GridOps Management Suite 3.10

Switching Management Reporting Interface

Functional Specification

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1. REFERENCES

#	Title	Description
1.	EcoStruxure GridOps Management Suite 3.10 Switching Management Notification Interface - Functional Specification	The document describes an out-of-the-box integration adapter designed to send all notifications related to the planned work to the external systems of interest.
2.	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.
3.	EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface	EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface zip file contains essential configuration information, data mappings, as well as web service definitions complemented with message examples.

2. ASSUMPTIONS

The Switching Management Reporting integration is designed under the following assumptions:

- Users of external system have capability to create, change and pull appropriate information related to planned work (Work Requests and Switching Plans).
- When inserting work request from the external system, users can specify the work request ID that needs to be unique. External system is responsible for providing unique IDs during insertion of work requests. If this assumption is not met, operations related to changing and querying work requests might not work as designed.
- Users of external system have capability to execute switching instruction from the 3rd party field client application or some other corporate system.
- System publishes work request related data to external system by using synchronous request-response message exchange pattern.
- Since the switching management functionality is highly configurable, appropriate types that need to be exchanged with the external systems must be defined during design sessions.
- Configurable coordinate conversion is possible for entities which encompass coordinates (switching plans, etc.).

3. 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 all solutions.

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.

In the distribution network, there is a need for managing procedures and all the activities related to planned and unplanned works for the purposes of maintenance, network reconfiguration and outage restoration.

The EcoStruxure GridOps provides support for creation of work requests and switching plans based on the work involved, regardless of whether it is of the energized or de-energized type.

In a typical use case of a planned work, a work request is submitted by external contractor or utility personnel from WebDMD, from DMD placed in Access Services (DMZ) System or it is done through Enterprise Asset Management or Workforce Management Systems.

Based on work request, a corresponding switching plan is created, validated and approved by a switching planner (or a switching writer) who sits in the control room environment. In some utilities switching plan can be created in offices outside of the control room, using DMD or WebDMD, and submitted to the control room when it is ready for approval. The switching plan contains the switching instructions. One or multiple field crews are assigned to switching instructions within a switching plan.

On the day of a switching plan execution, the switching plan is taken over by the responsible person, who coordinates the switching plan's execution. The responsible person is usually the control room operator, but in the situations when the switching plan is approved for an independent work, the field crew is able to issue and execute instructions autonomously without coordination with the control room. Switching instructions are issued to the field crew(s), switching and tagging are performed in the field and the software is updated to indicate the current state of the network.

In situations when work and switching plan is done through Enterprise Asset Management or Workforce Management Systems, work requests and switching plans are usually exchanged with external systems.

The Switching Management Reporting (SMR) Interface provides capability of inserting and updating work requests. Based on work requests semantics, the different type of work request can be created. Idea behind this integration is to have creation of Work requests in Enterprise Asset Management system and their execution. Also, the SMR Interface offers a simple operation dedicated for executing switching steps from the field. This eliminates the necessity of radio communication with the operator and manually executing switching steps in control room.

Besides above-mentioned functionalities related to the insertion/update of the data, the SMR Interfaces provides wide range of reporting functionalities, related to the switching management data. In situations when the utility prefers to analyze data related to planned works, there is an interface through which reporting

functionality is supported. This functionality is based on the request/reply pattern where the external system pulls necessary work request and switching plan data.

3.1. General Architecture

It is thoroughly described in the *EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification* [2].

4. INTERFACE OVERVIEW

The Switching Management Reporting integration is implemented through the SMR Adapter component. The aforementioned adapter implements (hosts) several SOAP based Web Services with appropriate set of operations:

- **ReceiveWorksService** – used for creating and updating work requests.
  - *CreatedWorks* operation
  - *ChangedWorks* operation
- **ReceiveSwitchingPlansService** – used for updating switching plans.
  - *ChangedSwitchingPlans* operation
- **ReceiveSwitchingStepsService** – used for updating switching steps.
  - *ChangedSwitchingSteps* operation
- **GetWorksService** – used for pulling active work requests from the EcoStruxure GridOps.
  - *GetWorks* operation
- **GetSwitchingPlansService** – used for pulling active switching plans from the EcoStruxure GridOps.
  - *GetSwitchingPlans* operation

The following chapters provide more details regarding these interfaces (web services) and appropriate web service operations, data mappings (CIM Profiles → SM Model), error handling scenarios etc.

The use case diagram that represents common participants (actors) and users of the interfaces in the SMR integration is given in Figure 4.1.

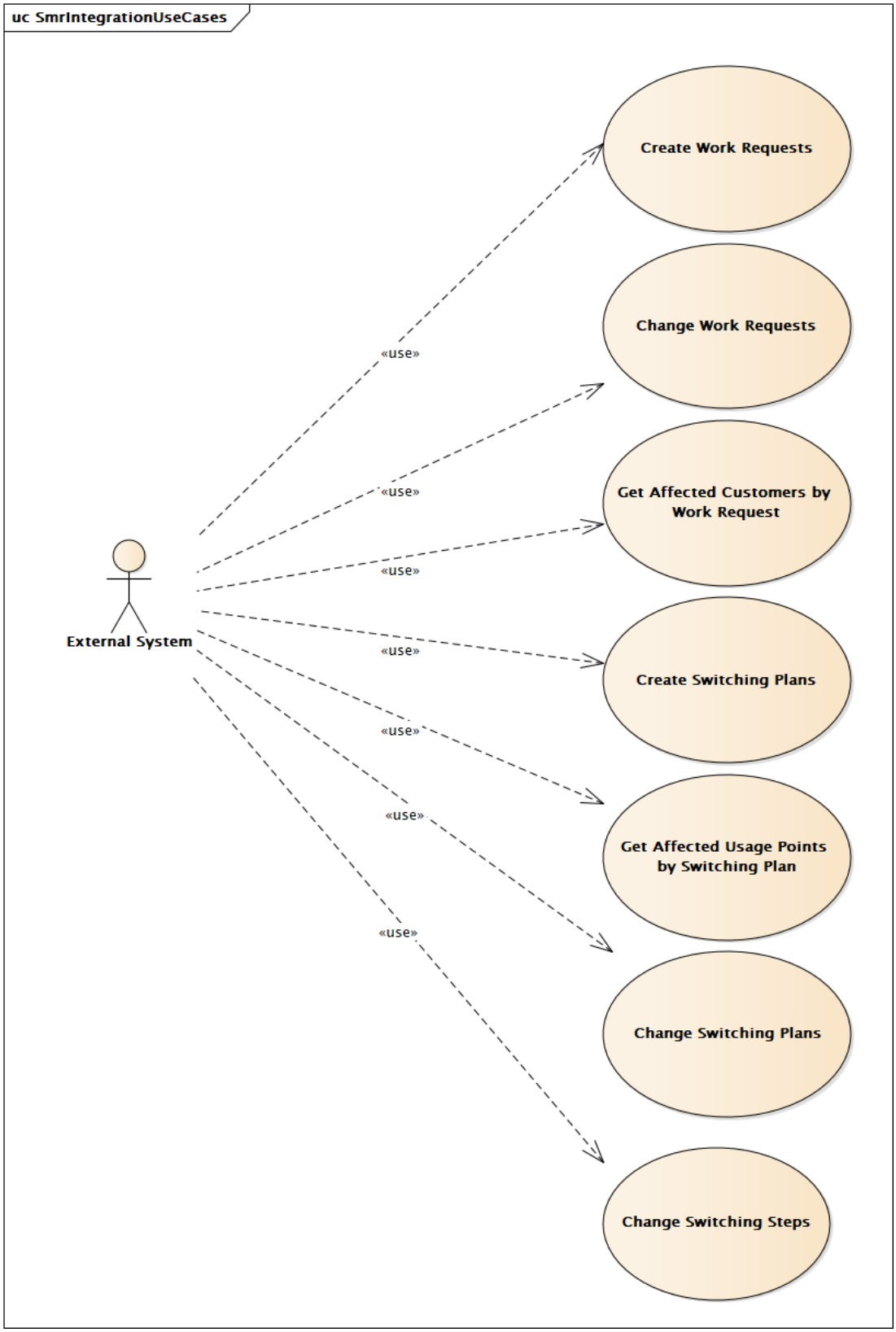

Figure 4.1 – The SMR Integration use case diagram

5. RECEIVEWORKS SERVICE

5.1. CreatedWorks Operation

5.1.1. Overview

In situations when Work Requests originate from external system (source), in order to insert collected work request data, *ReceiveWorksService* with *CreatedWorks* operation is available as a part of the SMR Interface.

Creation of work requests through *CreatedWorks* operation is done through *CreatedWorksEvent* object (request message).

Once the request message is received, SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and applies it to the DMZ system. The second level of validation is performed in the software during the insertion of the work request. All changes introduced to the DMZ are asynchronously replicated to the CORE system.

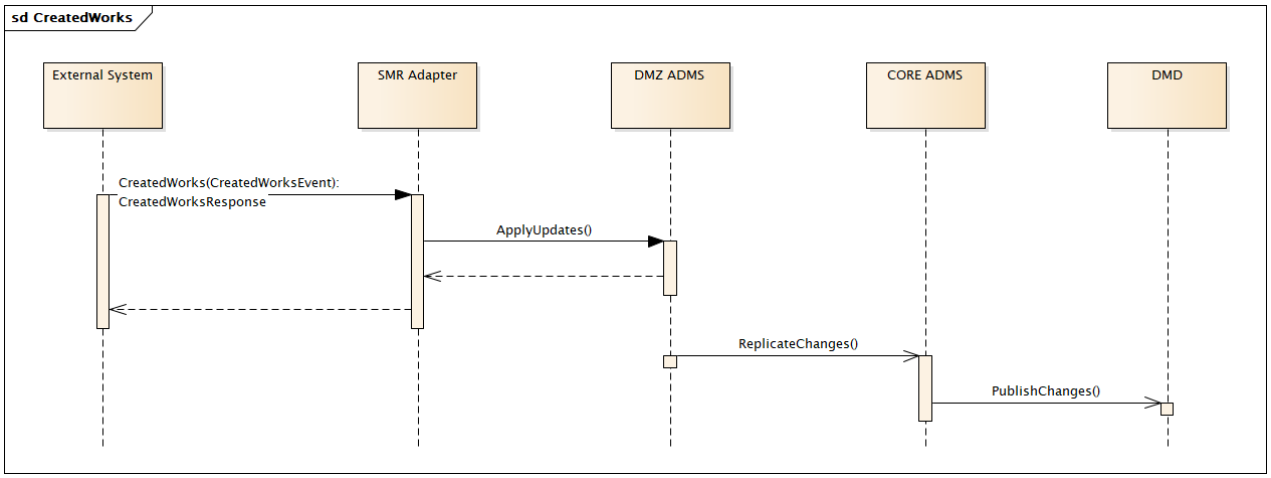

Figure 5.1 – The CreatedWorks operation execution

Depending on the both stages of validation, the SMR Adapter returns the appropriate *CreatedWorksResponse* or *CreatedWorksFault* with the detailed explanation of the occurred error. Figure 5.1 provides the visual representation for the described sequence of events.

5.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 5.1. Common use cases such as *Invalid Verb, Invalid Noun, Mandatory Element Missing, Unable to process the request* and *Non-active site fault* are described only in this table. For all other operations, it is only mentioned that they are applicable while whole description is omitted.

Table 5.1 – The CreatedWorks operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Invalid Verb	Result	String	FAILED	External system sends request message with invalid Verb. Response message is sent by SMR Adapter with FAILED result and message is discarded.
	Error.code	String	2.9	
	Error.level	String	FATAL	
	Error.reason	String	InvalidVerb	
	Error.details	String	Invalid verb: {0}.	
Invalid Noun	Result	String	FAILED	External system sends request message with invalid Noun. Response message is sent by SMR Adapter with FAILED result and message is discarded.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	InvalidNoun	
	Error.details	String	Invalid noun: {0}.	
Mandatory Element Missing	Result	String	FAILED	External system sends request message in which some of the mandatory elements are missing. Response message is sent by SMR Adapter with FAILED result and message is discarded.
	Error.code	String	1.8	
	Error.level	String	FATAL	
	Error.reason	String	InvalidMessage	
	Error.details	String	Received message is invalid against XSD schema. Reason: {0}.	
Unable to process the request	Result	String	FAILED	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.code	String	5.3	External system sends request message, but for some reason message processing fails due to various internal server error. Fault response message is sent by SMR Adapter.
	Error.level	String	FATAL	
	Error.reason	String	InternalServerError	
	Error.details	String	{0}.	
Created Works – Missing authorName	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have author name specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	authorNameMissing	
	Error.details	String	Missing authorName for entities: {1}	
Created Works – Successfully created	Result	String	OK	External system sends CreatedWorks message where all data in message are valid. All work requests are created. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Created Works – Invalid status	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have invalid work requests status. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatus	
	Error.details	String	Invalid status(es) {0} for entities: {1}.	
Created Works – Invalid initial status	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have invalid work requests initial status (status received in request message exist but it is not initial work request state). Valid
	Error.code	String	2.7	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	InvalidInitialStatus	work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.details	String	Invalid initial status(es) {0} for entities: {1}.	
Created Works – Invalid type	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have invalid type. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidType	
	Error.details	String	Invalid type(s): {0} for entities: {1}	
Created Works – Invalid typeOfWork	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have invalid work request type of work. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidTypeOfWork	
	Error.details	String	Invalid type(s) of work: {0} for entities: {1}	
Created Works – Duplicate work names in request message	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests in message have duplicate name (external system ID). Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateNames	
	Error.details	String	Duplicate work request name(s): {0} in request message	
Created Works – Duplicate work names	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests in message have name (external system ID) that already exist. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateNames	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.details	String	Work request(s) with name(s): {0} already exist(s) in ADMS.	
Created Works – Invalid safetyDocumentType	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have invalid safety document type. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidSafetyDocumentType	
	Error.details	String	Invalid safety document type(s): {0} for entities: {1}	
Created Works - Invalid requested equipment	Result	String	OK	External system sends CreatedWorks message where several work requests have specified equipment to be work on (requested equipment) that does not exist. All work requests are processed and created. For work request with invalid requested equipment appropriate warning is returned and invalid requested equipment information is specified within work request note (comment). Response message is sent by SMR Adapter with OK result.
	Error.code	String	2.7	
	Error.level	String	WARNING	
	Error.reason	String	InvalidRequestedEquipment	
	Error.details	String	Invalid requested equipment: {0} for entities: {1}	
Created Works – Duplicated requested equipment	Result	String	OK	External system sends CreatedWorks message where several work requests in message have device name for which there are more then one device found. All work requests are processed and created. For work request with duplicated devices found appropriate warning is returned and information about duplicated devices is specified within work request note (comment). Work request is created without device. Response message is sent by SMR Adapter with OK result. NOTE: For this use case in adapter configuration xml file addressing mode for devices filtering should be set to Name.
	Error.code	String	2.7	
	Error.level	String	WARNING	
	Error.reason	String	DuplicatedRequestedEquipment	
	Error.details	String	Duplicated requested equipment: {0} in ADMS.	
Created Works – Duplicated requested equipment in work	Result	String	OK	External system sends CreatedWorks message where one work requests in message have duplicated equipment. All work requests
	Error.code	String	2.7	
	Error.level	String	WARNING	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	DuplicatedRequestedEquipment	are processed and created. For work request with duplicated devices in message, appropriate warning is returned and work request is created on device from message. Response message is sent by SMR Adapter with OK result.
	Error.details	String	Duplicated requested equipment: {0} for entities: {1}.	
Created Works - Period endTime is before(or equal) to startTime	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have specified EndTime before StartTime. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	PeriodEndTimeIsBeforeOrEqualPeriodStartTime	
	Error.details	String	Period EndTime is before(or equal) to StartTime for entities: {0}	
Created Works - Created date time is in the future	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests have specified CreatedDateTime in the future. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	CreatedDateTimeInFuture	
	Error.details	String	Created date time is in the future for entities: {0}	
Created Works – Missing period	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have period specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	PeriodMissing	
	Error.details	String	Missing periods for entities: {1}	
Created Works – Missing type	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have type specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	TypeMissing	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.details	String	Missing type for entities: {1}	
Created Works – Missing status	Result	String	OK	External system sends CreatedWorks message where several work requests do not have status tag specified. All work requests are processed and created. Work requests with no status specified are created in initial state and appropriate warning is returned. Response message is sent by SMR Adapter with OK result.
	Error.code	String	1.2	
	Error.level	String	WARNING	
	Error.reason	String	StatusMissing	
	Error.details	String	Missing status for entities: {1}	
Created Works – Missing title	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have title specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	TitleMissing	
	Error.details	String	Missing title for entities: {1}	
Created Works – Missing type of work	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have type of work specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	TypeOfWorkMissing	
	Error.details	String	Missing type of work for entities: {1}	
Created Works – Missing safety document type	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have safety document type specified. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	SafetyDocumentTypeMissing	
	Error.details	String	Missing safety document type for entities: {1}	
Created Works – Missing phoneNumber	Result	String	PARTIAL/FAILED	External system sends CreatedWorks message where several work requests do not have phone number specified. Valid work requests
	Error.code	String	1.2	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	FATAL	are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.reason	String	phoneNumberMissing	
	Error.details	String	Missing phone number for entities: {1}	

5.2. ChangedWorks Operation

5.2.1. Overview

Once the work request is created, sometimes there is a need to change Work Request information. In case of work request change, external system should send work request snapshot (for incremental update it is necessary to do certain modification in adapter ErrorConfiguration .xml file to loosen validation for mandatory attributes expected to be sent in request message from external system). To provide these options, the *ReceiveWorksService* with *ChangedWorks* operation is introduced as a part of SMR Interface.

When Work Request needs to be changed the external system creates the *ChangedWorkstEvent* object and invokes appropriate operation. The SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and applies it to the DMZ system. The second level of validation is performed during work request changes. All changes introduced to the DMZ are asynchronously replicated to the CORE system. In adapter ErrorConfiguration .xml file it is possible additionally to define attributes expected to be sent as mandatory from external system.

Depending on the both stages of validation, the SMR Adapter returns the appropriate *ChangedWorksResponse* or *ChangedWorksFault* with the detailed explanation of the occurred error. Figure 5.2 provides the visual representation for the described sequence of events.

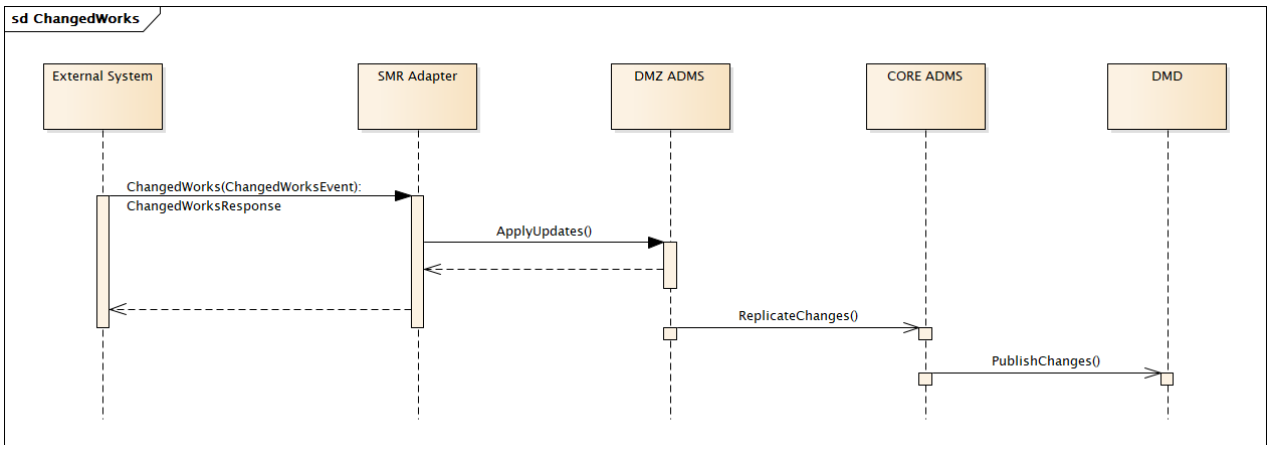

Figure 5.2 – The ChangedWorks operation execution

5.2.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 5.2.

Table 5.2 – The ChangedWorks operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Supported common use cases are described in Table 5.1 – The CreatedWorks operation use cases				
Changed Works – Successfully changed	Result	String	OK	External system sends ChangedWorks message where all data in message are valid. All work requests are changed. Response message is sent by SMR Adapter with OK result. **NOTE:** As SMR adapter performs initial validation of the received data and applies it to the DMZ system, work request status transition is limited to work request life cycle in DMZ system.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Changed Works – Requested equipment is successfully changed	Result	String	OK	External system sends ChangedWorks message for changing requested equipment. All work requests are changed. Response message is sent by SMR Adapter with OK result. **NOTE:** 1. Add – if requested equipment is specified in request message but work request does not contain defined requested equipment, it should be added during changed works operation. 2. Update - It means that already existing requested equipment should be updated when new one requested equipment is defined in request message during changed works operation. If requested equipment in received message is the same as already existing equipment within work request it won't be changed.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	

Use Case	Message Mapping			Action
	Property	Type	Value	
				For this use cases in adapter configuration xml file addressing mode for devices filtering can be device mRID or name.
Changed Works - Invalid requested equipment	Result	String	OK	External system sends ChangedWorks message for changing requested equipment where several work requests have specified equipment to be work on (requested equipment) that does not exist. All work requests are changed. For work request with invalid requested equipment appropriate warning is returned and invalid requested equipment information is specified within work request note (comment). If there was existing equipment within work request it should be removed. Response message is sent by SMR Adapter with OK result.
	Error.code	String	2.7	
	Error.level	String	WARNING	
	Error.reason	String	InvalidRequestedEquipment	
	Error.details	String	Invalid requested equipment: {0} for entities: {1}	
Changed Works – Duplicated requested equipment	Result	String	OK	External system sends ChangedWorks message where several work requests in message have device name for which there are more than one device found. All work requests are processed and changed. For work request with duplicated devices found, all attributes from message will be updated except requested equipment. Information about duplicated devices is specified within work request note (comment). 1. If there was no requested equipment within work request, requested equipment sent in message will not be added to work request. Information about duplicated devices is specified within work request note (comment) 2. If there was existing equipment within work request, different from requested equipment forwarded in the message, it should be removed from work request. Information about duplicated devices is specified within work request note (comment)
	Error.code	String	2.7	
	Error.level	String	WARNING	
	Error.reason	String	DuplicatedRequestedEquipment	
	Error.details	String	Duplicated requested equipment: {0} in ADMS.	

Use Case	Message Mapping			Action
	Property	Type	Value	
				Response message is sent by SMR Adapter with OK result. **NOTE:** For this use case in adapter configuration xml file addressing mode for devices filtering should be set to Name.
Changed Works – Duplicated requested equipment in work request	Result	String	OK	External system sends ChangedWorks message where one work requests in message have duplicated equipment. All work requests are processed and changed. For work request with duplicated devices in message, appropriate warning is returned and work request is changed (device from message is added or updated). Response message is sent by SMR Adapter with OK result.
	Error.code	String	2.7	
	Error.level	String	WARNING	
	Error.reason	String	DuplicatedRequestedEquipment	
	Error.details	String	Duplicated requested equipment: {0} for entities: {1}.	
Changed Works – Mandatory fields for status change are not populated	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for changing work request status which does not have mandatory fields for status changing populated. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** Status can be changed if company, phone number, purpose and requested equipment fields are populated. Emergency work should be checked in case that work request is not planned at least 3 days in advanced.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Status cannot be changed for entities: {0} Mandatory field(s) {1} are/is not populated.	
Changed Works – Mandatory attribute deletion when work request is not in Initial state	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for deletion mandatory attributes for work requests that are not in initial state. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Work request(s): {0} cannot be changed because mandatory field(s) {1} are/is not populated.	
Changed Works –	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for changing work request status for some work requests that are on the
	Error.code	String	2.7	

Use Case	Message Mapping			Action
	Property	Type	Value	
Work status change for works that are on the same feeder/substation	Error.level	String	FATAL	same feeder/substation. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Cannot change entity/ies: {0} because there is other work request(s) on the same feeder/substation.	
Changed Works – Changing work when it is in final state	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for changing several work request that are in final state. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Work request(s) {0} is/are in final state and cannot be changed.	
Changed Works – Emergency work change when work request is not in Initial state	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for changing emergency work for work requests that are not in initial state. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** Emergency work can be changed only if work request is in initial state.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Emergency work cannot be changed for entities: {0}. Work request(s) is/are not in initial state.	
Changed Works – TypeOfWork change when work request is not in Initial state	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message for changing typeOfWork for work requests that are not in initial state. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** TypeOfWork can be changed only if work request is in initial state.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	TypeOfWork cannot be changed for entities: {0}. Work request(s) is/are not in initial state.	
Changed Works –	Result	String	PARTIAL/FAILED	

Use Case	Message Mapping			Action
	Property	Type	Value	
SafetyDocumentType change when work request is not in Initial state	Error.code	String	2.7	External system sends ChangedWorks message for changing safetyDocumentType for work requests that are not in initial state. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** SafetyDocumentType can be changed only if work request is in initial state.
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	SafetyDocumentType cannot be changed for entities: {0}. Work request(s) is/are not in initial state.	
Changed Works – Invalid status transition	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have invalid work requests status transition. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	6.1	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatusTransition	
	Error.details	String	Invalid status transition for entities: {0}	
Changed Works – Invalid typeOfWork	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have invalid work request type of work. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidTypeOfWork	
	Error.details	String	Invalid type of work: {0} for entities: {1}	
Changed Works – Invalid Status	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have invalid status. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatus	
	Error.details	String	Invalid status: {0} for entities: {1}	
Changed Works – Duplicate works name in request message	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have duplicate work request name in request
	Error.code	String	5.3	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	FATAL	message. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.reason	String	DuplicateNames	
	Error.details	String	Duplicate work request name(s): {0} in request message.	
Changed Works - Duplicate works mRIDs in request message	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have duplicate work request mRIDs in request message. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateMrids	
	Error.details	String	Duplicate work request mRID(s): {0} in request message.	
Changed Works – Neither Works name nor Works mRID are provided request message	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests do not have neither work request name nor work request mRID provided in request message. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	MridAndNameMissing	
	Error.details	String	Neither Work request mRID nor Name are provided in request message.	
Changed Works – Element not found in message	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where for several work requests some attributes are not provided in request message. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	{ElementName}Missing	
	Error.details	String	Missing {ElementName} for entities: {0}.	
Changed Works – Invalid works name	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have work request name that do not exist. Valid
	Error.code	String	2.7	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	FATAL	work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid Work Request name(s): {0}	
Changed Works – Invalid works mRID	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have mRIDs that do not exist. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid Work Request mRID(s): {0}	
Changed Works - Works name is not in correlation with works mRID	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have name that is not in correlation with work request mRID. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Work Request name is not in correlation with ADMS work request mRID(s): {0}	
Changed Works - Invalid safetyDocumentType	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have invalid safety document type. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidSafetyDocumentype	
	Error.details	String	Invalid safety document type(s): {0} for entities: {1}	
Changed Works - Period endTime is before (or equal) startTime	Result	String	PARTIAL/FAILED	External system sends ChangedWorks message where several work requests have specified EndTime before StartTime. Valid work requests are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	PeriodEndTimeIsBeforeOrEqualPeriodStartTime	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.details	String	Period EndTime is before(or equal) to StartTime for entities: {0}	

6. RECEIVESWITCHINGPLANS SERVICE

6.1. ChangedSwitchingPlans Operation

6.1.1. Overview

Once the switching plan is created, sometimes there is a need to change Switching Plan information. In case of switching plan change, external system should send switching plan snapshot (for incremental update it is necessary to do certain modification in adapter ErrorConfiguration .xml file to loosen validation for mandatory attributes expected to be sent in request message from external system). To provide these options, the *ReceiveSwitchingPlansService* with *ChangedSwitchingPlans* operation is introduced as a part of the SMR Interface.

When Switching Plan needs to be changed the external system creates the *ChangedSwitchingPlansEvent* object and invokes appropriate operation.

The SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and applies it to the DMZ system.

The second level of validation is performed in the software during switching plan changes. All changes introduced to the DMZ are asynchronously replicated to the CORE system.

Depending on the both stages of validation, the SMR Adapter returns the appropriate *ChangedSwitchingPlansResponse* or *ChangedSwitchingPlansFault* with the detailed explanation of the occurred error. Figure 6.1 provides the visual representation for the described sequence of events.

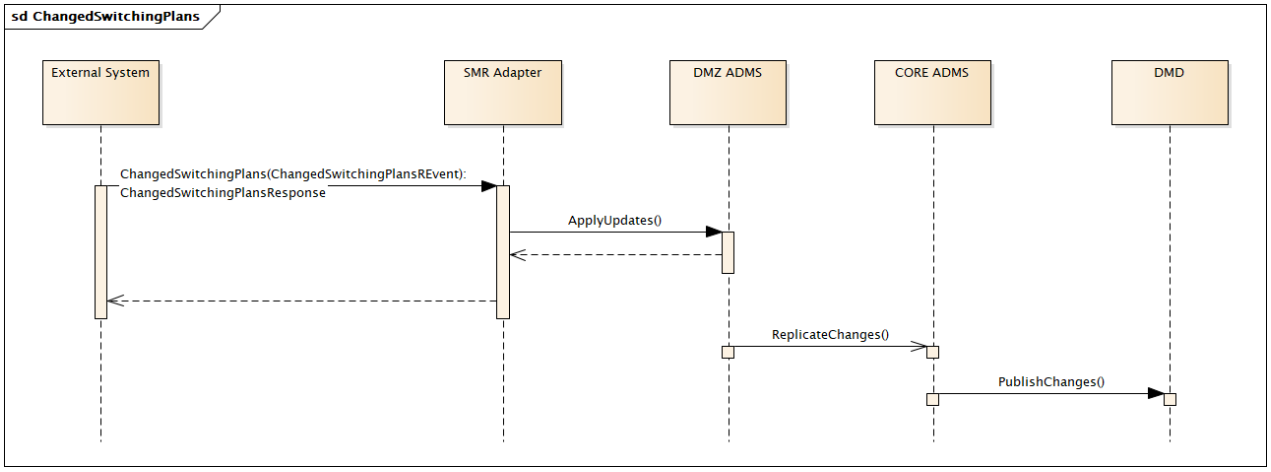

Figure 6.1 – The ChangedSwitchingPlans operation execution

6.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 5.2.

Table 6.1 – The ChangedSwitchingPlans operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Supported common use cases are described in Table 5.1 – The CreatedWorks operation use cases				
Changed SwitchingPlans – Successfully changed	Result	String	OK	External system sends ChangedSwitchingPlans message where all data in message are valid. All switching plans are changed. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Changed SwitchingPlans – Mandatory fields for status change are not populated	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message to change switching plan status which does not have mandatory fields for status changing populated. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** Switching plan status can be changed only if Switching Instructions are defined.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Status cannot be changed for entities: {0} Mandatory field(s) {1} are/is not populated.	
Changed SwitchingPlans – TypeOfWork change when switching plan is not in Initial state	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message for changing switching plan typeOfWork for switching plans that are not in initial state. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** TypeOfWork can be changed only if switching plan is in initial state.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	TypeOfWork cannot be changed for entities: {0}. Switching plan(s) is/are not in initial state.	
Changed SwitchingPlans –	Result	String	PARTIAL/FAILED	

Use Case	Message Mapping			Action
	Property	Type	Value	
Switching plan endTime is before switching instruction scheduling date time	Error.code	String	2.7	External system sends ChangedSwitchingPlans message for changing switching plan period where for some switching plans in message (they should have defined switching instruction) end time is specified to be before scheduling date time for Switching step instruction. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Period cannot be changed for entities: {0}, because there is some entries whose scheduling times are after populated work plan/s period end time/s.	
Changed SwitchingPlans – Switching plan status change for switching plan that are on the same feeder/substation	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message for changing switching plan status for some switching plans that are on the same feeder/substation. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Cannot change entity/ies: {0}, because there is other/s switching plan/s on the same feeder/substation.	
Changed SwitchingPlans – Switching plan change is not allowed due some validation errors	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans request message with several switching plans, but for some reason processing fails for some of them due to various internal errors. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Change operation is not allowed for entities: {0} because of some validation error/s. Check adapter log for details.	
Changed SwitchingPlans – Changing switching plan when it is in final state	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message for changing several switching plans that are in final state. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	OperationNotAllowed	
	Error.details	String	Switching plan(s) {0} is/are in final state and cannot be changed.	

Use Case	Message Mapping			Action
	Property	Type	Value	
Changed SwitchingPlans – Invalid status transition	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have invalid switching plans status transition. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	6.1	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatusTransition	
	Error.details	String	Invalid status transition {0} for entities: {1}.	
Changed SwitchingPlans - Invalid typeOfWork	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have invalid switching plan type of work. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidTypeOfWork	
	Error.details	String	Invalid type(s) of work: {0} for entities: {1}	
Changed SwitchingPlans - Duplicate switching plan names in request message	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have duplicate switching plan names in request message. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateNames	
	Error.details	String	Duplicate switching plan name(s): {0} in request message.	
Changed SwitchingPlans - Duplicate switching plan mRIDs in request message	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have duplicate switching plan mRIDs in request message. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateMrids	
	Error.details	String	Duplicate switching plan mRID(s): {0} in request message.	
Changed SwitchingPlans -	Result	String	PARTIAL/FAILED	

Use Case	Message Mapping			Action
	Property	Type	Value	
Invalid switching plan name	Error.code	String	2.7	External system sends ChangedSwitchingPlans message where several switching plans have names that do not exist. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid switching plan name(s): {0}	
Changed SwitchingPlans - Invalid switching plan mRID	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have mRIDs that do not exist. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid switching plan mRID(s): {0}	
Changed SwitchingPlans - Switching plan name is not in correlation with switching plan mRID	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have name that are not in correlation with switching plan mRID. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	SwitchingPlan name is not in correlation with ADMS switching plan mRID(s): {0}	
Changed SwitchingPlans – Neither Switching plan name nor Switching plan mRID are provided request message	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans do not have neither switching plan name nor switching plan mRID provided in request message. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	MridAndNameMissing	
	Error.details	String	Neither Switching plan mRID nor Name are provided in request message.	
Changed SwitchingPlans – Element not found in message	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where for several switching plans some attributes are not provided in request
	Error.code	String	1.2	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	FATAL	message. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.reason	String	{ElementName}Missing	
	Error.details	String	Missing {ElementName} for entities: {0}.	
Changed SwitchingPlans – Invalid Status	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have invalid status. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatus	
	Error.details	String	Invalid status: {0} for entities: {1}	
Changed SwitchingPlans - Period endTime is before(or equal) startTime	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingPlans message where several switching plans have specified EndTime before StartTime. Valid switching plans are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	PeriodEndTimeIsBeforeOrEqualPeriodStartTime	
	Error.details	String	Period EndTime is before(or equal) to StartTime for entities: {0}	

7. RECEIVESWITCHINSTEPS SERVICE

7.1. ChangedSwitchingSteps Operation

7.1.1. Overview

Considering the duties of field crews, management of switching plans is one of the most important functionalities. To eliminate the necessity of radio communication with the operator and manually executing switching steps in control room, SMR interface introduces a simple operation dedicated for executing switching steps from the field by using mobile application e.g. Field Client application.

When the switching plan is approved for an independent work, the field crew is able to issue and execute instructions autonomously without coordination with the control room. On the day of a switching plan execution, the switching plan is taken over by the responsible person, who coordinates the switching plan's execution. The responsible person is usually the control room operator, who is responsible for field crew assignment and for issuing switching instruction. After switching instructions is issued to the field crew(s), it needs to be propagated to appropriate crew by Switching Management Notification Interface (for more details check *EcoStruxure GridOps Management Suite 3.10 Switching Management Notification Interface - Functional Specification* [1]). Field crew receives the instruction on which is assigned. After the crew arrive at location and perform switching instruction on the field it can simply update instruction without requiring communication with operator.

When the switching step needs to be updated (executed), the external system creates the ChangedSwitchingStepsEvent object and invokes the appropriate operation. The SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and applies it to the DMZ system.

The second level of validation is performed in the software during the update of the switching plan. All changes introduced to the DMZ are asynchronously replicated to the CORE system. Depending on the both stages of validation, the SMR Adapter returns the appropriate ChangedSwitchingStepsResponse or ChangedSwitchingStepsFault with the detailed explanation of the occurred error. Figure 7.1 provides the visual representation for the described sequence of events.

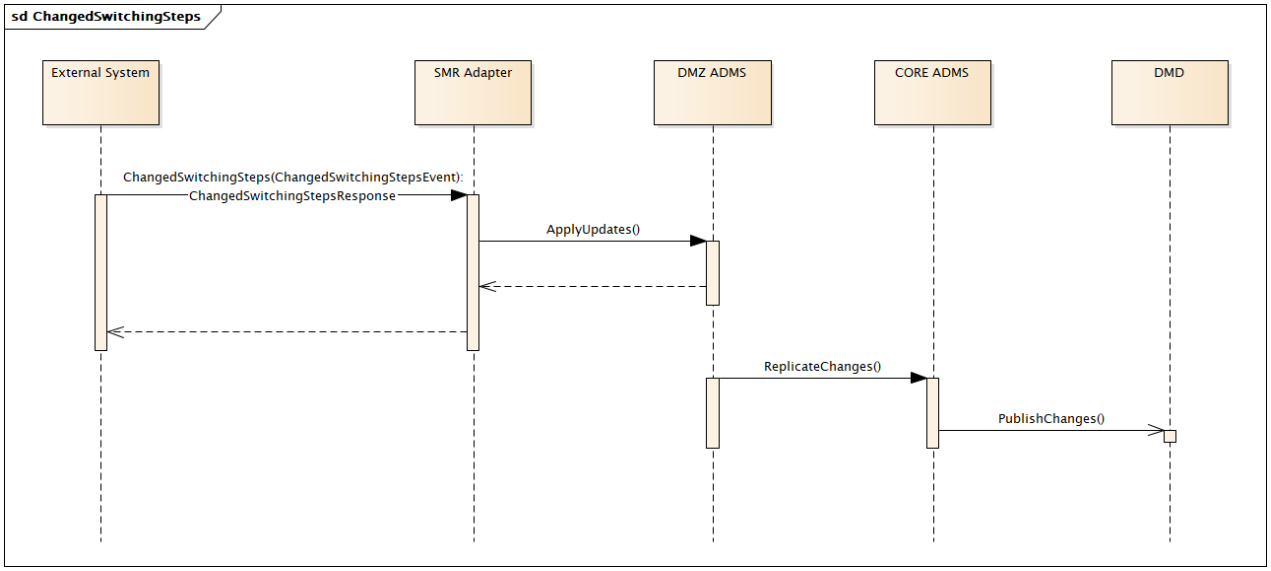

Figure 7.1 – The ChangedSwitchingSteps operation execution

7.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 5.2.

Table 7.1 – The ChangedSwitchingSteps operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Supported common use cases are described in Table 5.1 – The CreatedWorks operation use cases				
Changed SwitchingSteps – Successfully changed	Result	String	OK	External system sends ChangedSwitchingSteps message where all data in message are valid. All switching steps are updated. Response message is sent by SMR Adapter with OK result. **NOTE:** As Crew.mRID is optional parameter it can be omitted or provided in massage. If Crew.mRID attribute is provided in ChangedSwitchingSteps message, given crew must be assigned on switching step provided in same message.
	Error.code	String	0.0	
	Error.level	String	INFORM	
	Error.reason	String	RequestSent	
	Error.details	String	{0} request sent for switching step(s): {1}.	
Changed SwitchingSteps - Not existing switching step mRID	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where several switching steps have mRIDs that do not exist or are not in list of supported switching steps. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. **NOTE:** Unsupported switching step types are: Safety Document, Changeset, Breakpoint, Note.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Provided mRID(s): {0} is/are not in the list of supported switching steps.	
Changed SwitchingSteps - Duplicate switching step mRIDs in request message	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where several switching steps have duplicate switching step mRIDs in request message. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	5.3	
	Error.level	String	FATAL	
	Error.reason	String	DuplicateMrids	
	Error.details	String	Duplicate switching step mRID(s): {0} in request message.	

Use Case	Message Mapping			Action
	Property	Type	Value	
Changed SwitchingSteps - Update attempted by unassigned Crew mRID	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message with Crew mRID which is not assigned to the changed switching step. Switching steps that have corresponding Crew.mRID to the one in the EcoStruxure GridOps are updated. Otherwise, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result. Note: If entire Crew object (along with mRID element) is omitted from the request message, Crew.mRID validation will not be triggered.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidCrewId	
	Error.details	String	Crew with ID: {0} is not allowed to change the switching step(s): {1} since it is not assigned to it.	
Changed SwitchingSteps - executedDateTime is in the future	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where several switching steps have specified executed date time in the future. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	ExecutedDateTimeInTheFuture	
	Error.details	String	Cannot update switching step(s): {0}. Provided executed date time: {1} is in the future.	
Changed SwitchingSteps – Status transition is not supported	Result	String	PARTIAL/FAILED	In EcoStruxure GridOps there are several switching steps that are in status different then Issued. External system sends ChangedSwitchingSteps message for updating switching steps where are some of them are in status different then Issued. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	6.1	
	Error.level	String	FATAL	
	Error.reason	String	StatusTransitionIsNotSupported	
	Error.details	String	Status transition {0} is not supported for entities: {1}.	
Changed SwitchingSteps – Invalid Status	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where several switching steps have status that is not defined as supported in adapter registry configuration xml file. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatus	
	Error.details	String	Invalid status: {0} for entities: {1}	

Use Case	Message Mapping			Action
	Property	Type	Value	
				NOTE: Valid statuses are: Update and Unable to operate.
Changed SwitchingSteps - ExecutedBy is not provided	Result	String	OK	External system sends ChangedSwitchingSteps message where for switching steps executedBy attribute is not provided. All switching steps are successfully processed. ExecutedBy attribute is defaulted to value from registry configuration. Response message is sent by SMR Adapter with OK result and appropriate warning.
	Error.code	String	1.2	
	Error.level	String	WARNING	
	Error.reason	String	ExecutedByNotProvided	
	Error.details	String	ExecutedBy is not provided for entities: {0}. It will be defaulted to configuration value.	
Changed SwitchingPlans – Executed date time is not provided	Result	String	OK	External system sends ChangedSwitchingSteps message where for switching steps executedDateTime attribute is not provided. All switching steps are successfully processed. ExecutedDateTime attribute is defaulted to date time now. Response message is sent by SMR Adapter with OK result.
	Error.code	String	1.2	
	Error.level	String	WARNING	
	Error.reason	String	ExecutedDateTimeNotProvided	
	Error.details	String	Executed date time is not provided for entities: {0}. It will be defaulted to date time now.	
Changed SwitchingSteps – Switching step execution result is Failed	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where for several switching steps execution result will be failed. Valid switching steps are processed, while for invalid ones, appropriate error is returned. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	6.1	
	Error.level	String	FATAL	
	Error.reason	String	StatusTransitionIsNotExecutedSuccessfully	
	Error.details	String	Execute of switching steps: {0} failed. Please refer to logs for more details.	
Changed SwitchingSteps – Switching step on remote point	Result	String	PARTIAL/FAILED	External system sends ChangedSwitchingSteps message where for several switching steps are on remotely controlled point. Switching steps on remotely controlled point won be processed. Response message is sent by SMR Adapter with PARTIAL/FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	SwitchingStepIsRemotelyControlled	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.details	String	Switching steps: {0} won't be executed since they are remotely controlled. Please contact the operator.	

8. GETWORKS SERVICE

8.1. GetWorks Operation

8.1.1. Overview

External systems sometimes have a need to pull stored work requests information for various reporting purposes (planned work analysis or for alignment between systems). In order to provide interface for requesting active work requests information, the *GetWorksService* with *GetWorks* operation is available as part of the SMR Interface.

The *GetWorks* operation provides multiple options for pulling active work requests information:

- Pull work request data for all active work requests.
- Pull work request data per mRID.
- Pull work request data per name.
- Pull work request data per usage points mRID.
- Pull work request data per switching plan mRID.
- Pull work request data per period start and period end.

When the work request data needs to be pulled the external system creates the *GetWorks Request* object and invokes the appropriate operation. The SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and pulls the data from the DMZ system.

The *GetWorks Request* object must have the *Header.Context* attribute populated with information which work request data is requested: active. As for the search criteria itself, there are two possible scenarios:

- Work request data can be requested only for one of the mRID or name,
- Work request data can be requested either separately based on following criteria: Switching Plan mRID, Usage Points mRID or in combination with period start and period end.

In all other scenarios, request message will be considered as invalid.

As stated above, the work request data can be obtained by specifying different search criteria:

- *Pull work request data for all active work requests* – if the request message does not contain search criteria, the SMR Adapter populates the *GetWorksResponse* with the information about all active work requests.
- *Pull work request data per name* – the response is populated with information related to that particular work request.
- *Pull work request data per mRID* – the response is populated with information related to that particular work request.
- *Pull work request data per usage points mRID* – the response is populated with active work request information which affects a given usage point.
- *Pull work request data per switching plan mRID* – the response is populated with work requests information related to that particular switching plan.
- *Pull work request per period start and period end* – the response message is populated with active work requests which overlap with the period given in the request message for any period of time.

If the time interval is provided within the request message with arbitrary searching criteria, all work request that comply with searching criteria and provided time interval (work requests planned periods overlap with the period given in the request message for any period of time) are considered. If there is no time interval provided, all work requests which meet the search criteria are considered. Also, since data can constantly grow over time, the requested data can be too large to be returned to the calling system as part of response message.

In that case *GetWorksResponse* message is populated in following way:

- If the time interval is not provided in the request message, return configurable number (by default 500) of work requests sorted by creation time, from latest to oldest.
- If the time interval is provided in the request message with arbitrary search criteria, return configurable number (by default 500) of work requests that comply with searching criteria and provided time interval (work request start time and/or end time fall within specified period from the request message), and sorted by creation time, from latest to oldest.

For all situations reply result should be set to PARTIAL since response message does not contain all of work requests.

If for some reason external systems sends invalid request message, the SMR Adapter returns the *GetWorksFault* object with detailed explanation of the occurred error.

Figure 8.1 provide the visual representation for the described operations.

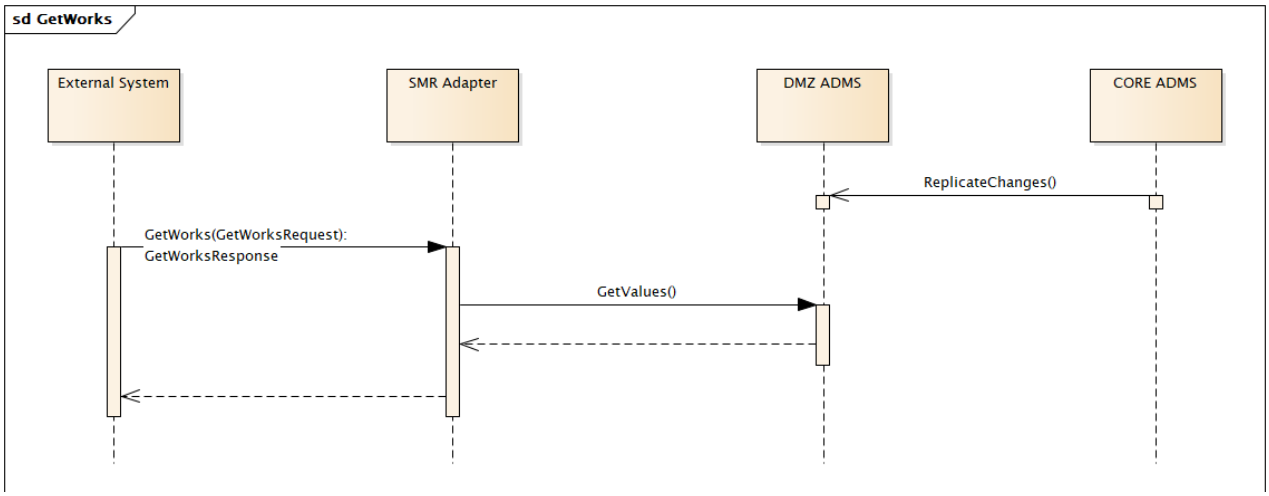

Figure 8.1 – The GetWorks (active) operation execution

8.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 8.1.

Table 8.1 – The GetWorks operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Supported common use cases are described in Table 5.1 – The CreatedWorks operation use cases				
Invalid Context	Result	String	FAILED	External system sends request message with invalid Context. Response message is sent by SMR Adapter with FAILED result and message is discarded.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidContext	
	Error.details	String	Invalid context: {0}.	
Get Works – Message contains period start and end matching with work requests planned periods	Result	String	OK	External system sends GetWorks request message with start and end period that overlap with work requests planned periods. Response message is sent by SMR Adapter with OK result. SMR Adapter returns work requests which overlap with the period given in the request message for any period of time.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains valid work request name	Result	String	OK	External system sends GetWorks request message with valid work request external system mRID. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains valid work request mRID	Result	String	OK	
	Error.code	String	N/A	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	N/A	External system sends GetWorks request message with valid work request mRID. Response message is sent by SMR Adapter with OK result.
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains valid SwitchingPlan.mRID	Result	String	OK	External system sends GetWorks request message with valid switching plan mRID. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains Usage Point mRID affected by Work Request(s)	Result	String	OK	External system sends GetWorks request message with Usage Point mRID that is affected by Work Request(s). Response message is sent by SMR Adapter with OK result. Payload contains information about Work Request(s)
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains Usage Point mRID affected by Work Request(s) and period start and period end	Result	String	OK	External system sends GetWorks request message with Usage Point mRID and period start and end. In EcoStruxure GridOps there is at least one work request that affects usage point from message and planned period for that work request overlaps with period given in message. Response message is sent by SMR Adapter with OK result. Payload contains information about Work Request that satisfy searching criteria.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains invalid work request name	Result	String	FAILED	External system sends GetWorks request message with work request name that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity name(s): {0}.	

Use Case	Message Mapping			Action
	Property	Type	Value	
Get Works – Message contains invalid work request mRID	Result	String	FAILED	External system sends GetWorks request message with work request mRID that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity mRID(s): {0}.	
Get Works – Work Request does not contain switching plan	Result	String	OK	External system sends GetWorks request message with valid switching plan mRID or switching plan name, but given switching plan does not contain any work request. Response message with empty payload is sent by SMR Adapter with OK result.
	Error.code	String	2.7	
	Error.level	String	INFORM	
	Error.reason	String	EntityNotFound	
	Error.details	String	No data found for provided search criteria: {0}.	
Get Works – No Work Requests found for provided search criteria	Result	String	OK	External system sends GetWorks request message with valid search criteria. Response message is sent by SMR Adapter with OK result and empty payload.
	Error.code	String	2.7	
	Error.level	String	INFORM	
	Error.reason	String	EntityNotFound	
	Error.details	String	No data found for provided search criteria: {0}.	
Get Works – Message does not contain search criteria	Result	String	OK	External system sends GetWorks request message without search criteria specified. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get Works – Message contains multiple search criteria	Result	String	FAILED	
	Error.code	String	1.2	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	FATAL	External system sends GetWorks request message with both work request mRID and e.g switching plan mRID specified. Response message is sent by SMR Adapter with FAILED result.
	Error.reason	String	MultipleSearchCriteriaProvided	
	Error.details	String	Multiple search criteria provided in request message.	
Get Works – Message contains Period.end time before Period.start time	Result	String	FAILED	External system sends GetWorks request message with Period.end time that is before Period.start time. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EndTimeBeforeStartTime	
	Error.details	String	Invalid period is provided. End time is before start time.	
Get Works – Message contains period start and end where no one of the work requests have planned period overlapping with period provided in message	Result	String	OK	External system sends GetWorks request message with period start and end which does not match with work requests planned periods. Response message is sent by SMR Adapter with OK result and empty payload.
	Error.code	String	2.7	
	Error.level	String	INFORM	
	Error.reason	String	EntityNotFound	
	Error.details	String	No data found for provided search criteria: {0}.	
Get Works – Message contains invalid switching plan mRID	Result	String	FAILED	External system sends GetWorks request message with switching plan mRID that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity mRID(s): {0}.	

9. GETSWITCHINGPLANS SERVICE

9.1. GetSwitchingPlans Operation

9.1.1. Overview

External systems sometimes have a need to pull stored switching plan information for various reporting purposes (planned work analysis or for alignment between systems). In order to provide interface for requesting active switching plan information, the *GetSwitchingPlansService* with *GetSwitchingPlans* operation is available as part of the SMR Interface.

The *GetSwitchingPlans* operation provides multiple options for pulling active switching plans information:

- Pull switching plan data for all active switching plans.
- Pull switching plan data per switching plan mRID.
- Pull switching plan data per work request name.
- Pull switching plan data per work request mRID.
- Pull switching plan data per usage points mRID.
- Pull switching plan data per usage points mRID and period start and period end.
- Pull switching plan data per status.

When the switching plan data needs to be pulled the external system creates the *GetSwitchingPlans Request* object and invokes the appropriate operation. The SMR Adapter performs initial validation of the received data, transforms it into the appropriate internal format and pulls the data from the DMZ system.

The *GetSwitchingPlans Request* object must have the *Header.Context* attribute populated with information which switching plan data is requested from: active. As for the search criteria itself, there are two possible scenarios:

- Switching plan data can be requested only for one of: switching plan mRID, work request mRID or work request name.
- Switching plan data can be requested either separately based on following criteria: status, usage points mRID. The switching plan data can be obtained by combining usage point mRID and period start and period end.

In all other scenarios, request message will be considered as invalid.

As stated above, the switching plan data can be obtained by specifying different search criteria:

- *Pull switching plan data for all active switching plans* – if the request message does not contain search criteria, the SMR Adapter populates the *GetSwitchingPlansResponse* with the information about all active switching plans.
- *Pull switching plan data per switching plan mRID* – the response is populated with information related to that particular switching plan.
- *Pull switching plan data per work request name* – the response is populated with information about switching plan related to that particular work request.
- *Pull switching plan data per usage points mRID* – the response is populated with active switching plan information which affects a given usage point.

- *Pull switching plan data per usage points mRID and period start and period end* – the response is populated with active switching plan information which affects usage point mRID and provided time interval (switching plans planned periods overlap with the period given in the request message).
- *Pull switching plan data per switching plan status* – the response is populated with active switching plans information that are with specified status.

Since data can constantly grow over time, the requested data can be too large to be returned to the calling system as part of response message. In that case *GetSwitchingPlansResponse* message is populated in following way:

- Response message contains configurable number (by default 500) of switching plans sorted by creation time, from latest to oldest.

Reply result should be set to PARTIAL since response message does not contain all of switching plans.

If for some reason external systems sends invalid request message, the SMR Adapter returns the *GetSwitchingPlansFault* object with detailed explanation of the occurred error.

Figure 9.1 provide the visual representation for the described operations.

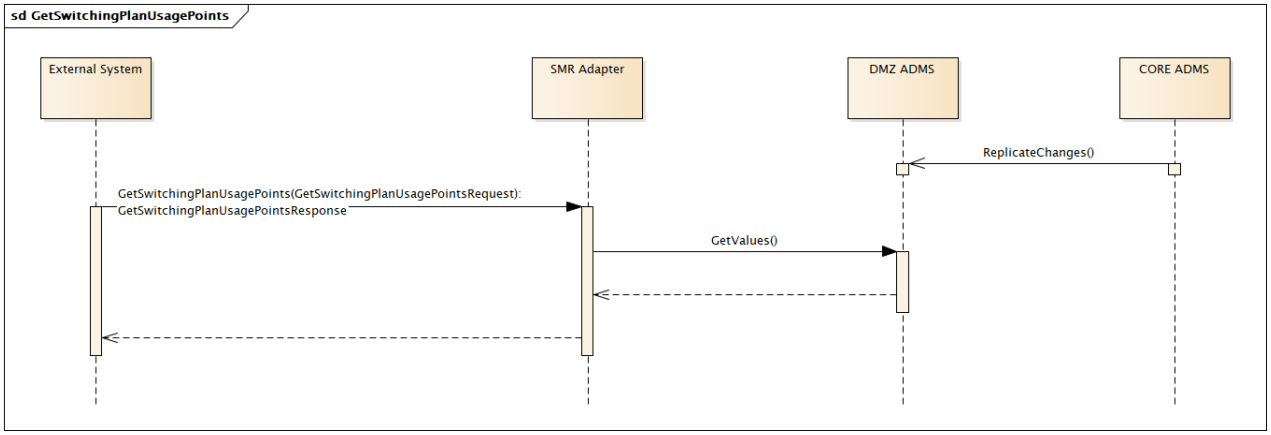

Figure 9.1 – The GetSwitchingPlans (active) operation execution

9.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 8.1.

Table 9.1 – The GetSwitchingPlans operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Supported common use cases are described in Table 5.1 – The CreatedWorks operation use cases				
Get SwitchingPlans – Message contains valid SwitchingPlan.mRID	Result	String	OK	External system sends GetSwitchingPlans request message with valid SwitchingPlan.mRID. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains valid work request name	Result	String	OK	External system sends GetSwitchingPlans request message with valid work request name. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains valid work request mRID	Result	String	OK	External system sends GetSwitchingPlans request message with valid work request mRID. Response message is sent by SMR Adapter with OK result.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains valid status	Result	String	OK	
	Error.code	String	N/A	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.level	String	N/A	External system sends GetSwitchingPlans request message with valid switching plan status. Response message is sent by SMR Adapter with OK result. NOTE: If period start and end date are specified, SMR Adapter returns switching plans which overlap with the period given in the request message for any period of time.
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains Usage Point mRID affected by Switching Plan(s)	Result	String	OK	External system sends SwitchingPlans request message with Usage Point mRID that is affected by Switching Plan(s). Response message is sent by SMR Adapter with OK result. Payload contains information about Switching Plan(s)
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains Usage Point mRID affected by Switching Plan(s) and period start and period end	Result	String	OK	External system sends SwitchingPlans request message with Usage Point mRID and period start and end. In EcoStruxure GridOps there is at least one switching plan that affects usage point from message and planned period for that switching plan overlaps with period given in message. Response message is sent by SMR Adapter with OK result. Payload contains information about Switching Plan(s) that satisfy searching criteria.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains invalid SwitchingPlan mRID	Result	String	FAILED	External system sends GetSwitchingPlans request message with switching plan mRID that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity mRID(s): {0}.	
Get SwitchingPlans – Message contains invalid work request name	Result	String	FAILED	External system sends GetSwitchingPlans request message with work request name that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity name(s): {0}.	
Get SwitchingPlans – Message contains invalid work request mRID	Result	String	FAILED	External system sends GetSwitchingPlans request message with work request mRID that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	EntityNotFound	
	Error.details	String	Invalid entity mRID(s): {0}.	
Get SwitchingPlans – Message contains invalid status	Result	String	FAILED	External system sends GetSwitchingPlans request message with switching plan status that does not exist. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	2.7	
	Error.level	String	FATAL	
	Error.reason	String	InvalidStatus	
	Error.details	String	Invalid status: {0}	
Get SwitchingPlans – Switching Plan does not contain work request	Result	String	OK	External system sends GetSwitchingPlans request message with valid work request mRID, but given work request does not contain any switching plan. Response message with empty payload is sent by SMR Adapter with OK result.
	Error.code	String	2.7	
	Error.level	String	INFORM	
	Error.reason	String	EntityNotFound	
	Error.details	String	No data found for provided search criteria: {0}.	
Get SwitchingPlans – No Switching Plans found for provided search criteria	Result	String	OK	External system sends GetSwitchingPlans request message with valid search criteria. Response message is sent by SMR Adapter with OK result and empty payload.
	Error.code	String	2.7	
	Error.level	String	INFORM	
	Error.reason	String	EntityNotFound	
	Error.details	String	No data found for provided search criteria: {0}.	
Get SwitchingPlans –	Result	String	OK	

Use Case	Message Mapping			Action
	Property	Type	Value	
Message does not contain search criteria	Error.code	String	N/A	External system sends GetSwitchingPlans request message without search criteria specified. Response message is sent by SMR Adapter with OK result.
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Get SwitchingPlans – Message contains multiple search criteria	Result	String	FAILED	External system sends GetSwitchingPlans request message with both work request mRID and e.g switching plan mRID specified. Response message is sent by SMR Adapter with FAILED result.
	Error.code	String	1.2	
	Error.level	String	FATAL	
	Error.reason	String	MultipleSearchCriteriaProvided	
	Error.details	String	Multiple search criteria provided in request message.	

10. MESSAGES

10.1. Common

10.1.1. Header

The header section is defined according to the IEC 61968-100 standard. Currently, there are two required fields that must be populated:

- ***Verb*** – to identify a specific action to be taken. There is an enumerated set of valid verbs, where commonly used values include “get”, “create”, “change”, “cancel”, “close”, “execute” and “reply”. Within the event notification messages “past tense” verbs are used, which can include “created”, “changed”, “canceled”, “closed” and “executed”.
- ***Noun*** – to identify the subject of the action and/or the type of the payload, such as Works, SwitchingPlans, SwitchingSteps etc.

Field that can be optionally supplied include the following:

- Revision – to indicate the revision of the message definition. By default, this should be “1”.
- ReplayDetection – this is a complex element with a timestamp and a nonce used to guard against replay attacks. The timestamp is generated by the source system to indicate when the message was created. The nonce is a sequence number or randomly generated string (e.g. UUID) that would not be repeated by the source system for at least a day. This serves to improve encryption.
- ***Context*** – a string that can be used to identify the context of the message. This can help provide an application level guard against incorrect message consumption in configurations where there may be multiple system environments running over the same messaging infrastructure. Some example values are PRODUCTION, TESTING, STUDY and TRAINING.
- Timestamp – an ISO 8601 compliant string that identifies the time the message was sent. This is analogous to the JMSTimestamp provided by JMS. Either Zulu (‘Z’) time or time with a time zone offset may be used.
- Source – identifying the source of the message, which should be the name of the system or organization.
- AsyncReplyFlag – the Boolean data type (“true” or “false” values) that indicates whether a reply message will be sent asynchronously. By default, replies are assumed to be sent synchronously.
- ReplyAddress – the address to which replies should be sent. This is typically used for asynchronous replies. This should take the form of a URL, topic name or queue name. This is analogous to the JMSReplyTo field provided by JMS. This is ignored when using unidirectional integration patterns (e.g., AckRequired=false). If the reply address is a topic, the topic name should be prefixed by “topic”. If the reply address is a queue, the queue name should be prefixed by “queue”. If the reply address is a web service, the reply address should be a URL beginning with “http://” or “https:/”.
- AckRequired – the Boolean data type (“true” or “false” values) that indicates whether an acknowledgement is required. If false, this would indicate that a unidirectional integration pattern is being used for communicating transactional messages.

- User – a complex structure that identifies the user and associated organization. Should be supplied as it may be required for some interfaces, depending upon underlying implementations. This allows the UsersID string and optional the Organization string as sub-elements.
- MessageID – a string that uniquely identifies a message. Use of the UUID or sequence number is recommended. This is analogous to the JMSMessageID provided by JMS. A process should not issue two messages using the same MessageID value.
- CorrelationID – this is used to “link” messages together. This can be supplied on a request, so that the client can correlate a corresponding reply message. The server will place the incoming CorrelationID value as the CorrelationID on the outgoing reply. If not supplied on the request, the CorrelationID of the reply should be set to the value of the MessageID that was used on the request, if present. This is analogous to the use of the JMSCorrelationID provided by JMS. Given that the CorrelationID is used to ‘link’ messages together, it may be reused on more than one message. Use of a UUID or sequence number is recommended.
- Comment – any descriptive text, but shall never be used for any processing logic.
- Property – a complex type that allows the custom name/value pairs to be conveyed. The source and targets would need to agree upon usage. These are analogous to a Property as defined by JMS.
- Any – it can be used for custom extensions.

Figure 10.1 shows the graphical representation of the header field.

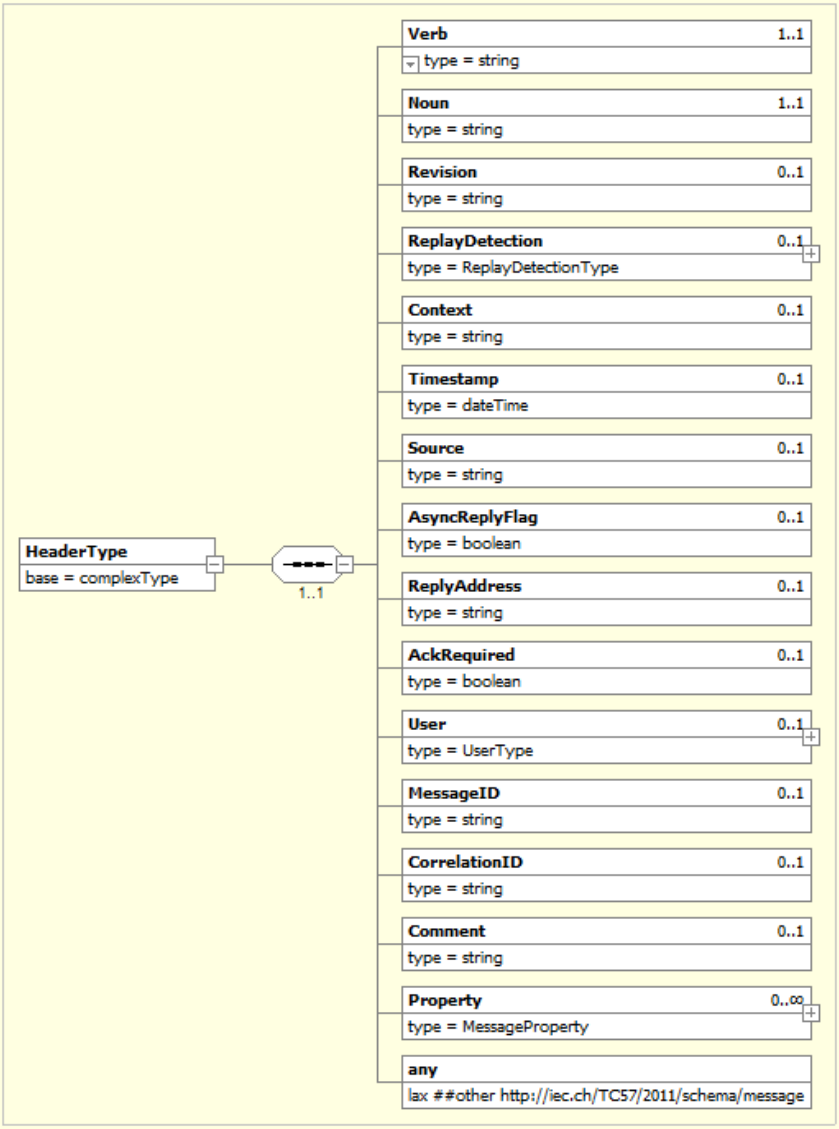

Figure 10.1 – The header field

10.1.2. Reply and Fault

The Reply.result value is an enumeration and would be populated in the following manner:

- "OK" – if there are no errors and all results have been returned. There is no requirement that a Reply.Error element be present.
- "PARTIAL" – if only a partial set of results has been returned, with or without errors. Existence of errors is indicated with one or more Reply.Error.code elements.
- “FAILED" – if no result can be returned due to one or more errors, indicated with one or more Reply.Error elements, each with a mandatory application level ‘code’.

If the result type is “PARTIAL” or “FAILED”, the **Error** field will be populated with the appropriate error description. The contents the **Reply** and **Error** fields are presented in Figure 10.2.

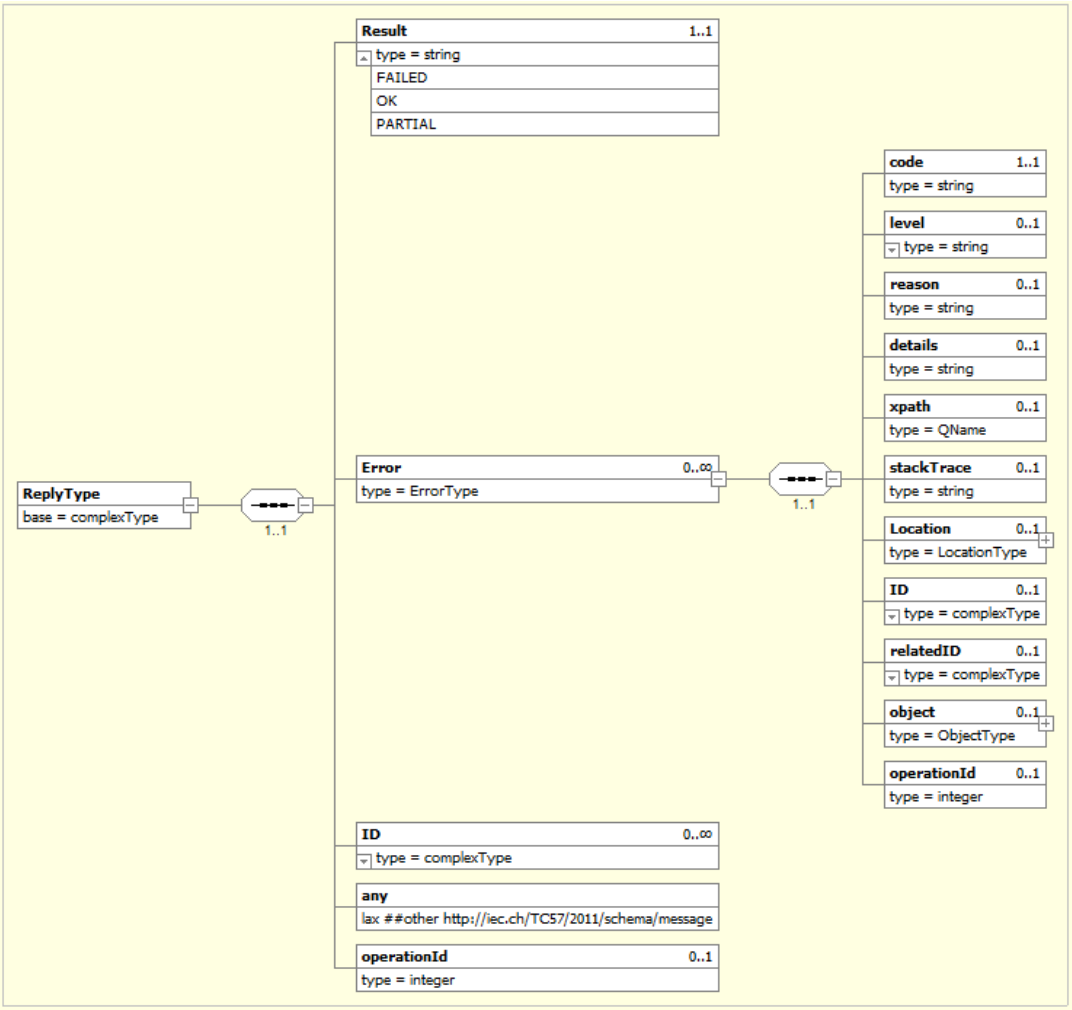

*Figure 10.2 – The **Reply** and **Error** field contents*

10.2. CreatedWorks Operation Messages

The operation definition:

CreatedWorksResponse CreatedWorks(CreatedWorksEvent)

10.2.1. Request

The *CreatedWorks* Event message is defined according to the IEC 61968-100 and contains the following two sections:

- Header
- Payload

CreatedWorks event message is defined in *WorksMessage.xsd* provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

The Payload section carries the CIM defined profile (*Works.xsd*) for insertion of one or several work requests. *Works.xsd* is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Mapping between the Works.xsd and the appropriate entities in the SM model for CreatedWorks operation is given in SMR Integration – Mappings in CreatedWorks sheet (table CreatedWorks message).

10.2.2. Response

After work requests are created, the response is returned in form of the *CreatedWorksResponse* message. The unique identifier of the created work request is returned within the response message. The content is given in SMR Integration – Mappings in CreatedWorks sheet (table CreatedWorksResponse message).

10.2.3. Fault

The *WorksFault* message is depicted in Figure 10.3.

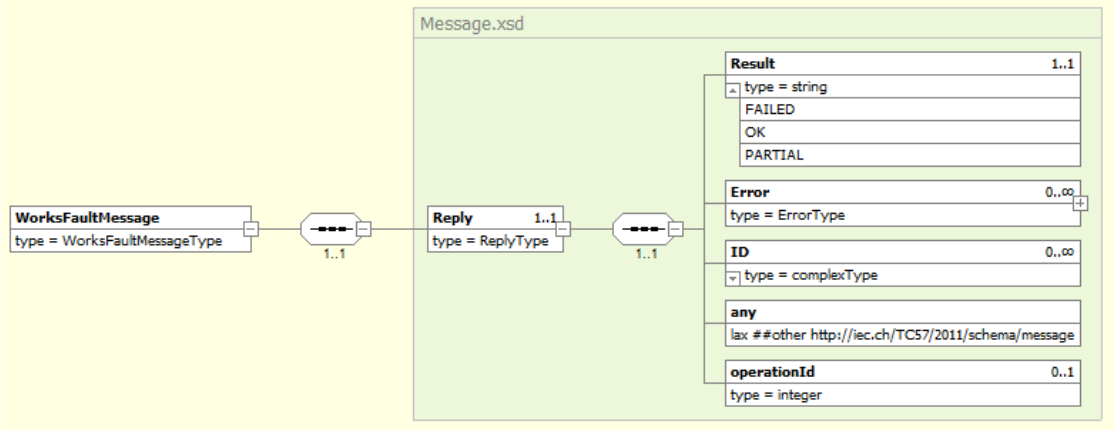

Figure 10.3 – The WorksFault message

10.3. ChangedWorks Operation Messages

The operation definition:

ChangedWorksResponse ChangedWorks(ChangedWorksEvent)

10.3.1. Request

The *ChangedWorks e*vent message is defined according to the IEC 61968-100 and contains the following two sections:

- Header
- Payload

ChangedWorks event message is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3]. The Payload section carries the CIM defined profile (*Works.xsd*) for update of one or several work requests. *Works.xsd* is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching*

Management Reporting Interface.zip file [3]. Mapping between the Works.xsd and the appropriate entities in the SM model for ChangedWorks operation is given in SMR Integration – Mappings in ChangedWorks sheet (table ChangedWorks message).

10.3.2. Response

After work requests are updated, the response is returned in form of the *ChangedWorksResponse* response message. The unique identifier of the changed work request is returned within the response message. The content is given in SMR Integration – Mappings in ChangedWorks sheet (table ChangedWorksResponse message).

10.3.3. Fault

The *WorksFault* message is depicted in Figure 10.3.

10.4. ChangedSwitchingPlans Operation Messages

The operation definition:

ChangedSwitchingPlansResponse ChangedSwitchingPlans(ChangedSwitchingPlansEvent)

10.4.1. Request

The *ChangedSwitchingPlans e*vent message is defined according to the IEC 61968-100 and contains the following two sections:

- Header
- Payload

ChangedSwitchingPlans event message is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3]. The Payload section carries the CIM defined profile (*SwitchingPlans.xsd*) for update of one or several switching plans. *SwitchingPlans.xsd* is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Mapping between the SwitchingPlans.xsd and the appropriate entities in the SM model for ChangedSwitchingPlans operation is given in SMR Integration – Mappings in ChangedSwitchingPlans sheet (table ChangedSwitchingPlans message).

10.4.2. Response

After switching plans are updated, the response is returned in form of the *SwitchingPlans* response message. The unique identifier of the changed switching plan is returned within the response message. The content is given in SMR Integration – Mappings in ChangedSwitchingPlans sheet (table ChangedSwitchingPlansResponse message).

10.4.3. Fault

The *SwitchingPlansFault* message is depicted in Figure 10.4.

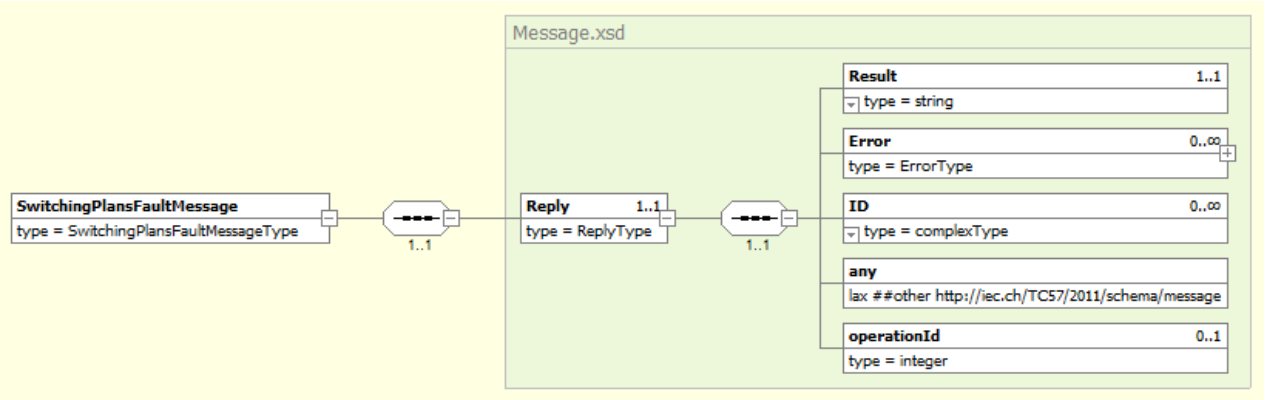

Figure 10.4 – The SwitchingPlansFault message

10.5. ChangedSwitchingSteps Operation Messages

The operation definition:

ChangedSwitchingStepsResponse ChangedSwitchingSteps(ChangedSwitchingStepsEvent)

10.5.1. Request

The *ChangedSwitchingSteps* event message is defined according to the IEC 61968-100 and contains the following two sections:

- Header
- Payload

ChangedSwitchingSteps event message is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3]. The Payload section carries the CIM defined profile (*SwitchingSteps.xsd*) for update of one or several switching steps. *SwitchingSteps.xsd* is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Mapping between the SwitchingSteps.xsd and the appropriate entities in the SM model for ChangedSwitchingSteps operation is given in SMR Integration – Mappings in ChangedSwitchingSteps sheet (table ChangedSwitchingSteps message).

10.5.2. Response

After work requests are updated, the response is returned in form of the *ChangedSwitchingStepsResponse* response message. The unique identifier of the changed switching steps is returned within the response message. The content is given in SMR Integration – Mappings in ChangedSwitchingSteps sheet (table ChangedSwitchingStepsResponse message).

10.5.3. Fault

The *SwitchingStepsFault* message is depicted in Figure 10.5.

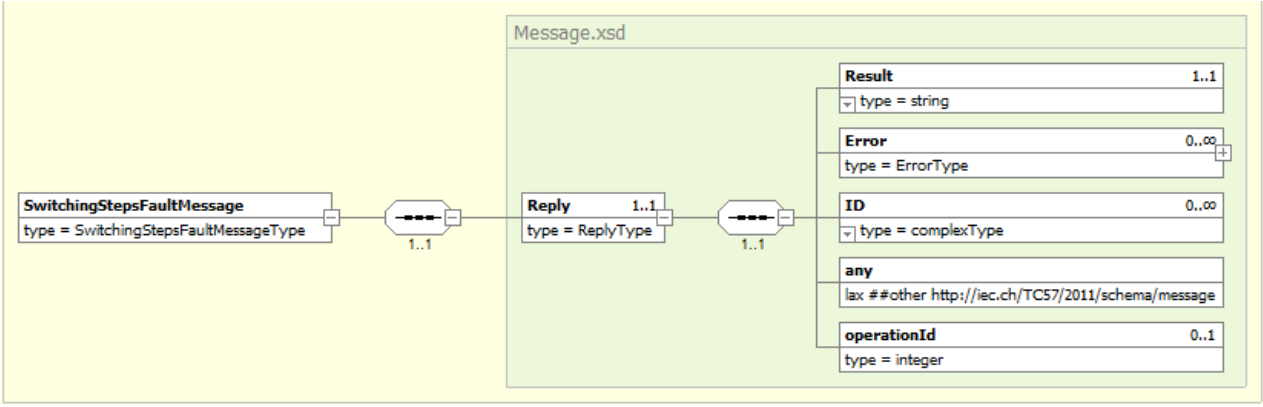

Figure 10.5 – The SwitchingStepsFault message

10.6. GetWorks Operation Messages

The operation definition:

GetWorksResponse GetWorks(GetWorksEvent)

10.6.1. Request

The *GetWorks request* message is defined according to the IEC 61968-100 and contains the following three sections:

- Header
- Request
- Payload

The request message contains the payload in form of the *GetWorks.xsd* schema while the response message contains the payload in form of the *Works.xsd* schema which represents the CIM Profile for work requests. The *Works.xsd* and *GetWorks.xsd* are provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Mapping between the GetWorks.xsd and the appropriate entities in the SM model for GetWorks operation is given in SMR Integration – Mappings in GetWorks sheet (table GetWorks message).

10.6.2. Response

After the *GetWorks* operation is invoked, the appropriate work requests are returned within the *WorksResponse* message. The content of the response message is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Depending on the information provided in the *GetWorks* request message, the response message contains the different level of details related to work requests.

In case when the request message contains the unique identifier of work request (mRID or name), the response message to the calling system contains full set information for work request with the provided mRID or name, otherwise response message contains only the basic information for all work requests.

10.6.2.1. Active-Reduced Set

The mapping between the payload of the *WorksResponse* message and the appropriate entities in the SM model in case that work request data is requested for the active work requests based on searching criteria listed below is given in SMR Integration – Mappings in GetWorks sheet (table GetWorksResponse message - Active Reduced set).

Searching criteria for active work requests – reduced set:

- No search criteria (all active work requests are returned).
- Usage points mRID.
- Switching plan mRID.
- Period start and period end.

10.6.2.2. Active-Full Set

In SMR Integration – Mappings in GetWorks sheet (table GetWorksResponse message - Active Full set) is defined mapping between the payload of the *WorksResponse* message and the appropriate entities in the SM model in case that work request data is requested for the active work requests based on:

- Work request name
- Work request mRID

10.6.3. Fault

The *WorksFault* message is depicted in Figure 10.3.

10.7. GetSwitchingPlans Operation Messages

The operation definition:

GetSwitchingPlansResponse GetSwitchingPlans (GetSwitchingPlansRequest)

10.7.1. Request

The *GetSwitchingPlans* request message is defined according to the IEC 61968-100 and contains the following three sections:

- Header
- Request
- Payload

The request message contains the payload in form of the *GetSwitchingPlans.xsd* schema provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

Mapping between the GetSwitchingPlans.xsd and the appropriate entities in the SM model for GetSwitchingPlans operation is given in SMR Integration – Mappings in GetSwitchingPlans sheet (table GetSwitchingPlans message).

10.7.2. Response

After the *GetSwitchingPlans* operation is invoked, the appropriate switching plans are returned within the *SwitchingPlansResponse* message. The content of the response message is provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management 3.10 Switching Management Reporting Interface.zip* file [3].

Depending on the information provided in the *GetSwitchingPlans* request message, the response message contains the different level of details related to switching plans.

In case when the request message contains the unique identifier of switching plan (switching plan mRID, work request mRID or work request name), the response message to the calling system contains full set information for switching plan with the provided unique identifier, otherwise response message contains only the basic information for all switching plans.

10.7.2.1. Active-Reduced Set

The mapping between the payload of the *SwitchingPlansResponse* message and the appropriate entities in the SM model in case that switching plan data is requested for the active switching plans based on searching criteria listed below is given in SMR Integration – Mappings in GetSwitchingPlans sheet (table GetSwitchingPlansResponse message - Active Reduced set).

Searching criteria for active switching plans – reduced set:

- No search criteria (all active switching plans are returned).
- Switching plan status.
- Usage points mRID.
- Combination Usage points mRID and period start and period end.

10.7.2.2. Active-Full Set

In SMR Integration – Mappings in GetSwitchingPlans sheet (table GetSwitchingPlansResponse message - Active Full set) is defined the mapping between the payload of the *SwitchingPlansResponse* message and the appropriate entities in the SM model in case that switching plan data is requested for the active switching plans based on:

- Work request name
- Work request mRID
- Switching plan mRID

10.7.3. Fault

The *SwitchingPlansFault* message is depicted in Figure 10.4.

11. DEPLOYMENT SPECIFICATION

It is thoroughly described in the *EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification* [2].

The deployment specification is provided in the following table:

Table 11.1 – The deployment specification

Deployment Specification	
Application	SmrAdapter
Critical process	No
OASyS service	OASyS DNA DMS_INTEGRATION Service
Servers	pdmz-int-1, pdmz-int-2, bdmz-int-1, bdmz-int-2
Zone	pdmz, bdmz
Installation Type	Product
Installation add-on name	Integration Adapters

12. INTERFACE CONFIGURATION

SMR adapter provides certain amount of configurability so that smaller adjustments in the functionality can be easily applied to the system, without interface down time. Such feature is provided through dedicated configuration files of the SMR adapter. Initially, following configuration files are used the adapter:

Table 12.1 – The configuration files specification

Name of the config file	Configuration File Description
AdapterSmr	Registry configuration xml file
SmrAdapter_ChangedSwitchingPlans_ErrorConfiguration	Error configuration xml file for ReceiveSwitchingPlans interface
SmrAdapter_ChangedSwitchingSteps_ErrorConfiguration	Error configuration xml file for ReceiveSwitchingSteps interface
SmrAdapter_ChangedWorks_ErrorConfiguration	Error configuration xml file for ReceiveWorks interface
SmrAdapter_CreatedWorks_ErrorConfiguration	Error configuration xml file for ReceiveWorks interface
SmrAdapter_GetSwitchingPlans_ErrorConfiguration	Error configuration xml file for GetSwitchingPlans interface
SmrAdapter_GetWorkRequests_ErrorConfiguration	Error configuration xml file for GetWorks interface
AdapterSmr_WebServiceConfiguration	Web service configuration xml file
SmrStatusTransitionMapping	Status transition mapping xml file

For more details about adapters configuration files refer to the *EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification* [2].

Detailed content of above-mentioned configuration files is provided within the *Configuration* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

13. APPENDIX

13.1. WSDL

The WSDL file, XSD schemas and sample messages defined according to the IEC 61968-100 for all SMR web services are provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

13.2. Message Examples

Message examples for several use cases are provided within the *Message Examples* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

13.3. SMR Integration – Mappings

Message mappings between messages and SM model are provided within the *Data Mappings* folder in the *EcoStruxure GridOps Management Suite 3.10 Switching Management Reporting Interface.zip* file [3].

14. RELEASE NOTES

The following new features related to Product SMR Interfaces were introduced in the software, starting from version 3.8 MHF.

14.1. Software Version 3.8 MHF

Feature	Description
Execute switching steps	Switching Management and Reporting interfaces implements an additional SOAP-based web service operation, ReceiveSwitchingSteps. ReceiveSwitchingSteps is designed for modifying switching instructions from 3rd party field client applications. Web service and appropriate messages are defined in accordance with the latest series of IEC standards (IEC 61968-100).

14.2. Software Version 3.9

Feature	Description
Switching Management and Reporting Interface – Get Interfaces filtering extension	GetWorkRequests and GetSwitchingPlans interfaces are extended to pull active Work Requests and Switching Plans based on SDP CustomID.

15. DEFINITIONS AND ABBREVIATIONS

Definition/Abbreviation	Description
ADMS	Advanced Distribution Management System
CIM	Common Information Model
DMD	Dynamic Mimic Diagram
DMZ	Demilitarized Zone
EAM	Enterprise Asset Management
ESB	Enterprise Service Bus
HTTP	Hypertext Transfer Protocol
IMS	Incident Management Service
mRID	Unique identifier
SD	Safety Document
SDP	Service Delivery Point (Usage Point)
SM	Switching Management
SMR	Switching Management Reporting
SOAP	Simple Object Access Protocol
SP	Switching Plan
WCF	Windows Communication Foundation
WMS	Work Management Service
WR	Work Request
WS	Web Service
XML	Extensible Markup Language
XSD	XML Schema Definition