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Using RESTCONF with LMAP Measurement Agents
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Abstract

This document describes how RESTCONF can be used with a YANG data model for Large-Scale Measurement Platforms (LMAP).

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Internet-Draft

LMAP Data Model

November 2015

Table of Contents

1.	Introduction	2
1.1.	Terminology	2
2.	Overview of RESTCONF	3
3.	RESTCONF as LMAP Control Protocol	3
4.	RESTCONF as LMAP Report Protocol	3
5.	Security Considerations	4
6.	IANA Considerations	4
7.	Acknowledgements	4
8.	Informative References	4
Appendix A.	Example RESTCONF Control Protocol Exchange	5
Appendix B.	Example RESTCONF Report Protocol Exchange	7
	Authors' Addresses	8

[1.](#) Introduction

This document discusses how a Controller can use the RESTCONF protocol [[I-D.ietf-netconf-restconf](#)] to configure Large-Scale Measurement of Broadband Performance (LMAP) Measurement Agents [[RFC7594](#)]. It also discusses how RESTCONF can be used by a Measurement Agent to report measurement results to a Collector.

Measurement Agents may be deployed as separate hardware devices or as functions embedded in consumer electronic devices and home routers or as pure software solutions that can be installed on off-the-shelf computing equipment. Measurement Agents receive instructions from a Controller about when and how to conduct what measurements (the measurement schedule) and how and when to report measurement results to a data Collector (the report schedule). Further information about the interaction between Measurement Agents and Controllers and Collectors can be found in [[RFC7594](#)].

The LMAP information model [[I-D.ietf-lmap-information-model](#)] defines the information exchanged between a Controller and an Measurement Agent and the information exchanged between an Measurement Agent and a Collector. An information model is conceptual and protocol-independent. A concrete YANG [[RFC6020](#)] data model derived from the conceptual information model is defined in [[I-D.ietf-lmap-yang](#)].

[1.1.](#) Terminology

This document uses the LMAP terminology defined in [[RFC7594](#)].

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 [[RFC2119](#)].

[2.](#) Overview of RESTCONF

The RESTCONF protocol [[I-D.ietf-netconf-restconf](#)] provides a REST-like interface to access and manipulate a so-called unified YANG datastore [[RFC6020](#)]. The basic idea behind RESTCONF is expose a YANG datastores as a collection of Web resources that can be manipulated using standard HTTP [[RFC7230](#)] DELETE, PATCH, POST, and PUT methods. The resource hierarchy is derived from the nesting structure of the YANG schema tree, leading to a so-called data model driven REST API.

RESTCONF is essentially a convention how to use HTTP over TLS to access a datastore that has a structure defined by a YANG data model. The data is exchanged in XML encoding or JSON encoding.

The normal mode of operation is that the RESTCONF client initiates a secure transport to the RESTCONF server. For devices located behind a NAT, a so called 'call-home' mechanism has been defined [[I-D.ietf-netconf-call-home](#)] that enables the RESTCONF server to establish a secure transport to a RESTCONF client. Note that call home only changes the TCP connection establishment, the TLS and HTTP client/server roles do not change. The policy used to call home can be configured through a configuration data model [[I-D.ietf-netconf-server-model](#)]. This model provides a mechanism to configure a list of redundant endpoints and it provides control over call-home policies (e.g, call-home frequency, idle-timers, keep-alive timers).

[3.](#) RESTCONF as LMAP Control Protocol

It is straight-forward to use RESTCONF as a control protocol. The YANG data model [[I-D.ietf-lmap-yang](#)] derived from the underlying information model [[I-D.ietf-lmap-information-model](#)] translates into a collection of RESTCONF resources that can be manipulated at various levels of granularity using DELETE, PATCH, POST, and PUT methods.

An example exchange showing a REST call to create a schedule object

is shown in [Appendix A](#).

[4.](#) RESTCONF as LMAP Report Protocol

For reporting results from the Measurement Agent to a Collector, the Collector is assumed to act as a RESTCONF server. The Measurement Agent pushes results to the Collector by invoking an operation on the Controller.

[5.](#) Security Considerations

TBD

[6.](#) IANA Considerations

This document has no requests for IANA.

[7.](#) Acknowledgements

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[Appendix A](#). Example RESTCONF Control Protocol Exchange

Below is a YANG tree diagram of a part of the data model covering schedules. This is taken from [[I-D.ietf-lmap-yang](#)].

```
module: ietf-lmap
  +--rw lmap
    +--rw schedules
      +--rw schedule* [name]
        +--rw name      string
        +--rw event     leafref
        +--rw action* [name]
          | +--rw name      string
          | +--rw task      leafref
          | +--rw option* [name]
          | | +--rw name      string
          | | +--rw value?    string
          | +--rw destination* leafref
        +--rw execution-mode enumeration
```

Below is an XML representation of instance data conforming to the YANG data model is shown below. Note that some of the strings are references to other portions of the instance data not show here. This is again taken from [[I-D.ietf-lmap-yang](#)].

```
<lmap xmlns="urn:ietf:params:xml:ns:yang:ietf-lmap">
  <schedules>
    <schedule>
      <name>hourly-schedule</name>
      <event>hourly</event>
      <action>
        <name>icmp-latency-hourly</name>
        <task>icmp-latency-measurement</task>
        <destination>daily</destination>
      </action>
      <execution-mode>sequential</execution-mode>
    </schedule>
  </schedules>
</lmap>
```

Below is an example showing how RESTCONF can be used to create the above schedule. The prefix C: indicates the Controller, the prefix M: indicates the Measurement Agent. This example uses a JSON encoding (and note that much of the white-space can be removed, this is only there to help with readability).

```
C: POST /restconf/data/ietf-lmap:lmap/schedules HTTP/1.1
C: Host: example.com
C: Content-Type: application/yang.data+json
C:
C: {
C:   "ietf-lmap:schedule": {
C:     "name": "hourly-schedule",
C:     "event": "hourly",
```

```

C:      "action": [
C:      {
C:      "name": "icmp-latency-hourly",
C:      "task": "icmp-latency-measurement",
C:      "destination": "daily",
C:      }
C:    ],
C:    "execution-mode": "sequential"
C:  }
C: }

M: HTTP/1.1 201 Created
M: Date: Mon, 26 Mar 2015 17:01:00 GMT
M: Server: example-server
M: Location: https://example.com/restconf/data
M:      /ietf-lmap:lmap/schedules/schedule=hourly-schedule
M: Last-Modified: Mon, 26 Mar 2015 17:01:00 GMT
M: ETag: b3a3e673be2

```

[Appendix B](#). Example RESTCONF Report Protocol Exchange

Below is an example showing how a Measurement Agent can submit results to a Collector running an RESTCONF server. The prefix C: indicates the Collector, the prefix M: indicates the Measurement Agent.

```

M: POST /restconf/operations/ietf-lmap-report:report HTTP/1.1

```



```

M: Host: example.com
M: Content-Type: application/yang.operation+xml
M:
M: <input>
M:   <report xmlns="urn:ietf:params:xml:ns:yang:ietf-lmap-report">
M:     <date>2015-10-28T13:27:42+02:00</date>
M:     <agent-id>550e8400-e29b-41d4-a716-446655440000</agent-id>
M:     <group-id>wireless measurement at the north-pole</group-id>
M:     <task>
M:       <name>icmp-latency-measurement</name>
M:       <metric>
M:         <uri>urn:....</uri>
M:       </metric>
M:       <header>
M:         <column>target</column>
M:         <column>rtt</column>
M:       </header>
M:       <row>
M:         <start-time>2015-03-25T00:00:55+00:00</start-time>
M:         <value>192.0.2.1</value>
M:         <value>42</value>
M:       </row>
M:       <row>
M:         <start-time>2015-03-25T00:00:56+00:00</start-time>
M:         <value>192.0.2.1</value>
M:         <value>42</value>
M:       </row>
M:     </task>
M:   </report>
M: </input>

C: HTTP/1.1 200 OK

```

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