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Registry for Performance Metrics
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Abstract

This document specifies the common aspects of the IANA registry for performance metrics, both active and passive categories. This document also gives a set of guidelines for Registered Performance Metric 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 August 16, 2014.

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1. Open Issues and Resolutions

1. I believe that the Performance Metrics Experts and the

Performance Metric Directorate will be a different group of people. Reason: every single time a new expert is added, the IESG needs to approve her/him. To be discussed with the Area Directors. *** (v7) Has this discussion taken place? If these

are different groups, we don't need to define Performance Metrics Directorate.

2. We should expand on the different roles and responsibilities of the Performance Metrics Experts versus the Performance Metric Directorate. At least, the Performance Metric Directorate one should be expanded. --- (v7) If these are different entities, our only concern is the role of the "PM Experts".

3. Not sure if this is interesting for this document to go in the details of the LMAP control protocol versus report protocol (see section 'Interoperability'. (the text currently does this in several sections, S5 comes to mind - Closed)

4. Marcelo, not sure what you mean by 'Single point of reference'. (Closed - see S5.3)

5. Define 'Measurement Parameter'. Even if this is active monitoring specific term, we need it in this draft. Done in v3 Terminology section as "Input Parameter". - Closed in v7 as "Parameter".

6. Performance Metric Description: part of this document of the active/ passive monitoring documents. -- Closed will be Part of Active & Passive docs.

7. Many aspects of the Naming convention are TBD, and need discussion. For example, we have distinguished RTCP-XR metrics as End-Point (neither active nor passive in the traditional sense, so not Act_ or Pas_). Also, the Act_ or Pas_ component is not consistent with "camel_case", as Marcelo points out. Even though we may not cast all naming conventions in stone at the start, it will be helpful to look at several examples of passive metric names now.

8. RTCP-XR metrics are currently referred to as "end-point", and

have aspects that similar to active (the measured stream characteristics are known a priori and measurement commonly takes place at the end-points of the path) and passive (there is no additional traffic dedicated to measurement, with the exception of the RTCP report packets themselves). We have one example expressing an end-point metric in the active sub-registry memo.

9. Revised Registry Entries: Keep for history (deprecated) or Delete?

10. In section 7 defining the Registry Common Columns, ~all column names begin with "Performance Metric". Al recommends deleting this prefix in each sub-section as redundant.

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 Metrics" (IPPM) WG is the WG primarily focusing on Performance Metrics definition at the IETF.

The "Metric Blocks for use with RTCP's Extended Report Framework" (XRBLOCK) WG recently specified many Performance 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) defined many Performance Metrics for use in laboratory benchmarking of inter-networking technologies.

The "IP Flow Information eXport" (IPFIX) WG Information elements related to Performance Metrics are currently proposed.

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

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

However, despite the importance of Performance Metrics, there are two related problems for the industry. First, how to ensure that when one party requests another party to measure (or report or in some way act on) a particular performance metric, then both parties have exactly the same understanding of what performance metric is being referred to. Second, how to discover which Performance Metrics have been specified, so as to avoid developing new performance metric that is very similar. The problems can be addressed by creating a

registry of performance metrics. The usual way in which IETF organizes namespaces is with Internet Assigned Numbers Authority (IANA) registries, and there is currently no Performance Metrics Registry maintained by the IANA.

This document therefore proposes the creation of a Performance Metrics Registry. It also provides best practices on how to define new or updated entries in the Performance Metrics Registry.

3. 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 defined in [RFC6390], and copied over in this document for the readers convenience.

Registered Performance Metric: A Registered Performance Metric (or Registered Metric) is a quantitative measure of performance (see

section 6.1 of [RFC2330]) expressed as an entry in the Performance Metric Registry, and comprised of a specifically named metric which has met all the registry review criteria, is under the curation of IETF Performance Metrics Experts, and whose changes are controlled by IANA.

Registry or Performance Metrics Registry: The IANA registry containing Registered Performance Metrics.

Non-IANA Registry: A set of metrics that are registered locally (and not by IANA).

Performance Metrics Experts: The Performance Metrics Experts is a group of experts selected by the IESG to validate the Performance Metrics before updating the Performance Metrics Registry. The Performance Metrics Experts work closely with IANA.

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.

Parameter: An input factor defined as a variable in the definition of a metric. A numerical or other specified factor forming one of a set that defines a metric or sets the conditions of its operation. Most Input Parameters do not change the fundamental nature of the metric's definition, but others have substantial influence. All Input Parameters must be known to measure using a metric and interpret the results.

Active Measurement Method: Methods of Measurement conducted on traffic which serves only the purpose of measurement and is generated for that reason alone, and whose traffic characteristics are known a priori. An Internet user's host can generate active measurement traffic (virtually all typical user-generated traffic is not dedicated to active measurement, but it can produce such traffic with the necessary application operating).

Passive Measurement Method: Methods of Measurement conducted on Internet user traffic such that sensitive information is present and may be stored in the measurement system, or observations of traffic from other sources for monitoring and measurement purposes.

Hybrid Measurement Method: Methods of Measurement which use a combination of Active Measurement and Passive Measurement methods.

4. Scope

The intended audience of this document includes those who prepare and submit a request for a Registered Performance Metric, and for the Performance Metric Experts who review a request.

This document specifies a Performance Metrics Registry in IANA. This Performance Metric Registry is applicable to Performance Metrics issued from Active Measurement, Passive Measurement, or from end-point calculation. This registry is designed to encompass performance metrics developed throughout the IETF and especially for the following working groups: IPPM, XRBLOCK, IPFIX, BMWG, and possibly others. This document analyzes an prior attempt to set up a Performance Metric Registry, and the reasons why this design was inadequate [RFC6248]. Finally, this document gives a set of guidelines for requesters and expert reviewers of candidate Registered Performance Metrics.

This document serves as the foundation for further work. It specifies the set of columns describing common aspects necessary for all entries in the Performance Metrics Registry.

Two documents describing sub-registries will be developed separately: one for active Registered Metrics and another one for the passive Registered Metrics. Indeed, active and passive performance metrics appear to have different characteristics which must be documented in their respective sub-registies. For example, active performance methods must specify the packet stream characteristics they generate and measure, so it is essential to include the stream specifications in the registry entry. In the case of passive Performance metrics,

there is a need to specify the sampling distribution in the registry, while it would be possible to force the definition of the registry field to include both types of distributions in the same registry column, we believe it is cleaner and clearer to have separated sub-registries with different columns that have a narrow definition.

It is possible that future metrics may be a hybrid of active and passive measurement methods, and it may be possible to register hybrid metrics using in one of the two planned sub-registries (active or passive), or it may be efficient to define a third sub-registry with unique columns. The current design with sub-registries allows for growth, and this is a recognized option for extension.

This document makes no attempt to populate the registry with initial entries.

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

5. Design Considerations for the Registry and Registered Metrics

In this section, we detail several design considerations that are relevant for understanding the motivations and expected use of the metric registry.

5.1. Interoperability

As any IETF registry, the primary use for a registry is to manage a namespace for its use within one or more protocols. In this particular case of the metric registry, there are two types of protocols that will use the values defined in the registry for their operation:

- Control protocol: this type of protocols is used to allow one entity to request another entity to perform a measurement using a specific metric defined by the registry. One particular example is the LMAP framework [I-D.ietf-lmap-framework]. Using the LMAP terminology, the registry is used in the LMAP Control protocol to allow a Controller to request a measurement task to one or more Measurement Agents. In order to enable this use case, the entries

of the metric registry must be well enough defined to allow a

Measurement Agent implementation to trigger a specific measurement task upon the reception of a control protocol message. This requirements heavily constrains the type of entries that are acceptable for the Metric registry.

- o Report protocol: This type of protocols is used to allow an entity to report measurement results to another entity. By referencing to a specific metric registry, it is possible to properly characterize the measurement result data being transferred. Using the LMAP terminology, the registry is used in the Report protocol to allow a Measurement Agent to report measurement results to a Collector.

5.2. Criteria for Registered Performance Metrics

It is neither possible nor desirable to populate the registry with all combinations of input parameters of all performance metrics. The Registered Performance Metrics should be:

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

In essence, there needs to be evidence that a candidate registry entry has significant industry interest, or has seen deployment, and there is agreement that the candidate Registered Metric serves its intended purpose.

5.3. Single point of reference for Performance metrics

A registry for Performance metrics serves as a single point of reference for performance metrics defined in different working groups in the IETF. As we mentioned earlier, there are several WGs that define performance metrics in the IETF and it is hard to keep track of all them. This results in multiple definitions of similar metrics that attempt to measure the same phenomena but in slightly different (and incompatible) ways. Having a registry would allow both the IETF community and external people to have a single list of relevant performance metrics defined by the IETF (and others, where appropriate). The single list is also an essential aspect of communication about metrics, where different entities that request

measurements, execute measurements, and report the results can benefit from a common understanding of the referenced metric.

5.4. Side benefits

There are a couple of 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. BCP 176 [RFC6576] examines whether the results produced by independent implementations are equivalent in the context of evaluating the completeness and clarity of metric specifications. This BCP defines the standards track advancement testing for (active) IPPM metrics, and the same process will likely suffice to determine whether registry entries are sufficiently well specified to result in comparable (or equivalent) results. Registry entries which have undergone such testing SHOULD be noted, with a reference to the test results.

6. Performance Metric Registry: Prior attempt

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".

A couple of interesting additional 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."

The current approach learns from this by tightly defining each entry

in the registry with only a few parameters open, if any. The idea is that entries in the registry represent different measurement methods

which require input parameters to set factors like source and destination addresses (which do not change the fundamental nature of the measurement). The downside of this approach is that it could result in a large 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 metrics that are well defined and that have proven to be operationally useful. In order to guarantee these two characteristics we require that a set of experts review the allocation request to verify that the metric is well defined and it is operationally useful.

6.1. Why this Attempt Will Succeed?

The registry defined in this document addresses the main issues identified in the previous attempt. As we mention in the previous section, one of the main issues with the previous registry was that the metrics contained in the registry were too generic to be useful. In this registry, the registry requests are evaluated by an expert group that will make sure that the metric is properly defined. This document provides guidelines to assess if a metric is properly defined.

Another key difference between this attempt and the previous one is that in this case there is at least one clear user for the registry: the LMAP framework and protocol. Because the LMAP protocol will use the registry values in its operation, this actually helps to determine if a metric is properly defined. In particular, since we expect that the LMAP control protocol will enable a controller to request a measurement agent to perform a measurement using a given metric by embedding the metric registry value in the protocol, a metric is properly specified if it is defined well-enough so that it is possible (and practical) to implement the metric in the measurement agent. This was clearly not the case for the previous attempt: defining a metric with an undefined P-Type makes its implementation unpractical.

7. Common Columns of the Performance Metric Registry

The metric registry is composed of two sub-registries: the registry for active performance metrics and the registry for passive performance metrics. The rationale for having two sub-registries (as opposed to having a single registry for all metrics) is because the set of registry columns must support unambiguous registry entries, and there are fundamental differences in the methods to collect active and passive metrics and the required input parameters. Forcing them into a single, generalized registry would result in a

less meaningful structure for some entries in the registry. Nevertheless, it is desirable that the two sub-registries share the same structure as much as possible. In particular, both registries will share the following columns: the identifier and the name, the requester, the revision, the revision date and the description. All these fields are described below. The design of these two sub-registries is work-in-progress.

7.1. Performance Metrics Identifier

A numeric identifier for the Registered Performance Metric. This identifier must be unique within the Performance Metric Registry and sub-registries.

The Registered Performance Metric unique identifier is a 16-bit integer (range 0 to 65535). When adding newly Registered Performance Metrics to the Performance Metric Registry, IANA should assign the lowest available identifier to the next active monitoring Registered Performance Metric, and the highest available identifier to the next passive monitoring Registered Performance Metric.

7.2. Performance Metrics Name

As the name of a Registered Performance Metric is the first thing a potential implementor will use when determining whether it is suitable for a given application, it is important to be as precise and descriptive as possible. Names of Registered Performance Metrics:

1. "must be chosen carefully to describe the Registered Performance Metric and the context in which it will be used."

2. "should be unique within the Performance Metric Registry (including sub-registries)."

3. "must use capital letters for the first letter of each component . All other letters are lowercase, even for acronyms. Exceptions are made for acronyms containing a mixture of lowercase and capital letters, such as 'IPv4' and 'IPv6'."

4. "must use '_' between each component composing the Registered Performance Metric name."

5. "must start with prefix Act_ for active measurement Registered Performance Metric."

6. "must start with prefix Pass_ for passive monitoring Registered Performance Metric." AL COMMENTS: how about just 3 letters for consistency: "Pas_"

7. MARCELO: I am uncertain whether we should give more guidance here for the naming convention. In particular, the second component could be the highest protocol used in the metric (e.g. UDP, TCP, DNS, SIP, ICMP, IPv4, etc). the third component should be a descriptive name (like latency, packet loss or similar). the fourth component could be stream distribution. the fifth component could be the output type (99mean, 95interval). this is of course very active metric oriented, would be good if we could figure out what is the minimum common structure for both passive and active. TBD. AL COMMENTS: Let's see some examples for passive monitoring. It may not make sense to have common name components, except for Act_ and Pas_.

8. BENOIT proposes (approximately this, Al's wording) : The remaining rules for naming are left to the Performance Experts to determine as they gather experience, so this is an area of planned update by a future RFC.

An example is "Act_UDP_Latency_Poisson_99mean" for a active monitoring UDP latency metric using a Poisson stream of packets and producing the 99th percentile mean as output.

>>>> NEED passive naming examples.

7.3. Performance Metrics Status

The status of the specification of this Registered Performance Metric. Allowed values are 'current' and 'deprecated'. All newly defined Information Elements have 'current' status.

7.4. Performance Metrics Requester

The requester for the Registered Performance Metric. The requester may be a document, such as RFC, or person.

7.5. Performance Metrics Revision

The revision number of a Registered Performance Metric, starting at 0 for Registered Performance Metrics at time of definition and incremented by one for each revision.

7.6. Performance Metrics Revision Date

The date of acceptance or the most recent revision for the Registered Performance Metric.

7.7. Performance Metrics Description

A Registered Performance Metric Description is a written representation of a particular registry entry. It supplements the metric name to help registry users select relevant Registered Performance Metrics.

7.8. Reference Specification(s)

Registry entries that follow the common columns must provide the reference specification(s) on which the Registered Performance Metric is based.

8. The Life-Cycle of Registered Metrics

Once a Performance Metric or set of Performance Metrics has been identified for a given application, candidate registry entry specifications in accordance with Section X are submitted to IANA to follow the process for review by the Performance Metric Experts, as defined below. This process is also used for other changes to the Performance Metric Registry, such as deprecation or revision, as described later in this section.

It is also desirable that the author(s) of a candidate registry entry seek review in the relevant IETF working group, or offer the opportunity for review on the WG mailing list.

8.1. The Process for Review by the Performance Metric Experts

Requests to change Registered Metrics in the Performance Metric Registry or a linked sub-registry are submitted to IANA, which forwards the request to a designated group of experts (Performance Metric Experts) appointed by the IESG; these are the reviewers called for by the Expert Review RFC5226 policy defined for the Performance Metric Registry. The Performance Metric Experts review the request for such things as compliance with this document, compliance with other applicable Performance Metric-related RFCs, and consistency with the currently defined set of Registered Performance Metrics.

Authors are expected to review compliance with the specifications in this document to check their submissions before sending them to IANA.

The Performance Metric Experts should endeavor to complete referred reviews in a timely manner. If the request is acceptable, the Performance Metric Experts signify their approval to IANA, which changes the Performance Metric Registry. If the request is not acceptable, the Performance Metric Experts can coordinate with the requester to change the request to be compliant. The Performance Metric Experts may also choose in exceptional circumstances to reject clearly frivolous or inappropriate change requests outright.

This process should not in any way be construed as allowing the Performance Metric Experts to overrule IETF consensus. Specifically,

any Registered Metrics that were added with IETF consensus require IETF consensus for revision or deprecation.

Decisions by the Performance Metric Experts may be appealed as in Section 7 of RFC5226.

8.2. Revising Registered Performance Metrics

Requests to revise the Performance Metric Registry or a linked sub-registry are submitted to IANA, which forwards the request to a designated group of experts (Performance Metric Experts) appointed by the IESG; these are the reviewers called for by the Expert Review [RFC5226] policy defined for the Performance Metric Registry. The Performance Metric Experts review the request for such things as compliance with this document, compliance with other applicable Performance Metric-related RFCs, and consistency with the currently defined set of Registered Performance Metrics.

A request for Revision is ONLY permissible when the changes maintain backward-compatibility with implementations of the prior registry entry describing a Registered Metric (entries with lower revision numbers, but the same Identifier and Name).

The purpose of the Status field in the Performance Metric Registry is to indicate whether the entry for a Registered Metric is 'current' or 'deprecated'.

In addition, no policy is defined for revising IANA Performance Metric entries or addressing errors therein. To be certain, changes and deprecations within the Performance Metric Registry are not encouraged, and should be avoided to the extent possible. However, in recognition that change is inevitable, the provisions of this section address the need for revisions.

Revisions are initiated by sending a candidate Registered Performance Metric definition to IANA, as in Section X, identifying the existing registry entry.

The primary requirement in the definition of a policy for managing changes to existing Registered Performance Metrics is avoidance of interoperability problems; Performance Metric Experts must work to maintain interoperability above all else. Changes to Registered

Performance Metrics already in use may only be done in an inter-operable way; necessary changes that cannot be done in a way to allow interoperability with unchanged implementations must result in deprecation of the earlier metric.

A change to a Registered Performance Metric is held to be backward-compatible only when:

1. "it involves the correction of an error that is obviously only editorial; or"

2. "it corrects an ambiguity in the Registered Performance Metric's definition, which itself leads to issues severe enough to prevent the Registered Performance Metric's usage as originally defined; or"

3. "it corrects missing information in the metric definition without changing its meaning (e.g., the explicit definition of 'quantity' semantics for numeric fields without a Data Type Semantics value); or"

4. "it harmonizes with an external reference that was itself corrected."

5. "BENOIT: NOTE THAT THERE ARE MORE RULES IN RFC 7013 SECTION 5 BUT THEY WOULD ONLY APPLY TO THE ACTIVE/PASSIVE DRAFTS. TO BE DISCUSSED."

If a change is deemed permissible by the Performance Metric Experts, IANA makes the change in the Performance Metric Registry. The requester of the change is appended to the requester in the registry.

Each Registered Performance Metric in the Registry has a revision number, starting at zero. Each change to a Registered Performance Metric following this process increments the revision number by one.

COMMENT: Al (and Phil) think we should keep old/revised entries as-is, marked as deprecated >>>> Since any revision must be inter-operable according to the criteria above, there is no need for the Performance Metric Registry to store information about old revisions.

When a revised Registered Performance Metric is accepted into the Performance Metric Registry, the date of acceptance of the most

recent revision is placed into the revision Date column of the registry for that Registered Performance Metric.

Where applicable, additions to registry entries in the form of text Comments or Remarks should include the date, but such additions may not constitute a revision according to this process.

8.3. Deprecating Registered Performance Metrics

Changes that are not permissible by the above criteria for Registered Metric's revision may only be handled by deprecation. A Registered Performance Metric MAY be deprecated and replaced when:

1. "the Registered Performance Metric definition has an error or shortcoming that cannot be permissibly changed as in Section Revising Registered Performance Metrics; or"

2. "the deprecation harmonizes with an external reference that was itself deprecated through that reference's accepted deprecation method; or"

A request for deprecation is sent to IANA, which passes it to the Performance Metric Expert for review, as in Section 'The Process for Review by the Performance Metric Experts'. When deprecating an Performance Metric, the Performance Metric description in the Performance Metric Registry must be updated to explain the deprecation, as well as to refer to any new Performance Metrics created to replace the deprecated Performance Metric.

The revision number of a Registered Performance Metric is incremented upon deprecation, and the revision Date updated, as with any revision.

The use of deprecated Registered Metrics should result in a log entry or human-readable warning by the respective application.

Names and Metric ID of deprecated Registered Metrics must not be reused.

9. Performance Metric Registry and other Registries

BENOIT: TBD.

THE BASIC IDEA IS THAT PEOPLE COULD DIRECTLY DEFINE PERF. METRICS IN OTHER EXISTING REGISTRIES, FOR SPECIFIC PROTOCOL/ENCODING. EXAMPLE: IPFIX. IDEALLY, ALL PERF. METRICS SHOULD BE DEFINED IN THIS REGISTRY AND REFERS TO FROM OTHER REGISTRIES.

10. Security considerations

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

11. IANA Considerations

This document specifies the procedure for Performance Metrics Registry setup. IANA is requested to create a new registry for performance metrics called "Registered Performance Metrics".

This Performance Metrics Registry contains two sub registries once for active and another one for passive performance metrics. These sub registries are not defined in this document. However, these two sub registries MUST contain the following columns: the identifier and the name, the requester, the revision, the revision date and the description, as specified in this document.

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

12. Acknowledgments

Thanks to Brian Trammell and Bill Cerveny, IPPM chairs, for leading some brainstorming sessions on this topic.

13. References

13.1. Normative References

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