OMA ORG LightweightM2M Guidelines for Logging Reusable Resources

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Open Mobile Alliance

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Contents

Figures

Tables

1. Scope

This document provides Guidance for defining LwM2M Objects having Data Collection Logging capabilities based on the usage of LwM2M Re-Usable Resources registered in [OMNA].

Data Collection Logging capabilities are commonly used in the Monitoring / Diagnostic System fields.

The inclusion of such registered Re-Usable resources with well defined functionalities across various LwM2M Objects definitions, allows to define a family of Objects which the behaviour is common regarding the Data Collection Logging process.

The benefit of adopting such a harmonized approach for Data Collection Logging is immediate: defining and/or handling any Object of such a family is easier since knowledge on usage is capitalized, generic tools around Data Collection Logging can be defined for the Object belonging to such a family while the specific functionality of any Object can be ignored.

2. References

2.1 Normative References

[LwM2M_TS] "Lightweight Machine to Machine Technical Specification", Open Mobile Alliance™, OMA-TS-LightweightM2M-V1_0_2, URL:http://www.openmobilealliance.org/

[OMNA] "OMNA Lightweight M2M (LwM2M) Object & Resource Registry", URL:http://www.openmobilealliance.org/

2.2 Informative References

[OMADICT] "Dictionary for OMA Specifications", Open Mobile Alliance™, OMA-ORG-Dictionary-V2_9, URL:http://www.openmobilealliance.org/

3. Terminology and Conventions

3.1 Conventions

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].

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

3.3 Abbreviations

DC	Data Collection. These data are collected during the logging process.

4. Introduction

A set of re-usable resources related to Data Collection Logging capabilities is defined. When used in the definition of a certain LwM2M Object, this set of resources equips the hosting Object of common Data Collection Logging capabilities.

The Objects concerned by such logging capabilities are Objects which are involved in Monitoring / Diagnostic System field.

The Chapter 5 provides the description and definition of this set of Re-Usable Resources, while the section 6 provides examples / guidelines how to fully or partially integrate this set of re-usable resources in a certain Object definition.

5. LwM2M Logging Event Re-Usable Resources

5.1 Description

This set of re-usable Resources dedicated to Data Collection Logging process is composed of several Resources:

- 3 Resources for controlling the logging process : to start, to stop the Data Collection and also to monitor it through its status (ID:4011 LogStart, ID:4012 LogStop, ID:4013 LogStatus)
- 2 Resources for accessing the Data Collection (ID:4014 LogData, ID:4015 LogDataFormat)
- 1 Resource to qualify the Data Collection (ID:4010 LogClass)

5.1.1 Controlling/Monitoring the Data Collection process

5.1.1.1 LogStart

This executable Resource is triggered to start the Data Collection Logging process (accumulation of the collected data in the LogData – cf ID 4014 - area). What is really stored in the Data Collection is Object Specific and then out-of-the-scope of the present specification.In addition the Resource LogStatus (ID:4013) is set to indicate the Data Collection Logging process is on-going.

Two options for this Executable Resource can be activated by using Arguments:

A. Argument ‘0’ : to specify if the Data Collection Logging area has to be clean-up/reset, or not, relatively to a previous session,

Namely :

- EXECUTE /ObjectID/ObjectInstanceID/LogStart 0=’0’ (Default : Argument ‘0’ and its value can be omitted)
  - means the Data Collection logging area must be clean-up/reset before the new collected data takes place in the LogData area
- EXECUTE /ObjectID/ObjectInstanceID/LogStart 0=’1’
  - means the Data Collection logging area is not emptied when the new Data Collection Logging process starts, and the new collected data is cumulated with the one already present in the LogData Area (cf ID:4014) .

B. Argument ‘1’: to specify the Data Collection Logging Time Window (in seconds)

Namely :

- EXECUTE /ObjectID/ObjectInstanceID/LogStart 1=’0’ (Default: Argument ‘1’ and its value can be omitted)
  - means the Data Collection Logging process will be stopped by the LogStop action only
- EXECUTE /ObjectID/ObjectInstanceID/LogStart 1=Value in seconds (Data Collection Time Window)
  - means the Data Collection Logging process will stop with the expiration of the specified Data Collection Time

5.1.1.2 LogStop

This executable resource is triggered to stop a Data Collection Logging process, meaning data to log are not collected any more. This state is reported by the LogStatus Resource (ID 4013) which - among other possible information -, indicates this process is stopped.

In addition, through the usage of the LogStop Executable Resource Argument (‘0’), it is possible to clean-up/reset the content of the Data Collection Logging area (LogData Resource) when the LogStop resource is triggered

Namely :

- EXECUTE /ObjectID/ObjectInstanceID/LogStop 0=’0’ (Default : Argument ‘0’ and its value can be omitted)
  - means the Data Collection Logging area is preserved (LogData Resource ID:4014)

- EXECUTE /ObjectID/ObjectInstanceID/LogStop 0='1'
  - means the Data Collection Logging area (LogData Resource ID:4014) is cleaned-up (reset)

5.1.1.3 LogStatus

This Resource provides various information related to the Data Collection Logging process. Not only this Resource indicates if the process is stopped or not, but also if an error occurred during the Data Collection and if the LogData area contains valid data or not.

It's a 8 bits Integer, each bit containing independent information . The 3 first LSB are currently specified, the 3rd to 7th bits are reserved for future usage and the 8th bit can be used for Vender Specific purpose.

When included in Object definition, this resource must be defined as SINGLE since the Data Collection Logging process is unique.

A typical usage of the Resource LogStatus is to set an LwM2M Server OBSERVE command on it; according to the notified information (still running, stopped due to Data Collection Time expiration, error occurrence ..), the LwM2M Server is able to accordingly react.

5.1.2 The Data Collection

5.1.2.1 LogDataFormat

This Resource is used by the LwM2M Server in two ways:

a) the Server MAY set that Resource to request the Client for a preferred data format regarding the LogData Resource report.

b) the Server SHOULD get that Resource before retrieving the LogData Resource to understand which data format will be used by the Client to report such a LogData Resource.

4 ranges of data formats are defined

- unspecified (0) or LogDataFormat Resource not present means no specific data format is used for the LogData Resource (simple sequence of bytes)
- Predefined data formats : LwM2M TLV data format , LwM2M JSON data format, LwM2M CBOR data format
- Reserved data format which could be defined by OMA in the future
- Vendor Specific data format which is defined when an Object embedding that re-usable Resource is specified.

5.1.2.2 LogData

This Opaque Resource contains the data collected during the Data Collection Logging process. While basically defined as a simple sequence of Bytes, the content of that Resource can be formatted according to various data format understood by the Applications and indicated by the LogDataFormat Resource.

Illustration :

- Object Data Collection Logging Configuration Phase : (Which informations/Resources to Log, specific Logging policy ..)
- Data Collection Logging Status Observation

  OBSERVE /ObjectID/ObjectInstanceID/LogStatus_ID
- Data Collection Logging : Start triggered with LogData Clean-up, Action stopped by LogStop action

  EXECUTE /ObjectID/ObjectInstanceID/LogStart_ID
- Data Collection Logging Status notification : something changed (data available, error, ..)

  …….

NOTIFY

……..

- Data Collection Logging : Stop triggered

EXECUTE /ObjectID/ObjectInstanceID/LogStop_ID

- Data Collection Logging retrieval

READ /ObjectID/ObjectInstanceID/LogData_ID ct=42 (Opaque)

5.1.2.3 LogClass

As an option this Resource qualifies the type of the Data Collection which is logged in a certain Object Instance embedding that Resource and the LogData Resource 3 ranges of LogClass are defined :

a) [0..5] Predefined range:
   - 0:generic (default)
   - 1:system
   - 2:security
   - 3:event
   - 4:trace
   - 5:panic

b) [6..99] Reserved range for future OMA usage

c) [100.255] Vendor Specific range which can be freely used when an Object embedding that re-usable Resource is specified.

This Resource embedded in an Object Instance may be set either by the LwM2M Client or by the LwM2M Server according to the Applications needs.

When setting that Resource, the Server may decide to "Tag" the Data Collection to its specific need, potentially in using the Vendor Specific LogClass range.

5.2 Resource Definitions

ID	Name	Operations	Type	Range or Enumeration	Units	Description
4010	LogClass	RW	Integer	255		Define the Log Event Class: 0: generic (default) 1: system 2: security 3: event 4: trace 5: panic 6: charging [7-99]: reserved [100-255]: vendor specific
4011	LogStart	E	none			Actions: a) Start data collection(DC) b) LogStatus is set to 0 (running) c) DC is emptied (default) or extended according arg'0' value Arguments definitions are described in the table below.
4012	LogStop	E	none			Actions: a) Stop data collection(DC) b) 1st LSB of LogStatus is set to "1"(stopped)

						c) DC is kept (default) or emptied according arg'0' value Arguments definitions are described in the table below.
4013	LogStatus	R	Integer	8-bits		Data Collection process status: Each bit of this Resource Instance value defines a specific status : 1st LSB 0=running, 1=stopped 2nd LSB 1=LogData contains Valid Data 0=LogData doesn't contain Valid Data 3rd LSB 1=Error occurred during Data Collection 0=No error [4th -7th] LSB : reserved 8th LSB: vendor specific.
4014	LogData	R	Opaque			Read Access on that Resource returns the Data Collection associated to the current Object Instance.
4015	LogDataFormat	RW	Integer	255		. when set by the Server, this Resource indicates to the Client, what is the Server preferred data format to use when the LogData Resource is returned . when retrieved by the Server, this Resource indicates which specific data format is used when the LogData Resource is returned to the Server 0 or Resource not present : no specific data format (sequence of bytes) 1 : OMA-LwM2M TLV format 2 : OMA-LwM2M JSON format 3: OMA-LwM2M CBOR format [4..99] reserved [100..255] vendor specific data format

Table 1: Logging Event re-usable Resource Definition

Execution Resource Arguments Definition

ID	Resource Name	Order	Name	Type	Range or Enum	Unit	Description
4011	LogStart	0	Data Collection Mode	Integer	[0-1]		• 0 or no argument (default) : the DC is emptied • 1 : the DC is extended
		1	Data Collection Period	Integer	-	sec	• 0 or no argument (default) : the DC is stopped by the LogStop action only • the value in seconds after

							which the Data Collection is stopped
4012	LogStop	0	Data Collection Mode	Integer	[0-1]		• 0 or no argument (default) : the DC is kept • 1 : the DC is emptied

Table 2: Definition for the Arguments of the Logging Event re-usable Executable Resources

6. Guidance to define LwM2M Objects including the Logging Event functionality

A simple illustration is to initially consider the Connectivity Statistics Core Object ID:7 [LwM2M_TS] and to target a derivative of it, to the light of the Logging Event set of re-usable Resources. It's a two steps illustration :

- step 1: to specify the derivative of the Connectivity Statistics Object, e.g. Object ID 77 embedding the Logging Event set of re-usable Resources 4010, 4011, 4012,4013, 4014, 4015
- step 2 : to use the new Object ID:77 to log Data Collection related to Connectivity Statistics

6.1 Specification of Object ID 77 embedding Logging Event capability

6.1.1 Description

This LwM2M Objects enables client to collect statistical information and enables the LwM2M Server to retrieve these information, set the collection duration and reset the statistical parameters.

6.1.2 Object definition

Name	Object ID	Object Version	LWM2M Version
Connectivity Statistics LogEvent Object	77	1.0	1.0
Object URN		Instances	Mandatory
urn:oma:lwm2m:oma:77:1.0		Single	Optional

6.1.3 Resource definitions

ID	Name	Operations	Instances	Mandatory	Type	Range or Enumeration	Units	Description
0	SMS Tx Counter	R	Single	Optional	Integer			Indicate the total number of SMS successfully transmitted during the collection period.
1	SMS Rx Counter	R	Single	Optional	Integer			Indicate the total number of SMS successfully received during the collection period.
2	Tx Data	R	Single	Optional	Integer		Kilo-Bytes	Indicate the total amount of data transmitted during the collection period.
3	Rx Data	R	Single	Optional	Integer		Kilo-Bytes	Indicate the total amount of data received during the collection period.
4	Max Message Size	R	Single	Optional	Integer		Byte	The maximum message size that is used during the collection period.
5	Average Message Size	R	Single	Optional	Integer		Byte	The average message size that is used during the collection period.
6	*LogData_MaxSize*	*RW*	*Single*	*Optional*	*Integer*		*KiloBytes*	*Max Size of the Data Collection in KiloBytes*

								If not specified or absent: 10Kbytes is assumed. *When the accumulated data in the LogData Resource reached the LogData_MaxSizethe DC Logging process is automatically stopped : LogStatus is then accordingly set*
4010	LogClass	RW	Single	Optional	Integer	255		Define the Log Event Class: 0: generic (default) 1: system 2: security 3: event 4: trace 5: panic 6: charging [7-255]: vendor specific
4011	LogStart	E	Single	Mandatory				Actions: a) Start data collection(DC) b) LogStatus is set to 0 (running) c) DC is emptied (default) or extended according arg'0' value Arguments definitions are described in the table below
4012	LogStop	E	Single	Mandatory				Actions: a) Stop data collection(DC) b) 1st LSB of LogStatus is set to 1 (stopped) c) DC is kept (default) or emptied according arg'0' value Arguments definitions are described in the table below.
4013	LogStatus	R	Single	Mandatory	Integer	8-bits		Data Collection process status: Each bit of this Resource Instance value defines a specific status: 1st LSB 0=running, 1=stopped 2nd LSB 1=LogData contains Valid Data 0=LogData doesn't contain Valid Data 3rd LSB 1=Error occurred during Data Collection 0=no Error

								[4th -7th] LSB : reserved 8th LSB : vendor specific.
4014	LogData	R	Single	Mandatory	Opaque			Read Access on that Resource returns the Data Collection associated to the current Object Instance. Data format followed by this Opaque Resource is given by the value of the LogDataFormat Resource (ID:4015)
4015	*LogDataFormat*	*RW*	*Single*	*Optional*	*Integer*	*255*		. when set by the Server, this Resource indicates to the Client, what is the Server preferred data format to use when the LogData Resource is returned . when retrieved by the Server, this Resource indicates which specific data format is used when the LogData Resource is returned to the Server 0 or Resource not present : no specific data format is used (sequence of bytes) 1 : OMA-LwM2M TLV format 2 : OMA-LwM2M JSON format 3: OMA-LwM2M CBOR format [4..99] reserved [100..255] vendor specific data format

Table 3 : Illustration : Object 77 including Logging Event re-usable Resources

Execution Resource Arguments definition

ID	Resource Name	Order	Name	Type	Range or Enum	Unit	Description
4011	LogStart	0	Data Collection Mode	Integer	[0-1]		• 0 or no argument (default) : the DC is emptied • 1 : the DC is extended
		1	Data Collection Period	Integer	-	sec	• 0 or no argument (default) : the DC is stopped by the LogStop action only • the value in

							seconds after which the Data Collection is stopped
4012	LogStop	0	Data Collection Mode	Integer	[0-1]		• 0 or no argument (default) : the DC is kept • 1 : the DC is emptied

DESCRIPTION II

- The Data Collection will concern the logging of six Resources : ID:0, 1, 2, 3, 4 &5
- The logging Class, Ressource ID 4010 of Instances of Object ID:77 will be set by the LwM2M Client to System
- The 8th bit of LogStatus (ID:4013) is used to indicate – when set – if the Data Collection stopped due to the Data Collection reached the allowed Max Size (see ID :6)
- The LogDataFormat value 100 (Vendor Specific range) , will indicate a ZIP file format

6.2 Object ID:77 at work

- Configuration Phase : DC max size is set, DC Collection requested format is set, the OBSERVE on LogStatus is requested

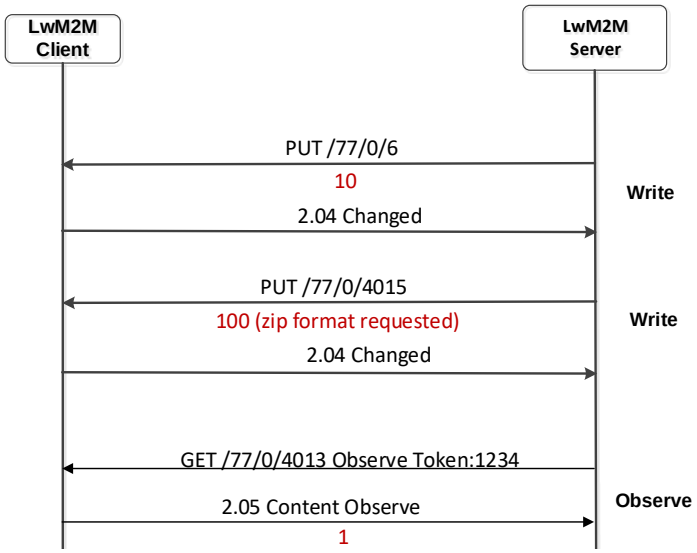

Figure 1: Object 77 at work : Data Collection Configuration sequence

- Active phase :
  - The Data Collection process is started with a DC period of 5 minutes (300 sec)
  - Some LogStatus notification take place for LwM2M Server Analysis
  - When Data Collection logging ends (DC period expires or DC logging Max Size is reached), the LwM2M Server can retrieve the LogData (DC) information (the data format is not the preferred one requested by the Server)

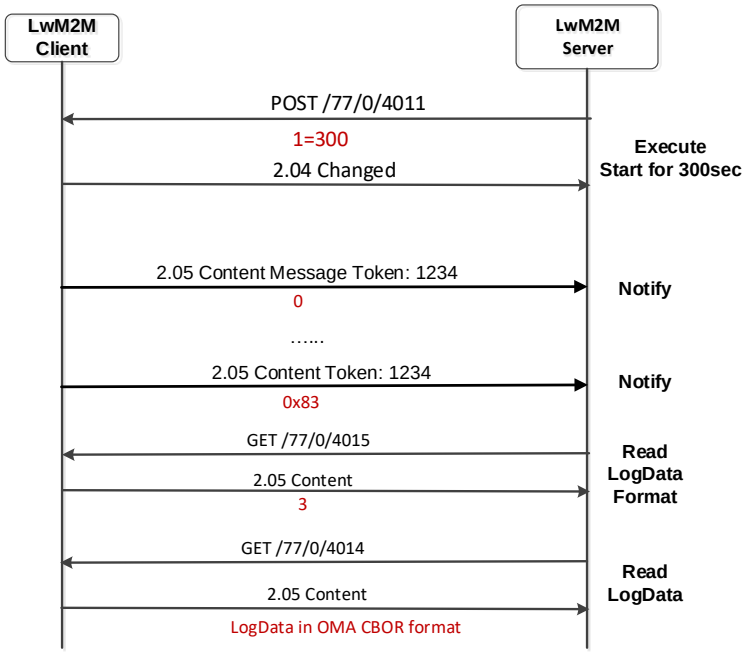

Figure 2: Object 77 at work : Data Collection Logging nominal sequence

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
OMA-ORG-LightweightM2M_Guidelines_Logging_Reusable_Resources-V1_0-20171129-A	29 Nov 2017	Status changed to Approved by TP TP Ref # OMA-TP-2017-0051-INP_OMA_ORG_LightweightM2M_Guidelines_for_Logging_Reusable_Resources_for_Approval