Outline

• Updates from v06-v07
• Remaining issues requiring WG discussions
• Plan for next step
Updates Overview (v06-v07)

- Structure changes
  - Move challenges to back; restructure metric definition
- Many small text changes as well
Main Update (v06-v07): Metric Definition

• Restructure the definition of each metric to be consistent with ALTO base protocol (RFC 7285): why
  – v06, structure, for each metric, - RFC7285

14.2. ALTO Cost Metric Registry

IANA has created and now maintains the "ALTO Cost Metric Registry", listed in Table 3.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Intended Semantics</th>
</tr>
</thead>
<tbody>
<tr>
<td>routincost</td>
<td>See Section 6.1.1.1</td>
</tr>
<tr>
<td>priv</td>
<td>Private use</td>
</tr>
</tbody>
</table>

Table 3: ALTO Cost Metrics

This registry serves two purposes. First, it ensures uniqueness of identifiers referring to ALTO cost metrics. Second, it provides references to particular semantics of allocated cost metrics to be applied by both ALTO servers and applications utilizing ALTO clients.

Requests to add a new value to the registry MUST include the following information:

- Identifier: The name of the desired ALTO cost metric.
- Intended Semantics: ALTO costs carry with them semantics to guide their usage by ALTO clients. For example, if a value refers to a measurement, the measurement units must be documented. For proper implementation of the ordinal cost mode (e.g., by a third-party service), it should be documented whether higher or lower values of the cost are more preferred.
- Security Considerations: ALTO costs expose information to ALTO clients. As such, proper usage of a particular cost metric may require certain information to be exposed by an ALTO service provider. Since network information is frequently regarded as proprietary or confidential, ALTO service providers should be made aware of the security ramifications related to usage of a cost metric.
Main Update (v06-v07): Metric Definition

- Restructure the definition of each metric to be consistent with ALTO base protocol (RFC 7285): change

  - v06, structure, for each metric, defines
    - Metric Name
    - Metric Description
    - Method of Measurement or Calculation
    - Units of Measurement
    - Measurement Point(s) with Potential Measurement Domain
    - Measurement Timing
    - Use and Applications

  - v07, structure, for each metric, defines
    - Metric Name
    - Metric identifier
    - Intended semantics
      - Metric Description
      - Metric Representation
    - Use and Example
    - Measurement Considerations
      - Method of Measurement or Calculation
      - Measurement Point(s) with Potential Measurement Domain
      - Measurement Timing
## Metric Details

<table>
<thead>
<tr>
<th>Metric</th>
<th>Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-Way Delay, Round-trip Time, Packet Delay Variation</td>
<td>A single JSONNumber conforming to Sec. 6 [RFC8259] (int [frac] [exp]); Must be non-negative; unit is ms;</td>
</tr>
<tr>
<td>Hop Count</td>
<td>The metric value type is a single 'JSONNumber' type value conforming to the number specification (Section 6, [RFC8259]). The number MUST be an integer and non-negative.</td>
</tr>
<tr>
<td>Packet Loss</td>
<td>The metric value type is a single 'JSONNumber' type value conforming to the number specification (Section 6, [RFC8259]). The number MUST be non-negative. The value represents the percentage of packet loss.</td>
</tr>
<tr>
<td>Throughput, Max Reservable BW, Residue BW</td>
<td>The metric value type is a single 'JSONNumber' type value conforming to the number specification (Section 6, [RFC8259]). The number MUST be non-negative. The unit is Mbps.</td>
</tr>
</tbody>
</table>

- Suggestions but not adopted: (1) add *infinity*; (2) allow units such as ms, s, Mbps/Kbps/Gbps, ...
Update: Operations Considerations

- Substantially extended the section on operations considerations, to emphasize,
  - Some performance metric can be a complex function of multiple factors:
    - Traffic type (e.g., UDP, TCP; video)
    - Client behavior (e.g., arrival patterns such as Poisson, periodical...)
    - Network settings (e.g., scheduling policies, cross traffic interference, ...)
    - Time
  - A network may adopt different measurement approaches
    - Active (e.g., probe measured, packet pair measured, ...)
    - Passive (e.g., derivation from existing data such as logs)
  - Computing some performance metrics can involve non-trivial computation, which has implications on timeliness, denial-of-service, ...
    - Data cleaning, aggregation, inference, ...
Remaining Issue (1): Metric Definition Consistency and Reusability

- A basic issue is consistency and reusability in IETF ALTO performance metrics [this document]

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Intended Semantics</th>
</tr>
</thead>
<tbody>
<tr>
<td>owdelay</td>
<td>See Section 2.1</td>
</tr>
<tr>
<td>rtt</td>
<td>See Section 2.2</td>
</tr>
<tr>
<td>pdv</td>
<td>See Section 2.3</td>
</tr>
<tr>
<td>hopcount</td>
<td>See Section 2.4</td>
</tr>
<tr>
<td>pktloss</td>
<td>See Section 2.5</td>
</tr>
<tr>
<td>throughput</td>
<td>See Section 2.6</td>
</tr>
<tr>
<td>maxresbw</td>
<td>See Section 3.1</td>
</tr>
<tr>
<td>residuebw</td>
<td>See Section 3.2</td>
</tr>
</tbody>
</table>

IPPM metrics [2][1]

- **UDP**
  - RTDelay_Active_IP-UDP-
    Periodic_RFCXXXXsecY_Seconds_95Percentile
  - RTLoss_Active_IP-UDP-
    Periodic_RFCXXXXsecY_Percent_LossRatio
  - OWPDV_Active_IP-UDP-
    Periodic_RFCXXXXsecY_Seconds_95Percentile
  - OWDelay_Active_IP-UDP-Poisson-
    Payload250B_RFCXXXXsecY_Seconds_<statistic>
  - OWDelay_Active_IP-UDP-Periodic20m-
    Payload142B_RFCXXXXsecY_Seconds_<statistic>

- **TCP**
  - RTDelay_Passive_IP-
    TCP_RFCXXXXsecY_Seconds_<statistic>

- **DNS**
  - RTDNS_Active_IP-UDP-
    Poisson_RFCXXXXsecY_Seconds_Raw RLDNS_Active_IP-UDP-Poisson_RFCXXXXsecY_Logical_Raw

Many levels of reusability and consistency

- Reusability:
  - base ALTO metrics on IPPM metric registry, or
  - not

- Consistency
  - Same ID
  - Same metric unit (e.g., ippm latency unit is second, current document is ms)
Author Discussion

- IPPM metrics are more for infrastructure management
  - Underlying network technology *aware* -- implementation focus
- ALTO metrics are more for applications
  - Underlying network technology *transparent* (e.g., do not care if the transport uses IP/MPLS, ...) – interface focus
## Example Network Metrics Exposure

### SLA Performance

To view current IP network performance, visit IP Network Performance Map.

Choose a Network: [SprintLink] [Global MPLS]

<table>
<thead>
<tr>
<th>Name</th>
<th>Metric</th>
<th>Committed Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTRA-REGION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>North America</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backbone Delay</td>
<td>55.00 ms</td>
<td>34.18 ms</td>
</tr>
<tr>
<td>Packet Loss</td>
<td>0.30 %</td>
<td>0.0050 %</td>
</tr>
<tr>
<td>Jitter</td>
<td>2 ms</td>
<td>0.00031 ms</td>
</tr>
<tr>
<td><strong>Europe</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backbone Delay</td>
<td>45.00 ms</td>
<td>17.35 ms</td>
</tr>
<tr>
<td>Packet Loss</td>
<td>0.30 %</td>
<td>0.00077 %</td>
</tr>
<tr>
<td>Jitter</td>
<td>2 ms</td>
<td>0.0006 ms</td>
</tr>
<tr>
<td><strong>Asia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backbone Delay</td>
<td>105.00 ms</td>
<td>65.07 ms</td>
</tr>
<tr>
<td>Packet Loss</td>
<td>0.30 %</td>
<td>0.0045 %</td>
</tr>
<tr>
<td>Jitter</td>
<td>2 ms</td>
<td>0.0030 ms</td>
</tr>
<tr>
<td><strong>INTER-REGION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Europe to North America</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example Network Metrics Exposure

Link statistics for Calgary, Canada to Chicago, IL

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Delay</th>
<th>Packet Loss</th>
<th>Jitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently (as of 33 mins ago)</td>
<td>35.00 ms</td>
<td>0.00 %</td>
<td>0.0000 ms</td>
</tr>
</tbody>
</table>
Author Discussion

• IPPM metrics are more for infrastructure management
  – Underlying network technology *aware* -- implementation focus

• ALTO metrics are more for applications
  – Underlying network technology *transparent* (e.g., do not care if the transport uses IP/MPLS, ...) – interface focus
  – Application-layer performance depends on
    • Network equivalent classes (e.g., categories)
    • Application behaviors
      • **UDP**
        - RTDelay_Active_IP-UDP-Periodic_RFCXXXsecY_Seconds_95Percentile
        - OWDelay_Active_IP-UDP-Poisson-Payload250B_RFCXXXsecY_Seconds_<statistic>
        - OWDelay_Active_IP-UDP-Periodic20m-Payload142B_RFCXXXsecY_Seconds_<statistic>
      • **TCP**
        - RTDelay_Passive_IP-TCP_RFCXXXsecY_Seconds_<statistic>
Proposed Moving Forward

- Distinguish performance metrics
  - reflecting categories
  - dependency on application behaviors or not
    - propagation delay vs
    - traffic pattern

- Scheduled a discussion meeting with IPPM
- Post to IPPM as well as ALTO to seek feedback after updates
Remaining Issue (2): Operations and Security Considerations

- How much to update
  - Operations considerations
  - Security considerations
Next Step Plan

- Finalize updates and submit an update by end of August