A(nother) Registry for Performance Metrics
draft-mornulo-ippm-registry-columns-01

Abstract

   This memo investigates a scheme to organize registry entries,
   especially those defined in RFCs prepared in the IP Performance
   Metrics (IPPM) Working Group of the IETF, and applicable to all IETF
   metrics. Three aspects make IPPM metric registration difficult: (1)
   Use of the Type-P notion to allow users to specify their own packet
   types. (2) Use of flexible input variables, called Parameters in IPPM
   definitions, some which determine the quantity measured and others
   which should not be specified until execution of the measurement. (3)
   Allowing flexibility in choice of statistics to summarize the results
   on a stream of measurement packets. Specifically, this memo proposes
   a way to organize registry entries into columns that are well-
   defined, permiting consistent development of entries over time.
   Also, this fosters development of registry entries based on existing
   reference RFCs for performance metrics, and requires expert review
   for every entry before IANA action.

   This version contains an example registry entry for a passive
   endpoint metric based on RFC7003, an example active metric entry
   based on RFC3393 and RFC5481, and an example pure passive metric
   based on RFC5472. Also, this version *continues* to allow blank
   entries in columns which have no applicability to a specific metric,
   or class of metrics. This is preferred to more general registry
   organization because each column serves as a check-list item and
   helps to avoid omissions during registration and expert review.

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].

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Table of Contents

1. Introduction

This memo investigates a scheme to organize registry entries,
especially those defined in RFCs prepared in the IP Performance
Metrics (IPPM) Working Group of the IETF, according to their
framework [RFC2330]. Three aspects make IPPM metric registration
difficult: (1) Use of the Type-P notion to allow users to specify
their own packet types. (2) Use of Flexible input variables, called
Parameters in IPPM definitions, some which determine the quantity
measured and others which should not be specified until execution of
the measurement. (3) Allowing flexibility in choice of statistics to
summarize the results on a stream of measurement packets. This memo
uses terms and definitions from the IPPM literature, primarily
[RFC2330], and the reader is assumed familiar with them or may refer
questions there as necessary.

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 was intended to become the basis for the columns of an
IETF-wide registry of metrics. As we examine the aspects of metric
specifications which need to be registered, we will see that none of
the existing metric templates fully satisfies the needs of a
registry.

The authors of [draft-bagnulo-ippm-new-registry] and
[draft-bagnulo-ippm-new-registry-independent] made important
contributions to this memo in the registry column structure, and the
problem of registry development in general. We also acknowledge
input from the authors of [draft-claise-ippm-perf-metric-registry],
especially the value of an Element ID and the need for naming
conventions.

1.1. Background and Motivation

The motivation for having such registry is to allow a controller to
request a measurement agent to execute a measurement using a specific
metric. Such request can be performed using any control protocol
that refers to the value assigned to the specific metric in the
registry. Similarly, the measurement agent can report the results of
the measurement and by referring to the metric value it can
unequivocally identify the metric that the results correspond to.

There was a previous attempt to define a metric registry RFC 4148
[RFC4148]. However, it was obsoleted by RFC 6248 [RFC6248] because
it was "found to be insufficiently detailed to uniquely identify IPPM

metrics... [there was too much] variability possible when
characterizing a metric exactly" which led to the RFC4148 registry
having "very few users, if any".

Our approach learns from this, by tightly defining each entry in the
registry with only a few parameters open for each. The idea is that
the entries in the registry represent different measurement tests,
whilst the run-time parameters set things like source and destination
addresses that don't change the fundamental nature of the test. The
downside of this approach is that it could result in an explosion in
the number of entries in the registry. We believe that less is more
in this context - it is better to have a reduced set of useful
metrics rather than a large set of metrics with questionable
usefulness. Therefore this document defines that the registry only
includes commonly used metrics that are well defined; hence we
require both reference specification required AND expert review
policies for the assignment of values in the registry.

There are several side benefits of having such a registry. First the
registry could serve as an inventory of useful and used metrics, that
are normally supported by different implementations of measurement
agents. Second, the results of the metrics would be comparable even
if they are performed by different implementations and in different
networks, as the metric is properly defined.

The registry forms part of a Characterization Plan. It describes
various factors that need to be set by the party controlling the
measurements, for example: specific values for the parameters
associated with the selected registry entry (for instance, source and
destination addresses); and how often the measurement is made. The
Characterization Plan determines the individual Measurement
Instructions that will be communicated to measurement agents, whose
task is then to execute the Instruction autonomously.

Measurement Instructions might look something like: "Dear measurement
agent: Please start test DNS(example.com) and RTT(server.com,150)
every day at 2000 GMT. Run the DNS test 5 times and the RTT test 50
times. Do that when the network is idle. Generate both raw results
and 99th percentile mean. Send measurement results to collector.com
in IPFIX format". The Characterization Plan depends on the
requirements of the controlling party. For instance the broadband
consumer might want a one-off measurement made immediately to one
specific server; a regulator might want the same measurement made
once a day until further notice to the 'top 10' servers; whilst an
operator might want a varying series of tests (some of which will be
beyond those defined in the registry) as determined from time to time
by their operational support system. While the registries defined in
this document help to define the Characterization Plan, its full

specification falls outside the scope of this document, and other
IETF work as currently chartered.

2. Scope

Specifically, this memo proposes a way to organize registry entries
into columns that are well-defined, permiting consistent development
of entries over time. Also, this fosters development of registry
entries based on existing reference RFCs for performance metrics, and
requires expert review for every entry before IANA action.

In this memo, we attempt a combinatoric registry, where all factors
that can be reasonably specified ARE specified, and changing even one
factor would require a new registry entry (row). It is believed that
this exercise can also be instructive for a registry based on
independent factors, [draft-bagnulo-ippm-new-registry-independent]
but that topic is beyond the scope of this effort.

Entries in the registry must reference an existing RFC or other
recognized standard, and are subject to expert review. The expert
review must make sure that the proposed metric is operationally
useful. This means that the metric has proven to be useful in
operational/real scenarios.

3. Registry Categories and Columns

This section briefly describes the categories and columns proposed
for the registry, as this is likely to be a topic for discussion and
revision. Below, categories are described at the 3.x heading level,
and columns are at the 3.x.y heading level. The Figure below
illustrates this organization.

Taken as a whole, the entries in the columns give a registered
instance of a metric with sufficient specificity to promote
comparable results across independent implementations. In other
words, a *complete description* of a Metric Instance. Some instances
may not require entries in all columns, but this is preferred to more
general organization because each column serves as a check-list item
and helps to avoid omissions during registration and expert review.

Registry Categories and Columns, shown as
```
                                              Category
                                              ------------------
                                              Column |  Column |
Registry Indexes
---------------------------
Element ID |  Metric Name |


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


Method of Measurement
---------------------------------------------------------------------------
Reference Method | Stream Type and Param | Output Type | Run-time Param |


Comments and Remarks
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```


3.1. Registry Indexes

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

3.1.1. Element ID

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

3.1.2. Metric Name

   A metric naming convention is TBD.

   The current guidance from Section 13 of [RFC2330], where Type-P is a
   feature of all IPPM metric names, is:

   "... we introduce the generic notion of a "packet of type P", where
   in some contexts P will be explicitly defined (i.e., exactly what
   type of packet we mean), partially defined (e.g., "with a payload of
   B octets"), or left generic. Thus we may talk about generic IP-type-
   P-connectivity or more specific IP-port-HTTP-connectivity. Some
   metrics and methodologies may be fruitfully defined using generic
   type P definitions which are then made specific when performing

actual measurements. Whenever a metric's value depends on the type
of the packets involved in the metric, the metric's name will include
either a specific type or a phrase such as "type-P". ..."

Registry entries are a context where Type-P must be defined.

IPPM Metric names have also included the typically included the
stream type, to distinguish between singleton and sample metrics (see
[RFC2330] for the definition of these terms).

3.2. Metric Definition

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

3.2.1. Reference Definition

This entry provides references to relevant sections of the RFC(s)
defining the metric, as well as any supplemental information needed
to ensure an unambiguous definition for implementations.

3.2.2. 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.

Where referenced metrics supply a list of Parameters as part of their
descriptive template, a sub-set of the Parameters will be designated
as Fixed Parameters. For example, Fixed Parameters determine most or
all of the IPPM Framework convention "packets of Type-P" as described
in [RFC2330], such as transport protocol, payload length, TTL, etc.

A Parameter which is Fixed for one Registry entry may be designated
as a Run-time Parameter for another Registry entry.

3.2.3. Metric Units

The measured results of a metric must be expressed using some
standard dimension or units of measure. This column provides the
units (and if possible, the data format, whose specification will
simplify both measurement implementation and collection/storage
tasks, see the Output Type column below).

When a sample of singletons (see [RFC2330] for definitions of these
terms) is collected, this entry will specify the units for each
measured value.

3.3. 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.

3.3.1. Reference Method

This entry provides references to relevant sections of the RFC(s)
describing the method of measurement, as well as any supplemental
information needed to ensure unambiguous interpretation for
implementations referring to the RFC text.

3.3.2. Stream Type and Stream Parameters

Principally, two different streams are used in IPPM metrics, Poisson
distributed as described in [RFC2330] and Periodic as described in
[RFC3432]. Both Poisson and Periodic have their own unique
parameters, and the relevant set of values is specified in this
column.

Some metrics, such as those intended for passive monitoring or RTCP
and RTCP-XR metrics, will not specifiy an entry for this column.

Each entry for this column contains the following information:

o Value: The name of the packet stream scheduling disipline

o Stream Parameters: The values and formats of input factors for
   each type of stream. For example, the average packet rate and
   distribution truncation value for streams with Poisson-distributed
   inter-packet sending times.

o Reference: the specification where the stream is defined

The simplest example of stream specification is Singleton scheduling,
where a single atomic measurement is conducted. Each atomic
measurement could consist of sending a single packet (such as a DNS
request) or sending several packets (for example, to request a a
webpage). Other streams support a series of atomic measurements in a
"sample", with a schedule defining the timing between each transmited
packet and subsequent measurement.

3.3.3. Output Type and Data Format

For entries which involve a stream and many singleton measurements, a
statistic may be specified in this column to summarize the results to
a single value. If the complete set of measured singletons is

output, this will be specified here.

Some metrics embed one specific statistic in the reference metric
definition, while others allow several output types or statistics.

Each entry in the output type column contains the following
information:

o Value: The name of the output type

o Data Format: provided to simplify the communication with
   collection systems and implementation of measurement devices.

o Reference: the specification where the output type is defined

The output type defines the type of result that the metric produces.
It can be the raw results or it can be some form of statistic. The
specification of the output type must define the format of the
output. Note that if two different statistics are required from a
single measurement (for example, both "Xth percentile mean" and
"Raw"), then a new output type must be defined ("Xth percentile mean
AND Raw").

3.3.4. 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).

Where metrics supply a list of Parameters as part of their
descriptive template, a sub-set of the Parameters will be designated
as Run-Time Parameters.

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

Examples of Run-time Parameters include IP addresses, measurement
point designations, start times and end times for measurement, and
other measurement-specific information.

3.4. Comments and Remarks

Besides providing additional details which do not appear in other
categories, this open Category (single column) allows for unforeseen

issues to be addressed by simply updating this Informational entry.

4. **Example RTCP-XR Registry Entry**

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

4.1. **Registry Indexes**

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

4.1.1. **Element ID**

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

4.1.2. **Metric Name**

A metric naming convention is TBD.

4.2. **Metric Definition**

This category includes columns to prompt the entry of all necessary
detalis 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.

4.2.1. **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.

4.2.2. **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.

4.2.3. Metric Units

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

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. 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].

4.3.1. 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.

4.3.2. 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.

4.3.3. 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]

4.3.4. 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 10.47.16.5

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 224.2.17.12/127

t=2873397496 2873404696

a=recvonly

m=audio 49170 RTP/AVP 0

   m=video 51372 RTP/AVP 99

   a=rtpmap:99 h263-1998/90000

4.4. Comments and Remarks

   Besides providing additional details which do not appear in other
   categories, this open Category (single column) allows for unforeseen
   issues to be addressed by simply updating this Informational entry.

5. Example IPPM Active Registry Entry

   This section gives an example registry entry for the active metric
   described in [RFC3393], on Packet Delay Variation.

5.1. Registry Indexes

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

5.1.1. Element ID

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

5.1.2. Metric Name

   A metric naming convention is TBD.

   One possibility based on IPPM's framework is:

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

5.2. Metric Definition

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

5.2.1. Reference Definition

   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

Where metrics supply a list of Parameters as part of their
descriptive template, a sub-set of the Parameters will be designated
as Fixed Parameters.

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).

5.2.3. Metric Units

See section 3.3 of [RFC3393] for singleton elements.

[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.

5.3. 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

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

5.3.2. Stream Type and Stream Parameters

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. Output Type and Data Format

See section 4.3 of [RFC3393] for details on the percentile statistic.

The percentile = 95.

Data format is a 32-bit unsigned floating point value.

Individual results (singletons) should be represented by the
following triple

o T1 and T2, times as described below in the Run-time parameters
   section.

o ddT as defined in section 2.4 of [RFC3393]

if needed. The result format for ddT is *similar to* the short
format in [RFC5905] (32 bits) 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.

5.3.4. Run-time Parameters and Data Format

Where metrics supply a list of Parameters as part of their
descriptive template, a sub-set of the Parameters will be designated
as Run-Time Parameters. In related registry entries, some of the
parameters below may be designated as Fixed Parameters instead.

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 test interval, 128-bit NTP Date Format, see
   section 6 of [RFC5905])

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

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]).

5.4. Comments and Remarks

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
IPDV.

6. Example IPFIX RTT Pair Matching Registry Entry

This section gives an example registry entry for the passive metric
described in section 2.5.2.1 of [RFC5472], for Round-Trip Time (RTT)
Measurements with Packet Pair Matching (Single-Point).

6.1. Registry Indexes

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

6.1.1. Element ID

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

6.1.2. Metric Name

A metric naming convention is TBD.

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. Section
2.5.2.1 of [RFC5472] provides the reference information for this
category.

6.2.1. Reference Definition

   Observations of both directions are required to correlate request/
   response packet pairs.

   Pair matching techniques are described in [Brow00].

6.2.2. 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.

   Protocol (Pair Type): TCP (SYN/SYN_ACK)

   Note: other possibilities are DNS, ICMP, SNMP or TCP (DATA/ACK),
   discussed in [Brow00].

6.2.3. Metric Units

   The measured results are expressed in microseconds, which follows the
   format of Information Elements per observed packet, see section 8.4.3
   of[RFC5477] titled "observationTimeMicroseconds".

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 the TCP(SYN/SYN_ACK) RTT metric, the guidance on methods of
   measurement is in slides 12 and 15 of [Brow00].

   Recognition of request response pairs is a REQUIRED function, as is
   the correlation of data from both directions of transmission, see
   section 2.5.2.1 of [RFC5472].

   The method requires the collection of the following Information
   Elements per packet:

   o Packet arrival time: observationTimeMicroseconds, see section
      8.4.3 of[RFC5477]

   o TCP header: ipPayloadPacketSection, see section 8.5.2 of[RFC5477]

6.3.2. **Stream Type and Stream Parameters**

   Since IPFIX passive Measurements are conducted on live/production
   network traffic, the measurement methods rely on user-generated
   packet flows. Such flows are not described in this column.

6.3.3. **Output Type and Data Format**

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

   o Value: RTT in microseconds

   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 2.5.2.1 of [RFC5472]

6.3.4. **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 list of Run-time
   parameters is not specified for purely passive metrics, as there are
   infinite possibilities.

   A likely Run-time parameter is the Destination host, which may be
   given as a Fully-Qualified Domain Name as done in [Brow00], or an IP
   address of the host (32-bit value for IPv4, 128-bit value for IPv6).

6.4. **Comments and Remarks**

   Additional (Informational) details for this entry, from [Brow00]:

   Can't get RTT for every packet, only those which are ACKed.

   Overlapping packets (resent) are counted as lost, but not queued.
   This means the first copy of resent packets are used for RTTs, giving
   a high RTT estimate.

7. **Security Considerations**

   This registry has no known implications on Internet Security.

8. IANA Considerations

Metrics previously defined in IETF were registered in the IANA IPPM
METRICS REGISTRY, however this process was discontinued when the
registry structure was found to be inadequate, and the registry was
declared Obsolete [RFC6248].

The form of metric registration will finalized in the future, and no
IANA Action is requested at this time.

9. Acknowledgements

The author thanks Brian Trammell for suggesting the term "Run-time
Parameters", which led to the distinction between run-time and fixed
parameters implemented in this memo.

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