



Guidelines for Virtual Observe Notify Object

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1. Scope

This document provides examples of how Virtual Observe Notify Object can be used to flexibly report resources across different objects in a single client notification message under different conditions and rules.

2. References

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3. Terminology and Conventions

3.1 Definitions

3.2 Abbreviations

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4. Introduction

The Information Reporting Interface is used by a LwM2M Server to observe any changes of resources on a registered LwM2M Client, receiving notifications when new values are available. In LightweightM2M version 1.0, a single notification message can only include resources in a single object. In LightweightM2M version 1.1, the LwM2M Enabler can support a mechanism for atomic reporting of resources across different objects in a single notification. However, the conditions and rules of a notification message are too simple to satisfy complex scenarios that described as follows:

- The notification message can only be sent when multiple subscription conditions are met at the same time.
- Only some of the observed resources are included in the notification message, and other resources are only used as subscription conditions.
- Compared with the last notification message, this notification message only contains the changed resources.

Virtual Observe Notify object is defined to address the requirements described above, providing flexible reporting of resources across different objects in a single client notification message under different conditions and rules.

4.1 Version 1.0

Version 1.0 of the Virtual Observe Notify object is used to support following functionalities.

1. Reporting resources across different objects in a single client notification message.
2. Supporting AND conditions for subscription, that is, a single client notification can be sent just when multiple subscription conditions are met at the same time.
3. Using resources as only the condition for Observe operation.
4. Reporting changed resources by a notification message.

4.2 Version 1.1

Version 1.1 of the Virtual Observe Notify object introduces two new resources to support the use of different content formats in encoding Reports from the client.

- Virtual Observe Report Format; this resource indicates the content format LwM2M Client should use to populate Virtual Observe Report Resource
- Virtual Observe Report

5. Virtual Observe Notify Use cases

5.1 Overview

The Virtual Observe Notify Object provides a mechanism to observe and notify multiple resources by less messages between LwM2M Client and Server which are in one object/object instance or across multiple objects/object instances. This mechanism can reduce the message numbers and improve communication efficiency between LwM2M Client and LwM2M Server.

5.2 Observe and Notify Multiple Resources

This use case describes the procedure when the LwM2M Server wants to get the report of multiple Resources of different Objects. It specifies the usage of Resource “ObserveLinks” and “Report”.

The LwM2M Server initiates a Write request for changes of the Resource ObserveLinks (/22/0/0), which includes the Resources within an Object or different Objects within the LwM2M Client.

For example, the LwM2M Server wants to get the report of the Radio Signal Strength (/4/0/2) and Battery Level (/3/0/9) resources when the Radio Signal Strength is less than -120dBm or the Battery Level is less than 50%.

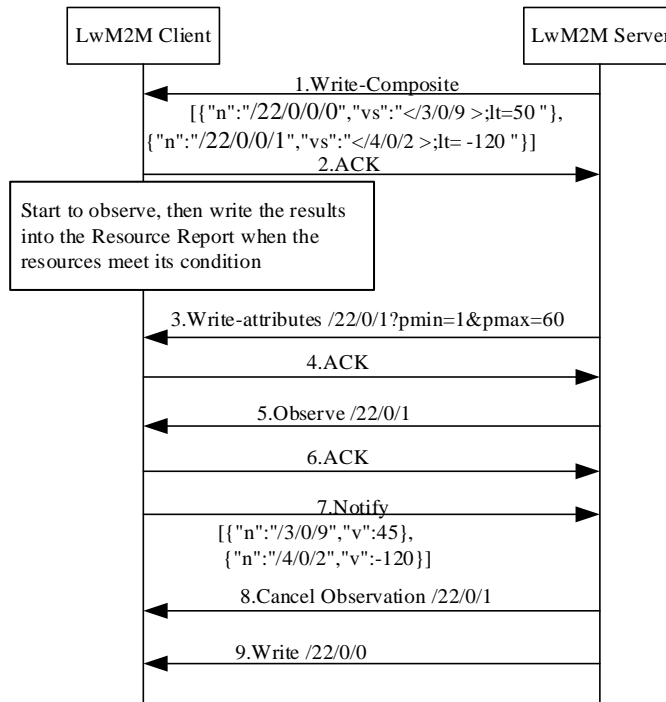


Figure 1 - Example flow for observing and notifying multiple Resources

Step 1: The LwM2M Server sends the Write-Composite request to LwM2M Client to observe multiple resources which are included in the Resource ObserveLinks (/22/0/0). The payload in the request is an array of application/link-format CoRE Links. In this example, the payload includes Radio Signal Strength (/4/0/2) and Batter Level (/3/0/9) with their “It” Attributes.

Step 2: The LwM2M Client sends the ACK to the LwM2M Server and starts to observe the two resources. When any of the two resource meets its condition set by the LwM2M Server using R-Attributes, the LwM2M Client writes the two resources into the Resource Report (/22/0/1).

Step 3: The LwM2M Server sends the Write-attribute request to the LwM2M Client to update the Attributes attached to the Resource /22/0/1 (Report).

Step 4: The LwM2M Client sends the ACK to the LwM2M Server.

Step 5: The LwM2M Server initiates an observation request for changes of the Resource Report (/22/0/1) within the LwM2M Client.

Step 6: The LwM2M Client sends the ACK to the LwM2M Server.

Step 7: The LwM2M Client sends the Notify message to the LwM2M Server when the timer expires.

Step 8: The LwM2M Server sends Cancel Observation operation to the LwM2M Client to stop the observation of the Resource Report within the LwM2M Client.

Step 9: The LwM2M Server sends Write request to LwM2M Client to stop the observation of the resources which are included in the Resource ObserveLinks.

5.3 Observe Multiple Resources and Notify Changed Resources

This use case describes the procedure when the LwM2M Server wants to get the changed Resources in the multiple Resources. It specifies the usage of Resource “ResourceFilter”.

The LwM2M Server initiates a Write request for changes of the Object Instant (/22/0), the payload includes ObserveLinks (/22/0/0) and ResourceFilter (/22/0/2).

For example, the DM server (LwM2M Server) needs changed Resources of the Device Object (/3/0) and Connectivity Monitoring Object (/4/0) of the water meter (LwM2M Client) via NB-IoT to monitor the device.

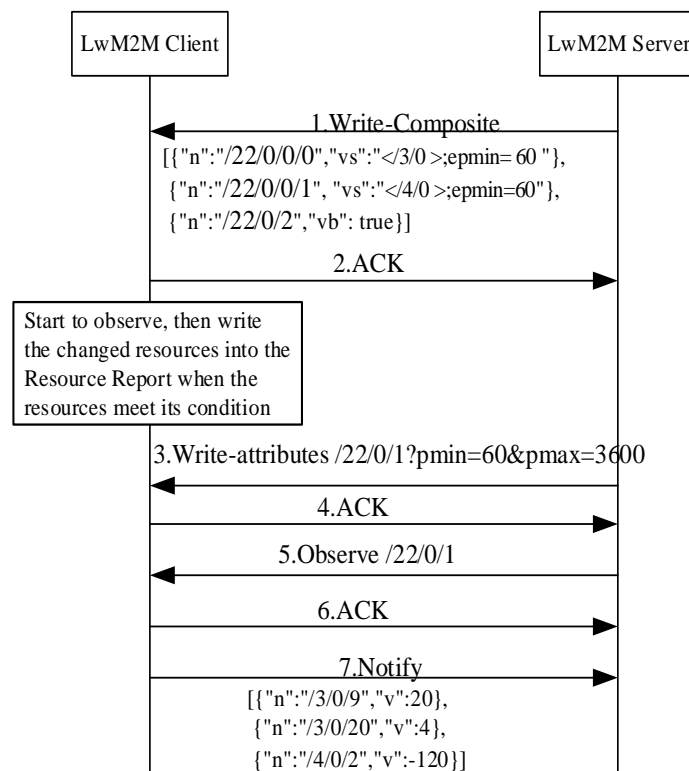


Figure 2 - Example flow for Observing Multiple Resources and Notifying Changed Resources

Step 1: The LwM2M Server sends the Write-Composite request to LwM2M Client to observe multiple resources which are included in the Resource ObserveLinks (/22/0/0). The request payload includes the Resource ObserveLinks (/22/0/0) and Resource ResourceFilter (/22/0/2). In this example, the value of the Resource ObserveLinks are Device Object Instance 0 and Connectivity Monitoring Object Instance 0; the value of the Resource ResourceFilter is 1.

Step 2: The LwM2M Client sends the ACK to the LwM2M Server and starts to observe the two object instance. When any Resource of two Objects is changed compared with the last notification message and meets its condition set by the LwM2M Server using R-Attributes, the LwM2M Client writes the changed Resources into the Resource Report (/22/0/1). The Resources which are not changed compared with the last notification aren't written into the Resource Report (/22/0/1).

Note: If any Resource of two Objects is not changed which is compared with the value in the last notification message, the LwM2M Client doesn't write any Resource into the Resource Report (/22/0/1).

Step 3: The LwM2M Server sends the Write-attribute request to the LwM2M Client to update the Attributes' values of Resource Report (/22/0/1).

Step 4: The LwM2M Client sends the ACK to the LwM2M Server.

Step 5: The LwM2M Server initiates an observation request for changes of the Resource Report (/22/0/1) within the LwM2M Client.

Step 6: The LwM2M Client sends the ACK to the LwM2M Server.

Step 7: The LwM2M Client sends the Notify message to the LwM2M Server including the changed resources in the Resource ObserveLink.

5.4 Observe Multiple Resources and Notify Different Resources

This use case describes the procedure when the LwM2M Server wants to get the different Resources from observed the multiple Resources. It specifies the usage of Resource "ReportLinks" and "ObserveRelation".

The LwM2M Server initiates a Write request for changes of the Object Instant (/22/0), the payload includes ObserveLinks (/22/0/0), ReportLinks (/22/0/3) and ObserveRelation (/22/0/4).

For example, the shared bike operator need protect the shared bike security. The LwM2M Server needs location (/6/0/1 and /6/0/2) of Device Object (/6/0) when the state of the lock is switched-off and the speed of the client is more than 1. The notification may trigger the LwM2M Server to trace the client and or do other processing.

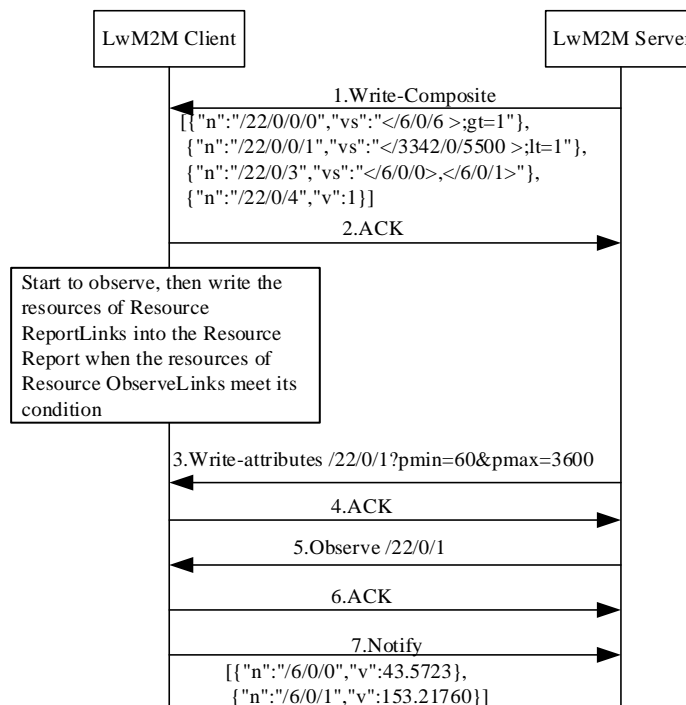


Figure 3 - Example flow for Observing Multiple Resources and Notifying Different Resources

Step 1: The LwM2M Server sends the Write-Composite request to LwM2M Client to observe multiple resources which are included in the Resource ObserveLinks (/22/0/0). The request payload includes the Resource ObserveLinks (/22/0/0), ReportLinks (/22/0/3) and ObserveRelation (/22/0/4). In this example, the value of the Resource ObserveLinks are the Resource Speed (/6/0/6) of Location Object (/6/0) with the “gt” attribute, and the Digital Input State resource (/3342/0/5500) of On/Off switch Object (/3342/0) with the “lt” attribute. The value of the Resource ReportLinks are the Resource Latitude (/6/0/0) and the Resource Longitude (/6/0/1). The value of ObserveRelation is 1.

Step 2: The LwM2M Client sends the ACK to the LwM2M Server and starts to observe the two resources. When the Digital Input State resource and the Resource Speed meet its condition set by the LwM2M Server using R-Attributes at the same time, that is the state of the lock is switched-off and the Speed of the bike is more than 1, the LwM2M Client writes the value of the Resource Latitude (/6/0/0) and Resource Longitude (/6/0/1) into the Resource Report (/22/0/1).

Step 3: The LwM2M Server sends the Write-attribute request to the LwM2M Client to update the Attributes' values of Resource /22/0/1 (Report).

Step 4: The LwM2M Client sends the ACK to the LwM2M Server.

Step 5: The LwM2M Server initiates an observation request for changes of the Resource Report (/22/0/1) within the LwM2M Client.

Step 6: The LwM2M Client sends the ACK to the LwM2M Server.

Step 7: The LwM2M Client sends the Notify message to the LwM2M Server including the resources in the Resource ReportLinks.

5.5 Observe Multiple Resources and Notify Partial Resources

This use case describes the procedure when the LwM2M Server wants to get the partial Resources in the multiple Resources. It specifies the usage of Resource “ReportLinks” and “ObserveRelation”.

The LwM2M Server initiates a Write request for changes of the Object Instant (/22/0), the payload includes ObserveLinks (/22/0/0), ReportLinks (/22/0/3) and ObserveRelation (/22/0/4).

For example, the LwM2M Server want to check the NB-IoT network coverage, and ask the LwM2M Client to report Radio Signal Strength when Network Bearer is NB-IoT and Radio Signal Strength is less than one threshold.

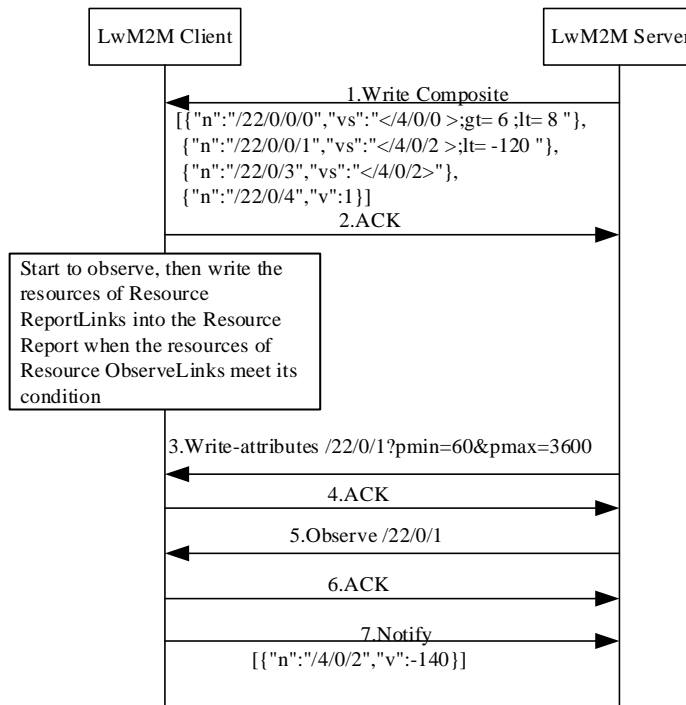


Figure 4 - Example flow for Observing Multiple Resources and Notifying Partial Resources

Step 1: The LwM2M Server sends the Write-Composite request to LwM2M Client to observe multiple resources which are included in the Resource ObserveLinks (/22/0/0). The request payload includes the Resource ObserveLinks (/22/0/0), ReportLinks (/22/0/3) and ObserveRelation (/22/0/4). In this example, the value of the Resource ObserveLinks are the Resource Network Bearer (/4/0/0) of Connectivity Monitoring (/4/0) with the “gt” and “lt” attribute, and the Resource Radio Signal Strength (/4/0/2) of Connectivity Monitoring (/4/0) with the “lt” attribute . The value of the Resource ReportLinks are the Resource Radio Signal Strength (/4/0/2). The value of ObserveRelation is 1.

Step 2: The LwM2M Client sends the ACK to the LwM2M Server and starts to observe the two resources. When the Network Bearer and Radio Signal Strength respectively meets its condition set by the LwM2M Server using R-Attributes and meets the report conditions which is the value of the ObserveRelation Resource, the LwM2M Client writes the value of the Resource Radio Signal Strength (/4/0/2) into the Resource Report (/22/0/1).

Step 3: The LwM2M Server sends the Write-attribute request to the LwM2M Client to update the Attributes’ values of Resource /22/0/1 (Report).

Step 4: The LwM2M Client sends the ACK to the LwM2M Server.

Step 5: The LwM2M Server initiates an observation request for changes of the Resource Report (/22/0/1) within the LwM2M Client.

Step 6: The LwM2M Client sends the ACK to the LwM2M Server.

Step 7: The LwM2M Client sends the Notify message to the LwM2M Server.

Appendix A. Change History

A.1 Approved Version History

Reference	Date	Description
OMA-Guidelines-LwM2M_VirtualObserveNotify-V1_1-20211130-A	30 Nov 2021	Status changed to Approved by IPSO WG Ref. "Agenda and Meeting Minutes DMSE 30 Nov 2021"