



GridOps Management Suite 3.10

Meter Data Management - MultiSpeak Interface

Functional Specification

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1. REFERENCES

#	Title	Description
1.	EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification	The document represents a set of common integration principles applied to all baseline integration adapters.

2. INTRODUCTION

EcoStruxure GridOps Management Suite is a family of solutions designed to help electric utilities in the operations and management of their grid. It is offered as EcoStruxure ADMS, EcoStruxure Grid Operation, EcoStruxure DERMS or EcoStruxure Energy Transmission Operation solutions, which share the same technology platform.

NOTE: The functionality described in this document applies to the following solutions: EcoStruxure ADMS and EcoStruxure Grid Operation.

NOTE: Most images presented in this document are related to the EcoStruxure ADMS solution and should be used as an example. The images for other solutions may differ slightly.

Meter Data Management (MDM) MultiSpeak Interface is developed as a part of the EcoStruxure GridOps Enterprise Integration Platform. It shares the common architecture principles as the rest of platform interfaces. MDM Interface is implemented through EcoStruxure GridOps MDM adapter component. This component is hosted in the Access Services (DMZ) system as a standalone windows process controlled by DMS_Integration OaSyS service component.

Purpose of this interface is to provide an alternative option of integrating with various AMI head end systems by implementing it against MultiSpeak standard interface definitions. Interface utilizes the MultiSpeak MDM service definitions and implements service operations designed for requesting outage event notifications from AMI HES and processing them upon receipt.

Aforementioned service operations together with mandatory MultiSpeak operations per service domain represent the set of supported EcoStruxure GridOps MDM Adapter functionalities.

3. OVERVIEW

EcoStruxure MDM Adapter implements following MultiSpeak MDM service operations:

- *InitiateOutageDetectionEventRequest* – generates requests towards AMI HES for querying smart meter statuses.
 - Notifies the AMI HES that a new status update is necessary for the meter present in the request message.
- *ODEventNotification* – represents a response from AMI HES which carries the information about queried smart meter statuses. Additionally, *ODEventNotification* is utilized for representing smart meter events.
 - AMI HES submits the requested meter status update asynchronously by matching the transaction ID from the meter status update request message.
 - AMI HES receives last gasp or power up event from the meter and generates *ODEventNotification* message. Difference between these two notification messages lies in the transaction ID. Smart meter event messages do not carry transaction ID, since they do not provide a response to a query, rather a proactive notification about meter status.
- *GetMethods* – returns the information about the set of implemented MDM service operations
 - Regarding the MDM adapter component, the response contains the names of the two previously mentioned service operations.
- *PingURL* – defined for health monitoring purpose.

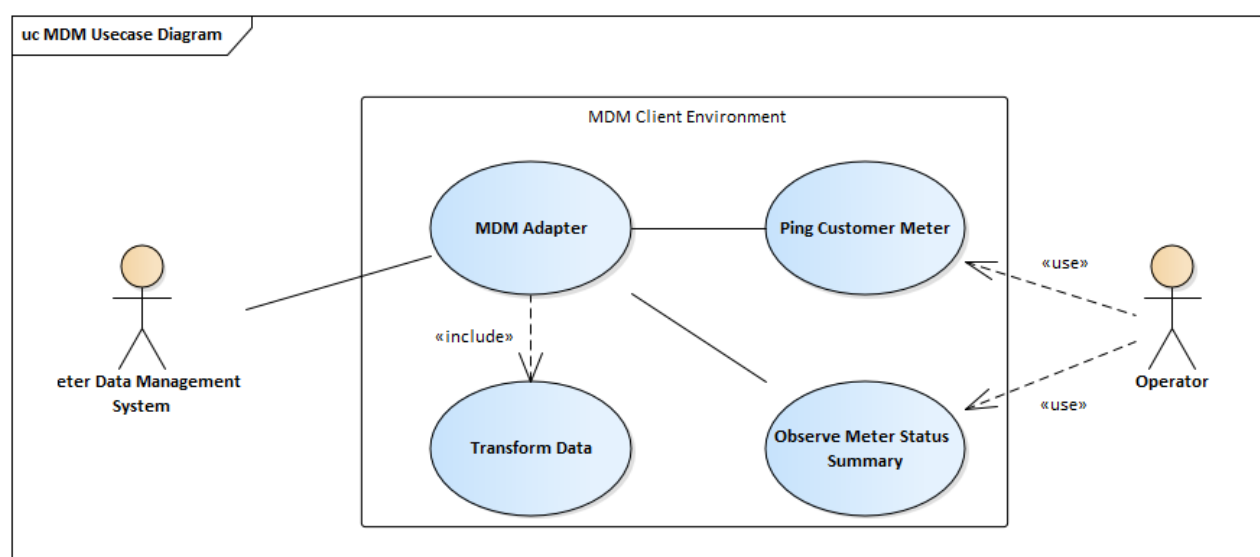


Figure 3.1 – Meter Data Management supported use cases

3.1. General Architecture

Described in the *EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification* [1].

4. FUNCTIONALITY

4.1. Query Customer Meter Status

Querying the customer meter status is a frequent operator activity in outage scenarios. It enables operators to verify the customer meter status, to confirm the outage in question for particular customers. EcoStruxure MultiSpeak MDM Adapter is implemented in order to enable operators to perform this action, by providing a proxy between external MDM system and EcoStruxure Smart Meter Management system. Figure 4.1 represents sequence of events necessary for the Operator to view the status of a customer meter.

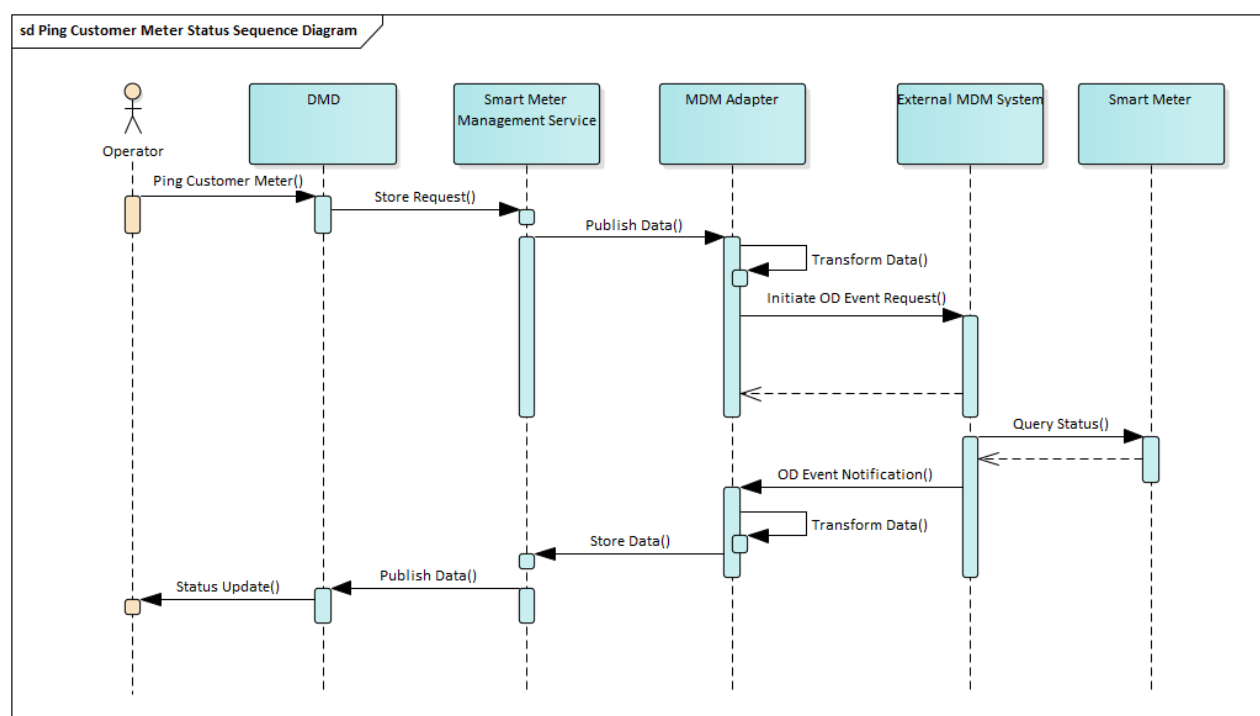


Figure 4.1 – Query Customer Meter Status Sequence Diagram

Operator locates the specific customer (or a set of customers) and invokes the ping meter option. This creates a new meter status request in the EcoStruxure SMMS service database. MDM Adapter component, which is subscribed the changes related to smart meter requests, receives the necessary data. It performs the necessary data transformation which results in creation of the *InitiateOutageDetectionEventRequest* message. Then it invokes the appropriate service endpoint on the external MDM system in order to submit the status query. MDM system acknowledges the request and queries the status of the specified meter. Upon receiving the results, it invokes the *ODEventNotification* endpoint on the MDM adapter component in order to submit the requested meter status information. MDM adapter processes the event data, correlates the data with the pending smart meter status reading request, and stores it into EcoStruxure SMMS database. This data is then published to the DMD client application and visible to the operator which initiated the process.

4.1.1. Initiate Outage Detection Event Request

4.1.1.1. Overview

EcoStruxure MDM Adapter implementation of the Initiate outage detection event requests operation encapsulates the functionality of querying for smart meter status update. Adapter component generates standard request message based on the data from smart meter management service and invokes the service endpoint either in the AMI HES (MDMS), or on a mediating service bus. Request message contains transaction identifier which is used to pair the meter status ping request with the asynchronous response which is awaited.

4.1.1.2. Use Cases

Table 4.1 contains the list of supported use cases:

Table 4.1 – Initiate Outage Detection Event Request Use Cases

Initiate Outage Detection Event Request			
Name	Description	Result	
Successful Scenario	MDM Adapter successfully sends the request to the AMI HES (MDMS). AMI HES responds with a synchronous acknowledgement message which contains no errors.	Status	Success
		Error	N/A
AMI HES (MDMS) is unavailable	MDM Adapter tries to send the request message to the AMI HES (MDMS) but fails due to unavailability of the service endpoint. Adapter retries configurable number of times. Upon unsuccessful retry process completion, adapter updates the status of the request to Failed,	Status	Failed
		Error	Service Endpoint is unavailable
AMI HIS (MDMS) responds with an error message	MDM adapter successfully sends the request message to the AMI HES (MDMS). AMI HES responds with a synchronous response which contains error information. Adapter logs the information and updates the meter status update request to Failed.	Status	Failed.
		Error	Service processing error.

4.1.2. Outage Detection Event Notification

4.1.2.1. Overview

MDM adapter components hosts a service endpoint for receiving asynchronous responses to smart meter ping requests. To complete the action of submitting fresh meter status information, the request must contain the transaction id present in the *InitiateOutageDetectionEventRequest* message. Adapter utilizes the transaction ID to match the asynchronous response with the meter status update request and update the data accordingly.

4.1.2.2. Use Cases

Table 4.2 contains the list of supported use cases:

Table 4.2 – Outage Detection Event Notification Use Cases

Outage Detection Event Notification			
Name	Description	Result	
Successful Scenario	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS) with corresponding transaction ID and valid status update data. Adapter processes the request and stores the meter status update Correspondingly. Synchronous response without errors is returned to AMI HES.	Status	Success
		Error	N/A
Invalid Message	MDM Adapter receives the <i>ODEventNotofication</i> message from AMI HES (MDMS), but the message is invalid against the XSD schema. Adapter rejects the message with the corresponding soap fault.	Status	Failed
		Error	Message is invalid against the XSD schema.
Missing Header Data	MDM Adapter receives the <i>ODEventNotofication</i> message from AMI HES (MDMS), but the message has missing mandatory header data (message ID or timestamp). Adapter rejects the message with the corresponding synchronous error response.	Status	Failed
		Error	MessageId (Timestamp) is missing.
Invalid Transaction ID	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message contains invalid transaction ID. Adapter cannot associate the message with the <i>OutageDetectionEventRequest</i> and discards it. Appropriate synchronous error is returned.	Status	Failed
		Error	Invalid Transaction ID
Event Time in the Future	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message contains event time which is set in the future. Adapter rejects the message with the corresponding synchronous error response.	Status	Failed
		Error	EventTime is in the future.

4.2. Smart Meter Events

Smart meters are capable of generating notifications about power outage or restoration, voltage problems, etc. These smart notifications are used as input for various outage management services in order to detect potential customer outages. EcoStruxure MDM MultiSpeak adapter implements a service endpoint designed to process these notifications and store them for further analysis. Represents the sequence of events from the point of event creation, until it reaches the operator sitting in front of EcoStruxure DMD application.

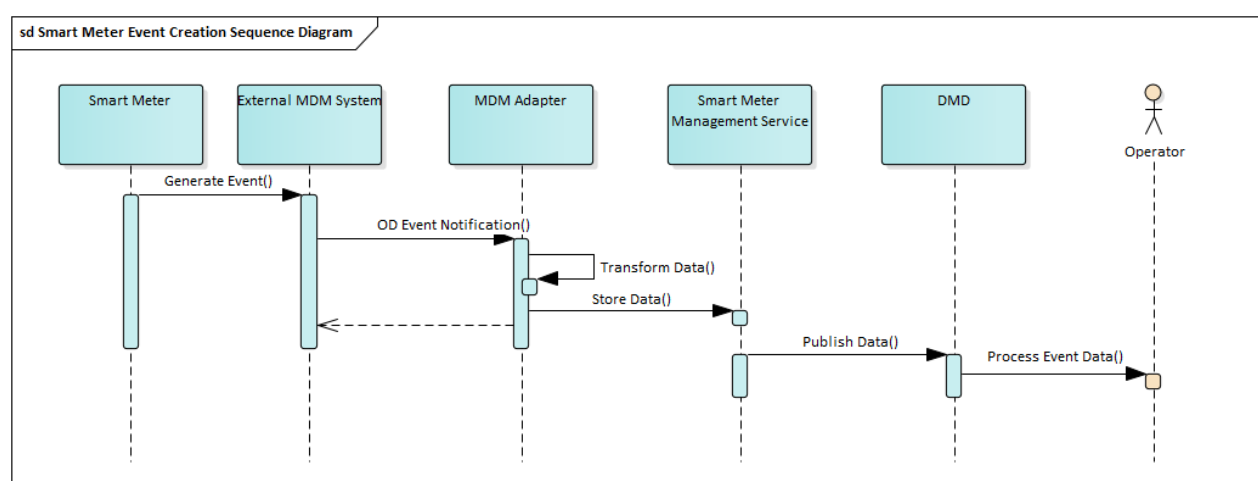


Figure 4.2 – Smart Meter Event Creation Sequence Diagram

New Smart event is generated by the meter which is forwarded via the AMI network to the AMI HES (MDM system). The system generates the *ODEventNotification* messages and invokes the corresponding service endpoint hosted on the EcoStruxure MDM adapter component. The adapter transforms the data stores it in the EcoStruxure SMMS service database. This data is published to the EcoStruxure DMD Client application and visible to the operator in the corresponding smart meter events browser. Additionally, insertion of specific smart meter events, like last gasp, triggers the creation of an incident (potential outage) in the EcoStruxure Outage Management Service.

4.2.1. Outage Detection Event Notification

4.2.1.1. Overview

MDM adapter component hosts a service endpoint for receiving smart meter event notifications. In order to differentiate these. The service endpoint is shared between smart meter event notifications and asynchronous meter status query responses. The differentiator between these two is the existence of the transaction id message attribute. As aforementioned, this ID correlates the meter status query with its asynchronous result. Therefore, its existence is redundant when submitting smart meter events, since they are not triggers from client environment, but rather generated proactively.

4.2.1.2. Use Cases

Table 4.3 contains the list of supported use cases:

Table 4.3 – Outage Detection Event Notification Use Cases

Outage Detection Event Notification			
Name	Description	Result	
Successful Scenario	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS) with valid data. Adapter processes the request and stores the smart meter event correspondingly. Synchronous response without errors is returned to AMI HES.	Status	Success
		Error	N/A

Outage Detection Event Notification			
Name	Description	Result	
Invalid Message	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message is invalid against the XSD schema. Adapter rejects the message with the corresponding soap fault.	Status	Failed
		Error	Message is invalid against the XSD schema.
Missing Header Data	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message has missing mandatory header data (message ID or timestamp). Adapter rejects the message with the corresponding synchronous error response.	Status	Failed
		Error	MessageId (Timestamp) is missing.
Invalid Meter ID	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message contains invalid meter ID. Adapter cannot associate the smart meter event message with the customer present in the schematic and discards it. Appropriate synchronous error is returned.	Status	Failed
		Error	Invalid Meter ID
Event Time in the Future	MDM Adapter receives the <i>ODEventNotification</i> message from AMI HES (MDMS), but the message contains event time which is set in the future. Adapter rejects the message with the corresponding synchronous error response.	Status	Failed
		Error	EventTime is in the future.

5. MESSAGES

MultiSpeak standard is transport specific. SOAP messages using HTTP, TCP/IP socket connections directly between applications are used for transferring data in MultiSpeak. XML schemas are used for message definitions.

5.1. Common

5.1.1. MultiSpeak Message Header

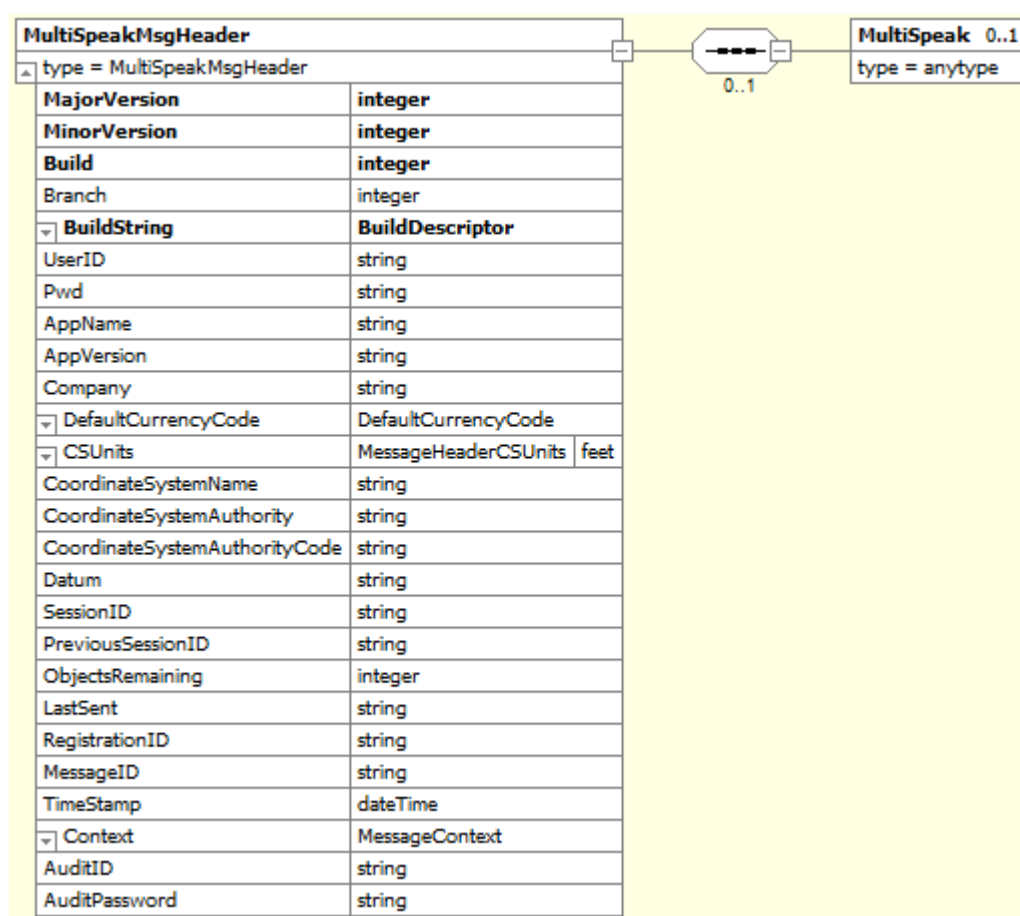


Figure 5.1 – MultiSpeakMsgHeader Schema

MultiSpeakMsgHeader is a common object for all MultiSpeak SOAP messages. It is transferred within the SOAP envelope header object, whilst the concrete data structures related to the service operations are transferred within the SOAP envelope body.

EcoStruxure MDM adapter component utilizes only two of the *MultiSpeakMsgHeader* attributes visible on Figure 5.1, and those are MessageID and Timestamp.

- MessageID – represents unique identifier for this instance of a message and is utilized for tracing.
- Timestamp – indicates the moment in time when the message was created.

5.2. Initiate Outage Detection Event Request Operation

The interface specification is provided in the Table 5.1:

Table 5.1 – Initiate Outage Detection Event Request Specifications

Specification	
Interface (Service) name	MeterDataManagementService
Operation name	InitiateOutageDetectionEventRequest
Hosting	External
Role	Client
Integration Style	Remote Procedure Invocation
Transport (Integration) Technology	SOAP WS
Transport Protocol	HTTPS
Transport Port	443
Request	InitiateOutageDetectionEventRequest
Response	InitiateOutageDetectionEventRequestResponse
Concurrency	Multiple
Instances	Single
WSDL	MultiSpeak MDM WSDL

5.2.1. Request Message

InitiateOutageDetectionEventRequest is transferred within the SOAP message envelope body. The message schema definitions is visible on Figure 5.2.

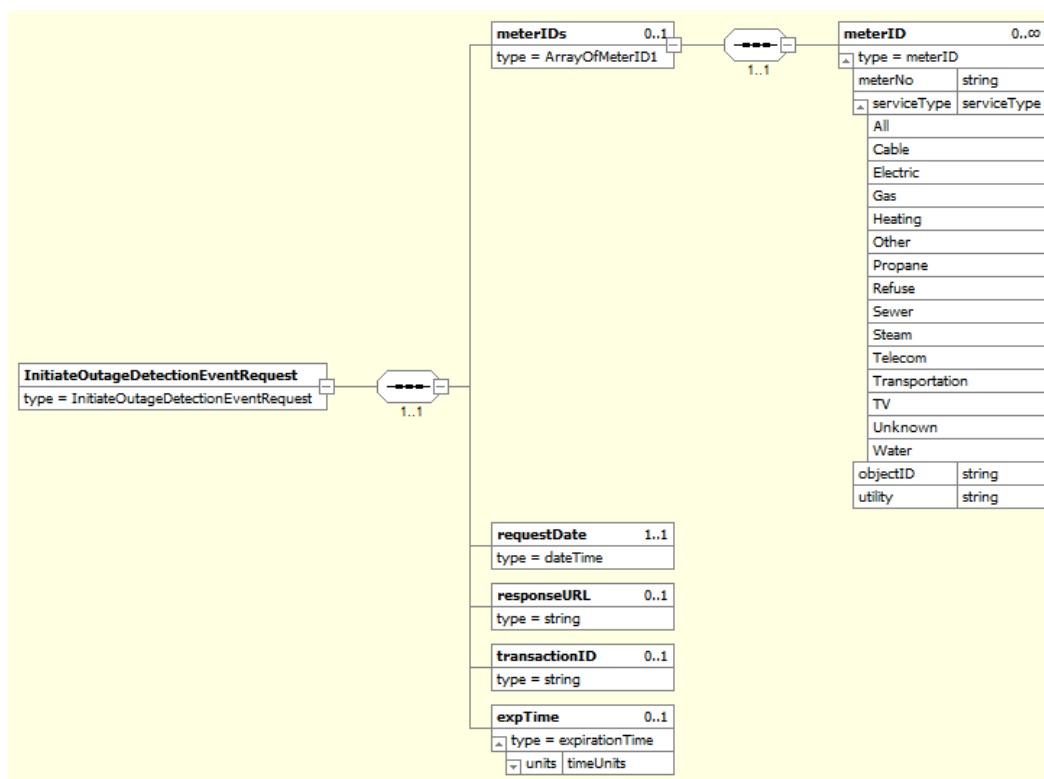


Figure 5.2 – InitiateOutageDetectionEventRequest schema

Table 5.2 represents the request message mapping in regard to the EcoStruxure GridOps SMMS data model.

Table 5.2 – Initiate Outage Detection Event Request Data Mapping

Request Message		Description	Model Code
Element (Attribute)	Type		
meterID.meterNo	string	Unique identifier of the electrical meter	SMMS_REQUEST _SRVDELIVERYPOINT _METERID
requestDate	datetime	Moment in time when the meter ping request was generated	N/A
responseURL	string	URL address on which the service endpoint for asynchronous meter status updates is sent	N/A
transactionID	string	Meter ping request identifier, used to associate asynchronous response with the request that trigger its creation	SMMS_ELEMENT _OBJECT_GID (SMMS_REQUEST)
expTime	expirationTime*	Request expiration time	SMMS_PROFILE _BASE_STATUS _PING_TIMEOUT

expirationTime is a complex element which structure is visible on the Figure 5.1.

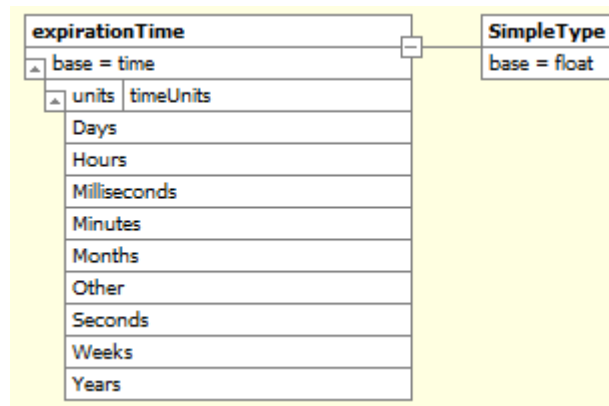


Figure 5.3 – ExpirationTime Element Schema

5.2.2. Response Message

The *InitiateOutageDetectionEventRequestResponse* message schema is visible on Figure 5.4.

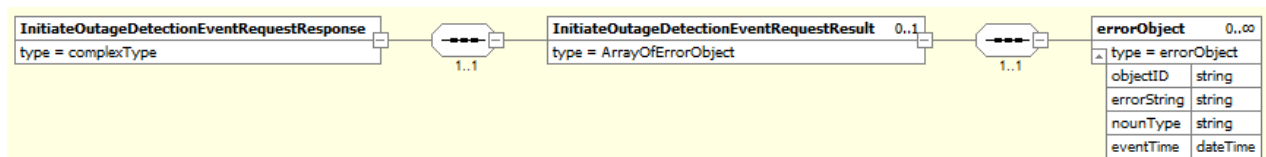


Figure 5.4 – InitiateOutageDetectionEventRequestResponse schema

The response message is consisted only with an array of error objects. Table 5.3 represents the data mapping of error objects according to MultiSpeak standard definitions.

Table 5.3 – errorObject data mapping

errorObject		Description	Model Code
Element (Attribute)	Type		
objectId	string	Identifier for object with error	N/A
errorString	string	Text description of the error itself	N/A
nounType	string	Type of noun for which this error is associated	N/A
eventTime	datetime	Failure timestamp	N/A

Since error objects are situational, no model mapping is applicable.

5.3. OD Event Notification

The interface specification is provided in the Table 5.4:

Table 5.4 – ODEventNotification Specification

Specification	
Interface (Service) name	MeterDataManagementService
Operation name	ODEventNotification
Hosting	Internal
Role	Service
Integration Style	Remote Procedure Invocation
Transport (Integration) Technology	SOAP WS
Transport Protocol	HTTPS
Transport Port	443
Request	ODEventNotification
Response	ODEventNotificationResponse
Concurrency	Multiple
Instances	Single
WSDL	MultiSpeak MDM WSDL

5.3.1. Request

ODEventNotification is transferred within the SOAP message envelope body. The message schema definitions is visible on Figure 5.5.

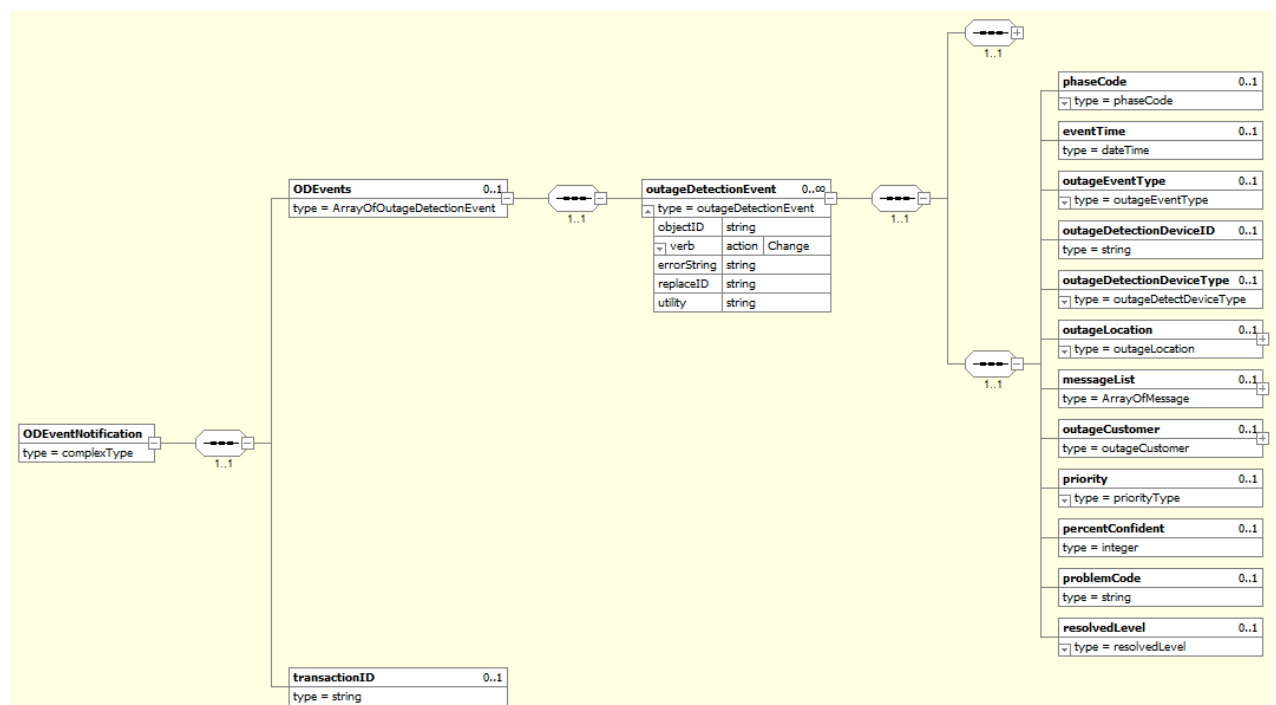


Figure 5.5 – ODEventNotification Schema

Table 5.5 represents the request message mapping in regard to the EcoStruxure GridOps SMMS data model for the process described in [Outage Detection Event Notification](#).

Table 5.5 – OD Event Notification Data Mapping applicable for Meter Ping Operation

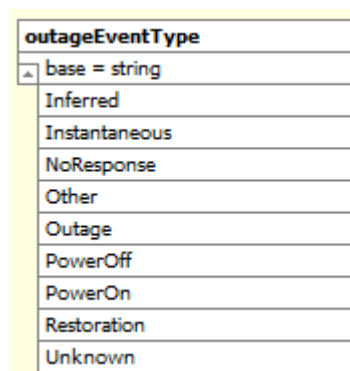
Request Message		Description	Model Code
Element (Attribute)	Type		
outageDetectionEvent. eventTime	datetime	Date and time outage event detected	SMMS_RESPONSE_TIMESTAMP
outageDetectionEvent. outageEventType	outageEventType*	Type of outage event(see enumerations)	SMMS_READING_PHASE_A_VALUE
outageDetectionEvent. outageLocation	outageLocation*	Unique identifier of the electrical meter	SMMS_REQUEST_SRVDELIVERYPOINT_METERID
transactionID	string	Meter ping request identifier, used to associate asynchronous response with the request that trigger its creation	SMMS_IDOBJ_GID

Additionally, Table 5.6 represents the data mapping of the *SmartMeterEvents* interface.

Table 5.6 – OD Event Notification Data Mapping applicable for Smart Meter Events operation

Request Message		Description	Model Code
Element (Attribute)	Type		
outageDetectionEvent. eventTime	datetime	Date and time outage event detected	SMMS_EVENT _RECEIVED_TIME
outageDetectionEvent. outageEventType	outageEventType*	Type of outage event(see enumerations)	SMMS_EVENT _PHASE_VALUE
outageDetectionEvent. outageLocation	outageLocation*	Unique identifier of the electrical meter	SMMS_ELEMENT _OBJ_CUSTOM_ID

outageEventType is a restricted string type which offers a set of values visible in. Since this value represents meter status, only “PowerOn” and “PowerOff” are used for the process.



outageEventType
base = string
Inferred
Instantaneous
NoResponse
Other
Outage
PowerOff
PowerOn
Restoration
Unknown

Figure 5.6 – outageEventType enum

outageLocation represents the customer identifier. It's schema is represented on Figure 5.7. outage location offers a choice of four possible customer identifiers:

- serviceLocationID – custom identifier of the service location (service delivery point in EcoStruxure GridOps network model).
- meterID – custom identifier of the associated electrical meter.
- account number – customer account number.
- phone number – customer phone number.

For the purpose of MDM integration interface, which is designed to integrate with AMI HES (MDMS), it is assumed that the meterID will be utilized.

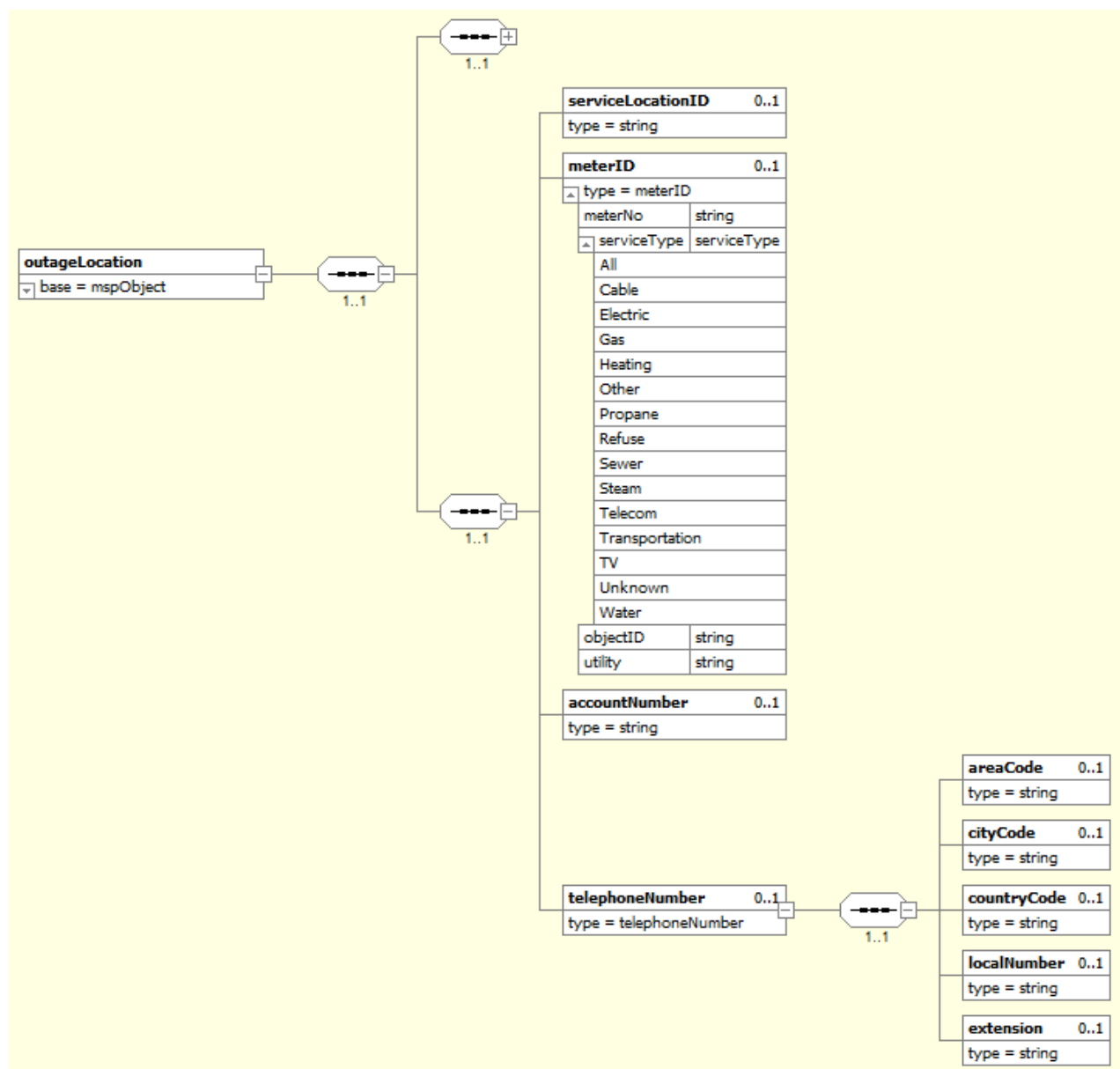


Figure 5.7 – outageLocation Element Schema

5.3.2. Response

The *ODEventNotificationResponse* message schema is visible on

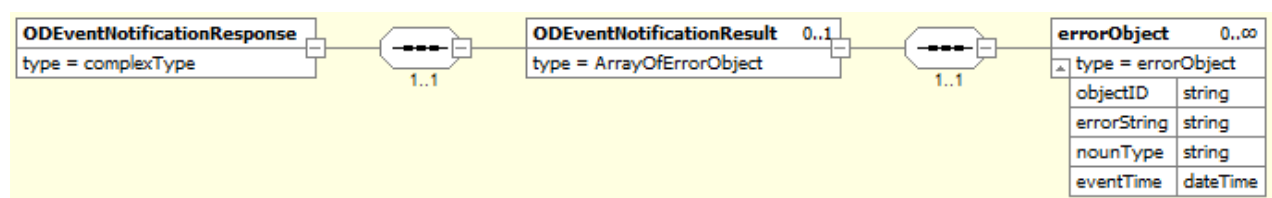


Figure 5.8 – ODEventNotificationResponse Schema

The response message is consisted only with an array of error objects. Table 5.3 represents the data mapping of error objects according to MultiSpeak standard definitions.

6. DEFINITIONS AND ABBREVIATIONS

Definition/Abbreviation	Description
ADMS	Advanced Distribution Management System
AMI	Advanced Metering Infrastructure
AMI HES	AMI Head End System
DMZ	Demilitarized Zone
HTTP	Hypertext Transport Protocol
MDM	Meter Data Management
MDMS	Meter Data Management System
OMS	(EcoStruxure) Outage Management Service
SMMS	(EcoStruxure) Smart Meter Management Service
SOAP	Simple Object Access Protocol
TCP/IP	Transmission Control Protocol / Internet Protocol
WS	Web Service
WSDL	Web Service Description Language
XML	eXtensible Markup Language
XSD	XML schema definition