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Initial Performance Metric Registry Entries
draft-ietf-ippm-initial-registry-00

Abstract

   This memo defines the Initial Entries for the Performance Metrics
   Registry.

   WG 00 is the same as Individual 04, which was updated 3 times since
   IETF-94.

   Version 04 * All section 4 parameters reference YANG types for
   alternate data formats. * Discussion has concluded that usecase(s)
   for machine parse-able registry columns are not needed.

   Still need: * suggestion of standard naming format for parameters. *
   revisions that follow section 4 changes in other proposed metrics.

Requirements Language

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [RFC2119].

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any

time. It is inappropriate to use Internet-Drafts as reference
material or to cite them other than as "work in progress."

This Internet-Draft will expire on September 13, 2016.

Copyright Notice

Table of Contents

1. Introduction

   Note: Efforts to synchronize structure and terminology with
   [I-D.ietf-ippm-metric-registry] will likely be incomplete until both
   drafts are stable.

   This memo proposes an initial set of entries for the Performance
   Metric Registry. It uses terms and definitions from the IPPM
   literature, primarily [RFC2330]. Proponents of Passive Performance
   Metrics are encouraged to develop a similar document.

   Although there are several standard templates for organizing
   specifications of performance metrics (see [RFC2679] for an example
   of the traditional IPPM template, based to large extent on the
   Benchmarking Methodology Working Group's traditional template in
   [RFC1242], and see [RFC6390] for a similar template), none of these
   templates were intended to become the basis for the columns of an
   IETF-wide registry of metrics. While examining aspects of metric
   specifications which need to be registered, it became clear that none
   of the existing metric templates fully satisfies the particular needs
   of a registry.

   Therefore, [I-D.ietf-ippm-metric-registry] defines the overall format
   for a Performance Metric Registry. Section 5 of
   [I-D.ietf-ippm-metric-registry] also gives guidelines for those
   requesting registration of a Metric, that is the creation of entry(s)
   in the Performance Metric Registry: "In essence, there needs to be
   evidence that a candidate Registered Performance Metric has
   significant industry interest, or has seen deployment, and there is
   agreement that the candidate Registered Performance Metric serves its
   intended purpose." The process in [I-D.ietf-ippm-metric-registry]
   also requires that new entries are administered by IANA through
   Expert Review, which will ensure that the metrics are tightly
   defined.

2. Scope

   This document defines the initial set of Performance Metrics Registry
   entries, for which IETF approval (following development in the IP
   Performance Metrics (IPPM) Working Group) will satisfy the
   requirement for Expert Review. Note that all are Active Performance
   Metrics, which are based on RFCs prepared in the IPPM working group
   of the IETF, according to their framework [RFC2330] and its updates.

3. Registry Categories and Columns

   This section provides the categories and columns of the registry, for
   easy reference. An entry (row) therefore gives a complete
   description of a Registered Metric.

    Registry Categories and Columns, shown as

```
                                            Category
                                            ------------------
                                            Column |  Column |

   Summary
   ---------------------------------
   ID | Name | URIs | Description |


   Metric Definition
   --------------------------------------------
   Reference Definition | Fixed Parameters |


   Method of Measurement
   ----------------------------------------------------------------
   Reference | Packet     | Traffic | Sampling | Run-time | Role |
   Method    | Generation | Filter  | dist.    | Param    |      |
             | Stream     |

   Output
   ----------------------------
    Type | Reference  | Units |
         | Definition |       |


    Administrative information
    ----------------------------------
    Status |Request | Rev | Rev.Date |


                 Comments and Remarks
                 --------------------
```

4. UDP Round-trip Latency Registry Entry

   This section gives an initial registry entry for the UDP Round-trip
   Latency.

Note: Each Registry entry only produces a "raw" output or a
statistical summary. To describe both "raw" and one or more
statistics efficiently, the Identifier, Name, and Output Categories
can be split and this section can become two or more closely-related
metrics. See Section 7 for an example specifying multiple Registry
entries with many common columns.

4.1. Summary

This category includes multiple indexes to the registry entry: the
element ID and metric name.

4.1.1. ID (Identifier)

<insert a numeric identifier, an integer, TBD>

4.1.2. Name

<insert name according to metric naming convention>

Act_IP_UDP_Round-trip_Delay_Poisson_95th-percentile

4.1.3. URIs

URN: Prefix urn:ietf:params:performance:metric...<name>

URL: http://<TBD by IANA>/<name>

4.1.4. Description

This metric assesses the delay of a stream of packets exchanged
between two hosts (which are the two measurement points), and the
Output is the Round-trip delay for all successfully exchanged packets
expressed as the 95th percentile of their conditional delay
distribution.

4.2. Metric Definition

This category includes columns to prompt the entry of all necessary
details related to the metric definition, including the RFC reference
and values of input factors, called fixed parameters.

4.2.1. Reference Definition

<Full bibliographic reference to an immutable doc.>

Almes, G., Kalidindi, S., and M. Zekauskas, "A Round-trip Delay
Metric for IPPM", RFC 2681, September 1999.

[RFC2681]

<specific section reference and additional clarifications, if needed>

Section 2.4 of [RFC2681] provides the reference definition of the singleton (single value) Round-trip delay metric. Section 3.4 of [RFC2681] provides the reference definition expanded to cover a multi-value sample. Note that terms such as singleton and sample are defined in Section 11 of [RFC2330].

Note that although the definition of "Round-trip-Delay between Src and Dst" is directionally ambiguous in the text, this metric tightens the definition further to recognize that the host in the "Src" role will send the first packet to "Dst", and ultimately receive the corresponding return packet from "Dst" (when neither are lost).

Finally, note that the variable "dT" is used in [RFC2681] to refer to the value of Round-trip delay in metric definitions and methods. The variable "dT" has been re-used in other IPPM literature to refer to different quantities, and cannot be used as a global variable name.

4.2.2. Fixed Parameters

<list and specify Fixed Parameters, input factors that must be determined and embedded in the measurement system for use when needed>

Type-P:

o   IPv4 header values:

    * DSCP: set to 0

    * TTL: set to 255

    * Protocol: Set to 17 (UDP)

o   IPv6 header values:

    * DSCP: set to 0

    * Hop Count: set to 255

    * Protocol: Set to 17 (UDP)

o   UDP header values:

    * Checksum: the checksum MUST be calculated

   o UDP Payload

      * total of 9 bytes

   Other measurement parameters:

   o Tmax: a loss threshold waiting time

      * 3.0, expressed in units of seconds, as a positive value of type
         decimal64 with fraction digits = 5 (see section 9.3 of
         [RFC6020]) and with resolution of 0.0001 seconds (0.1 ms), with
         lossless conversion to/from the 32-bit NTP timestamp as per
         section 6 of [RFC5905].

4.3. Method of Measurement

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

4.3.1. Reference Method

   <for metric, insert relevant section references and supplemental
   info>

   The methodology for this metric is defined as Type-P-Round-trip-
   Delay-Poisson-Stream in section 2.6 of RFC 2681 [RFC2681] and section
   3.6 of RFC 2681 [RFC2681] using the Type-P and Tmax defined under
   Fixed Parameters.

   The reference method distinguishes between long-delayed packets and
   lost packets by implementing a maximum waiting time for packet
   arrival. Tmax is the waiting time used as the threshold to declare a
   packet lost. Lost packets SHALL be designated as having undefined
   delay.

   The calculations on the delay (RTT) SHALL be performed on the
   conditional distribution, conditioned on successful packet arrival
   within Tmax. Also, when all packet delays are stored, the process
   which calculates the RTT value MAY enforce the Tmax threshold on
   stored values before calculations. See section 4.1 of [RFC3393] for
   details on the conditional distribution to exclude undefined values
   of delay, and Section 5 of [RFC6703] for background on this analysis
   choice.

   The reference method requires some way to distinguish between
   different packets in a stream to establish correspondence between
   sending times and receiving times for each successfully-arriving

   packet. Sequence numbers or other send-order identification MUST be
   retained at the Src or included with each packet to dis-ambiguate
   packet reordering if it occurs.

   If a standard measurement protocol is employed, then the measurement
   process will determine the sequence numbers or timestamps applied to
   test packets after the Fixed and Runtime parameters are passed to
   that process. The chosen measurement protocol will dictate the
   format of sequence numbers and time-stamps, if they are conveyed in
   the packet payload.

   Refer to Section 4.4 of [RFC6673] for expanded discussion of the
   instruction to "send a Type-P packet back to the Src as quickly as
   possible" in Section 2.6 of RFC 2681 [RFC2681]. Section 8 of
   [RFC6673] presents additional requirements which MUST be included in
   the method of measurement for this metric.

4.3.2. Packet Generation Stream

   This section gives the details of the packet traffic which is the
   basis for measurement. In IPPM metrics, this is called the Stream,
   and can easily be described by providing the list of stream
   parameters.

   <section/specification references, and description of any new
   generation parameters, if needed>

   Section 11.1.3 of [RFC2330] provides three methods to generate
   Poisson sampling intervals. the reciprocal of lambda is the average
   packet spacing, thus the Run-time Parameter is Reciprocal_lambda = 1/
   lambda, in seconds.

   >>> Check with Sam, most likely it is this...

   Method 3 SHALL be used, where given a start time (Run-time
   Parameter), the subsequent send times are all computed prior to
   measurement by computing the pseudo-random distribution of inter-
   packet send times, (truncating the distribution as specified in the
   Run-time Parameter, Trunc), and the Src sends each packet at the
   computed times.

   Note that Trunc is the upper limit on inter-packet times in the
   Poisson distribution. A random value greater than Trunc is set equal
   to Trunc instead.

4.3.3. Traffic Filtering (observation) Details

The measured results based on a filtered version of the packets
observed, and this section provides the filter details (when
present).

<section reference>.

NA

4.3.4. Sampling Distribution

<insert time distribution details, or how this is diff from the
filter>

NA

4.3.5. Run-time Parameters and Data Format

Run-time Parameters are input factors that must be determined,
configured into the measurement system, and reported with the results
for the context to be complete.

<list of run-time parameters, and their data formats>

Src the IP address of the host in the Src Role (format ipv4-address-
    no-zone value for IPv4, or ipv6-address-no-zone value for IPv6,
    see Section 4 of [RFC6991])

Dst the IP address of the host in the Dst Role (format ipv4-address-
    no-zone value for IPv4, or ipv6-address-no-zone value for IPv6,
    see section 4 of [RFC6991])

T0 a time, the start of a measurement interval, (format "date-and-
    time" as specified in Section 5.6 of [RFC3339], see also Section 3
    of [RFC6991]). The UTC Time Zone is required by Section 6.1 of
    [RFC2330]. When T0 is "all-zeros", a start time is unspecified
    and Tf is to be interpreted as the Duration of the measurement
    interval. The start time is controlled through other means.

Tf a time, the end of a measurement interval, (format "date-and-time"
    as specified in Section 5.6 of [RFC3339], see also Section 3 of
    [RFC6991]). The UTC Time Zone is required by Section 6.1 of
    [RFC2330]. When T0 is "all-zeros", a end time date is ignored and
    Tf is interpreted as the Duration of the measurement interval.

Reciprocal_lambda average packet interval for Poisson Streams
    expressed in units of seconds, as a positive value of type

decimal64 with fraction digits = 5 (see section 9.3 of [RFC6020])
with resolution of 0.0001 seconds (0.1 ms), and with lossless
conversion to/from the 32-bit NTP timestamp as per section 6 of
[RFC5905].

Trunc Upper limit on Poisson distribution expressed in units of
seconds, as a positive value of type decimal64 with fraction
digits = 5 (see section 9.3 of [RFC6020]) with resolution of
0.0001 seconds (0.1 ms), and with lossless conversion to/from the
32-bit NTP timestamp as per section 6 of [RFC5905] (values above
this limit will be clipped and set to the limit value). (if fixed,
Trunc = 30.0000 seconds.)

>>> should Poisson run-time params be fixed instead? probably yes if
modeling a specific version of MBA tests.

4.3.6. Roles

<lists the names of the different roles from the measurement method>

Src launches each packet and waits for return transmissions from
Dst.

Dst waits for each packet from Src and sends a return packet to Src.

4.4. Output

This category specifies all details of the Output of measurements
using the metric.

4.4.1. Type

<insert name of the output type, raw or a selected summary statistic>

Percentile -- for the conditional distribution of all packets with a
valid value of Round-trip delay (undefined delays are excluded), a
single value corresponding to the 95th percentile, as follows:

See section 4.1 of [RFC3393] for details on the conditional
distribution to exclude undefined values of delay, and Section 5 of
[RFC6703] for background on this analysis choice.

The percentile = 95, meaning that the reported delay, "Percentile95",
is the smallest value of Round-trip delay for which the Empirical
Distribution Function (EDF), F(Percentile95) >= 95% of the singleton
Round-trip delay values in the conditional distribution. See section
11.3 of [RFC2330] for the definition of the percentile statistic
using the EDF.

4.4.2. **Data Format**

   <describe the data format for each type of result>

   For all outputs ---

   T0 the start of a measurement interval, (format "date-and-time" as
       specified in Section 5.6 of [RFC3339], see also Section 3 of
       [RFC6991]). The UTC Time Zone is required by Section 6.1 of
       [RFC2330].

   Tf the start of a measurement interval, (format "date-and-time" as
       specified in Section 5.6 of [RFC3339], see also Section 3 of
       [RFC6991]). The UTC Time Zone is required by Section 6.1 of
       [RFC2330].

   Raw -- REMOVED IN VERSION 01

   For Act_IP_UDP_Round-trip_Delay_Poisson_95th-percentile:

   Percentile95 The time value of the result is expressed in units of
       seconds, as a positive value of type decimal64 with fraction
       digits = 9 (see section 9.3 of [RFC6020]) with resolution of
       0.000000001 seconds (1.0 ns), and with lossless conversion to/from
       the 64-bit NTP timestamp as per section 6 of RFC [RFC5905]

4.4.3. **Reference**

   <pointer to section/spec where output type/format is defined>

   See the Data Format column for references.

4.4.4. **Metric Units**

   <insert units for the measured results, and the reference
   specification>.

   The 95th Percentile of Round-trip Delay is expressed in seconds.

4.5. **Administrative items**

4.5.1. **Status**

4.5.2. Requestor (keep?)

   name or RFC, etc.

4.5.3. Revision

   1.0

4.5.4. Revision Date

   YYYY-MM-DD

4.6. Comments and Remarks

   Additional (Informational) details for this entry

5. Packet Delay Variation Registry Entry

   This section gives an initial registry entry for a Packet Delay
   Variation metric.

   Note: If each Registry entry should only produce a "raw" output or a
   statistical summary, then the "Output" Category can be split and this
   section can become two closely-related metrics.

5.1. Summary

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

   <skipping some Summary columns for now>

5.1.1. ID (Identifier)

   <insert numeric identifier, an integer>

5.1.2. Name

   <insert name according to metric naming convention>

   Act_IP-UDP-One-way-pdv-95th-percentile-Poisson

   URL: ??

5.1.3. **URI**

   URI: Prefix urn:ietf:params:performance:metric<add name>

5.1.4. **Description**

   An assessment of packet delay variation with respect to the minimum
   delay observed on the stream.

5.2. **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

5.2.1. **Reference Definition**

   <Full bibliographic reference to an immutable doc.>

   Paxson, V., Almes, G., Mahdavi, J., and M. Mathis, "Framework for IP
   Performance Metrics", RFC 2330, May 1998. [RFC2330]

   Demichelis, C. and P. Chimento, "IP Packet Delay Variation Metric
   for IP Performance Metrics (IPPM)", RFC 3393, November 2002.
   [RFC3393]

   Morton, A. and B. Claise, "Packet Delay Variation Applicability
   Statement", RFC 5481, March 2009. [RFC5481]

   Mills, D., Martin, J., Burbank, J., and W. Kasch, "Network Time
   Protocol Version 4: Protocol and Algorithms Specification", RFC 5905,
   June 2010.[RFC5905]

   <specific section reference and additional clarifications, if needed>

   See sections 2.4 and 3.4 of [RFC3393]. Singleton delay differences
   measured are referred to by the variable name "ddT".

5.2.2. **Fixed Parameters**

   <list and specify Fixed Parameters, input factors that must be
   determined and embedded in the measurement system for use when
   needed>

   o F, a selection function defining unambiguously the packets from
      the stream selected for the metric. See section 4.2 of [RFC5481]
      for the PDV form.

o L, a packet length in bits. L = 200 bits.

o Tmax, a maximum waiting time for packets to arrive at Dst, set
   sufficiently long to disambiguate packets with long delays from
   packets that are discarded (lost). Tmax = 3 seconds.

o Type-P, as defined in [RFC2330], which includes any field that may
   affect a packet's treatment as it traverses the network. The
   packets are IP/UDP, with DSCP = 0 (BE).

5.3. Method of Measurement

This category includes columns for references to relevant sections of
the RFC(s) and any supplemental information needed to ensure an
unambiguous methods for implementations.

5.3.1. Reference Method

<for metric, insert relevant section references and supplemental
info>

See section 2.6 and 3.6 of [RFC3393] for singleton elements.

5.3.2. Packet Generation Stream

<list of generation parameters and section/spec references if needed>

Poisson distributed as described in [RFC2330], with the following
Parameters.

o lambda, a rate in reciprocal seconds (for Poisson Streams).
   lambda = 1 packet per second

o Upper limit on Poisson distribution (values above this limit will
   be clipped and set to the limit value). Upper limit = 30 seconds.

5.3.3. Traffic Filtering (observation) Details

<insert the measured results based on a filtered version of the
packets observed, and this section provides the filter details (when
present), and section reference>.

NA

5.3.4. Sampling Distribution

   <insert time distribution details, or how this is diff from the
   filter>

   NA

5.3.5. Run-time Parameters and Data Format

   <list of run-time parameters, and any reference(s)>.

   o Src, the IP address of a host (32-bit value for IPv4, 128-bit
      value for IPv6)

   o Dst, the IP address of a host (32-bit value for IPv4, 128-bit
      value for IPv6)

   o T, a time (start of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905]). When T0 is "all-zeros", a start time
      is unspecified and Tf is to be interpreted as the Duration of the
      measurement interval.

   o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905]), interpreted as the Duration of the
      measurement interval.

5.3.6. Roles

   <lists the names of the different roles from the measurement method>

   Src - the host that sends the stream of packets.

   Dst - the host that receives the stream of packets.

5.4. Output

   This category specifies all details of the Output of measurements
   using the metric.

5.4.1. Type/Value (two diff terms used)

   <insert name of the output type, raw or a selected summary statistic>

   Raw -- for each packet sent, pairs of values.

   Percentile -- for the conditional distribution of all packets with a
   valid value of one-way delay (undefined delays are excluded), a

single value corresponding to the 95th percentile of the singletons, ddT.

5.4.2. Data Format

<describe the data format for each type of result>

For all Output types

o T, a time (start of measurement interval, 128-bit NTP Date Format, see section 6 of [RFC5905])

o Tf, a time (end of measurement interval, 128-bit NTP Date Format, see section 6 of [RFC5905])

Raw -

o T1, the wire time of the first packet in a pair, measured at MP(Src) as it leaves for Dst (64-bit NTP Timestamp Format, see section 6 of [RFC5905]).

o T2, the wire time of the second packet in a pair, measured at MP(Src) as it leaves for Dst (64-bit NTP Timestamp Format, see section 6 of [RFC5905]).

o I(i),I(i+1), i >=0, pairs of times which mark the beginning and ending of the intervals in which the packet stream from which the measurement is taken occurs. Here, I(0) = T0 and assuming that n is the largest index, I(n) = Tf (pairs of 64-bit NTP Timestamp Format, see section 6 of [RFC5905]).

o When the one-way delay of a packet in the calculation pair for ddT is undefined, then ddT is undefined for that pair.

Percentile -- for the conditional distribution of all packets with a valid value of one-way delay (undefined delays are excluded), a single value as follows:

See section 4.1 of [RFC3393] for details on the conditional distribution to exclude undefined values of delay, and Section 5 of [RFC6703] for background on this analysis choice.

See section 4.3 of [RFC3393] for details on the percentile statistic (where pdv should be substituted for "ipdv").

The percentile = 95.

   Data format is a 32-bit signed floating point value, *similar to* the
   32-bit short NTP Time format in Section 6 of [RFC5905] and is as
   follows: the first 16 bits represent the *signed* integer number of
   seconds; the next 16 bits represent the fractional part of a second.

5.4.3. Reference

   <pointer to section/spec where output type/format is defined>

   see Data Format column.

5.4.4. Metric Units

   <insert units for the measured results, and the reference
   specification>.

   See section 3.3 of [RFC3393] for singleton elements, ddT. The units
   are seconds, and the same units are used for 95th percentile.

   [RFC2330] recommends that when a time is given, it will be expressed
   in UTC.

   The timestamp format (for T, Tf, etc.) is the same as in [RFC5905]
   (64 bits) and is as follows: the first 32 bits represent the unsigned
   integer number of seconds elapsed since 0h on 1 January 1900; the
   next 32 bits represent the fractional part of a second that has
   elapsed since then.

5.5. Administrative items

5.5.1. Status

   <current or depricated>

5.5.2. Requestor (keep?)

   <name of individual or RFC, etc.>

5.5.3. Revision

   1.0

5.5.4. Revision Date

   YYYY-MM-DD

5.6. **Comments and Remarks**

   <Additional (Informational) details for this entry>

   Lost packets represent a challenge for delay variation metrics. See
   section 4.1 of [RFC3393] and the delay variation applicability
   statement[RFC5481] for extensive analysis and comparison of PDV and
   an alternate metric, IPDV.

6. **DNS Response Latency Registry Entry**

   This section gives an initial registry entry for DNS Response
   Latency. RFC 2681 [RFC2681] defines a Round-trip delay metric. We
   build on that metric by specifying several of the input parameters to
   precisely define a metric for measuring DNS latency.

6.1. **Summary**

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

   <skipping some admin columns for now>

6.1.1. **ID (Identifier)**

   <insert numeric identifier, an integer>

6.1.2. **Name**

   <insert name according to metric naming convention>

   URL: ??

6.1.3. **URI**

   URI: Prefix urn:ietf:params:performance:metric

6.1.4. **Description**

   This metric assesses the response time, the interval from the query
   transmission to the response.

6.2. **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

6.2.1. Reference Definition

<Full bibliographic reference to an immutable doc.>

Mockapetris, P., "Domain names - implementation and specification", STD 13, RFC 1035, November 1987. (and updates)

[RFC1035]

Almes, G., Kalidindi, S., and M. Zekauskas, "A Round-trip Delay Metric for IPPM", RFC 2681, September 1999.

[RFC2681]

<specific section reference and additional clarifications, if needed>

Section 2.4 of [RFC2681] provides the reference definition of the singleton (single value) Round-trip delay metric. Section 3.4 of [RFC2681] provides the reference definition expanded to cover a multi-value sample. Note that terms such as singleton and sample are defined in Section 11 of [RFC2330].

For DNS Response Latency, the entities in [RFC1035] must be mapped to [RFC2681]. The Local Host with its User Program and Resolver take the role of "Src", and the Foreign Name Server takes the role of "Dst".

Note that although the definition of "Round-trip-Delay between Src and Dst at T" is directionally ambiguous in the text, this metric tightens the definition further to recognize that the host in the "Src" role will send the first packet to "Dst", and ultimately receive the corresponding return packet from "Dst" (when neither are lost).

6.2.2. Fixed Parameters

<list and specify Fixed Parameters, input factors that must be determined and embedded in the measurement system for use when needed>

Type-P:

o   IPv4 header values:

    *   DSCP: set to 0

    *   TTL set to 255

   * Protocol: Set to 17 (UDP)

o UDP header values:

   * Source port: 53

   * Destination port: 53

   * Checksum: the checksum must be calculated

o Payload: The payload contains a DNS message as defined in RFC 1035
   [RFC1035] with the following values:

   * The DNS header section contains:

      + QR: set to 0 (Query)

      + OPCODE: set to 0 (standard query)

      + AA: not set

      + TC: not set

      + RD: set to one (recursion desired)

      + RA: not set

      + RCODE: not set

      + QDCOUNT: set to one (only one entry)

      + ANCOUNT: not set

      + NSCOUNT: not set

      + ARCOUNT: not set

   * The Question section contains:

      + QNAME: the FQDN provided as input for the test

      + QTYPE: the query type provided as input for the test

      + QCLASS: set to IN

   * The other sections do not contain any Resource Records.

   Observation: reply packets will contain a DNS response and may
   contain RRs.

   Timeout: Tmax = 5 seconds (to help disambiguate queries)

6.3. Method of Measurement

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

6.3.1. Reference Method

   <for metric, insert relevant section references and supplemental
   info>

   The methodology for this metric is defined as Type-P-Round-trip-
   Delay-Poisson-Stream in section 2.6 of RFC 2681 [RFC2681] and section
   3.6 of RFC 2681 [RFC2681] using the Type-P and Timeout defined under
   Fixed Parameters.

   The method requires sequence numbers or other send-order information
   to be retained at the Src or included with each packet to dis-
   ambiguate packet reordering if it occurs. Sequence number is part of
   the payload described under Fixed Parameters.

   DNS Messages bearing Queries provide for random ID Numbers, so more
   than one query may be launched while a previous request is
   outstanding when the ID Number is used.

   IF a DNS response does not arrive within Tmax, the result is
   undefined. The Message ID SHALL be used to disambiguate the
   successive queries.

   >>> This would require support of ID generation and population in the
   Message. An alternative would be to use a random Source port on the
   Query Message, but we would choose ONE before proceding.

   Refer to Section 4.4 of [RFC6673] for expanded discussion of the
   instruction to "send a Type-P packet back to the Src as quickly as
   possible" in Section 2.6 of RFC 2681 [RFC2681]. Section 8 of
   [RFC6673] presents additional requirements which shall be included in
   the method of measurement for this metric.

6.3.2. Packet Generation Stream

   This section gives the details of the packet traffic which is the
   basis for measurement. In IPPM metrics, this is called the Stream,
   and can easily be dscribed by providing the list of stream
   parameters.

   <list of generation parameters and section/spec references if needed>

   Section 11.1.3 of RFC 2681 [RFC2330] provides three methods to
   generate Poisson sampling intervals. the reciprocal of lambda is the
   average packet rate, thus the Run-time Parameter is 1/lambda.

   >>> Check with Sam, most likely it is this...

   Method 3 is used, where given a start time (Run-time Parameter), the
   subsequent send times are all computed prior to measurement by
   computing the pseudo-random distribution of inter-packet send times,
   (truncating the distribution as specified in the Run-time
   Parameters), and the Src sends each packet at the computed times.

6.3.3. Traffic Filtering (observation) Details

   The measured results based on a filtered version of the packets
   observed, and this section provides the filter details (when
   present).

   <section reference>.

   NA

6.3.4. Sampling Distribution

   <insert time distribution details, or how this is diff from the
   filter>

   NA

6.3.5. Run-time Parameters and Data Format

   Run-time Parameters are input factors that must be determined,
   configured into the measurement system, and reported with the results
   for the context to be complete.

   <list of run-time parameters, and their data formats>

   o Src, the IP address of a host (32-bit value for IPv4, 128-bit
      value for IPv6)

o Dst, the IP address of a host (32-bit value for IPv4, 128-bit
   value for IPv6)

o T0, a time (start of measurement interval, 128-bit NTP Date
   Format, see section 6 of [RFC5905]). When T0 is "all-zeros", a
   start time is unspecified and Tf is to be interpreted as the
   Duration of the measurement interval.

o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
   see section 6 of [RFC5905]), interpreted as the Duration of the
   measurement interval.

o 1/lambda, average packet rate (for Poisson Streams). (1/lambda =
   0.1 packet per second, if fixed)

o Upper limit on Poisson distribution (values above this limit will
   be clipped and set to the limit value). (if fixed, Upper limit =
   300 seconds.)

o ID, the 16-bit identifier assigned by the program that generates
   the query, and which must vary in successive queries, see
   Section 4.1.1 of [RFC1035]. This identifier is copied into the
   corresponding reply and can be used by the requester to match-up
   replies to outstanding queries.

The format for 1/lambda and Upper limit of Poisson Dist. are the
short format in [RFC5905] (32 bits) and is as follows: the first 16
bits represent the integer number of seconds; the next 16 bits
represent the fractional part of a second.

>>> should Poisson run-time params be fixed instead? probably yes if
modeling a specific version of MBA tests.

6.3.6. Roles

<lists the names of the different roles from the measurement method>

Src - launches each packet and waits for return transmissions from
Dst.

Dst - waits for each packet from Src and sends a return packet to
Src.

6.4. Output

This category specifies all details of the Output of measurements
using the metric.

6.4.1. Type/Value (two diff terms used)

   <insert name of the output type, raw or a selected summary statistic>

   For all output types:

   o T0, a time (start of measurement interval, 128-bit NTP Date
      Format, see section 6 of [RFC5905])

   o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905])

   Raw -- for each packet sent, pairs of values.

   >>> and the status of the response, only assigning values to
   successful query-response pairs.

   Percentile -- for the conditional distribution of all packets with a
   valid value of Round-trip delay (undefined delays are excluded), a
   single value corresponding to the 95th percentile.

6.4.2. Data Format

   <describe the data format for each type of result>

   Raw -- for each packet sent, pairs of values as follows:

   o T, the time when the packet was sent from Src, 128-bit NTP Date
      Format, see section 6 of [RFC5905])

   o dT, a value of Round-trip delay, format is *similar to* the 32-bit
      short NTP Time format in Section 6 of [RFC5905] and is as follows:
      the first 16 bits represent the *signed* integer number of
      seconds; the next 16 bits represent the fractional part of a
      second.

   o dT is undefined when the packet is not received at Src in waiting
      time Tmxax seconds (need undefined code for no-response or un-
      successful response)

   Percentile -- for the conditional distribution of all packets with a
   valid value of Round-trip delay (undefined delays are excluded), a
   single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

See section 4.3 of [RFC3393] for details on the percentile statistic
(where Round-trip delay should be substituted for "ipdv").

The percentile = 95.

Data format is a 32-bit signed floating point value, *similar to* the
32-bit short NTP Time format in Section 6 of [RFC5905] and is as
follows: the first 16 bits represent the *signed* integer number of
seconds; the next 16 bits represent the fractional part of a second.

6.4.3. Reference

<pointer to section/spec where output type/format is defined>

See the Data Format column for references.

6.4.4. Metric Units

<insert units for the measured results, and the reference
specification>.

Round-trip Delay, dT, is expressed in seconds.

The 95th Percentile of Round-trip Delay is expressed in seconds.

6.5. Administrative items

6.5.1. Status

<current or depricated>

6.5.2. Requestor (keep?)

name or RFC, etc.

6.5.3. Revision

1.0

6.5.4. Revision Date

YYYY-MM-DD

6.6. Comments and Remarks

Additional (Informational) details for this entry

7. UDP Poisson One-way Delay Registry Entries

   This section gives an initial registry entry for the UDP Poisson One-
   way Delay.

   Note: Each Registry "Name" below specifies a single registry entry,
   whose output format varies according to a component of the name that
   specifies one form of statistical summary.

   IANA is asked to assign a different numeric identifiers to each Name.
   All column entries beside the Summary and Output categories are the
   same, thus this section proposes five closely-related registry
   entries. As a result, IANA is also asked to assign corresponding
   URIs and URLs.

7.1. Summary

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

7.1.1. ID (Identifier)

   <insert numeric identifier, an integer, one corresponding to each
   name below>

7.1.2. Name

   <insert name according to metric naming convention>

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_<statistic>

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_Percentile95

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_Mean

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_Min

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_Max

   Act_IP_UDP_Poisson_UDP-Payload-250_One-way_Delay_Std_Dev

7.1.3. URI and URL

   URI: Prefix urn:ietf:params:performance:metric...<name>

   URL: http:\\www.iana.org\ ... <name>

7.1.4. **Description**

   This metric assesses the delay of a stream of packets exchanged
   between two hosts (or measurement points), and reports the
   <statistic> One-way delay for all successfully exchanged packets
   based on their conditional delay distribution.

7.2. **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

7.2.1. **Reference Definition**

   <Full bibliographic reference to an immutable doc.>

   Almes, G., Kalidindi, S., and M. Zekauskas, "A One-way Delay Metric
   for IPPM", RFC 2679, September 1999.

   [RFC2679]

   Morton, A., and Stephan, E., "Spatial Composition of Metrics", RFC
   6049, January 2011.

   [RFC6049]

   <specific section reference and additional clarifications, if needed>

   Section 3.4 of [RFC2679] provides the reference definition of the
   singleton (single value) One-way delay metric. Section 4.4 of
   [RFC2679] provides the reference definition expanded to cover a
   multi-value sample. Note that terms such as singleton and sample are
   defined in Section 11 of [RFC2330].

   Only successful packet transfers with finite delay are included in
   the sample, as prescribed in section 4.1.2 of [RFC6049].

   NOTE: RFC2679 will be replaced by 2679-bis on approval, see draft-
   ietf-ippm-2679-bis-01.

7.2.2. **Fixed Parameters**

   <list and specify Fixed Parameters, input factors that must be
   determined and embedded in the measurement system for use when
   needed>

   Type-P:

   o IPv4 header values:

      * DSCP: set to 0

      * TTL set to 255

      * Protocol: Set to 17 (UDP)

   o UDP header values:

      * Checksum: the checksum must be calculated

   o UDP Payload: TWAMP Test Packet Formats, Section 4.1.2 of [RFC5357]

      * Security features in use influence the number of Padding
         octets.

      * 250 octets total, including the TWAMP format

   Timeout, Tmax: 3 seconds

7.3. Method of Measurement

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

7.3.1. Reference Method

   <for metric, insert relevant section references and supplemental
   info>

   The methodology for this metric is defined as Type-P-One-way-Delay-
   Poisson-Stream in section 3.6 of [RFC2679] and section 4.6 of
   [RFC2679] using the Type-P and Timeout defined under Fixed
   Parameters.

   The method requires sequence numbers or other send-order information
   to be retained at the Src or included with each packet to dis-
   ambiguate packet reordering if it occurs. Sequence number is part of
   the TWAMP payload described under Fixed Parameters.

7.3.2. Packet Generation Stream

   This section gives the details of the packet traffic which is the
   basis for measurement. In IPPM metrics, this is called the Stream,
   and can easily be dscribed by providing the list of stream
   parameters.

Section 11.1.3 of RFC 2681 [RFC2330] provides three methods to
generate Poisson sampling intervals. The reciprocal of lambda is the
average packet rate, thus the Run-time Parameter is 1/lambda.

Method 3 or equivalent SHALL used, where given a start time (Run-time
Parameter), the subsequent send times are all computed prior to
measurement by computing the pseudo-random distribution of inter-
packet send times, (truncating the distribution as specified in the
Run-time Parameters), and the Src sends each packet at the computed
times.

7.3.3. Traffic Filtering (observation) Details

NA

7.3.4. Sampling Distribution

NA

7.3.5. Run-time Parameters and Data Format

Run-time Parameters are input factors that must be determined,
configured into the measurement system, and reported with the results
for the context to be complete.

<list of run-time parameters, and their data formats>

o Src, the IP address of a host (32-bit value for IPv4, 128-bit
   value for IPv6)

o Dst, the IP address of a host (32-bit value for IPv4, 128-bit
   value for IPv6)

o T0, a time (start of measurement interval, 128-bit NTP Date
   Format, see section 6 of [RFC5905]). When T0 is "all-zeros", a
   start time is unspecified and Tf is to be interpreted as the
   Duration of the measurement interval.

o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
   see section 6 of [RFC5905]), interpreted as the Duration of the
   measurement interval.

o 1/lambda, average packet rate (for Poisson Streams). (1/lambda =
   1 packet per second, if fixed)

   o Upper limit on Poisson distribution (values above this limit will
      be clipped and set to the limit value). (if fixed, Upper limit =
      30 seconds.)

   The format for 1/lambda and Upper limit of Poisson Dist. are the
   short format in [RFC5905] (32 bits) and is as follows: the first 16
   bits represent the integer number of seconds; the next 16 bits
   represent the fractional part of a second.

   >>> should Poisson run-time params be fixed instead? probably yes if
   modeling a specific version of tests. Note in the NAME, i.e.
   Poisson3.3

7.3.6. Roles

   <lists the names of the different roles from the measurement method>

   Src - launches each packet and waits for return transmissions from
   Dst. This is the TWAMP Session-Sender.

   Dst - waits for each packet from Src and sends a return packet to
   Src. This is the TWAMP Session-Reflector.

7.4. Output

   This category specifies all details of the Output of measurements
   using the metric.

7.4.1. Type/Value (two diff terms used)

   <insert name of the output type, raw or a selected summary statistic>

   See subsection titles below for Types.

7.4.2. Data Format

   <describe the data format for each type of result>

   For all output types ---

   o T0, a time (start of measurement interval, 128-bit NTP Date
      Format, see section 6 of [RFC5905])

   o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905])

7.4.2.1. **Percentile95**

   The 95th percentile SHALL be calculated using the conditional
   distribution of all packets with a finite value of One-way delay
   (undefined delays are excluded), a single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

   See section 4.3 of [RFC3393] for details on the percentile statistic
   (where Round-trip delay should be substituted for "ipdv").

   The percentile = 95.

   Data format is a 32-bit signed value, *similar to* the 32-bit short
   NTP Time format in Section 6 of [RFC5905] and is as follows: the
   first 16 bits represent the *signed* integer number of seconds; the
   next 16 bits represent the fractional part of a second.

7.4.2.2. **Mean**

   The mean SHALL be calculated using the conditional distribution of
   all packets with a finite value of One-way delay (undefined delays
   are excluded), a single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

   See section 4.2.2 of [RFC6049] for details on calculating this
   statistic, and 4.2.3 of [RFC6049].

   Data format is a 32-bit signed value, *similar to* the 32-bit short
   NTP Time format in Section 6 of [RFC5905] and is as follows: the
   first 16 bits represent the *signed* integer number of seconds; the
   next 16 bits represent the fractional part of a second.

7.4.2.3. **Min**

   The minimum SHALL be calculated using the conditional distribution of
   all packets with a finite value of One-way delay (undefined delays
   are excluded), a single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

   See section 4.3.2 of [RFC6049] for details on calculating this
   statistic, and 4.3.3 of [RFC6049].

   Data format is a 32-bit signed value, *similar to* the 32-bit short
   NTP Time format in Section 6 of [RFC5905] and is as follows: the
   first 16 bits represent the *signed* integer number of seconds; the
   next 16 bits represent the fractional part of a second.

7.4.2.4. Max

   The maximum SHALL be calculated using the conditional distribution of
   all packets with a finite value of One-way delay (undefined delays
   are excluded), a single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

   See section 4.3.2 of [RFC6049] for a closely related method for
   calculating this statistic, and 4.3.3 of [RFC6049]. The formula is
   as follows:

           Max = (FiniteDelay [j])

                   such that for some index, j, where 1 <= j <= N
                   FiniteDelay[j] >= FiniteDelay[n] for all n

   Data format is a 32-bit signed value, *similar to* the 32-bit short
   NTP Time format in Section 6 of [RFC5905] and is as follows: the
   first 16 bits represent the *signed* integer number of seconds; the
   next 16 bits represent the fractional part of a second.

7.4.2.5. Std_Dev

7.4.3. Reference

   <pointer to section/spec where output type/format is defined>

   See the Data Format column for references.

7.4.4. Metric Units

   <insert units for the measured results, and the reference
   specification>.

   The <statistic> of One-way Delay is expressed in seconds.

   The 95th Percentile of One-way Delay is expressed in seconds.

[7.5](#). **Administrative items**

[7.5.1](#). **Status**

   <current or depricated>

[7.5.2](#). **Requestor (keep?)**

   name or RFC, etc.

[7.5.3](#). **Revision**

   1.0

[7.5.4](#). **Revision Date**

   YYYY-MM-DD

[7.6](#). **Comments and Remarks**

   Additional (Informational) details for this entry

[8](#). **UDP Periodic One-way Delay Registry Entries**

   This section gives an initial registry entry for the UDP Periodic
   One-way Delay.

   Note: Each Registry "Name" below specifies a single registry entry,
   whose output format varies according to a component of the name that
   specifies one form of statistical summary.

   IANA is asked to assign a different numeric identifiers to each Name.
   All other column entries are the same, thus this section is proposes
   five closely-related registry entries. As a result, IANA is also
   asked to assign corresponding URIs and URLs.

[8.1](#). **Summary**

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

[8.1.1](#). **ID (Identifier)**

   <insert numeric identifier, an integer, one corresponding to each
   name below>

[8.1.2](#). **Name**

   <insert name according to metric naming convention>

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_<statistic>

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_Percentile95

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_Mean

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_Min

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_Max

   Act_IP_UDP_Periodic-var_UDP-Payload-142_One-way_Delay_Std_Dev

[8.1.3](#). **URI and URL**

   URI: Prefix urn:ietf:params:performance:metric...<name>

   URL: http:\\www.iana.org\ ... <name>

[8.1.4](#). **Description**

   This metric assesses the delay of a stream of packets exchanged
   between two hosts (or measurement points), and reports the
   <statistic> One-way delay for all successfully exchanged packets
   based on their conditional delay distribution.

[8.2](#). **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

[8.2.1](#). **Reference Definition**

   <Full bibliographic reference to an immutable doc.>

   Almes, G., Kalidindi, S., and M. Zekauskas, "A One-way Delay Metric
   for IPPM", [RFC 2679](#), September 1999.

   [RFC2679]

   Morton, A., and Stephan, E., "Spatial Composition of Metrics", [RFC
   6049](#), January 2011.

   [RFC6049]

Section 3.4 of [RFC2679] provides the reference definition of the
singleton (single value) One-way delay metric. Section 4.4 of
[RFC2679] provides the reference definition expanded to cover a
multi-value sample. Note that terms such as singleton and sample are
defined in Section 11 of [RFC2330].

Only successful packet transfers with finite delay are included in
the sample, as prescribed in section 4.1.2 of [RFC6049].

NOTE: RFC2679 will be replaced by 2679-bis on approval, see draft-
ietf-ippm-2679-bis-01.

ANY other conditions, ...

8.2.2. Fixed Parameters

<list and specify Fixed Parameters, input factors that must be
determined and embedded in the measurement system for use when
needed>

Type-P:

o IPv4 header values:

   * DSCP: set to 0

   * TTL set to 255

   * Protocol: Set to 17 (UDP)

o UDP header values:

   * Checksum: the checksum must be calculated

o UDP Payload: TWAMP Test Packet Formats, Section 4.1.2 of [RFC5357]

   * Security features in use influence the number of Padding
      octets.

   * 142 octets total, including the TWAMP format

Timeout, Tmax: 3 seconds

8.3. **Method of Measurement**

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

8.3.1. **Reference Method**

   <for metric, insert relevant section references and supplemental
   info>

   The methodology for this metric is defined as Type-P-One-way-Delay-
   Poisson-Stream in section 3.6 of [RFC2679] and section 4.6 of
   [RFC2679] using the Type-P and Timeout defined under Fixed
   Parameters.

   The method requires sequence numbers or other send-order information
   to be retained at the Src or included with each packet to dis-
   ambiguate packet reordering if it occurs. Sequence number is part of
   the TWAMP payload described under Fixed Parameters.

8.3.2. **Packet Generation Stream**

   This section gives the details of the packet traffic which is the
   basis for measurement. In IPPM metrics, this is called the Stream,
   and can easily be dscribed by providing the list of stream
   parameters.

   <list of generation parameters and section/spec references if needed>

   Section 3 of [RFC3432] prescribes the method for generating Periodic
   streams using associated parameters.

   o incT, the nominal duration of inter-packet interval, first bit to
      first bit

   o dT, the duration of the interval for allowed sample start times

   o T0, the actual start time

   NOTE: an initiation process with a number of control exchanges
   resulting in unpredictable start times (within a time interval) may
   be sufficient to avoid synchronization of periodic streams, and
   therefore a valid replacement for selecting a start time at random
   from a fixed interval.

   These stream parameters will be specified as Run-time parameters.

8.3.3. Traffic Filtering (observation) Details

   NA

8.3.4. Sampling Distribution

   NA

8.3.5. Run-time Parameters and Data Format

   Run-time Parameters are input factors that must be determined,
   configured into the measurement system, and reported with the results
   for the context to be complete.

   <list of run-time parameters, and their data formats>

   o Src, the IP address of a host (32-bit value for IPv4, 128-bit
      value for IPv6)

   o Dst, the IP address of a host (32-bit value for IPv4, 128-bit
      value for IPv6)

   o T0, a time (start of measurement interval, 128-bit NTP Date
      Format, see section 6 of [RFC5905]). When T0 is "all-zeros", a
      start time is unspecified and Tf is to be interpreted as the
      Duration of the measurement interval.

   o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905]), interpreted as the Duration of the
      measurement interval.

   o incT, the nominal duration of inter-packet interval, first bit to
      first bit

   o dT, the duration of the interval for allowed sample start times

   The format for incT and dT are the short format in [RFC5905] (32
   bits) and is as follows: the first 16 bits represent the integer
   number of seconds; the next 16 bits represent the fractional part of
   a second.

   >>> should Periodic run-time params be fixed instead? probably yes if
   modeling a specific version of tests. Note in the NAME, i.e.
   Poisson3.3

8.3.6. **Roles**

   <lists the names of the different roles from the measurement method>

   Src - launches each packet and waits for return transmissions from
   Dst. This is the TWAMP Session-Sender.

   Dst - waits for each packet from Src and sends a return packet to
   Src. This is the TWAMP Session-Reflector.

8.4. **Output**

   This category specifies all details of the Output of measurements
   using the metric.

8.4.1. **Type/Value (two diff terms used)**

   <insert name of the output type, raw or a selected summary statistic>

   See subsection titles in Data Format for Types.

8.4.2. **Data Format**

   <describe the data format for each type of result>

   For all output types ---

   o T0, a time (start of measurement interval, 128-bit NTP Date
      Format, see section 6 of [RFC5905])

   o Tf, a time (end of measurement interval, 128-bit NTP Date Format,
      see section 6 of [RFC5905])

8.4.2.1. **Percentile95**

   The 95th percentile SHALL be calculated using the conditional
   distribution of all packets with a finite value of One-way delay
   (undefined delays are excluded), a single value as follows:

   See section 4.1 of [RFC3393] for details on the conditional
   distribution to exclude undefined values of delay, and Section 5 of
   [RFC6703] for background on this analysis choice.

   See section 4.3 of [RFC3393] for details on the percentile statistic
   (where Round-trip delay should be substituted for "ipdv").

   The percentile = 95.

Data format is a 32-bit signed value, *similar to* the 32-bit short
NTP Time format in Section 6 of [RFC5905] and is as follows: the
first 16 bits represent the *signed* integer number of seconds; the
next 16 bits represent the fractional part of a second.

8.4.2.2. Mean

The mean SHALL be calculated using the conditional distribution of
all packets with a finite value of One-way delay (undefined delays
are excluded), a single value as follows:

See section 4.1 of [RFC3393] for details on the conditional
distribution to exclude undefined values of delay, and Section 5 of
[RFC6703] for background on this analysis choice.

See section 4.2.2 of [RFC6049] for details on calculating this
statistic, and 4.2.3 of [RFC6049].

Data format is a 32-bit signed value, *similar to* the 32-bit short
NTP Time format in Section 6 of [RFC5905] and is as follows: the
first 16 bits represent the *signed* integer number of seconds; the
next 16 bits represent the fractional part of a second.

8.4.2.3. Min

The minimum SHALL be calculated using the conditional distribution of
all packets with a finite value of One-way delay (undefined delays
are excluded), a single value as follows:

See section 4.1 of [RFC3393] for details on the conditional
distribution to exclude undefined values of delay, and Section 5 of
[RFC6703] for background on this analysis choice.

See section 4.3.2 of [RFC6049] for details on calculating this
statistic, and 4.3.3 of [RFC6049].

Data format is a 32-bit signed value, *similar to* the 32-bit short
NTP Time format in Section 6 of [RFC5905] and is as follows: the
first 16 bits represent the *signed* integer number of seconds; the
next 16 bits represent the fractional part of a second.

8.4.2.4. Max

The maximum SHALL be calculated using the conditional distribution of
all packets with a finite value of One-way delay (undefined delays
are excluded), a single value as follows:

See section 4.1 of [RFC3393] for details on the conditional
distribution to exclude undefined values of delay, and Section 5 of
 [RFC6703] for background on this analysis choice.

See section 4.3.2 of [RFC6049] for a closely related method for
calculating this statistic, and 4.3.3 of [RFC6049]. The formula is
as follows:

        Max = (FiniteDelay [j])

                such that for some index, j, where 1 <= j <= N
                FiniteDelay[j] >= FiniteDelay[n] for all n

Data format is a 32-bit signed value, *similar to* the 32-bit short
NTP Time format in Section 6 of [RFC5905] and is as follows: the
first 16 bits represent the *signed* integer number of seconds; the
next 16 bits represent the fractional part of a second.

8.4.2.5. Std_Dev

8.4.3. Reference

<pointer to section/spec where output type/format is defined>

See the Data Format column for references.

8.4.4. Metric Units

<insert units for the measured results, and the reference
specification>.

The <statistic> of One-way Delay is expressed in seconds.

8.5. Administrative items

8.5.1. Status

<current or depricated>

8.5.2. Requestor (keep?)

name or RFC, etc.

8.5.3. Revision

1.0

8.5.4. Revision Date

   YYYY-MM-DD

8.6. Comments and Remarks

   Additional (Informational) details for this entry

9. partly BLANK Registry Entry

   This section gives an initial registry entry for ....

9.1. Summary

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

   <skipping the admin columns for now>

9.1.1. ID (Identifier)

   <insert numeric identifier, an integer>

9.1.2. Name

   <insert name according to metric naming convention>

   URL: ??

9.1.3. URI

   URI: Prefix urn:ietf:params:performance:metric

9.1.4. Description

   TBD.

9.2. Metric Definition

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

9.2.1. Reference Definition

   <Full bibliographic reference to an immutable doc.>

Almes, G., Kalidindi, S., and M. Zekauskas, "A Round-trip Delay
Metric for IPPM", RFC 2681, September 1999.

<specific section reference and additional clarifications, if needed>

Section 2.4 of [RFC2681] provides the reference definition of the
singleton (single value) Round-trip delay metric. Section 3.4 of
[RFC2681] provides the reference definition expanded to cover a
multi-value sample. Note that terms such as singleton and sample are
defined in Section 11 of [RFC2330].

Note that although the definition of "Round-trip-Delay between Src
and Dst at T" is directionally ambiguous in the text, this metric
tightens the definition further to recognize that the host in the
"Src" role will send the first packet to "Dst", and ultimately
receive the corresponding return packet from "Dst" (when neither are
lost).

<<< Check how the Methodology also makes this clear (or not) >>>

9.2.2. Fixed Parameters

<list and specify Fixed Parameters, input factors that must be
determined and embedded in the measurement system for use when
needed>

Type-P:

o   IPv4 header values:

    *   DSCP: set to 0

    *   TTL set to 255

    *   Protocol: Set to 17 (UDP)

o   UDP header values:

    *   Checksum: the checksum must be calculated

o   Payload

    *   Sequence number: 8-byte integer

    *   Timestamp: 8 byte integer. Expressed as 64-bit NTP timestamp
        as per section 6 of RFC 5905 [RFC5905]

    *   No padding (total of 9 bytes)

   Timeout: 3 seconds

9.3. Method of Measurement

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

9.3.1. Reference Method

   <for metric, insert relevant section references and supplemental
   info>

9.3.2. Packet Generation Stream

   This section gives the details of the packet traffic which is the
   basis for measurement. In IPPM metrics, this is called the Stream,
   and can easily be dscribed by providing the list of stream
   parameters.

   <list of generation parameters and section/spec references if needed>

9.3.3. Traffic Filtering (observation) Details

   The measured results based on a filtered version of the packets
   observed, and this section provides the filter details (when
   present).

   <section reference>.

9.3.4. Sampling Distribution

   <insert time distribution details, or how this is diff from the
   filter>

9.3.5. Run-time Parameters and Data Format

   Run-time Parameters are input factors that must be determined,
   configured into the measurement system, and reported with the results
   for the context to be complete.

   <list of run-time parameters>

   <reference(s)>.

9.3.6. **Roles**

   <lists the names of the different roles from the measurement method>

9.4. **Output**

   This category specifies all details of the Output of measurements
   using the metric.

9.4.1. **Type/Value (two diff terms used)**

   <insert name of the output type, raw or a selected summary statistic>

9.4.2. **Data Format**

   <describe the data format for each type of result>

   o Value:

   o Data Format: (There may be some precedent to follow here, but
      otherwise use 64-bit NTP Timestamp Format, see section 6 of
      [RFC5905]).

   o Reference: <section reference>

9.4.3. **Reference**

   <pointer to section/spec where output type/format is defined>

9.4.4. **Metric Units**

   <insert units for the measured results, and the reference
   specification>.

9.5. **Administrative items**

9.5.1. **Status**

   <current or depricated>

9.5.2. **Requestor (keep?)**

   name or RFC, etc.

9.5.3. **Revision**

   1.0

9.5.4. **Revision Date**

   YYYY-MM-DD

9.6. **Comments and Remarks**

   Additional (Informational) details for this entry

10. **BLANK Registry Entry**

   This section gives an initial registry entry for ....

10.1. **Summary**

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

   <skipping the Summary columns for now>

10.1.1. **ID (Identifier)**

   <insert numeric identifier, an integer>

10.1.2. **Name**

   <insert name according to metric naming convention>

   URL: ??

10.1.3. **URI**

   URI: Prefix urn:ietf:params:performance:metric

10.1.4. **Description**

   TBD.

10.2. **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters.

10.2.1. **Reference Definition**

   <Full bibliographic reference to an immutable doc.>

   <specific section reference and additional clarifications, if needed>

10.2.2. **Fixed Parameters**

   <list and specify Fixed Parameters, input factors that must be
   determined and embedded in the measurement system for use when
   needed>

10.3. **Method of Measurement**

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations.

10.3.1. **Reference Method**

   <for metric, insert relevant section references and supplemental
   info>

10.3.2. **Packet Generation Stream**

   <list of generation parameters and section/spec references if needed>

10.3.3. **Traffic Filtering (observation) Details**

   <insert the measured results based on a filtered version of the
   packets observed, and this section provides the filter details (when
   present), and section reference>.

10.3.4. **Sampling Distribution**

   <insert time distribution details, or how this is diff from the
   filter>

10.3.5. **Run-time Parameters and Data Format**

   <list of run-time parameters, and any reference(s)>.

10.3.6. **Roles**

10.4. Output

   This category specifies all details of the Output of measurements
   using the metric.

10.4.1. Type/Value (two diff terms used)

   <insert name of the output type, raw or a selected summary statistic>

10.4.2. Data Format

   <describe the data format for each type of result>

10.4.3. Reference

   <pointer to section/spec where output type/format is defined>

10.4.4. Metric Units

   <insert units for the measured results, and the reference
   specification>.

10.5. Administrative items

10.5.1. Status

   <current or depricated>

10.5.2. Requestor (keep?)

   <name of individual or RFC, etc.>

10.5.3. Revision

   1.0

10.5.4. Revision Date

   YYYY-MM-DD

10.6. Comments and Remarks

   Additional (Informational) details for this entry

11. Example RTCP-XR Registry Entry

   This section is MAY BE DELETED or adapted before submission.

   This section gives an example registry entry for the end-point metric
   described in RFC 7003 [RFC7003], for RTCP-XR Burst/Gap Discard Metric
   reporting.

11.1. Registry Indexes

   This category includes multiple indexes to the registry entries, the
   element ID and metric name.

11.1.1. Identifier

   An integer having enough digits to uniquely identify each entry in
   the Registry.

11.1.2. Name

   A metric naming convention is TBD.

11.1.3. URI

   Prefix urn:ietf:params:performance:metric

11.1.4. Status

   current

11.1.5. Requestor

   Alcelip Mornuley

11.1.6. Revision

   1.0

11.1.7. Revision Date

   2014-07-04

11.1.8. Description

   TBD.

11.1.9. **Reference Specification(s)**

   [RFC3611][RFC4566][RFC6776][RFC6792][RFC7003]

11.2. **Metric Definition**

   This category includes columns to prompt the entry of all necessary
   details related to the metric definition, including the RFC reference
   and values of input factors, called fixed parameters. Section 3.2 of
   [RFC7003] provides the reference information for this category.

11.2.1. **Reference Definition**

   Packets Discarded in Bursts:

   The total number of packets discarded during discard bursts. The
   measured value is unsigned value. If the measured value exceeds
   0xFFFFFD, the value 0xFFFFFE MUST be reported to indicate an over-
   range measurement. If the measurement is unavailable, the value
   0xFFFFFF MUST be reported.

11.2.2. **Fixed Parameters**

   Fixed Parameters are input factors that must be determined and
   embedded in the measurement system for use when needed. The values
   of these parameters is specified in the Registry.

   Threshold: 8 bits, set to value = 3 packets.

   The Threshold is equivalent to Gmin in [RFC3611], i.e., the number of
   successive packets that must not be discarded prior to and following
   a discard packet in order for this discarded packet to be regarded as
   part of a gap. Note that the Threshold is set in accordance with the
   Gmin calculation defined in Section 4.7.2 of [RFC3611].

   Interval Metric flag: 2 bits, set to value 11=Cumulative Duration

   This field is used to indicate whether the burst/gap discard metrics
   are Sampled, Interval, or Cumulative metrics [RFC6792]:

   I=10: Interval Duration - the reported value applies to the most
   recent measurement interval duration between successive metrics
   reports.

   I=11: Cumulative Duration - the reported value applies to the
   accumulation period characteristic of cumulative measurements.

   Senders MUST NOT use the values I=00 or I=01.

11.3. **Method of Measurement**

   This category includes columns for references to relevant sections of
   the RFC(s) and any supplemental information needed to ensure an
   unambiguous methods for implementations. For the Burst/Gap Discard
   Metric, it appears that the only guidance on methods of measurement
   is in Section 3.0 of [RFC7003] and its supporting references.
   Relevant information is repeated below, although there appears to be
   no section titled "Method of Measurement" in [RFC7003].

11.3.1. **Reference Method**

   Metrics in this block report on burst/gap discard in the stream
   arriving at the RTP system. Measurements of these metrics are made
   at the receiving end of the RTP stream. Instances of this metrics
   block use the synchronization source (SSRC) to refer to the separate
   auxiliary Measurement Information Block [RFC6776], which describes
   measurement periods in use (see [RFC6776], Section 4.2).

   This metrics block relies on the measurement period in the
   Measurement Information Block indicating the span of the report.
   Senders MUST send this block in the same compound RTCP packet as the
   Measurement Information Block. Receivers MUST verify that the
   measurement period is received in the same compound RTCP packet as
   this metrics block. If not, this metrics block MUST be discarded.

11.3.2. **Stream Type and Stream Parameters**

   Since RTCP-XR Measurements are conducted on live RTP traffic, the
   complete description of the stream is contained in SDP messages that
   proceed the establishment of a compatible stream between two or more
   communicating hosts. See Run-time Parameters, below.

11.3.3. **Output Type and Data Format**

   The output type defines the type of result that the metric produces.

   o Value: Packets Discarded in Bursts

   o Data Format: 24 bits

   o Reference: Section 3.2 of [RFC7003]

11.3.4. **Metric Units**

   The measured results are apparently expressed in packets, although
   there is no section of [RFC7003] titled "Metric Units".

11.3.5. Run-time Parameters and Data Format

Run-Time Parameters are input factors that must be determined, configured into the measurement system, and reported with the results for the context to be complete. However, the values of these parameters is not specified in the Registry, rather these parameters are listed as an aid to the measurement system implementor or user (they must be left as variables, and supplied on execution).

The Data Format of each Run-time Parameter SHALL be specified in this column, to simplify the control and implementation of measurement devices.

SSRC of Source: 32 bits As defined in Section 4.1 of [RFC3611].

SDP Parameters: As defined in [RFC4566]

Session description v= (protocol version number, currently only 0)

o= (originator and session identifier : username, id, version number, network address)

s= (session name : mandatory with at least one UTF-8-encoded character)

i=* (session title or short information) u=* (URI of description)

e=* (zero or more email address with optional name of contacts)

p=* (zero or more phone number with optional name of contacts)

c=* (connection information--not required if included in all media)

b=* (zero or more bandwidth information lines) One or more Time descriptions ("t=" and "r=" lines; see below)

z=* (time zone adjustments)

k=* (encryption key)

a=* (zero or more session attribute lines)

Zero or more Media descriptions (each one starting by an "m=" line; see below)

m= (media name and transport address)

i=* (media title or information field)

   c=* (connection information -- optional if included at session level)

   b=* (zero or more bandwidth information lines)

   k=* (encryption key)

   a=* (zero or more media attribute lines -- overriding the Session
   attribute lines)

   An example Run-time SDP description follows:

   v=0

   o=jdoe 2890844526 2890842807 IN IP4 192.0.2.5

   s=SDP Seminar i=A Seminar on the session description protocol

   u=http://www.example.com/seminars/sdp.pdf e=j.doe@example.com (Jane
   Doe)

   c=IN IP4 233.252.0.12/127

   t=2873397496 2873404696

   a=recvonly

   m=audio 49170 RTP/AVP 0

   m=video 51372 RTP/AVP 99

   a=rtpmap:99 h263-1998/90000

11.4. Comments and Remarks

   TBD.

12. Revision History

   This section may be removed for publication. It contains partial
   information on updtes.

   This draft replaced draft-mornuley-ippm-initial-registry.

   In version 02, Section 4 has been edited to reflect recent discussion
   on the ippm-list: * Removed the combination or "Raw" and left 95th
   percentile. * Hanging Indent on Run-time parameters (Fixed parameters
   use bullet lists and other indenting formats. * Payload format for

measurement has been removed. * Explanation of Conditional delay
distribution.

Version 03 addressed Phil Eardley's comments and suggestions in
sections [1](#)-[4](#). and resolved the definition of Percentiles.

Version 04 * All [section 4](#) parameters reference YANG types for
alternate data formats. * Discussion has concluded that usecase(s)
for machine parse-able registry columns are not needed.

Still need: * suggestion of standard naming format for parameters.

Note: lambda parameter description is correct in [section 4](#), elsewhere
needs fix.

[13](#). Security Considerations

These registry entries represent no known security implications for
Internet Security. Each referenced Metric contains a Security
Considerations section.

[14](#). IANA Considerations

IANA is requested to populate The Performance Metric Registry defined
in [[I-D.ietf-ippm-metric-registry](#)] with the values defined above.

<more is needed here>

[15](#). Acknowledgements

The authors thank Brian Trammell for suggesting the term "Run-time
Parameters", which led to the distinction between run-time and fixed
parameters implemented in this memo, for identifying the IPFIX metric
with Flow Key as an example, and for many other productive
suggestions. Thanks to Peter Koch, who provided several useful
suggestions for disambiguating successive DNS Queries in the DNS
Response time metric.

The authors also acknowledge the constructive reviews and helpful
suggestions from Barbara Stark, Juergen Schoenwaelder, Tim Carey, and
participants in the LMAP working group.

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