



Path Computation Based on Precision Availability Metrics

draft-contreras-pce-pam-03

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Recap

- Some communication services present performance requirements expressed as Service Level Objectives (SLO) (e.g., [RFC9543])
- IPPM WG has defined Performance Availability Metrics (PAM) for describing and monitoring SLOs [RFC9544]
- PCE nowadays can compute or select paths based on metrics that can represent a bound or maximum, but not in the form of PAM
- For services with SLOs is convenient to create / select a path knowing its behavior along the time

- The draft has been already presented at IETF 118 and 119

Changes in -03

- Applicability sub-section added to describe scenarios of interest: path provisioning, path selection and incident management (details in next slide)
- Initial description of PCEP message extension, following Routing Backus-Naur Form (RBNF), inspired by [RFC8233] definitions (details in next slide)
- Additional comments incorporated
- Quan added as co-author
- Update of references (e.g., PAM RFC)

Applicability

- Provision of paths according to the desired behavior along the time.
 - The path calculation can take into consideration the measured characteristics of the segments forming that path for decision.
- Selection of a path according to its long-run characteristics.
 - An existing path being monitored along the time can be selected if its behavior is compliant with the long-run behavior expected by the customer.
- Triggering of corrective actions for a selected path.
 - The precision metrics can assist on the identification of such potential problems, e.g., raising incidents or anomalies to operational groups, as described in [I-D.ietf-nmop-network-incident-yang].

PCEP messages

```
<PCReq Message> ::= <Common Header>
                    [<svec-list>]
                    <request-list>

where:
  <svec-list> ::= <SVEC>
                [<OF>]
                [<metric-list>]
                [<precision-metric-list>]
                [<svec-list>]

  <request-list> ::= <request> [<request-list>]

  <request> ::= <RP>
              <END-POINTS>
              [<LSP>]
              [<LSPA>]
              [<BANDWIDTH>]
              [<bu-list>]
              [<metric-list>]
              [<precision-metric-list>]
              [<OF>]
              [<RRO> [<BANDWIDTH>]]
              [<IRO>]
              [<LOAD-BALANCING>]

  and where:
    <precision-metric-list> ::= <PRECISION-METRIC> [<precision-metric-
list>]
```

```
<PCRep Message> ::= <Common Header>
                    [<svec-list>]
                    <response-list>
```

where:

```
<svec-list> ::= <SVEC>
                [<OF>]
                [<metric-list>]
                [<precision-metric-list>]
                [<svec-list>]
```

```
<response-list> ::= <response> [<response-list>]
```

```
<response> ::= <RP>
               [<LSP>]
               [<NO-PATH>]
               [<attribute-list>]
               [<path-list>]
```

```
<path-list> ::= <path> [<path-list>]
```

```
<path> ::= <ERO>
          <attribute-list>
```

and where:

```
<attribute-list> ::= [<OF>]
                    [<LSPA>]
                    [<BANDWIDTH>]
                    [<bu-list>]
                    [<metric-list>]
                    [<precision-metric-list>]
                    [<IRO>]
```

```
<precision-metric-list> ::= <PRECISION-METRIC> [<precision-metric-
list>]
```

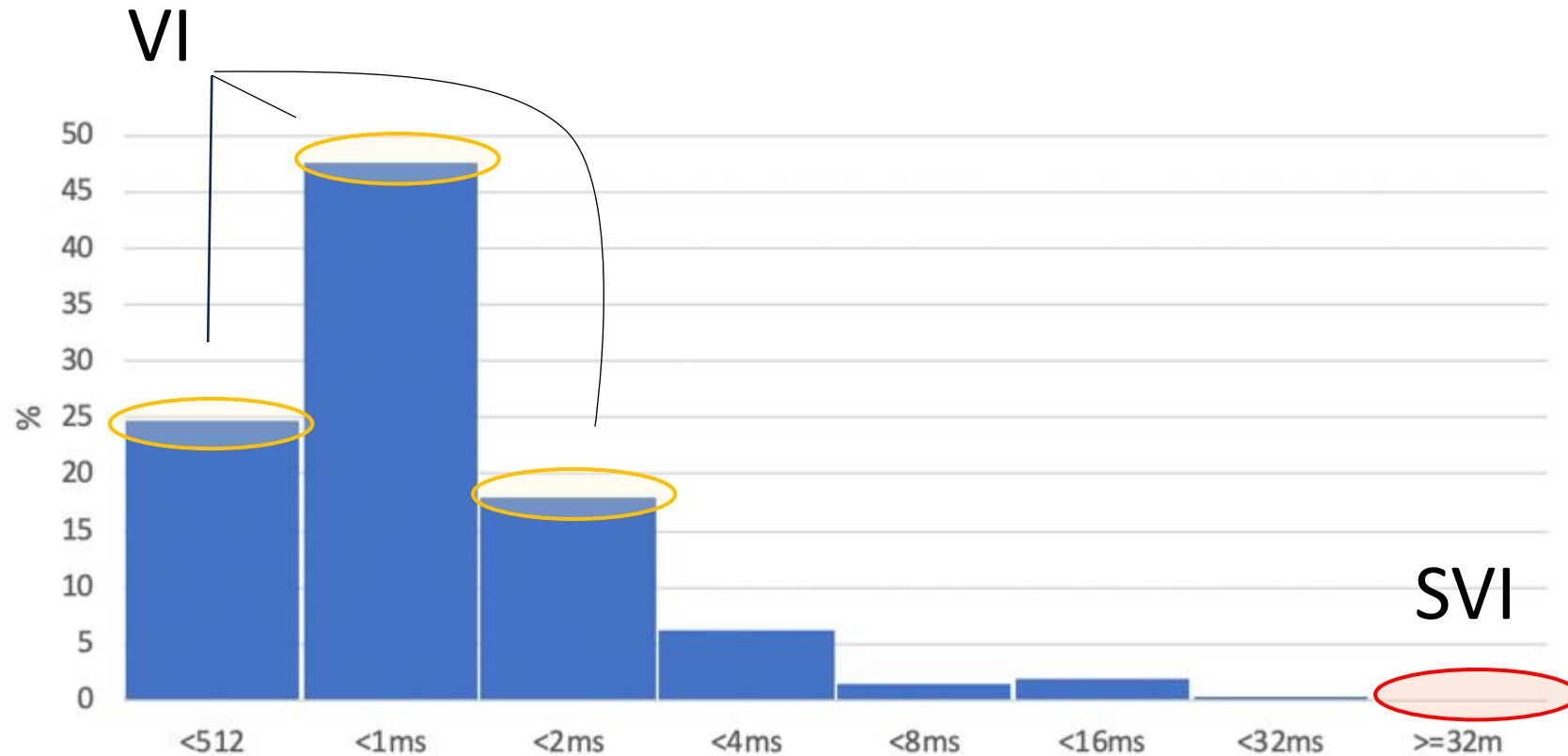
Next steps

- Assess the PCEP messages proposed according to RBNF grammar
- Collect more feedback from PCE WG
 - Collect feedback from other WG as well, such as TEAS and DetNet, and figuring out how to make progress
- Clarify what is the better way to follow: extension of METRIC Object vs new PRECISION METRIC Object
- To align with [RFC8655] which metrics from DetNet services can be expressed as PAM and what other have strict behavior
- Change draft status from Informational to Standard Track

- Prepare new version for IETF 121

Backup

Statistical distribution of latency (e.g., histogram)



PAM metrics

- **Violated Interval (VI)** is a time interval during which at least one of the performance parameters presents degradation respect to a predefined optimal level threshold.
- **Severe Violated Interval (VI)** is a time interval during which at least one of the performance parameters presents degradation respect to a predefined critical level threshold.

- **Violated Interval Ratio (VIR)** is defined as the ratio of the summed numbers of VIs and SVIs to the total number of time unit intervals along a predefined availability period.
- **Severely Violated Interval Ratio (SVIR)** is defined as the ratio of SVIs to the total number of time unit intervals along a predefined availability period.

PRECISION METRIC Object

Proposed new PRECISION METRIC Object

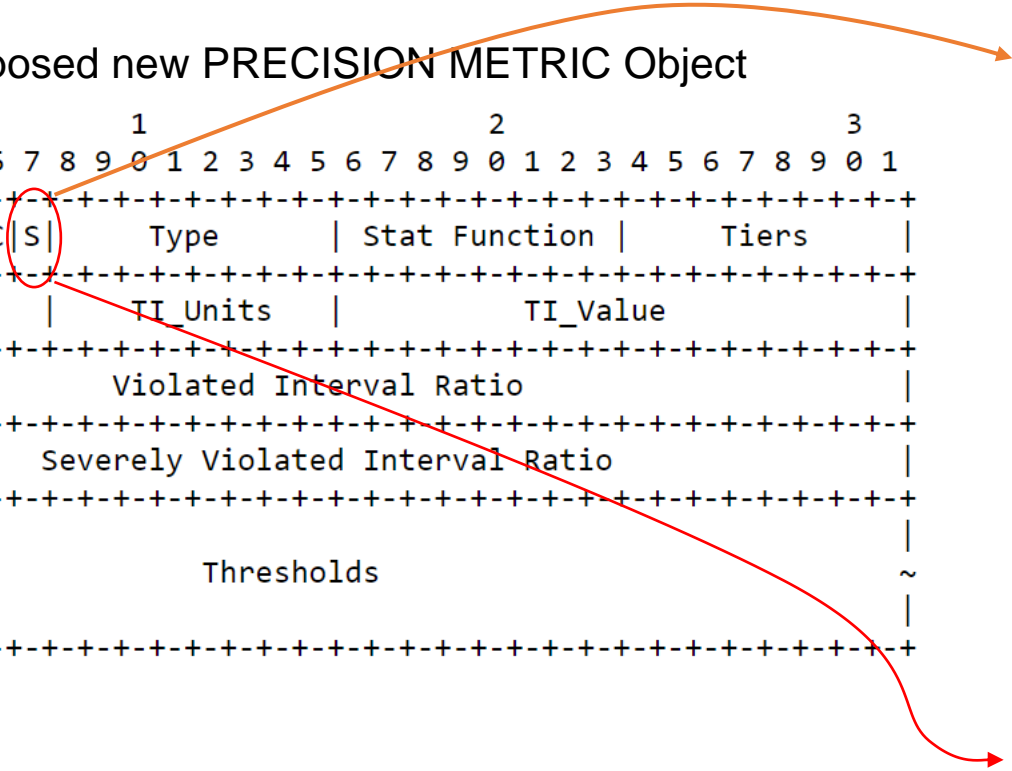
0										1										2										3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9										
Flags										C S										Type										Stat Function										Tiers									
AvPeriod										TI Units										TI_Value																													
										Violated Interval Ratio																																							
										Severely Violated Interval Ratio																																							
																														Thresholds																			

S=0 - only an optimal and critical thresholds are considered

0										1										2										3									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
										Optimal Threshold										Tier Boundary																			
										Optimal Threshold																													
										Critical Threshold																													

S=1 - several thresholds are considered

0										1										2										3									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
										Tier 1 Boundary																													
										Threshold for Tier 1																													
										Tier N-1 Boundary																													
										Threshold for Tier N-1																													
										Critical Threshold																													



Examples

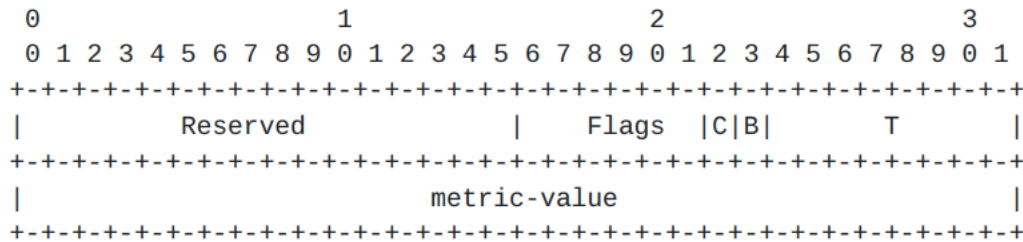
- From [I-D.ietf-ippm-pam], consider a path delay metric is statistically defined in the form of:
 - not to exceed 30 ms for any packet;
 - to not exceed 25 ms for 99.999% of packets;
 - to not exceed 20 ms for 99% of packets
- Assume availability expectation for this service is VIR of 5% and SVIR of 0,2%, with availability period of one day, and time interval is considered 1 hour

0										1										2										3									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Flags										Type = 12										Histogram										0x3									
24										sec										3600																			
										5																													
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										99																													
										20																													
										99.999																													
										25																													
										30																													

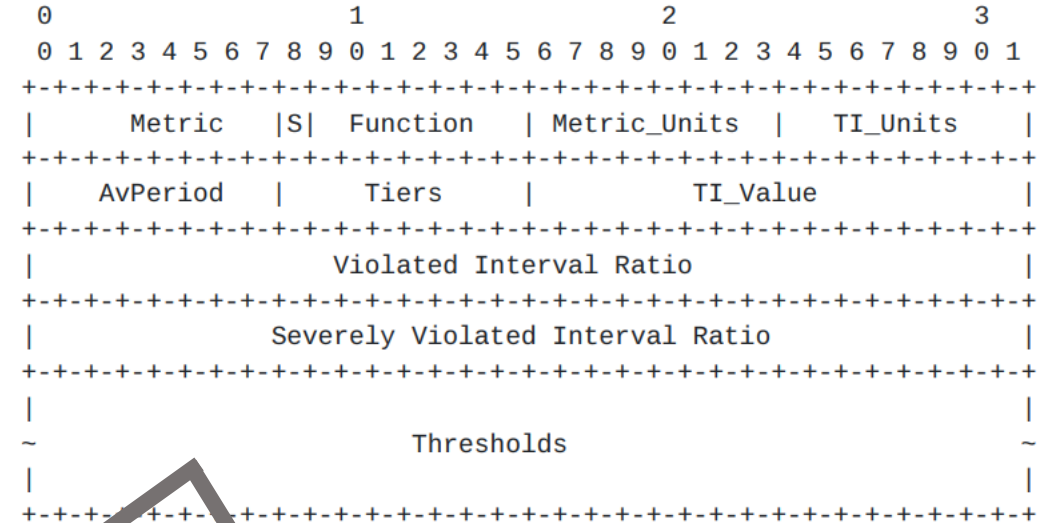
Backup - Proposal in v00/01

Extension of METRIC object

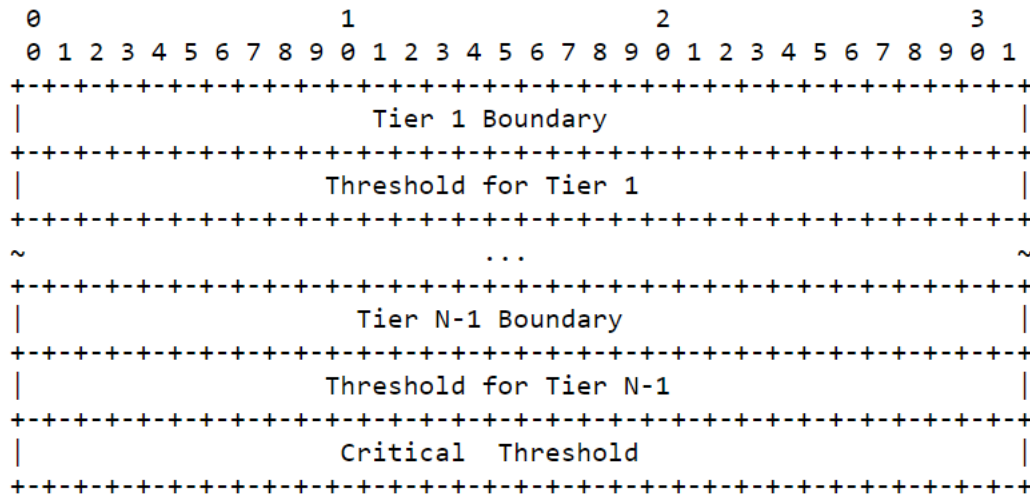
METRIC Object as per RFC5440



METRIC Object extension
(for T == PAM type)



PAM metric assessed against a multi-tiered SLO, presenting different thresholds per tier



PAM metric assessed against an optimal (for VI) and a critical (for SVI) thresholds

