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Performance Metrics Registry
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Abstract

This document specifies an IANA registry for Performance Metrics, for both active monitoring and passive monitoring, along with the initial content. This document also gives a set of guidelines for Performance Metrics requesters and reviewers.

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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This Internet-Draft will expire on April 07, 2014.

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1. Open Issues

1. Check whether the "Initial Set of Performance Metrics" is up to date with the latest Performance Metrics published in XRBLOCK.

2. Do we want to organize the Performance Metrics list into different layers? IP, transport layer stats, application stats, etc?

3. "IPPM Performance Metric Mapping Experiment" for IPDV must be validated.

4. The community will have to agree on which Performance Metrics (along with the specific values of the measurements parameters) are operationally relevant

5. Define "Measurement Parameter"

2. Introduction

The IETF specifies and uses Performance Metrics of protocols and applications transported over its protocols. Performance metrics are such an important part of the operations of IETF protocols that [RFC6390] specifies guidelines for their development.

The definition and use of performance metrics in the IETF happens in various working groups (WG), most notably:

The "IP Performance Metris" (IPPM) WG [IPPM] is the WG primarily focusing on Peformance Metrics definition at the IETF.

The "Metric Blocks for use with RTCP's Extended Report Framework" WG [XRBLOCK] recently specified many Peformance Metrics related to "RTP Control Protocol Extended Reports (RTCP XR)" [RFC3611], which establishes a framework to allow new information to be conveyed in RTCP, supplementing the original report blocks defined in "RTP: A Transport Protocol for Real-Time Applications", [RFC3550].

The "Benchmarking Methodology" WG [BMWG] proposed some Peformance Metrics part of the benchmarking methodology.

The "IP Flow Information eXport" (IPFIX) WG [IPFIX] Information elements related to performance metrics are currently proposed.

The "Performance Metrics for Other Layers" (PMOL) concluded WG [PMOL], defined some Peformance Metrics related to Session Initiation Protocol (SIP) voice quality [RFC6035].

It is expected that more and more Performance Metrics will be defined in the future, not only IP based metrics, but also protocol-specific and application-specific ones.

However, despite the abundance and importance of performance metrics, there are still some problems for the industry: first, how to discover which Performance Metrics have already specified, and second, how to avoid Performance Metrics redefinition. Only someone with a broad IETF knowledge would be able to find its way among all the different Performance Metrics specified in the different WGs. The way in which IETF manages namespaces is with IANA registries, and there is currently no Peformance Metrics Registry in IANA.

This document specifies an IANA registry for Performance Metrics, along with the initial content, taken from the Performance Metrics already specified at the IETF. Firstly, from the Performance Metrics already specified by the RFC630 template (mentioned later on in the document), and secondly from the existing set of IPPM Performance Metrics. This second category requires a mapping to the RFC6390 template. This Performance Metric Registry is applicable to Performance Metrics issued from active monitoring, passive monitoring, or from the end point calculation. Therefore, it must relevant to work developed in the following WGs: IPPM, LMAP, XRBLOCK, BMWG, and IPFIX. Finally, this document gives a set of guidelines for Performance Metrics requesters and reviewers.

Based on [RFC5226] Section 4.3, this document is processed as Best Current Practice (BCP) [RFC2026].

The IPPM Metrics Registry [RFC4148] was an attempt to create such a Performance Metrics registry. However, that registry was reclassified as obsolete with [RFC6248], "RFC 4148 and the IP Performance Metrics (IPPM) Registry of Metrics Are Obsolete", and consequently withdrawn.

A couple of interesting quotes from RFC 6248 might help understand the issues related to that registry.

1. "It is not believed to be feasible or even useful to register every possible combination of Type P, metric parameters, and Stream parameters using the current structure of the IPPM Metrics Registry."

2. "The registry structure has been found to be insufficiently detailed to uniquely identify IPPM metrics."

3. "Despite apparent efforts to find current or even future users, no one responded to the call for interest in the RFC 4148 registry during the second half of 2010."

2.1. Terminology

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

The terms Performance Metric and Performance Metrics Directorate are direct quotes from [RFC6390], and copied over in this document for the readers convenience.

Performance Metric: A Performance Metric is a quantitative measure of performance, specific to an IETF-specified protocol or specific to an application transported over an IETF-specified protocol. Examples of Performance Metrics are the FTP response time for a complete file download, the DNS response time to resolve the IP address, a database logging time, etc.

Performance Metrics Directorate: The Performance Metrics Directorate is a directorate that provides guidance for Performance Metrics development in the IETF. The Performance Metrics Directorate should be composed of experts in the performance community, potentially selected from the IP Performance Metrics (IPPM), Benchmarking Methodology (BMWG), and Performance Metrics for Other Layers (PMOL) WGs.

Performance Metrics Registry: The IANA registry containing the Performance Metrics. This registry is initially populated from this document.

Measurement Parameter: NOT SURE HOW TO DEFINE THIS

3. Guidelines for Performance Metric Requesters and Reviewers

3.1. Performance Metrics Template

"Guidelines for Considering New Performance Metric Development", [RFC6390] defines a framework and a process for developing Performance Metrics for protocols above and below the IP layer (such as IP-based applications that operate over reliable or datagram transport protocols). These metrics can be used to characterize traffic on live networks and services. As such, RFC 6390 does not define any Performance Metrics.

RFC 6390 scope covers guidelines for the Performance Metrics directorate members for considering new Performance Metrics and suggests how the Performance Metrics Directorate will interact with the rest of the IETF. Its mission is mentioned at [performance-metrics-directorate]. In practice, a weekly cron job discovers all the IETF drafts that refers to RFC 6390, or that contains the keyword "performance metric". Once discovered, the different drafts are assigned a Performance Metric Directorate reviewer. One of the primary task is to ensure that the RFC 6390 template is correctly applied, making sure that the Performance Metric semantic is correctly specified.

RFC 6390, specified in Section 5.4, proposes a template for Performance Metrics specifications:

Normative

- Metric Name
- Metric Description
- Method of Measurement or Calculation

- Units of Measurement
- Measurement Point(s) with potential Measurement Domain
- Measurement Timing

Informative

- Implementation
- Verification
- Use and Applications
- Reporting Model

The template specified in Section 5.4 of "Guidelines for Considering New Performance Metric Development", [RFC6390] MUST be used as a basis for the Performance Metrics Registry Definition.

3.2. Other Guidelines

RFC 6390 lacks a naming convention for Performance Metrics, but specifies that "Performance Metric names are RECOMMENDED to be unique within the set of metrics being defined for the protocol layer and context.". Imposing an unique Performane Metric name, while ideal, is not practicable in real live. Indeed, some metrics have already been specified, and the name clashes appeared already. Therefore, all Performance Metrics specified in the registry MUST have an unique performance metric Id. Regarding naming convention, the Performance Metric Names SHOULD be meaningfull and easily searchable in the registry.

The group of experts (the reviewers) MUST check the requested Peformance Metric for completeness, accuracy of the template description, and for correct naming according to [RFC6390].

Requests for Performance Metric that duplicate the functionality of existing Performance Metris SHOULD be declined.

4. Initial Set of Performance Metrics

4.1. Existing Performetrics Metrics, Based on the RFC6390 Template

This section contains a list of Performance Metrics specified according to [RFC6390], either in RFCs, or IETF drafts currently in the RFC editor queue. This list should serve as initial content for the Performance Metrics Registry.

Performance Metric Id	Performance Metric	Reference
1	Threshold in RTP	[RFC6958], appendix A
2	Sum of Burst Durations in RTP	[RFC6958], appendix A
3	RTP Packets lost in bursts	[RFC6958], appendix A
4	Total RTP packets expected in bursts	[RFC6958], appendix A
5	Number of bursts in RTP	[RFC6958], appendix A
6	Sum of Squares of Burst Durations in RTP	[RFC6958], appendix A
7	Number of RTP packets discarded Metric	[RFC7002], appendix A
8	Threshold in RTP	[RFC7003], appendix A
9	RTP Packets discarded in bursts	[RFC7003], appendix A
10	Total RTP packets expected in bursts	[RFC7003], appendix A
11	RTP Burst Loss Rate	[RFC7004], appendix A
12	RTP Gap Loss Rate	[RFC7004], appendix A
13	RTP Burst Duration Mean	[RFC7004], appendix A
14	RTP Burst duration variance	[RFC7004], appendix A
15	RTP Burst Discard Rate	[RFC7004], appendix A
16	RTP Gap Discard Rate	[RFC7004], appendix A
17	Number of discarded frames in RTP	[RFC7004], appendix A
18	Number of duplicate frames in RTP	[RFC7004], appendix A
19	Number of full lost frames in RTP	[RFC7004], appendix A
20	Number of partial lost frames in RTP	[RFC7004], appendix A
21	De-jitter buffer nominal delay in RTP	[RFC7005], appendix A
22	De-jitter buffer maximum delay in RTP	[RFC7005], appendix A

	23	De-jitter buffer high water mark in RTP	[RFC7005], appendix A
	24	De-jitter buffer low water mark in RTP:	[RFC7005], appendix A

Table 1: List of Existing Performance Metrics Specified at the IETF

4.2. Mapping Some IPPM Performance Metrics in the Registry

The IPPM WG [IPPM] specified some Measurement Parameters (or measurement characteristics), for example Type-P [RFC2330], packet distribution, etc.

The IPPM WG also specified Performance Metrics. For example:

A One-way Delay Metric for IPPM [RFC2679]

A One-way Packet Loss Metric for IPPM [RFC2680]

A Round-trip Delay Metric for IPPM [RFC2681]

Those Performance Metrics are based on specific values for the Measurement Parameters. For example: the mean packet loss at IP layer, based on a periodic packet distribution, represented with percentile 95th.

The Performance Metrics Registry should contain the IPPM-specified Performance Metrics that are operationally relevant, as oppposed to all Performance Metrics, resulting of all the potential combination of Measurement Parameters.

In a typical Large-Scale Measurement of Broadband Performance (LMAP) environment, some information can complement the test to be run:

Measurement Parameters configured part of the test definition

run-time parameters observed during the test

If a test definition requests the round-trip delay metric to a DNS server to be metered "now", the DNS server is a Measurement Parameter configured part of the test definition. Some run-time parameters observed during the test complement the test report: the IP address of the DNS server, the measurement start time, the measurement end time, the DSCP, the TTL, etc.

Those run-time parameters are not part of the Performance Metric definition, while the specific values for the Measurement Parameters are part of it.

4.2.1. IPPM Performance Metric Mapping Experiment

This section is an illustration on how the IP Packet Delay Variation (IPDV) Performance Metric [RFC3393] maps to the RFC 6390 template. Note that the delay variation is sometimes called "jitter", as mentioned in the section 1.1 of [RFC3393], and in section 1 of [RFC5481].

Normative Reference

Performance Metric Element ID

TBD1: The next available Performance Metric Element ID in the Performance Metric Registry.

Metric Name

Packet Delay Variation for UDP Packet with Periodic Distribution reported as 95th percentile

Metric Description

The difference between the one-way-delay of the selected packets, reported as the positive 95th percentile.

The default measurement parameters are

o L, a packet length in bits, in case of active probing. 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 Inter packets time of 20 msec

o etc. (I have not reviewed all the parameters of [RFC3393]

If any of those measurement parameters is not the default value, its value must be stored with the performance metric value, as context information. THIS IS UP TO DISCUSSION.

Method of Measurement or Calculation

As documented in Section 4.1 of [RFC5481]: If we have packets in a stream consecutively numbered i = 1,2,3,... falling within the test interval, then IPDV(i) = D(i)-D(i-1) where D(i) denotes the one-way delay of the ith packet of a stream.

One-way delays are the difference between timestamps applied at the ends of the path, or the receiver time minus the transmission time.

So D(2) = R2-T2. With this timestamp notation, it can be shown that IPDV also represents the change in inter-packet spacing between transmission and reception:

IPDV(2) = D(2) - D(1) = (R2-T2) - (R1-T1) = (R2-R1) - (T2-T1)

Units of Measurement

As documented in Section 8.3 of [RFC5481]: With IPDV, it is interesting to report on a positive percentile, and an inter-quantile range is appropriate to reflect both positive and negative tails (e.g., 5% to 95%). If the IPDV distribution is symmetric around a mean of zero, then it is sufficient to report on the positive side of the distribution.

The unit of measurement is percentile 95th.

Measurement Point(s) with potential Measurement Domain

As documented in Section 4.1 of [RFC5481]: Both IPDV and PDV are derived from the one-way-delay metric. One-way delay requires knowledge of time at two points, e.g., the source

and destination of an IP network path in end-to-end measurement. Therefore, both IPDV and PDV can be categorized as 2-point metrics because they are derived from one-way delay. Specific methods of measurement may make assumptions or have a priori knowledge about one of the measurement points, but the metric definitions themselves are based on information collected at two measurement points.

Measurement Timing

As documented in Section 4.1 of [RFC5481]: The mean of all IPDV(i) for a stream is usually zero. However, a slow delay change over the life of the stream, or a frequency error between the measurement system clocks, can result in a non-zero mean.

See also http://tools.ietf.org/html/rfc5481#section-6.3 for "clock stability and error" considerations.

See also http://tools.ietf.org/html/rfc5481#section-8.5 for "clock Sync Options" considerations.

Informative Reference

Implementation

As documented in Section 4.1 of [RFC5481]: Note that IPDV can take on positive and negative values (and zero). One way to analyze the IPDV results is to concentrate on the positive excursions. However, this approach has limitations that are discussed in more detail below (see Section 5.3 of [RFC5481]).

Verification

Not Applicable

Use and Applications

See section 7 " Applicability of the Delay Variation Forms and Recommendations" of [RFC5481]:

Reporting Model

As mentioned previously: If any of those measurement parameters is not the default, its value must be stored with the performance metric value, as context information.

4.2.2. Which IPPM Performance Metrics?

Not all possible combinations of Measurement Parameters for all IPPM Performance Metrics will populate the Performance Metrics Registry. The criteria for selecting the Performance Metrics are (based on discussion with Brian Trammell):

(1) interpretable by the user

(2) implementable by the software designer

(3) deployable by network operators, without major impact on the networks

(4) accurate, for interoperability and deployment across vendors

Which IPPM Performance Metrics will be selected for the Performance Registry is out of the scope of this document, for now. What is envisioned is a RFC similar to "Basic Requirements for IPv6 Customer Edge Routers", [RFC6204], but for Performance Metrics: "Basic Performance Metrics Requirements for IP Packet SLA Monitoring with Active Probing", or something similar. This document would explain the list of Performance Metrics (from the Performance Metrics Registry, so with fixed Measurement Parameters), along with some proposed run time parameters, depending on the deployment scenario.

5. Performance Metrics in the IPFIX Registry

There are multiple proposals to add performance metrics Information Elements in the IPFIX IANA registry [iana-ipfix-assignments], to be used with the IPFIX protocol [RFC7011]. This is perfectly legal according the "Information Model for IPFIX" [RFC7012] and "Guidelines for Authors and Reviewers of IPFIX Information Elements" [RFC7013].

Simply adding some text in the Information Element Description field might be a solution if this description is compliant with the RFC6390 template definition. However, this is not an ideal solution. On the

top of having potentially long descriptions, this imposes a specific formatting for the description field of the performance metrics-related Information Elements, while none is imposed for the non performance metrics-related ones.

The preferred approach is for the Performance Metrics to be self-described in their own registry. When the Performance Metrics needs to be defined in the IPFIX IANA registry, the new Information Element can simply refer to the specific entry in the Performance Metrics registry.

6. Security Considerations

This draft doesn't introduce any security considerations. However, the definition of Performance Metrics may introduce some security concerns, and should be reviewed with security in mind.

7. IANA Considerations

This document refers to an initial set of Performance Metrics. The list of these Information Elements is given in the "Initial Set of Performance Metrics" Section. The Internet Assigned Numbers Authority (IANA) has created a new registry for Performance Metrics called "Performance Metrics", and filled it with the initial list in Section 4.

New assignments for Peformance Metric will be administered by IANA through Expert Review [RFC5226], i.e., review by one of a group of experts appointed by the IESG upon recommendation of the Ops Area Directors. The experts will initially be drawn from the Working Group Chairs and document editors of the Performance Metrics directorate [performance-metrics-directorate].

8. Acknowledgments

Thanks to Carlos Pignataro for improving the text of version 00.

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