr>
<td>two / a.b.c.0</td>
<td>1446.4</td>
<td>1446</td>
</tr>
<tr>
<td>two / a.b.c.32</td>
<td>1460.8</td>
<td>1460.5</td>
</tr>
</tbody>
</table>

Table: Destination-IP-address variation
MPLS topology detection

- the LDP signaled MPLS topology is discovered by management plane access
- For more information, see:
  - Blili, R. and Maghbouleh, A.
    NANOG 43 Brooklyn, NY.
  - Horneffer, M. and Schnitter, S.
    Traffic Matrices for MPLS Networks with LDP Traffic Statistics.