

Reporting IP Performance Metrics to Users

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Aim of this document

- Small set of metrics: the more numbers, the more confusing it is
- Robust: don't change much when measurements don't change much
- Easy to understand: aimed at users; each metric must have immediate intuitive qualitative meaning (what does it mean for this to be larger?)
- Orthogonal: a consequence of desire for small—any redundancy increases the size of the set
- Relevant: who needs them otherwise?
- Easy to compute: “online calculation” (single pass over data with $O(1)$ of memory)

Scope

- short-term network measurements (seconds or at most minutes)
- aimed at real-time display of such measurements
- (Possible extension of the scope might be longer-term measurements, if we can agree on it. Would almost certainly need network availability: exclude the time the network was down from the calculation. Not the focus.)

The reportable set

1. delay
2. loss
3. jitter
4. duplication
5. reordering

Delay

- median of all delays in the sample
- delay of lost packets is $+\infty$
- (if more than half of packets are lost, delay is $+\infty$)

LOSS

- fraction of packets that did not arrive intact within a given number of seconds (timeout value)
- expressed as a percentage
- human is waiting → timeout is short (by default, 2 seconds)

Jitter

- interquartile spread of delay
- (finite iff loss $< 25\%$)
- (defined iff loss $< 75\%$)
- falls within IPDV framework
- robust
- widely used by statisticians

Duplication

- fraction of packets for which more than a single copy of the packet was received
- same timeout as in the definition of loss
- expressed in percentage points
- (not actually defined by the IPPM yet)

Reordering

- out-of-sequence metric
- single number, just like all other metrics
- metric the most dependent on the sample source: send slower, and reordering disappears

Sample source

One of:

- one-way active measurement
- round-trip measurement
- passive measurement

Preferences:

- one-way over round-trip if clocks are synchronized
- round-trip permissible when clocks are not synchronized
- no preference between active and passive measurements

One-Way Active Measurement Default Parameters

- default duration: ~10 seconds
- default sending schedule: Poisson stream
- default sending rate: 10 packets/second on average
- default sample size: 100 packets
- default packet size: the minimum necessary for the measurement
 - was suggested to fix a small value
- characterization: source IP, destination IP, time, type of packets

Round-Trip Active Measurement Default Parameters

- same as one-way

Passive Measurement Applicability

- sometimes measurements are collected incidentally to the use
- use case: a VoIP phone might display network statistics
- use whatever data it is natural to use
 - IP telephony application or a networked game would use data it sends anyway
 - link performance analysis would use all packets on the link
- same default duration (10 seconds)
- sliding window (so recent data are quickly reflected in the display)