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Terminology for Large MeAsurement Platforms (LMAP) draft-eardley-lmap-terminology-01

Abstract

This documents defines terminology for Large Scale Measurement Platforms.

Status of This Memo

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This Internet-Draft will expire on November 03, 2013.

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1. Introduction

This document, in Section 3, defines terminology for LMAP. Since 'raw' terminology is reader-unfriendly, Section 2 provides an initial idea of the terminology by explaining how LMAP works whilst using the terms. Section 4 provides some commentary on the terminology, including a comparison with that in [RFC2330].

Please note that defined terms are capitalized.

2. Summary

A Measurement Task is an act that yields a single Measurement Result. An Active Measurement Task involves (for example) a Measurement Agent injecting test packet(s) into the network destined for a Measurement Peer and measuring some performance or reliability parameter associated with the transfer. The generic version of the Measurement Task is the Measurement Method; in other words the Measurement Task is the instantiation of the Measurement Method at a specific time and place.

For example, a Measurement Method might be the injection of a UDP packet by a Measurement Agent destined for a Measurement Peer, which immediately reflects the UDP packet back to the Measurement Agent, which measures the round trip latency. The associated Measurement Task might be: the injection of a UDP packet by the Measurement Agent at 192.0.2.0 destined for the Measurement Peer at 198.51.100.0 at UTC 13:01 and 58.6 seconds on 2013-06-15, with the Measurement Peer immediately reflecting the UDP packet back to the source, which measures the associated round trip latency (using a second timestamp associated with arrival).

A Metric is a parameter of interest that is related to the performance and reliability of the Internet. For example, "UDP latency". Typically the value of a Metric is assessed as simply the average of several Measurement Results. However a Derived Metric consists of some combination of various Measurement Results. For example, a path delay might be assessed by adding several component delays, or the bulk transport capacity might be assessed by combining several different parameters as suggested in [I-D.mathis-ippm-model-based-metrics].

How and when to perform the Measurement Task and report the Measurement Result is defined by the Instruction, which the Controller sends to the Measurement Agent. Whilst the Instruction may define a single Measurement Task, more typically it defines a series of Measurement Tasks, all based on the same Measurement Method and carried out at regular times according to a Measurement Schedule. The Measurement Result of the former is likely to be reported immediately, whilst Measurement Results of the latter will be sent at regular time intervals, as defined by the Report Schedule. The Instruction consists of the following items (which effectively define a series of Measurement Tasks):

1. The Measurement Method: typically this is defined by a reference in a well-known registry (for example, 'how to measure UDP latency')

2. The configuration of parameters left open by the Measurement Method (for example, the addresses of the Measurement Agent and Measurement Peer)

3. The Measurement Schedule (for example, start at 0400 UTC, repeat every 500 ms, end at 0403 UTC)

4. Any environmental constraints (for example, do not perform the Measurement Task if there is cross-traffic)

The Report consists of following items:

1. The definition of the Report. Typically the Report includes every single Measurement Result (since the last Report), but it may instead be a statistic (such as their average). Typically the Report also includes other relevant information, for example an 'echo' of the Measurement Method, configuration parameters and schedule.

2. The configuration of parameters associated with the Report (for example, the address of the Collector to which the Report is sent)

3. The Report Schedule (for example, send once a day at 01:00 hours)

The Control Protocol and Report Protocol define the delivery of the Instruction and the Report (respectively); they consist of a Data Model (the semantics and structure of the information, in a particular data modeling language such as a JSON schema language or YANG) and a transport protocol (such as HTTP or NETCONF).

3. LMAP Terminology

Active Measurement Method (Task): A type of Measurement Method (Task) that involves a Measurement Agent and a Measurement Peer (or possibly Peers), where either the Measurement Agent or Measurement Peer injects test packet(s) into the network destined for the other, and which involves one of them measuring some performance or reliability parameter associated with the transfer of the packet(s).

Bootstrap Protocol: A protocol that initialises a Measurement Agent with the information necessary to talk to a Controller.

Collector: A function that receives a Report from a Measurement Agent. Colloquially, a Collector is a physical device that performs this function.

Controller: A function that provides a Measurement Agent with Instruction(s). Colloquially, a Controller is a physical device that performs this function.

Control Protocol: The protocol delivering Instruction(s) from a Controller to a Measurement Agent.

Data Model: The implementation of an Information Model in a particular data modelling language.

Derived Metric: A Metric that is a combination of other Metrics, and/or a combination of the same Metric measured over different parts of the network, or at different times.

Information Model: The protocol-neutral definition of the semantics of either the Instruction or the Report.

Instruction: The description of Measurement Tasks to perform and the details of the Report to send. The Instruction is sent by a Controller to a Measurement Agent.

Measurement Agent (MA): The function that receives Instructions from a Controller, performs Measurement Tasks (perhaps in concert with a Measurement Peer) and reports Measurement Results to a Collector.

Colloquially, a Measurement Agent is a physical device that performs this function.

Measurement Method: The process for assessing the value of a Metric; the process of measuring some performance or reliability parameter; the generalisation of a Measurement Task.

Measurement Peer: The function that receives control messages and test packets from a Measurement Agent and may reply to the Measurement Agent as defined by the Measurement Method.

Measurement Result: The output of a single Measurement Task (the value obtained for the parameter of interest, or Metric)

Measurement Schedule: the schedule for performing a series of Measurement Tasks

Measurement Task: The act that yields a single Measurement Result; the act consisting of the (single) operation of the Measurement Method at a particular time and with all its parameters set to specific values

Metric: The quantity related to the performance and reliability of the Internet that we'd like to know the value of, and that is carefully specified.

Passive Measurement Method (Task): A Measurement Method (Task) in which a Measurement Agent observes existing traffic at a specific measurement point, but does not inject test packet(s).

Report: The Measurement Results and other associated information (as defined by the Instruction); a specific instance of the Data Model. The Report is sent by a Measurement Agent to a Collector

Report Protocol: The protocol delivering Report(s) from a Measurement Agent to a Collector.

Report Schedule: the schedule for sending a series of Reports to a Collector.

3.1. Other potentially useful terminology

The following terms have also been suggested and will be included above, assuming they prove useful during the early stages of the LMAP work.

Cycle-ID: A tag that is sent by the Controller in an Instruction and echoed by the MA in its Report; Measurement Results with the same Cycle-ID are expected to be comparable.

Measurement Parameter: A parameter whose value is left open by the Measurement Method.

Environmental Constraint: A parameter that is measured as part of the Measurement Task, its value determining whether the rest of the Measurement Task proceeds.

4. Commentary and notes

To avoid confusion the word 'Measurement' is only used as an adjective.

It is worth explaining how the terms defined here compare with those in [RFC2330], "Framework for IP Performance Metrics". The definition of Metric is taken from RFC2330. The definition of Measurement Method is (we believe) equivalent in RFC2330's terms to a measurement methodology for a singleton metric. A set of Measurement Tasks defined by a Measurement Schedule relates to RFC2330's concept of a sample metric.

If a Measurement Method is used multiple times under identical or similar conditions, it should result in a consistent value for the Metric.

A Measurement Method may be a more specific version of another Measurement Method. For example, [I-D.bagnulo-ippm-new-registry-independent] defines UDP latency as a round trip delay [RFC2681] with the packet type set to UDP.

A registry, as proposed in [I-D.bagnulo-ippm-new-registry-independent], would be a registry of Measurement Methods and their associated Metrics. A Passive Measurement Method (Task) involves only a Measurement Agent; for example, it measures the mix of applications. An Active Measurement Method (Task) also involves a Measurement Peer. It is possible that some Active Measurement Methods (Tasks) involve additional Measurement Agent(s) or Measurement Peer(s); for example, one way to measure 'latency under load' may be to send test traffic between a Measurement Agent and Measurement Peer whilst a second Measurement Peer generates the load (cross-traffic).

The consensus seems to be that the proposed LMAP working group should make the assumption that a Measurement Agent receives Instruction from only a single Controller at any point in time (however it may Report to more than one Collector).

By definition a Measurement Peer does not interact with a Controller or Collector. A Measurement Peer will typically respond to the test packet(s) from the Measurement Agent. For example, it may echo a UDP packet, or measure the amount of loss of the test packets and then send the Measurement Results to the Measurement Agent.

The Measurement Agent is implemented either in specialised hardware or as code on general purpose devices like a PC, tablet or smartphone. Note that a Measurement Peer may not have specific LMAP or IPPM functionality. For example, to assess DNS response time a Measurement Agent sends DNS requests to a standard DNS server.

A Controller can send an Instruction for immediate action, containing a one-off Measurement Task. This is in addition to the more typical scenario of a series of Measurement Tasks carried out on a regular schedule, with the Measurement Results reported periodically.

It may be sensible for an Instruction to be able to refer to more than one Measurement Method. This is for further study.

The right set of Information Models is for further study - for example, perhaps there should be three Information Models, with one containing all the scheduling information. Also, note that different fields of the Information Models may be relevant for different Measurement Methods.

The Control Protocol defines the Data Model and so effectively defines the Instruction. The Instruction includes: the Measurement Method; values for the parameters that the Measurement Method leaves open (configuration); when to perform the Measurement Tasks (the Measurement Schedule); any environmental conditions (such as "don't perform the Measurement Task if there is end user traffic present"); the Report Protocol, which includes its Data Model; when to send a Report (the Report Schedule); where to send the Report (the address of the Collector) and values for any other parameters that the Report Protocol leaves open (configuration). This is for discussion.

Typically the Report includes every single Measurement Result, but it may instead be a statistic (such as their average). The latter may be useful when the bandwidth between the Measurement Agent and Collector is severely constrained and/or the full set of Measurement Results provides little extra information.

The Report includes: the Measurement Results (or statistic based on them); the details of the Measurement Tasks (essentially a copy of much of the Instruction, for example the Measurement Method, the configuration parameters and the time at which each Measurement Result was obtained); and other relevant information known by the Measurement Agent (such as the line's speed, the version of the Measurement Agent, and the amount of cross-traffic during the measurement). Again this is very much for discussion.

A proposal for a Control Protocol based on HTTP is currently under development. There are already internet drafts describing a Control Protocol based on NETCONF and a Report Protocol based on IPFIX.

The job of a Bootstrap Protocol is to provide an automated way to associate a Measurement Agent to its Controller, including authentication credentials. Similarly, there should be a way to pull the plug on rogue Measurement Agents. The current consensus on the LMAP mailing list seems to be that the prospective working group should define the bootstrap process but not a protocol. The reason is that could be done in many different ways, depending on the device and the measurement system, for instance: loaded at manufacture, updated locally via USB port, or orchestrated via a protocol (which may be defined by organisations other than the IETF, for example, the Broadband Forum).

The purpose of the Cycle-ID is to allow the data analysis tools to identify easily Measurement Results that are expected to be comparable, typically because the associated Measurement Tasks all operate the same Measurement Method with the same values for its parameters. This set of Measurement Tasks could be termed the Measurement Cycle.

An example of an Environmental Constraint is "no end-user traffic". The Measurement Agent could measure the amount of end-user traffic over the previous 10 seconds; if there is none then it uploads a file to the Measurement Peer, whilst if the end-user is active then it defers the upload.

5. Security considerations

There are no security considerations in this memo.

6. IANA Considerations

There are no IANA considerations in this memo.

7. Acknowledgments

We thank participants on the LMAP mailing list for their input, especially Juergen Schoenwaelder for his detailed review.

8. History

from -00 to -01:

'Complete Measurement Agent' replaced by 'Measurement Agent', and 'Remote Measurement Agent' replaced by 'Measurement Peer'.

Bootstrap protocol added

Section 3.1 added, with terms Cycle-ID, Measurement Parameter and Environmental Constraints

Adjustments to terms for: Active Measurement Method (Task), Control Protocol, Information Model, Instruction, Report Protocol.

9. Informative References

[I-D.bagnulo-ippm-new-registry-independent]
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[RFC2330] Paxson, V., Almes, G., Mahdavi, J., and M. Mathis, "Framework for IP Performance Metrics", RFC 2330, May 1998.

[I-D.mathis-ippm-model-based-metrics]
Mathis, M. and A. Morton, "Model Based Internet Performance Metrics", draft-mathis-ippm-model-based-metrics-01 (work in progress), February 2013.

[RFC2681] Almes, G., Kalidindi, S., and M. Zekauskas, "A Round-trip Delay Metric for IPPM", RFC 2681, September 1999.

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