GridOps Management Suite 3.10

DERMS Interface

Functional Specification

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1. REFERENCES

#	Title	Description
1.	EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification	The document represents a set of common integration principles applied to all baseline integration adapters.
2.	EcoStruxure GridOps Management Suite 3.10 DERMS Interface	EcoStruxure GridOps Management Suite 3.10 DERMS Interface zip file contains essential configuration information, as well as web service definitions complemented with message examples.

2. INTRODUCTION

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

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

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.

Technology achievements in distributed generation, energy storage, smart home devices are known collectively as Distributed Energy Resources (DER), and microgrid technologies have made it feasible for customers to use these technologies to locally generate, store, and manage power at their premises. These DERs are often connected to the grid at the distribution level where their presence in a large scale can be disruptive for the distribution grid and challenges the operational actions to plan, design, operate and manage the distribution grid to ensure reliable supply to each customer. On the other side, DER provides more opportunities for the utility to take all DER advantages they could provide for managing the grid. In most cases, DERs are connected to the grid by inverters, the power converter devices that are highly-capable devices from the perspective of functionalities they provide to support grid operation with fast power controls such that they can respond quickly to commands and local conditions.

Utility must address these challenges and prepare for renewable and distributed energy resource integration by modernizing the electric grid and identify the set of new capabilities required for a managing of the grid in sense to observe, orchestrate and coordinate DERs in a manner such that they not only offer benefit to customers and resource owners, but also act as a grid of assets providing positive value in a safe, reliable, resilient, and flexible manner.

If DER capabilities can be properly exposed and integrated into traditional utility system operations, high penetration of DERs can be transformed from problematic uncertainties to beneficial tools for distribution management.

However, the present generation of utility systems (ADMS and “Utility DERMS” systems) is not designed to support a wide range of communication protocols and to communicate with individual DER, but rather, communicate with an external DER management system which is responsible to manage DER in aggregate. This system is envisioned as a system which manages groups of DER. On the behalf of other interested systems, it manages the communications and control of individual DER (and may do this with a variety of field message protocols) and aggregates this information and communicates with other utility systems (e.g. ADMS or DERMS for utility) via standardized protocols (e.g. CIM-based integration based on IEC 61968-100). In this way, the external DER management system effectively informs other systems regarding the resources available and to exchange information that allows the DER to be managed effectively. The external DER management system can be the DER Aggregator system, microgrid controller, demand response management system (DRMS).

DER group presents a technical or commercial grouping of distributed energy resources (generators and controllable load). It may represent a commercial DER aggregation, virtual power plant, demand response program, micro grid (campus or industrial facilities).

DER can be grouped on different network hierarchy from circuit (feeder) level up to system level in accordance with the main purpose of the group. Thus, end customers participating in a demand response program can be grouped in the DER group on the region or system level to provide demand control for transmission needs. Similarly, DERs can be grouped on circuit (feeder) level to provide support for solving operational issues such as overload, reverse flow or voltage violation, offering the capacity to flexibly manage active, reactive power flow and voltages on the circuit.

The scope of this document is the description of the functions which are primarily intended to support integration between external DER management system and utility systems such as EcoStruxure DERMS or EcoDERMS (Schneider Electric DERMS system tailored for utilities).

2.1. General Architecture

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

3. OVERVIEW

The DERMS interface is implemented through the DERMS Client Adapter component. The adapter component carries the name DERMS Client because it is not directly communicating (or issue commands) to DER groups or individual DERs. DERMS Client adapter represents a component that integrates an external DER management system with EcoStruxure GridOps.

The aforementioned adapter implements (hosts) several SOAP based Web Services with the appropriate set of operations and also behaves as Web Service Client:

- QueryDERGroupStatuses service:
  - QueryDERGroupStatuses operation – Periodically queries information about DER group statuses from external DERMS and updates status information in EcoStruxure GridOps.
- QueryDERGroupForecasts service:
  - QueryDERGroupForecasts operation – Periodically queries information about DER group forecasts schedule for the preconfigured time period that follows and stores the information in EcoStruxure GridOps.
- ExecuteDERGroupDispatches service:
  - CreateDERGroupDispatches operation – Notifies the external DERMS upon the creation of a new DER group dispatch.
- ReceiveDERGroupStatuses service:
  - ChangedDERGroupStatuses operation – External DERMS proactively sends information about DER group statuses modifications.
- ReceiveDERGroupForecasts service:
  - CreatedDERGroupForecasts operation – External DERMS proactively sends information upon the creation of a new DER group forecast schedule.

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

The use case diagram that represents common participants (actors) and users of the aforementioned interfaces in DERMS Client integration is given in Figure 3.1.

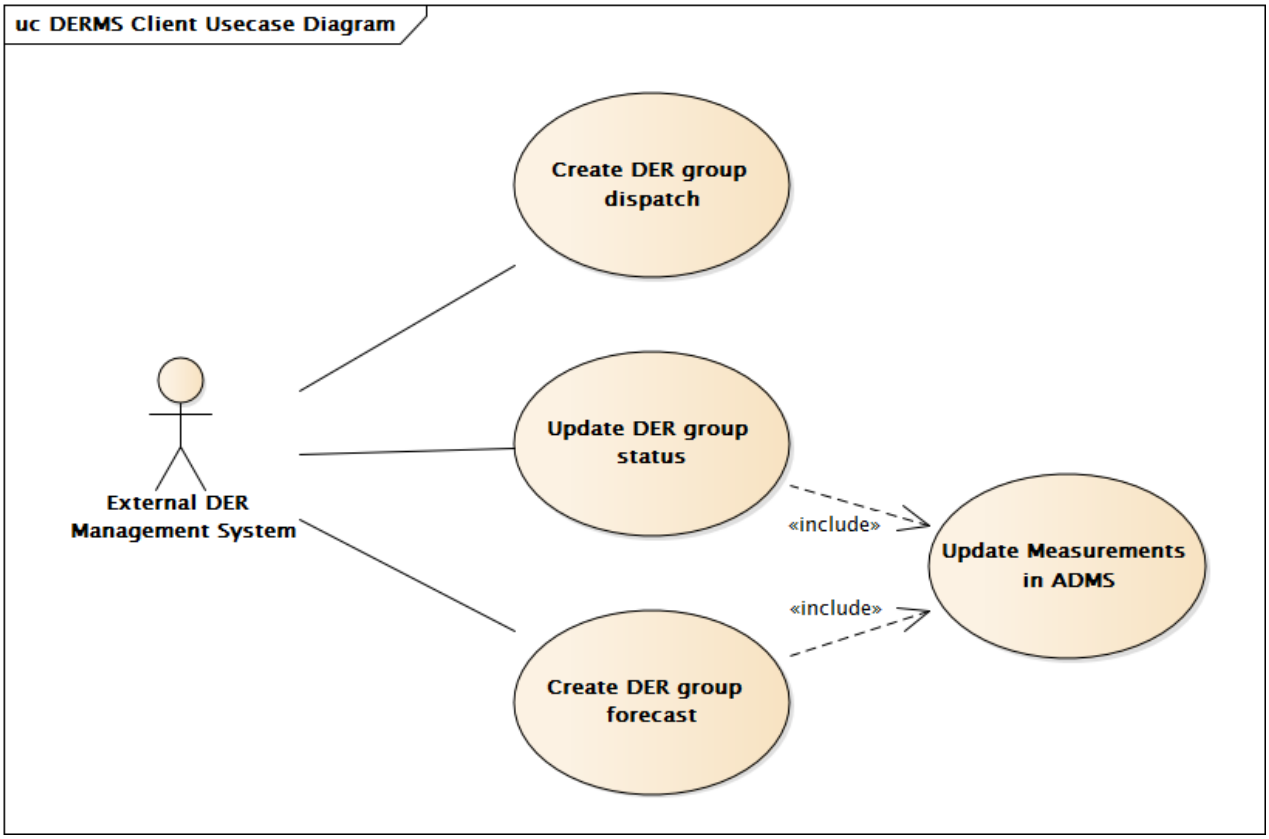

Figure 3.1 – DERMS Client integration use-case diagram

4. FUNCTIONALITY

4.1. QueryDerGroupStatuses Service

4.1.1. QueryDERGroupStatuses Service Operation

4.1.1.1. Overview

The current DER group output and its capability to currently adjust output are presented by:

- Current value – current output.
- Maximum value – maximum capability, or maximum value to which output can be adjusted.
- Minimum value – minimum capability, or minimum value to which output can be adjusted.

Having information about current DER group output from the external system enhances observability of the network and gives information about available DER group flexibility to change its output and help system to solve real-time operational issues.

These measurements are modeled by **MeasuredValue** signals of appropriate type associated with DER group. Current DER capability is modeled by **ControlLimitHigh** and **ControlLimitLow** signals associated with **Control Settings**.

The sequence of events which describe this operation in detail are depicted on Figure 4.1.

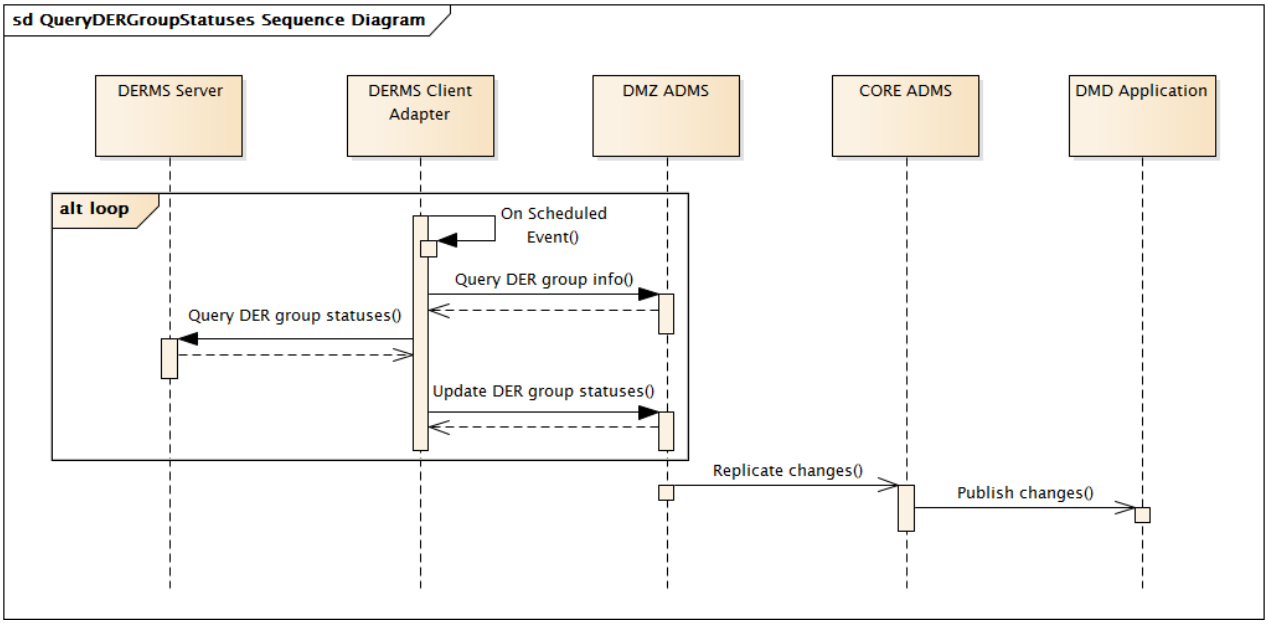

Figure 4.1 – QueryDERGroupStatuses operation sequence diagram

As aforementioned, QueryDERGroupStatuses is a periodical operation. It is triggered by an internal scheduling component. The time period on which this operation is triggered is configurable. Upon receiving the triggering event, the adapter queries the information about currently active DER groups located in the network model service (NMS). A list of DER group names queried from NMS is used to generate a query request to the external DERMS. The synchronous response contains the status updates for requested DER groups.

The DERMS Client 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 system before applying the analog signal value change requests. All changes introduced to the DMZ are asynchronously replicated to the CORE system.

DERMS Client adapter creates a system event for all validation errors encountered which are visible in DMZ and CORE systems.

NOTE: QueryDERGroupStatuses operation is disabled with out-of-the-box product configuration. It is enabled by setting a time period in the adapter registry configuration to a value greater than zero timespan.

4.1.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 4.1.

Table 4.1 – The QueryDerGroupStatuses operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Successful update of all DER Group statuses	Result	String	OK	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and status updates for all DER groups. DERMS Client Adapter stores the status updates in EcoStruxure GridOps.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Partial update of DER Group statuses	Result	String	OK	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and status updates for some DER groups. DERMS Client Adapter stores information about the received DER Groups. Additionally, it logs and events the information about missing status updates that were requested.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Status updates for non-existing DER groups	Result	String	OK	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and status for some DER groups that do not exist in EcoStruxure GridOps. DERMS Client Adapter stores information about existing DER groups. Additionally, it logs and events the information about non existing DER groups in EcoStruxure GridOps.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Status updates are missing	Result	String	OK	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and status for some of
	Error.code	String	N/A	
	Error.level	String	N/A	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	N/A	the requested DER groups. DERMS Client Adapter stores information about existing DER groups. Additionally, it logs and events the information about the requested DER groups updates that were not provided by external DERMS.
	Error.details	String	N/A	
External system is unavailable	Result	String	FAILED	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server is unavailable. DERMS Client Adapter tries to query the data a configurable number of times. After it fails, error message is dumped to log file and system event is created.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
External system replies with a failed response	Result	String	FAILED	DERMS Client adapter periodically queries DER group status updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies with a FAILED response. DERMS Client adapter dumps the response data to log and creates a system event.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	

4.2. QueryDerGroupForecasts Service

4.2.1. QueryDERGroupForecasts Service Operation

4.2.1.1. Overview

DER Group Forecast presents the forecasted output of the DER group and forecasted capability of the DER group to change its output. DER Group Forecast is presented by:

- Forecasted value – forecasted DER group output.
- Maximum forecasted value – maximum output of DER group expected to be available in the future with respect to technical constraints of DER participating in the group.
- Minimum forecasted value – minimum output of DER group expected to be available in the future with respect to technical constraints of DER participating in the group.

Having information about forecasted DER group output and capacity from the external system enhances insight into available DER group capacity and flexibility to support the management of demand on a large-scale level or to be used as resources to resolve some grid operational issues in look-ahead or day-ahead period.

The forecasted schedule and capability of external DER groups are modeled by array signals. These signals are associated with **Control Settings** of the group regulator of the DER group.

The sequence of events which describe this operation in detail are depicted on Figure 4.2.

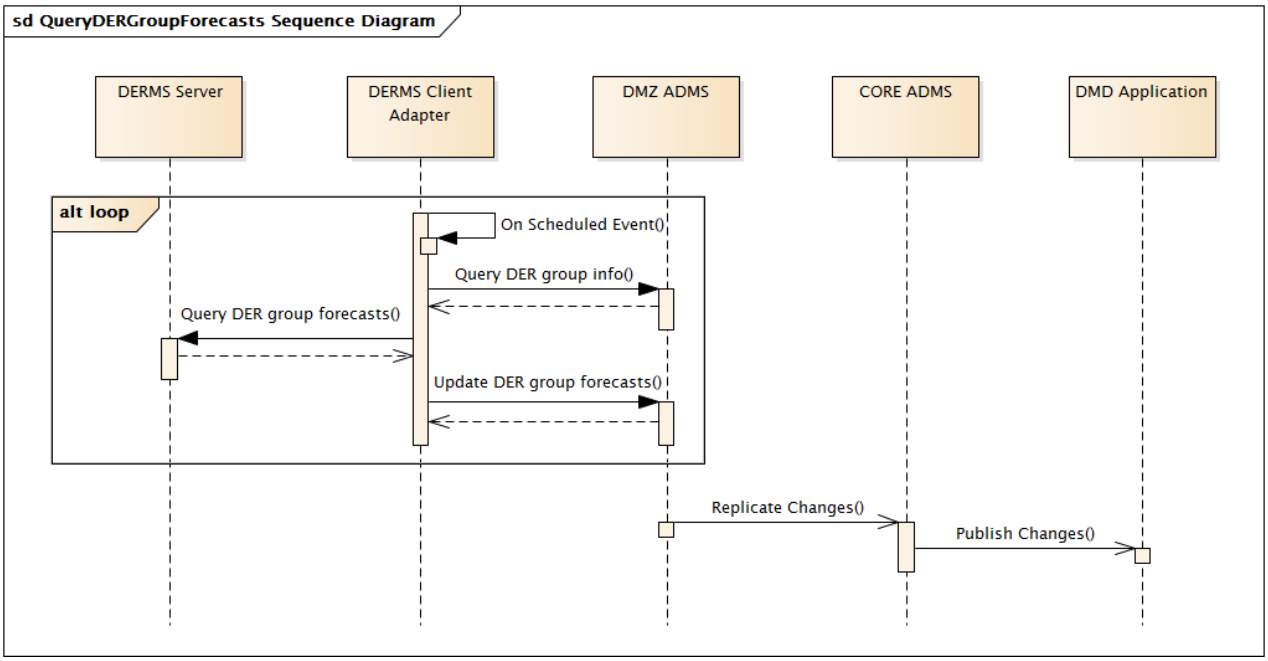

Figure 4.2 – QueryDERGroupForecasts operation sequence diagram

As aforementioned, QueryDERGroupForecasts is a periodical operation. It is triggered by an internal scheduling component. The time period on which this operation is triggered is highly configurable. Upon receiving the triggering event, the adapter queries the information about currently active DER groups located in the network model service (NMS). A list of DER group names queried from NMS is used to generate a

query request to the external DERMS. The synchronous response contains the forecasted output values for requested DER groups.

The DERMS Client 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 system before applying the array signal value change requests. All changes introduced to the DMZ are asynchronously replicated to the CORE system.

DERMS Client adapter creates a system event for all validation errors encountered which are visible in DMZ and CORE systems.

NOTE: QueryDERGroupForecasts operation is disabled with out-of-the-box product configuration. It is enabled by setting a time period in the adapter registry configuration to a value greater than zero timespan.

4.2.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 4.2.

Table 4.2 – The QueryDerGroupForecasts operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Successful update of all DER Group forecasts	Result	String	OK	DERMS Client adapter periodically queries DER group forecast updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and forecast updates for all DER groups. DERMS Client Adapter stores the forecast updates in EcoStruxure GridOps.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Partial update of DER Group statuses	Result	String	OK	DERMS Client adapter periodically queries DER group forecast updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and forecast updates for some DER groups. DERMS Client Adapter stores forecast information for the received DER Groups. Additionally, it logs and events the information about missing forecast updates that were requested.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Status updates for non-existing DER groups	Result	String	OK	DERMS Client adapter periodically queries DER group forecast updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and forecast for some DER groups that do not exist in EcoStruxure GridOps. DERMS Client Adapter stores forecast information about existing DER groups. Additionally, it logs and events the information about non existing DER groups in EcoStruxure GridOps.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Status updates are missing	Result	String	OK	DERMS Client adapter periodically queries DER group forecasts from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies synchronously with an OK result and forecasts for some of the
	Error.code	String	N/A	
	Error.level	String	N/A	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	N/A	requested DER groups. DERMS Client Adapter stores information about existing DER groups. Additionally, it logs and events the information about the requested DER groups forecasts that were not provided by external DERMS.
	Error.details	String	N/A	
External system is unavailable	Result	String	FAILED	DERMS Client adapter periodically queries DER group forecast updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server is unavailable. DERMS Client Adapter tries to query the data a configurable number of times. After it fails, error message is dumped to log file and system event is created.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
External system replies with a failed response	Result	String	FAILED	DERMS Client adapter periodically queries DER group forecast updates from DERMS Server for all DER groups that are currently in EcoStruxure GridOps. DERMS Server replies with a FAILED response. DERMS Client adapter dumps the response data to log and creates a system event.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	

4.3. ExecuteDerGroupDispatches Service

4.3.1. CreateDERGroupDispatches Service Operation

4.3.1.1. Overview

DER Group Dispatch enables control of DER group power output. It presents a request that the power output of the group be set to a specified level in real-time and also in the look-ahead period.

If it is requested by EcoDERMS that the power output of the DER group be adjusted to a certain level, the external DER management system will manage and dispatch individual DER participating in the group so that it satisfies the request. The algorithms and methods by which individual DER are managed is the responsibility of the external DER management system.

The required real-time and look-ahead schedule of the DER group can be sent using **Schedule Interchange** signals. Scheduling of DER group output can be initiated from Demand management (Watt/VAR Flexibility) and Look-Ahead Constraint Management which utilize DER groups as resources along with other traditional resources to control demand on large-scale level or to resolve approaching operational issues.

The sequence of events which describe this operation in detail are depicted on Figure 4.3.

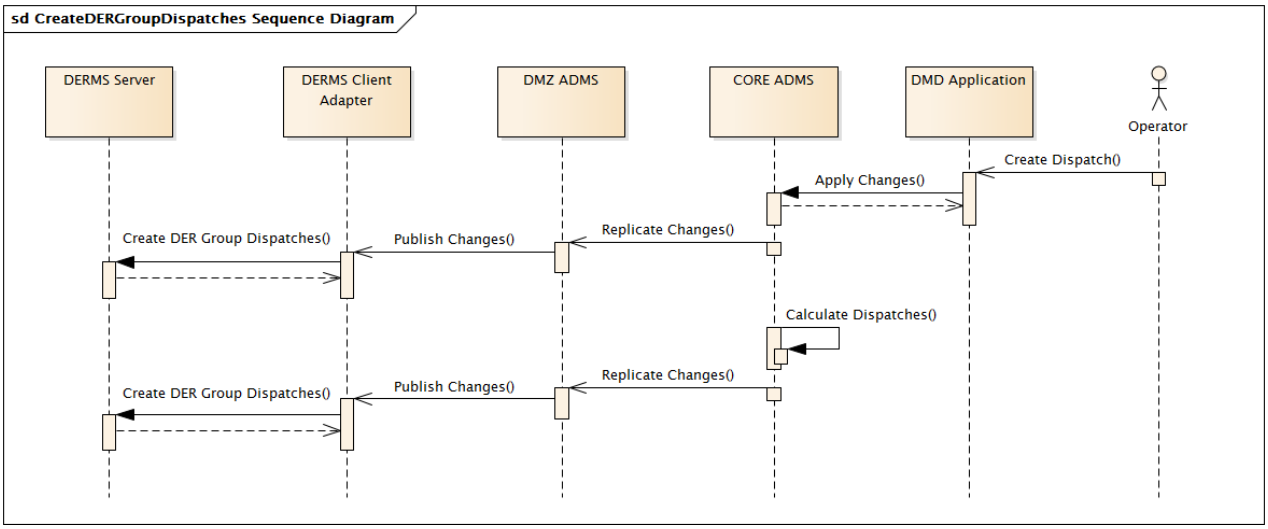

Figure 4.3 – CreateDERGroupDispatches operation sequence diagram

DERMS Client adapter is subscribed to modifications of **Schedule Interchange** signal. Upon receiving information that the value of the aforementioned signal is modified, the adapter creates a DER group dispatch request and forwards it to the external DER management system.

4.3.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 4.3.

Table 4.3 – The CreateDerGroupDispatches operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Successful creation of DER group dispatches	Result	String	OK	DERMS Client adapter receives the information about creation of a new DER group dispatch. It forms a notification messages and sends it to external system. DERMS Client adapter logs the information about successful dispatch notification.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
External system is unavailable	Result	String	FAILED	DERMS Client adapter receives the information about creation of a new DER group dispatch. It forms a notification messages and sends it configurable number of times to external system which is currently unavailable. After it fails, information about failed attempt is logged and system event is created.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
External system replies with a failed response	Result	String	FAILED	DERMS Client adapter receives the information about creation of a new DER group dispatch. It forms a notification messages and sends it external system. External system replies with a FAILED result. Information is logged and system event is created.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	

4.4. ReceiveDerGroupStatuses Service

4.4.1. ChangedDERGroupStatuses Service Operation

4.4.1.1. Overview

Besides the aforementioned periodical update of DER group statuses, described in chapter 4.1.1, DERMS client adapter exposes a service operation to the external DER management system in order to proactively submit DER group output changes.

The sequence of events which describe this operation in detail are depicted on Figure 4.4 – ChangedDERGroupStatuses operation sequence diagram.

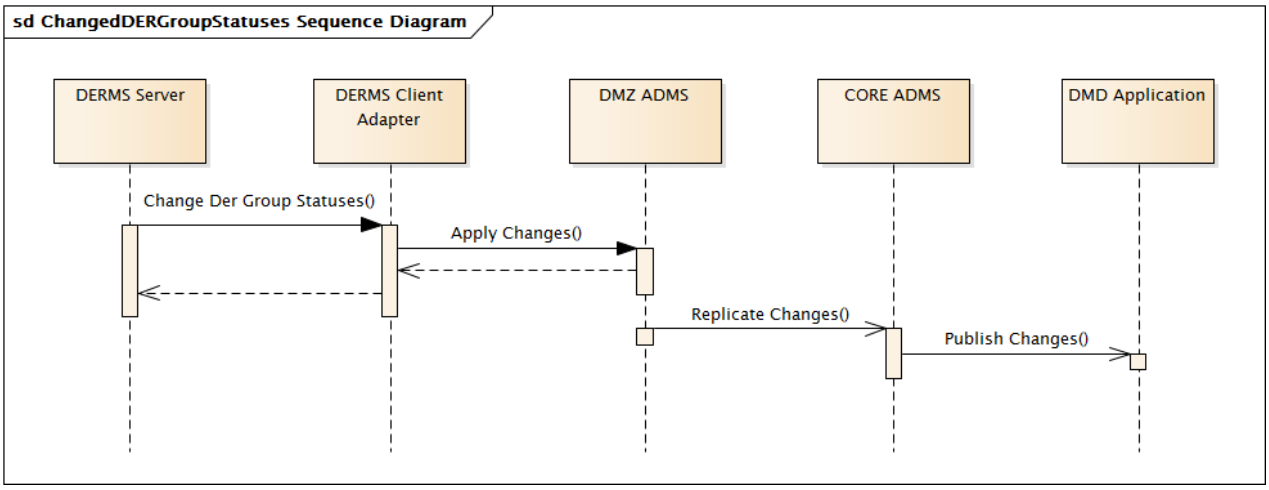

Figure 4.4 – ChangedDERGroupStatuses operation sequence diagram

4.4.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 4.4.

Table 4.4 – The ChangedDERGroupStatuses operation use-cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Successful update of DER group statuses	Result	String	OK	DERMS Client adapter receives the DERGroupStatusesEvent message for several DER groups. All DER groups are present in EcoStruxure GridOps and their status is successfully updated.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Invalid Header Verb	Result	String	FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message with invalid header verb attribute. Response message is sent back by the adapter with FAILED result and the message is discarded.
	Error.code	String	2.9	
	Error.level	String	FATAL	
	Error.reason	String	InvalidVerb	
	Error.details	String	Invalid verb: {0}.	
Invalid Header Noun	Result	String	FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message with invalid header noun attribute. Response message is sent back by the adapter with FAILED result and the message is discarded.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	InvalidNoun	
	Error.details	String	Invalid noun: {0}.	
Unable to process the request	Result	String	FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message for several DER groups. Adapter fails processing the DER group status update request for some reason. Fault response message is returned by DERMS Client adapter.
	Error.code	String	5.3	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	InternalServerError	
	Error.details	String	{0}.	
Non-existing DER groups.	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message for several DER groups. Some of the DER groups do not exist in EcoStruxure GridOps. Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	DerDoesNotExist	
	Error.details	String	DER group(s): {0} does not exist in ADMS.	
Invalid DER parameter value	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message for several DER groups. Some of the DER groups have invalid DER parameter (measurement type). Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	SignalDoesNotExist	
	Error.details	String	DER group(s): {0} has no defined signal measurement for {1}	
Invalid min and max signal relation	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupStatusesEvent message for several DER groups. Some of the DER groups have min signal value higher the max signal value. Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	DerUpdateMinMaxSignalRelation	
	Error.details	String	DER Group(s): {0} has invalid Curve data. Max value cannot be lower than min value.	
Invalid request message against XSD schema	Result	String	FAILED	DERMS Client adapter receives the invalid DERGroupStatusesEvent message against the XSD schema. Response message is sent back by the adapter with FAILED result and the message is discarded.
	Error.code	String	1.8	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	InvalidMessage	
	Error.details	String	Received message is invalid against xsd schema. Reason: {0}.	

4.5. ReceiveDerGroupForecasts Service

4.5.1. CreatedDERGroupForecasts Service Operation

4.5.1.1. Overview

Besides the aforementioned periodical update of DER group forecasted outputs, described in chapter 4.2.1, DERMS client adapter exposes a service operation to the external DER management system in order to proactively submit DER group forecasted output creations.

The sequence of events which describe this operation in detail are depicted on Figure 4.4 – ChangedDERGroupStatuses operation sequence diagram

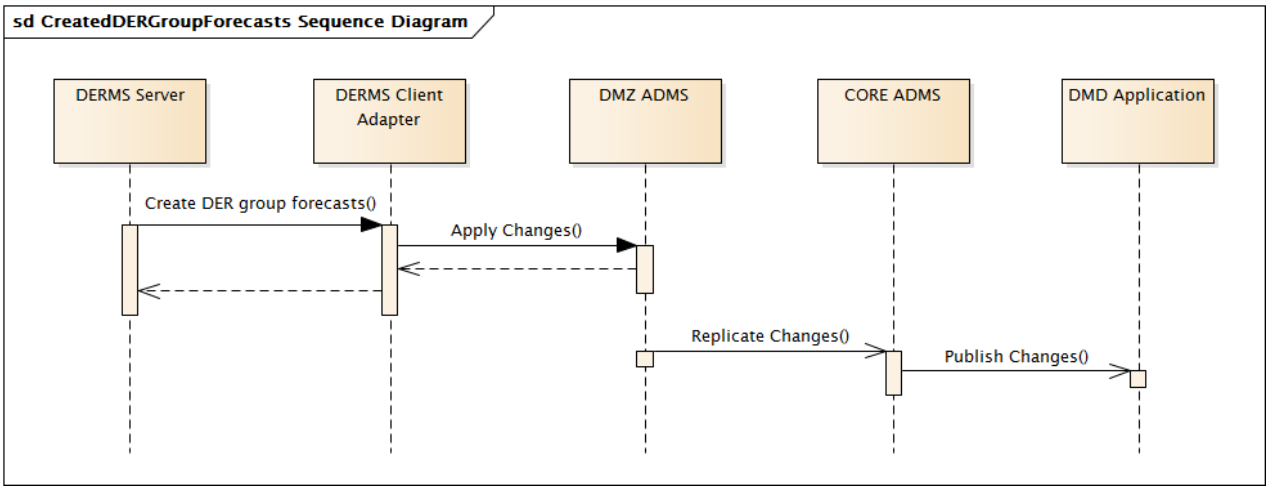

Figure 4.5 – CreatedDERGroupForecasts operation sequence diagram

4.5.1.2. Use Cases

The list of possible use cases and corresponding faults is given in Table 4.5.

Table 4.5 – The CreatedDERGroupForecasts operation use cases

Use Case	Message Mapping			Action
	Property	Type	Value	
Successful creation of DER group forecasts	Result	String	OK	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups. All DER groups are present in EcoStruxure GridOps and their forecast is successfully created.
	Error.code	String	N/A	
	Error.level	String	N/A	
	Error.reason	String	N/A	
	Error.details	String	N/A	
Invalid Header Verb	Result	String	FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message with invalid header verb attribute. Response message is sent back by the adapter with FAILED result and the message is discarded.
	Error.code	String	2.9	
	Error.level	String	FATAL	
	Error.reason	String	InvalidVerb	
	Error.details	String	Invalid verb: {0}.	
Invalid Header Noun	Result	String	FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message with invalid header noun attribute. Response message is sent back by the adapter with FAILED result and the message is discarded.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	InvalidNoun	
	Error.details	String	Invalid noun: {0}.	
Unable to process the request	Result	String	FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups. Adapter fails processing the DER group forecasts creation
	Error.code	String	5.3	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	InternalServerError	request for some reason. Fault response message is returned by DERMS Client adapter.
	Error.details	String	{0}.	
Non-existing DER groups.	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups. Some of the DER groups do not exist in EcoStruxure GridOps. Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	DerDoesNotExist	
	Error.details	String	DER group(s): {0} does not exist in ADMS.	
Invalid DER parameter value	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups. Some of the DER groups have invalid DER parameter (measurement type). Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	SignalDoesNotExist	
	Error.details	String	DER group(s): {0} has no defined signal measurement for {1}	
Invalid min and max signal relation	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups. Some of the DER groups have min value curve higher the max value. Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.code	String	2.5	
	Error.level	String	FATAL	
	Error.reason	String	DerUpdateMinMaxSignalRelation	
	Error.details	String	DER Group(s): {0} has invalid Curve data. Max value cannot be lower than min value.	
Outdated DER curve values	Result	String	PARTIAL/FAILED	DERMS Client adapter receives the DERGroupForecastsEvent message for several DER groups Some DER groups have DER curve values that start and
	Error.code	String	2.5	
	Error.level	String	FATAL	

Use Case	Message Mapping			Action
	Property	Type	Value	
	Error.reason	String	HistoricalForecastData	end in the past. Adapter processes the valid DER group updates, if any, and returns PARTIAL/FAILED response.
	Error.details	String	DER Group(s): {0} have historical Curve data. Changes will not be applied.	
Invalid request message against XSD schema	Result	String	FAILED	DERMS Client adapter receives the invalid DERGroupStatusesEvent message against the XSD schema. Response message is sent back by the adapter with FAILED result and the 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}.	

5. MESSAGES

5.1.1. Common

5.1.1.1. Header

The header section is defined according to the IEC 61968-100. 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 event notification messages "past tense" verbs are used, which can include "created", "changed", "canceled", "closed" and "executed". Implementations should treat deprecated verbs "update" and "updated" as synonyms to "change" and "changed".
- ***Noun*** – to identify the subject of the action and/or the type of the payload, such as DerGroupStatuses, DerGroupForecasts, DerGroupDispatches.

Field that can be optionally supplied include the following:

- ***Revision*** – to indicate the revision of the message definition. By default, this needs to 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 the 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 it is 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 custom name/value pairs to be conveyed. The source and targets would need to agree upon usage. These are analogous to the Property as defined by JMS.
- Any – it can be used for custom extensions.

Figure 5.1 shows the graphical representation of the header section.

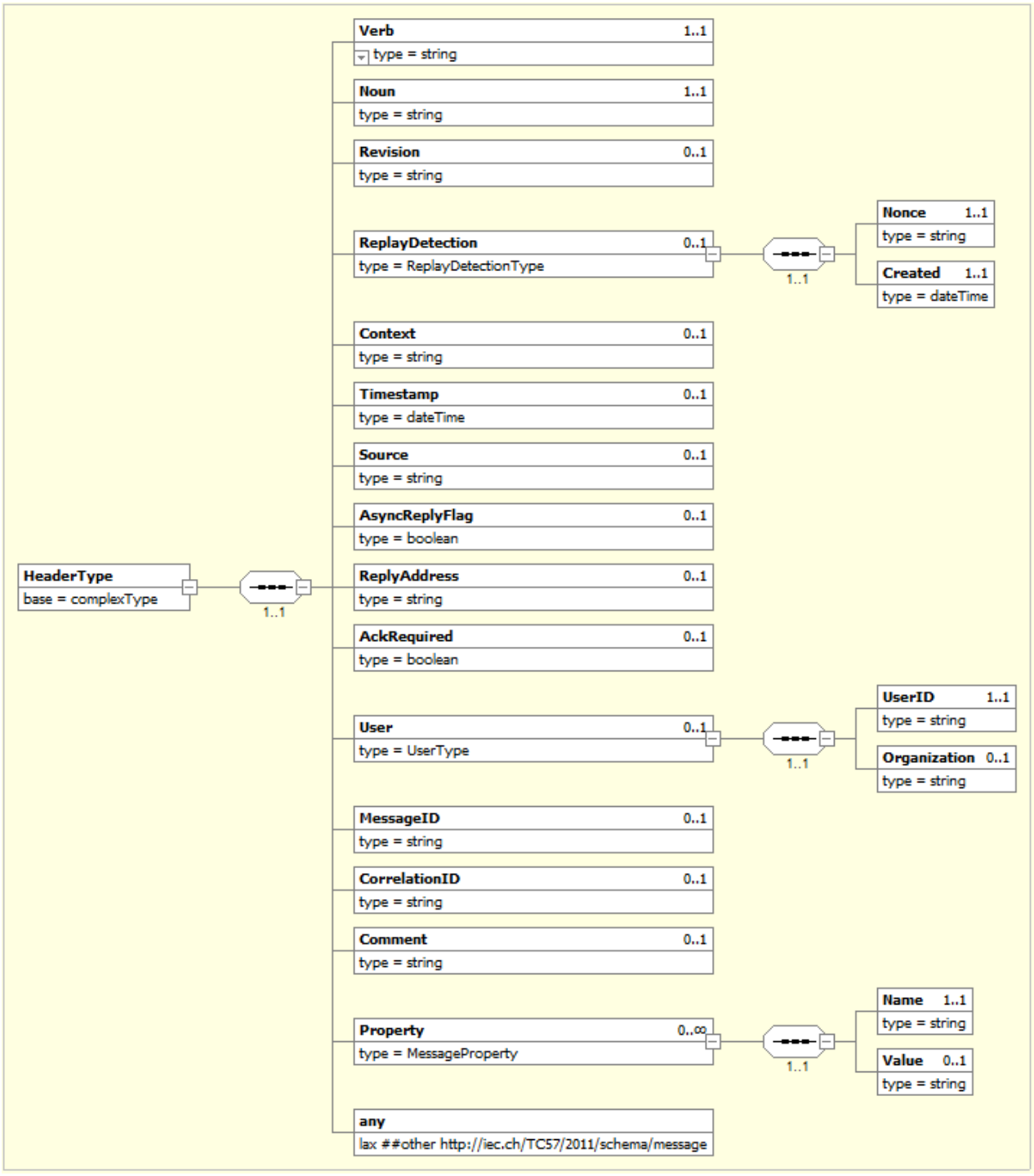

Figure 5.1 – The Header section

5.1.1.2. 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 the 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 the Reply.Error.code elements.
- "FAILED" – if no result can be returned due to one or more errors, indicated with one or more the 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 of the **Reply** and **Error** fields are presented in Figure 5.2.

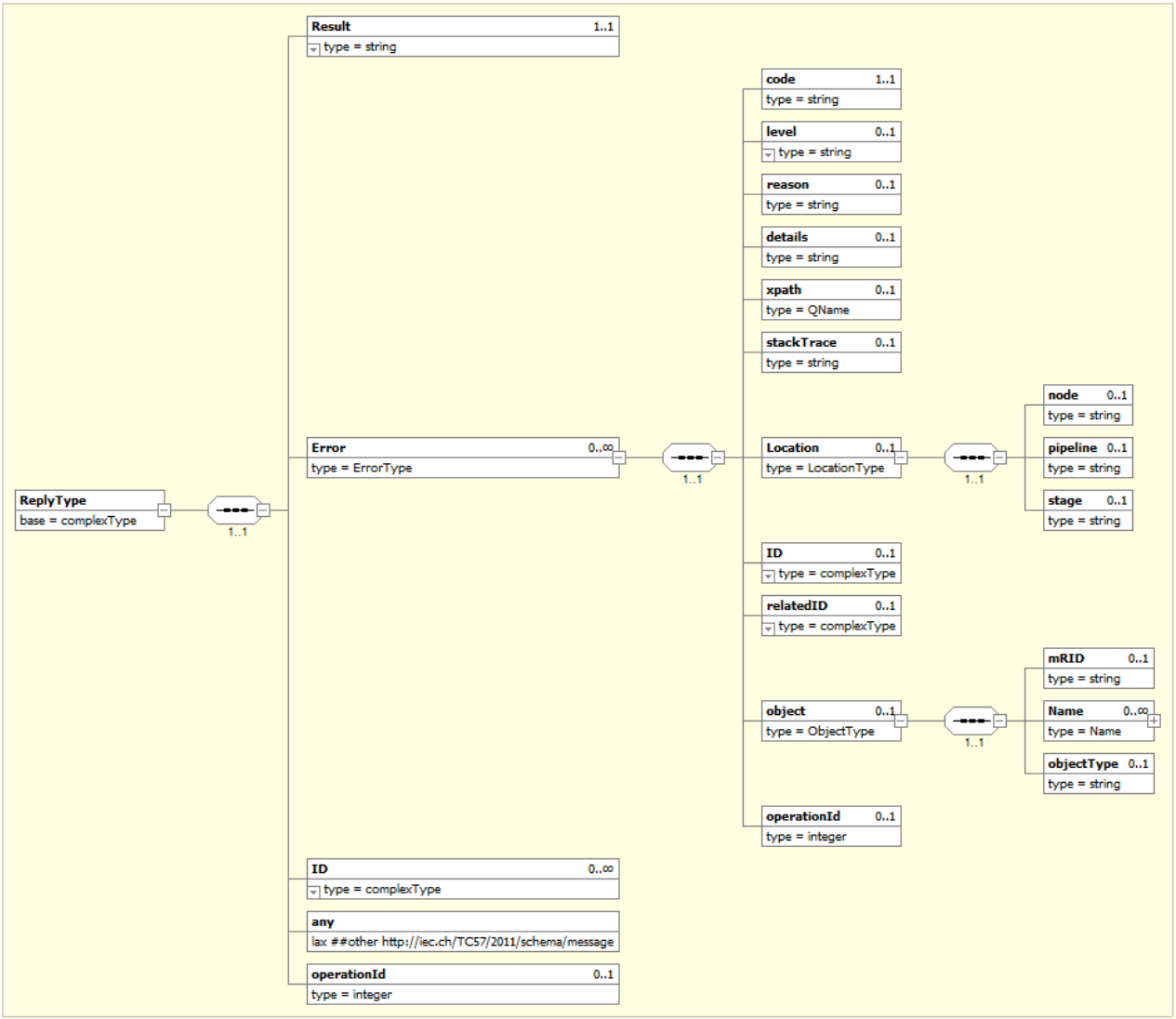

Figure 5.2 – Reply and Error section

5.1.2. QueryDERGroupStatuses Operation Message

The operation definition:

DerGroupStatusQueriesResponseMessage QueryDERGroupStatuses (*DerGroupStatusQueriesRequestMessage*)

5.1.2.1. Request

The *DerGroupStatusQueriesRequest message* is defined according to the IEC 61968-5 and contains the following two sections:

- Header
- Request

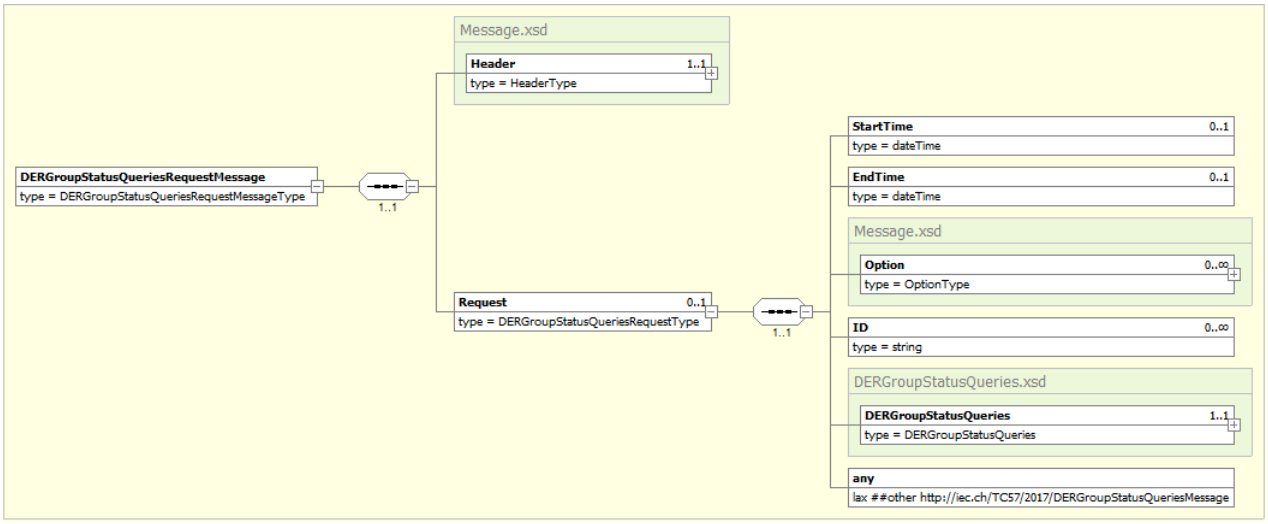

Figure 5.3 – The DerGroupStatusQueriesRequest message

The Payload sections carries the CIM defined profile (*DerGroupStatusQueries.xsd*) for querying of DER group status updates for all DER groups currently in EcoStruxure GridOps. The visual representation of the *DerGroupStatusQueries.xsd* schema is given in Figure 5.4.

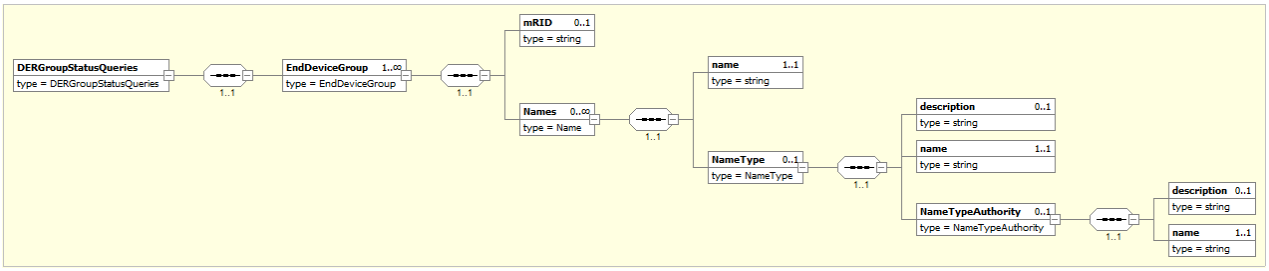

Figure 5.4 – DerGroupStatusQueries.xsd

Table 5.1 defines the mapping between the DERGroupStatusQueriesMessage.xsd and the appropriate entities in the network model.

Table 5.1 – The DERGroupStatusQueries message → network model mapping

DERGroupStatusQueries message			Description	Network model		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be get.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupStatuses	Populated by DERMS Client Adapter	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by DERMS Client Adapter	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by DERMS Client Adapter	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by DERMS Client Adapter	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by DERMS Client Adapter	N/A	N/A
Request	DerGroupStatusQueres.EndDeviceGroups.Names.name	String	DER Group name in EcoStruxure GridOps. Used for querying status updates from external system.	Populated by DERMS Client Adapter	String	IDOBJ_NAME

5.1.2.2. Response

The *DERGroupStatusQueriesResponse message* is defined according to the IEC 61968-5 and contains the following three sections:

- Header
- Reply
- Payload

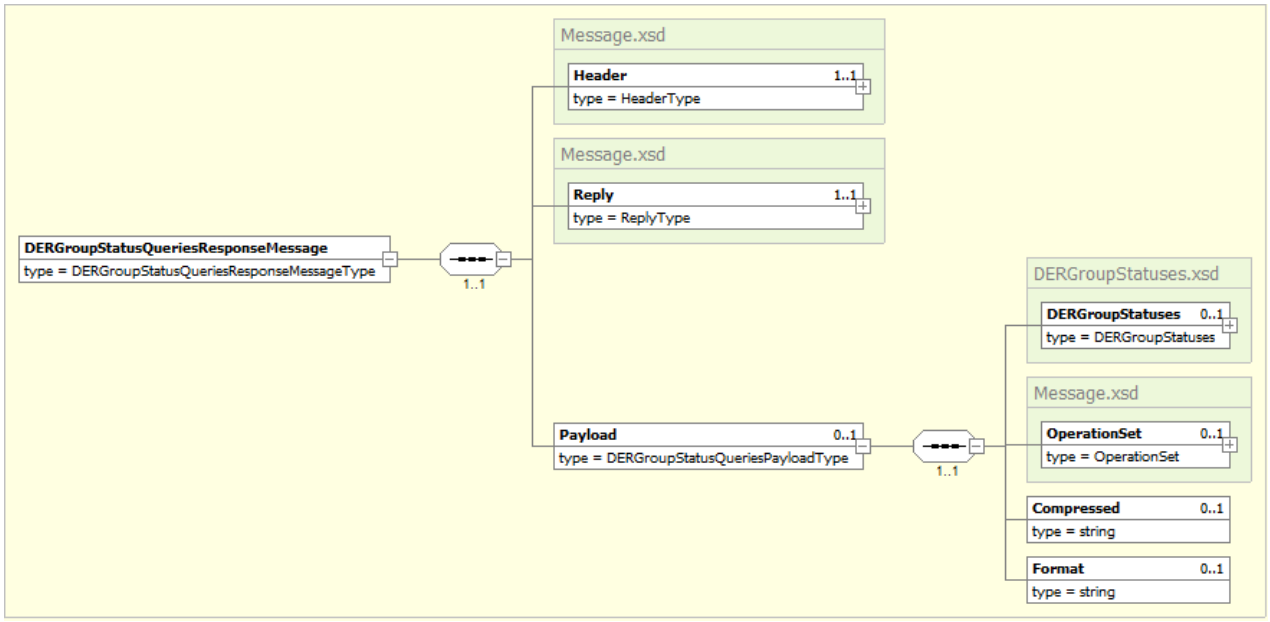

Figure 5.5 – The DERGroupStatusQueriesResponse message

The Payload sections carries the CIM defined profile (*DerGroupStatuses.xsd*) for transferring the data on DER group statuses. The visual representation of the *DerGroupStatuses.xsd* schema is given in Figure 5.6.

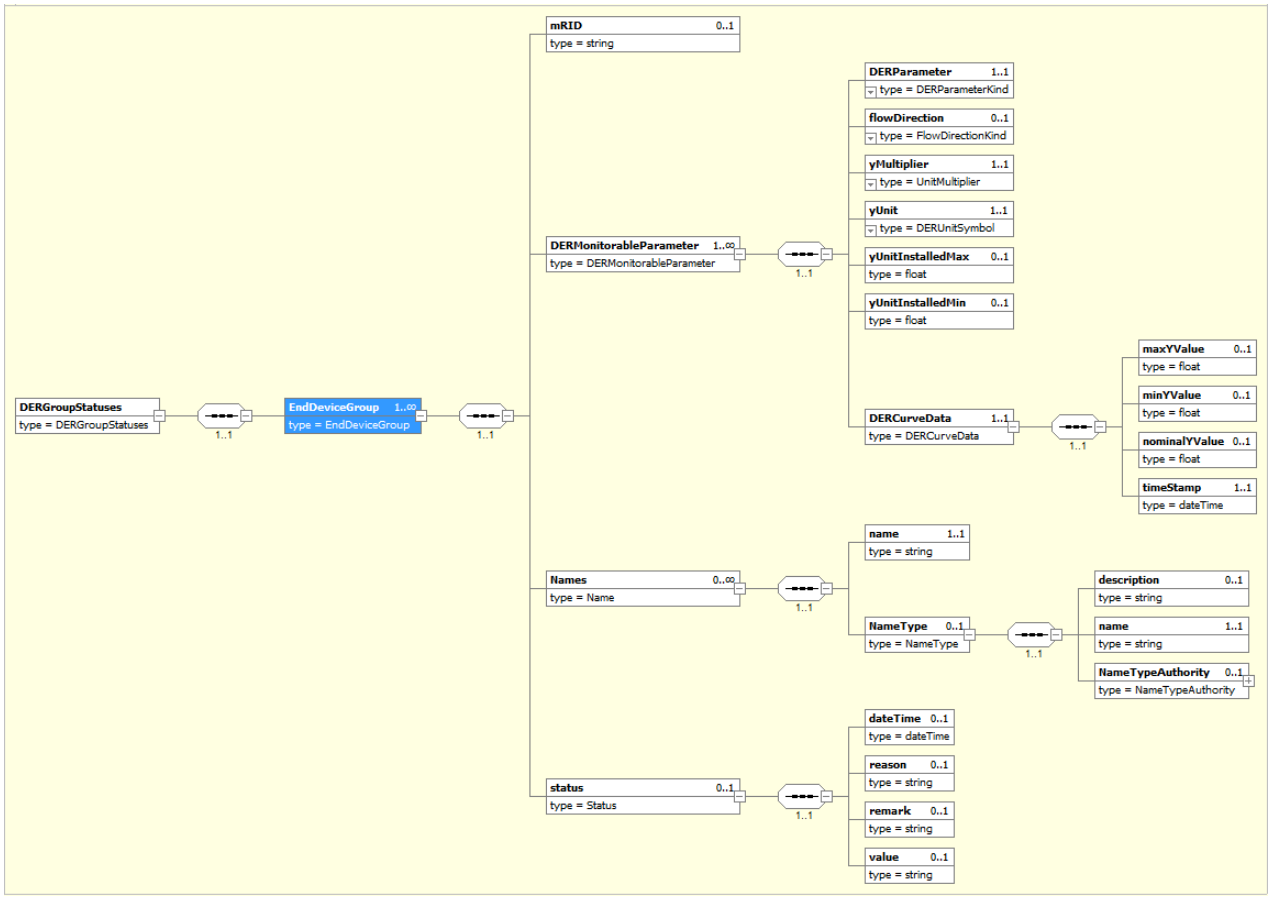

Figure 5.6 – DERGroupStatuses.xsd

Table 5.2 defines the mapping between the DERGroupStatusQueriesMessage.xsd and the appropriate entities in the network model

Table 5.2 – The DERGroupStatusQueriesResponse message → network model mapping

DERGroupStatusQueriesResponse message			Description	Network model / Network dynamics		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be reply.	Populated by External system	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupStatuses.	Populated by External system	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by External system	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by External system	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by External system	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by External system	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by External system	N/A	N/A
Payload	DERGroupStatuses.EndDeviceGroup.mrID	String	Custom Identifier of the DER Group	Populated by External system	String	IDOBJ_CUSTOMID
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by External system	Enum	MEASUREMENT_TYPE
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.yMultiplier**	Enum	DER Parameter value unit multiplier. Default unit multiplier in EcoStruxure GridOps is kilo.	Populated by External system	N/A	N/A

DERGroupStatusQueriesResponse message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.yUnit**	Enum	DER Parameter value unit. DER Parameter units (Measurement types in EcoStruxure GridOps) are predefined. Entering the wrong measurement unit does not affect the process execution.	Populated by External system	N/A	N/A
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.maxYValue	Float	DER Parameter max value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.minYValue	Float	DER Parameter min value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.nominalYValue	Float	DER Parameter nominal value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.timestamp**	Datetime	Timestamp that corresponds to the current DER Parameter values.	Populated by External system	Datetime	SIGVAL_TIMESTAMP
Payload	**DerGroupStatuses.EndDeviceGroup.Names.name**	String	DER Group name in EcoStruxure GridOps.	Populated by External system	String	IDOBJ_NAME

5.1.2.3. Fault

The DERGroupStatusQueriesFault message is depicted in Figure 5.7.

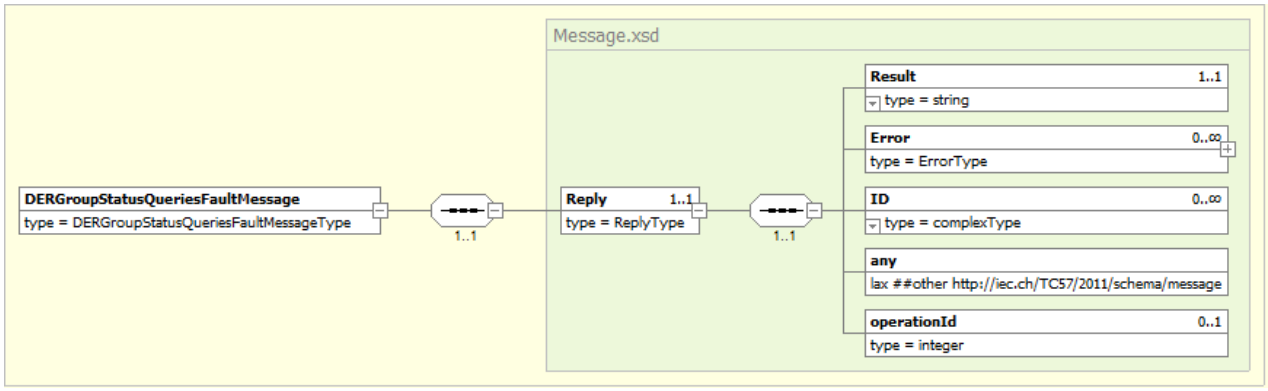

Figure 5.7 – The DERGroupStatusQueriesFault message

5.1.3. QueryDERGroupForecasts Operation Messages

The operation definition:

DERGroupForecastQueriesResponseMessage QueryDERGroupForecasts (*DerGroupForecastQueriesRequestMessage*)

5.1.3.1. Request

The *DerGroupForecastQueriesRequest message* is defined according to the IEC 61968-5 and contains the following two sections:

- Header
- Request

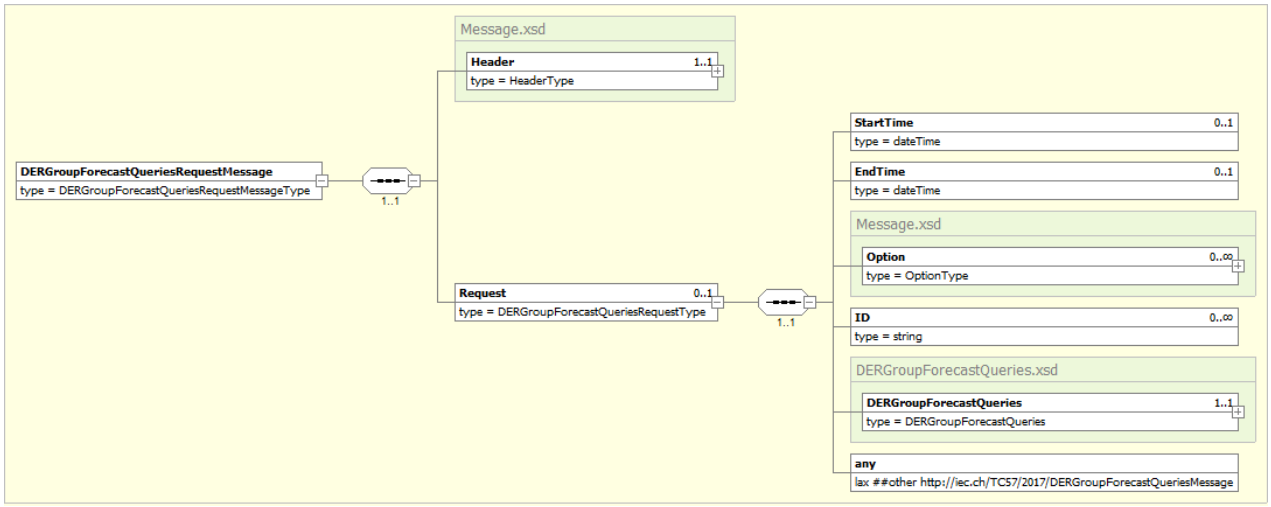

Figure 5.8 – The DerGroupForecastQueriesRequest Message

The Payload sections carries the CIM defined profile (*DerGroupForecastQueries.xsd*) for querying of DER group forecasts for all DER groups currently in EcoStruxure GridOps. The visual representation of the *DerGroupForecastQueries.xsd* schema is given in Figure 5.9.

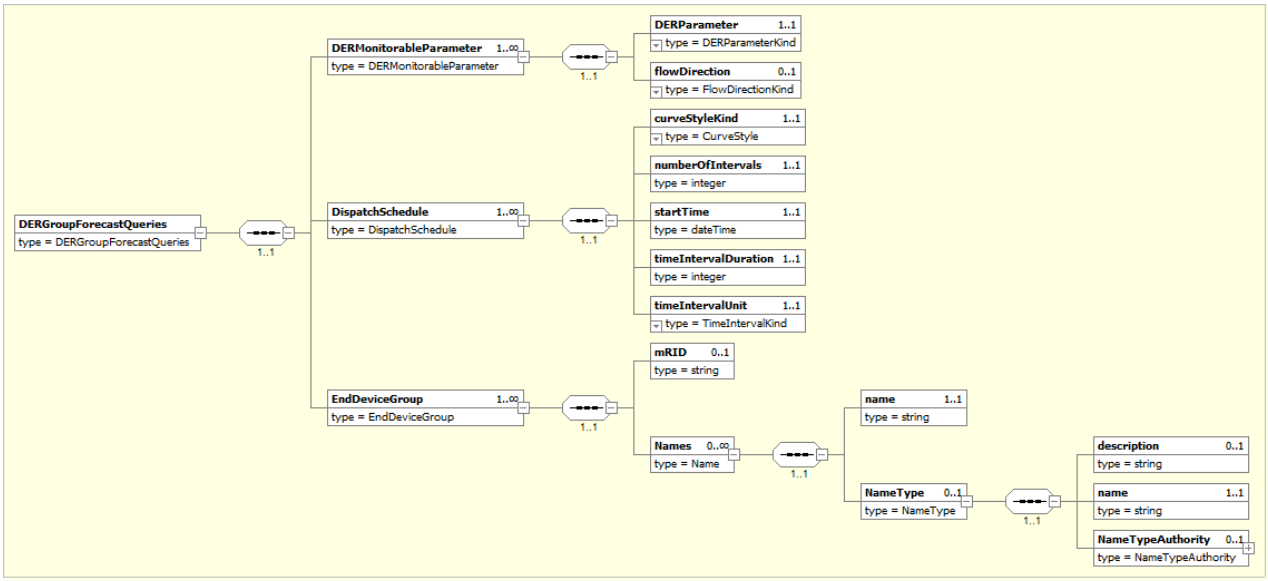

Figure 5.9 – DERGroupForecastQueries.xsd

Table 5.3 defines the mapping between the DERGroupStatusQueriesMessage.xsd and the appropriate entities in the network model.

Table 5.3 – The DERGroupForecastQueries message → network model mapping

DERGroupForecastQueries message			Description	Network model		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be get.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupForecasts.	Populated by DERMS Client Adapter	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by DERMS Client Adapter	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by DERMS Client Adapter	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by DERMS Client Adapter	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by DERMS Client Adapter	N/A	N/A
Request	**DerGroupStatusQueries.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by DERMS Client Adapter	Enum	MEASUREMENT_TYPE
Request	**DerGroupStatusQueries.DispatchSchedule.curveStyle**	Enum	Curve style. Possible values: ConstantYValues, StraightLineYValues. Value is populated based on adapter registry configuration file.	Populated by DERMS Client Adapter	N/A	N/A

DERGroupForecastQueries message			Description	Network model		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Request	**DerGroupStatusQueries.DispatchSchedule.numberOfIntervals**	Int	Number of DER curve intervals. Value is populated based on adapter registry configuration file.	Populated by DERMS Client Adapter	N/A	N/A
Request	**DerGroupStatusQueries.DispatchSchedule.timeIntervalDuration**	int	DER curve interval duration. Represents a value in seconds, minutes and hours when paired with the timeIntervalUnit value. Populated based on adapter registry configuration file.	Populated by DERMS Client Adapter	N/A	N/A
Request	**DerGroupStatusQueries.DispatchSchedule.timeIntervalDuration**	Enum	DER curve interval unit. Populated based on adapter registry configuration file.	Populated by DERMS Client Adapter	N/A	N/A
Request	**DerGroupStatusQueries.EndDeviceGroups.Names.name**	String	DER Group name in EcoStruxure GridOps. Used for querying forecasts from external system.	Populated by DERMS Client Adapter	String	IDOBJ_NAME

5.1.3.2. Response

The *DERGroupForecastQueriesResponse message* is defined according to the IEC 61968-5 and contains the following three sections:

- Header
- Reply
- Payload

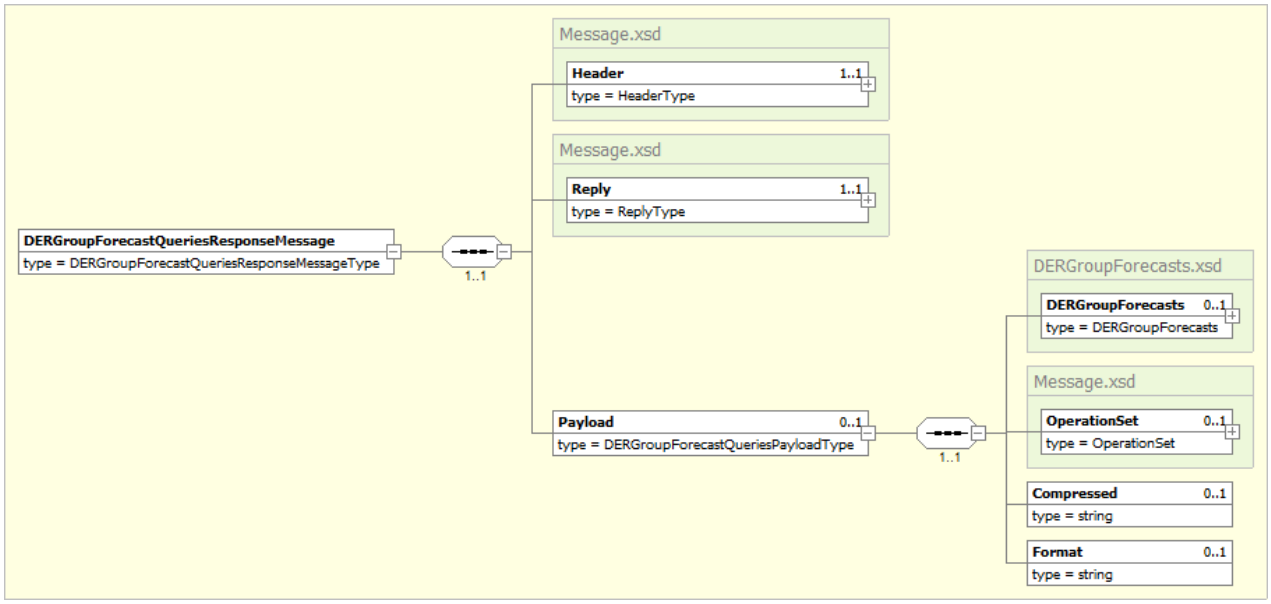

Figure 5.10 – The DERGroupForecastQueriesResponse Message

The Payload sections carries the CIM defined profile (*DerGroupForecasts.xsd*) for transferring the data on DER group forecasts. The visual representation of the *DerGroupForecasts.xsd* schema is given in Figure 5.11 and Figure 5.12.

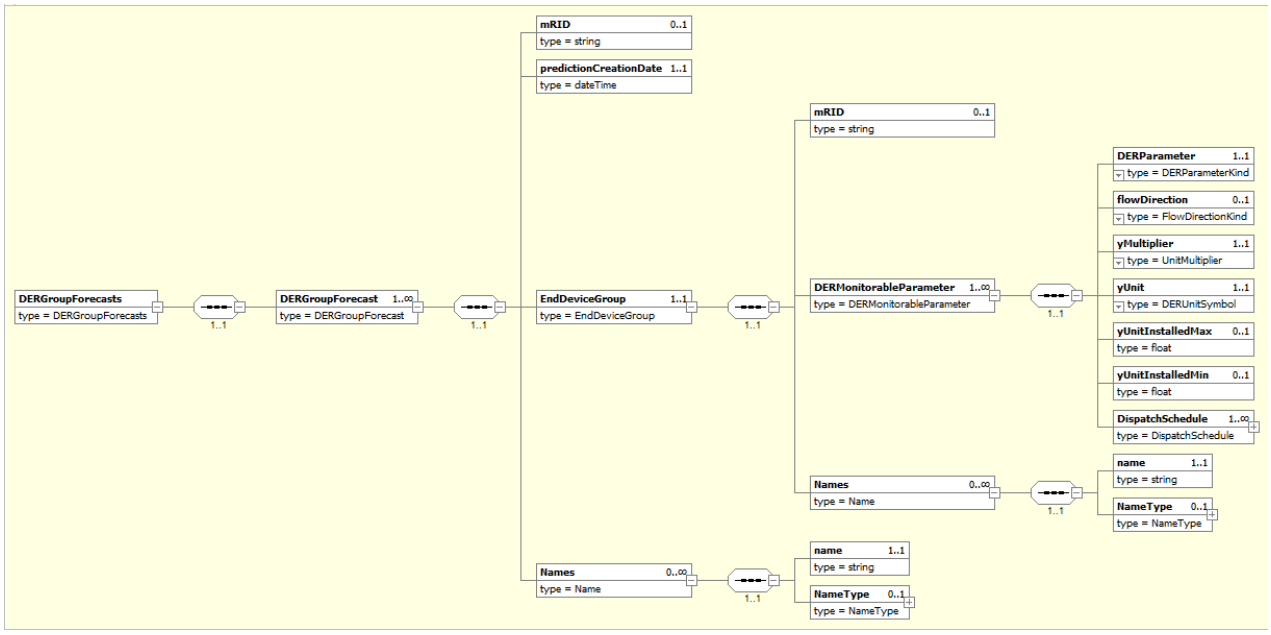

Figure 5.11 – DERGroupForecasts.xsd

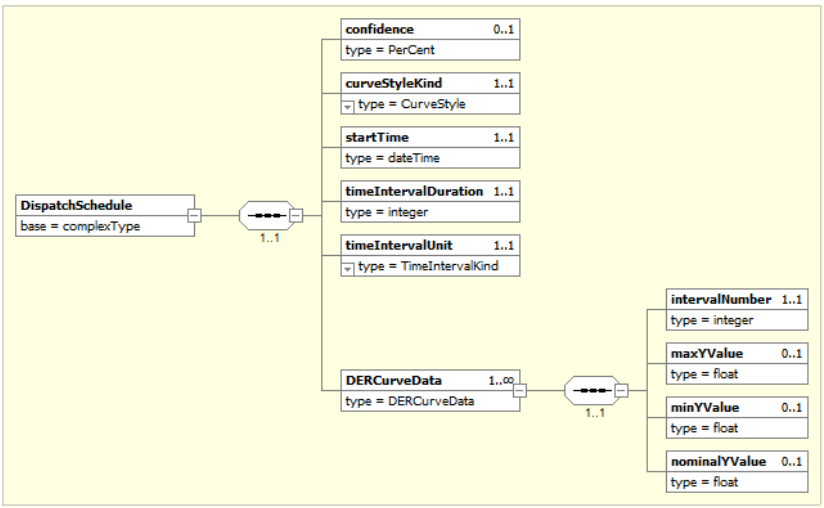

Figure 5.12 – The DispatchSchedule segment

Table 5.4 defines the mapping between the DERGroupStatusQueriesMessage.xsd and the appropriate entities in the netwok model.

Table 5.4 – The DERGroupForecastQueriesResponse message → network model mapping

DERGroupForecastQueriesResponse message			Description	Network model / Network dynamics		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be reply.	Populated by External system	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupForecasts.	Populated by External system	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by External system	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by External system	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by External system	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by External system	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by External system	N/A	N/A
Payload	DERGroupForecast.predictionCreationDate	Datetime	Timestamp when the forecast is created.	Populated by External system	N/A	N/A
Payload	DERGroupForecast.EndDeviceGroup.mrID	String	Custom Identifier of the DER Group	Populated by External system	String	IDOBJ_CUSTOMID
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by External system	Enum	MEASUREMENT_TYPE

DERGroupForecastQueriesResponse message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.yMultiplier**	Enum	DER Parameter value unit multiplier. Default unit multiplier in EcoStruxure GridOps is kilo.	Populated by External system	N/A	N/A
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.yUnit**	Enum	DER Parameter value unit. DER Parameter units (Measurement types in EcoStruxure GridOps) are predefined. Entering the wrong measurement unit does not affect the process execution.	Populated by External system	N/A	N/A
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.curveStyleKind**	Enum	Curve style. Possible values: ConstantYValues, StraightLineYValues.	Populated by External system	N/A	N/A
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.startTime**	Datetime	Starting time of the forecast measurement	Populated by External system	Datetime	TIMESERSIGVAL_STARTTIME
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalDuration**	Int	Interval between two consecutive measurement values.	Populated by External system	Timespan	TIMESERSIGVAL_TIMESTEP
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalUnit**	Enum	Time interval unit. Together with timeinterval duration, they form the corresponding timespan attribute in EcoStruxure GridOps.	Populated by External system	Timespan	TIMESERSIGVAL_TIMESTEP
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.DerCurveData.intervalNumber**	Int	Interval number that defines its position in the sequence of intervals that are contained in forecast measurement	Populated by External system	N/A	N/A

DERGroupForecastQueriesResponse message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.maxYValue	Float	DER Parameter max value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.minYValue	Float	DER Parameter min value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.nominalYValue	Float	DER Parameter nominal value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Payload	**DERGroupForecast.EndDeviceGroup.Names.name**	String	DER Group name in EcoStruxure GridOps.	Populated by External system	String	IDOBJ_NAME

5.1.3.3. Fault

The DERGroupForecastQueriesFault message is depicted in Figure 5.13.

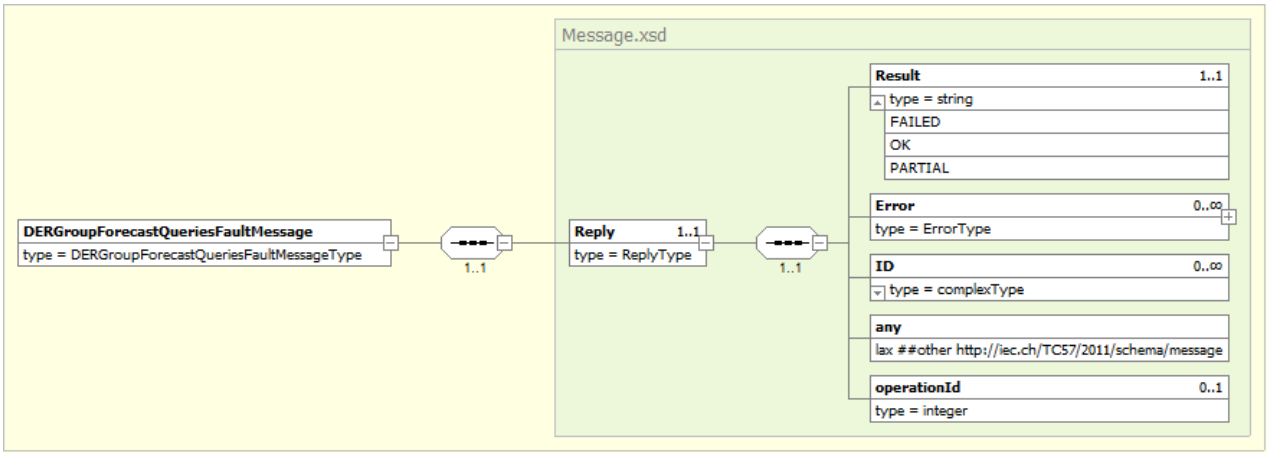

Figure 5.13 – The DERGroupForecastQueriesFault Message

5.1.4. CreateDERGroupDispatches Operation Messages

The operation definition:

DERGroupDispatchesResponseMessage CreateDERGroupDispatches (*DERGroupDispatchesRequestMessage*)

5.1.4.1. Request

The *DERGroupDispatchesRequest message* is defined according to the IEC 61968-5 and contains the following two sections:

- Header
- Request
- Payload

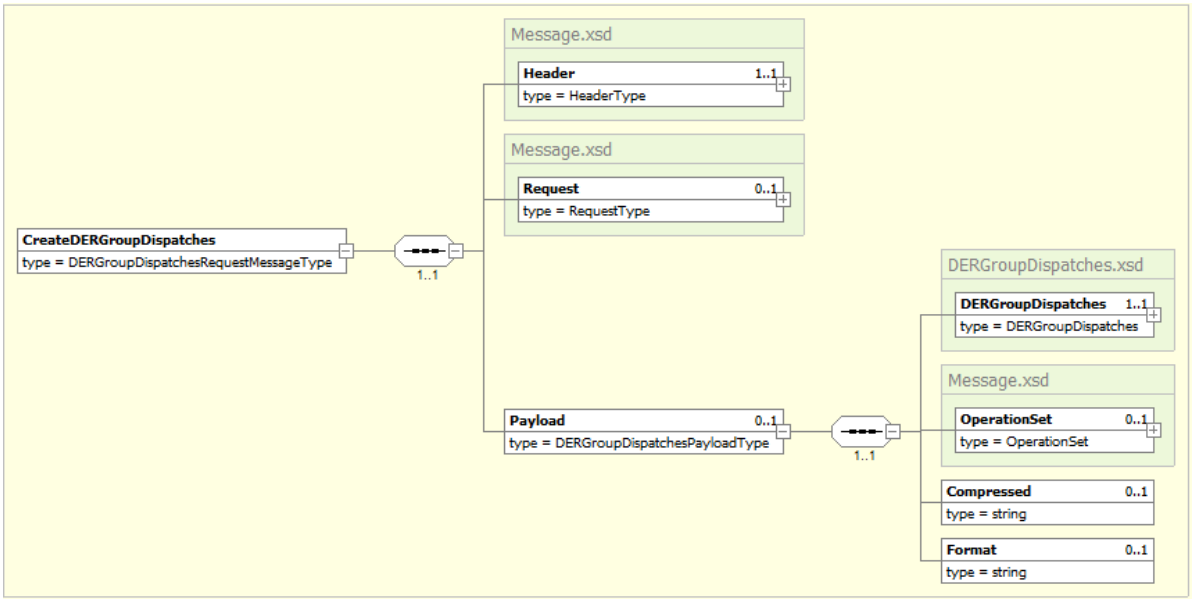

Figure 5.14 – The DERGroupDispatchesRequest Message

The Payload sections carries the CIM defined profile (*DerGroupDispatches.xsd*) for transferring the DER group Dispatches data. The visual representation of the *DerGroupDispatches.xsd* schema is given in Figure 5.15 and Figure 5.16.

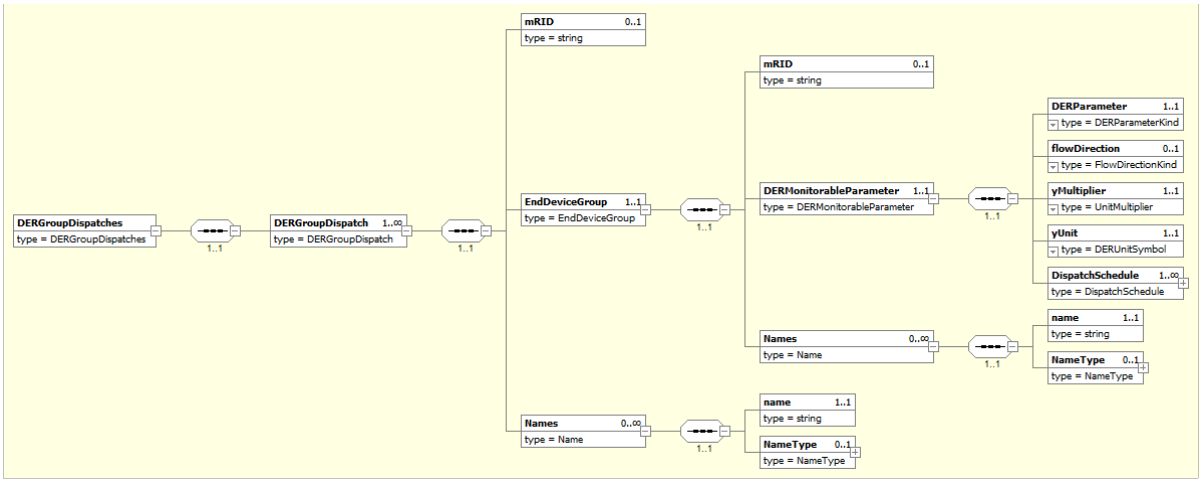

Figure 5.15 – DERGroupDispatches.xsd

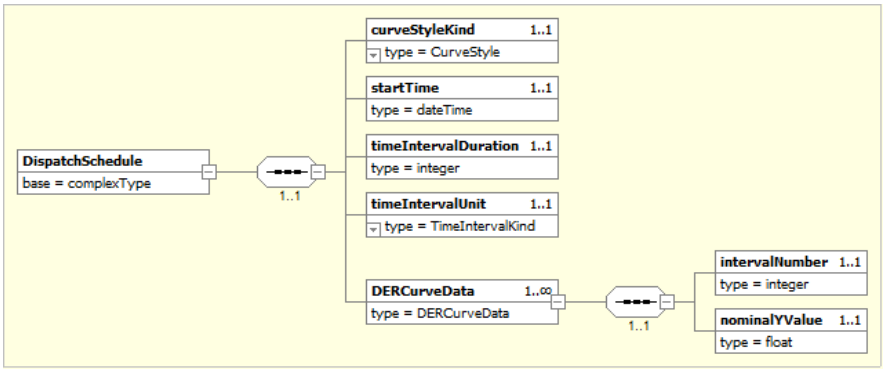

Figure 5.16 – The DispatchSchedule Segment

Table 5.4 defines the mapping between the DERGroupDispatchesMessage.xsd and the appropriate entities in the network model.

Table 5.5 - The DERGroupDispatchesRequest message → network model mapping

DERGroupDispatchesRequest message			Description	Network model / Network dynamics		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be create.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupDispatches.	Populated by DERMS Client Adapter	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by DERMS Client Adapter	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by DERMS Client Adapter	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by DERMS Client Adapter	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by DERMS Client Adapter	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by DERMS Client Adapter	N/A	N/A
Payload	DERGroupDispatch.mrID	String	GUID identifier of the DERGroupDispatch operation.	Populated by DERMS Client Adapter	N/A	N/A
Payload	DERGroupDispatch.EndDeviceGroup.mrID	String	Custom Identifier of the DER Group	Populated by DERMS Client Adapter	String	IDOBJ_CUSTOMID
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by DERMS Client Adapter	Enum	MEASUREMENT_TYPE

DERGroupDispatchesRequest message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.yMultiplier**	Enum	DER Parameter value unit multiplier. Default unit multiplier in EcoStruxure GridOps is kilo.	Populated by DERMS Client Adapter	N/A	N/A
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.yUnit**	Enum	DER Parameter value unit. DER Parameter units (Measurement types in EcoStruxure GridOps) are predefined. Entering the wrong measurement unit does not affect the process execution.	Populated by DERMS Client Adapter	N/A	N/A
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.curveStyleKind**	Enum	Curve style. EcoStruxure GridOps defaults the straightLineYValues	Populated by DERMS Client Adapter	N/A	N/A
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.startTime**	Datetime	Starting time of the scheduled interchange measurement	Populated by DERMS Client Adapter	Datetime	TIMESERSIGVAL_STARTTIME
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalDuration**	Int	Interval between two consecutive measurement values.	Populated by DERMS Client Adapter	Timespan	TIMESERSIGVAL_TIMESTEP
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalUnit**	Enum	Time interval unit. Together with timeinterval duration, they form the corresponding timespan attribute in EcoStruxure GridOps.	Populated by DERMS Client Adapter	Timespan	TIMESERSIGVAL_TIMESTEP
Payload	**DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.DerCurveData.intervalNumber**	Int	Interval number that defines its position in the sequence of intervals that are contained in scheduled interchange measurement	Populated by DERMS Client Adapter	N/A	N/A

DERGroupDispatchesRequest message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	DERGroupDispatch.EndDeviceGroup.DERMonitorableParameter.DerCurveData.nominalYValue	Float	DER Parameter nominal value.	Populated by DERMS Client Adapter	Float	TIMESERSIGVAL_VALUES1
Payload	**DerGroupDispatch.EndDeviceGroup.Names.name**	String	DER Group name in EcoStruxure GridOps.	Populated by DERMS Client Adapter	String	IDOBJ_NAME

5.1.4.2. Response

The *DERGroupDispatchesResponse message* is defined according to the IEC 61968-5 and contains the following three sections:

- Header
- Reply
- Payload

It is depicted on Figure 5.17.

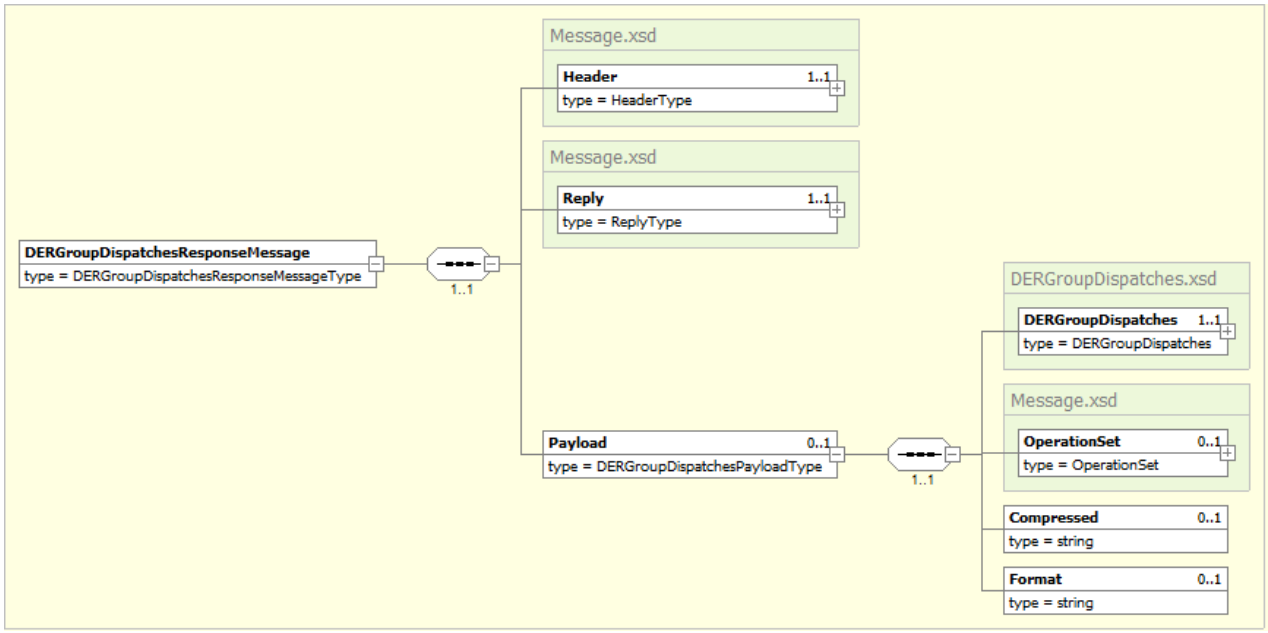

Figure 5.17 – The DERGroupDispatchesResponse Message

5.1.4.3. Fault

The *DERGroupDispatchesFault* message is depicted in Figure 5.18.

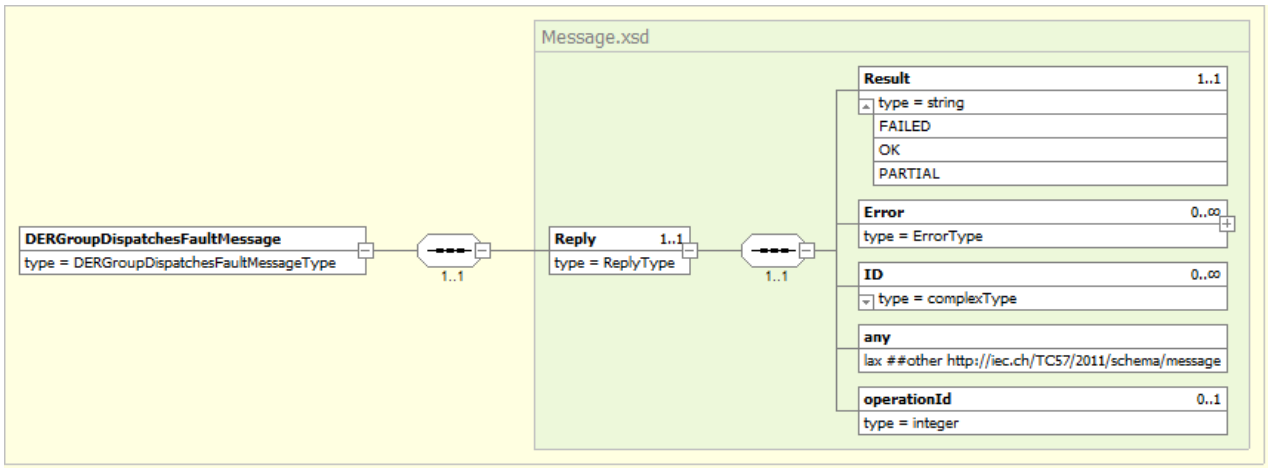

Figure 5.18 – The DERGroupDispatchesFault Message

5.1.5. ChangedDerGroupStatuses Operation Messages

The operation definition:

DERGroupStatusesResponseMessage ChangedDERGroupStatuses (*DerGroupStatusesEventMessage*)

5.1.5.1. Event

The *DERGroupStatusesEvent message* is defined according to the IEC 61968-5 and contains the following two sections:

- Header
- Payload

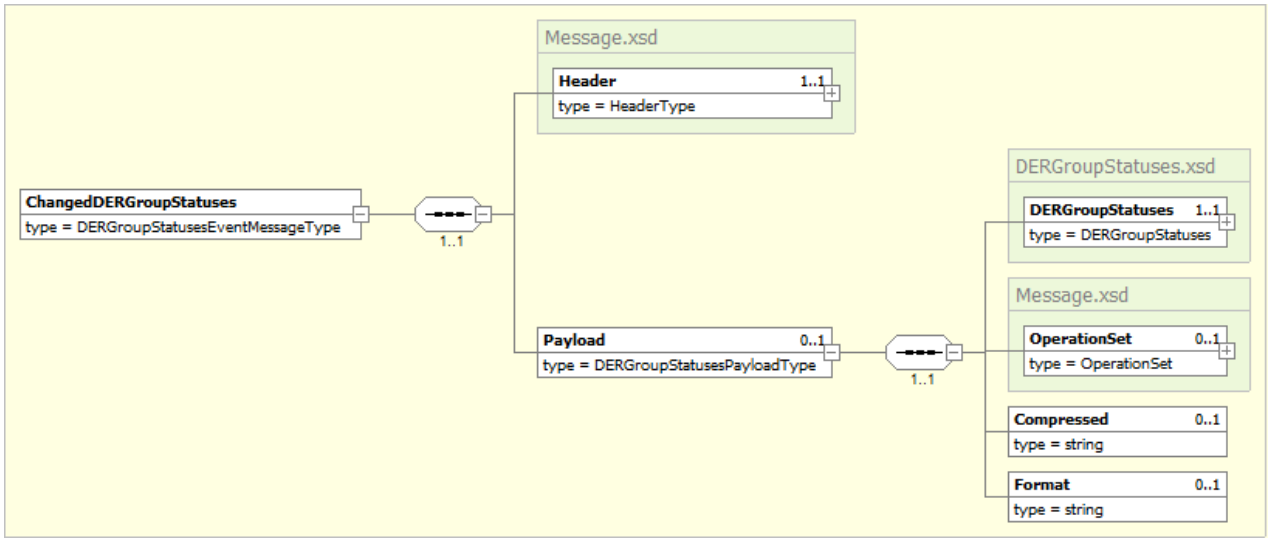

Figure 5.19 – The DERGroupStatusesEvent Message

The Payload sections carries the CIM defined profile (*DerGroupStatuses.xsd*) for transferring the data on DER group statuses. The visual representation of the *DerGroupStatuses.xsd* schema is given in Figure 5.6.

Table 5.6 defines the mapping between the DERGroupStatusesMessage.xsd and the appropriate entities in the network model

Table 5.7 – The DERGroupStatusesEvent message → network model mapping

DerGroupStatusesEvent message			Description	Network model / Network dynamics		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be changed.	Populated by External system	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupStatuses.	Populated by External system	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by External system	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by External system	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by External system	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by External system	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by External system	N/A	N/A
Payload	DERGroupStatuses.EndDeviceGroup.mrID	String	Custom Identifier of the DER Group	Populated by External system	String	IDOBJ_CUSTOMID
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by External system	Enum	MEASUREMENT_TYPE
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.yMultiplier**	Enum	DER Parameter value unit multiplier. Default unit multiplier in EcoStruxure GridOps is kilo.	Populated by External system	N/A	N/A

DerGroupStatusesEvent message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.yUnit**	Enum	DER Parameter value unit. DER Parameter units (Measurement types in EcoStruxure GridOps) are predefined. Entering the wrong measurement unit does not affect the process execution.	Populated by External system	N/A	N/A
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.maxYValue	Float	DER Parameter max value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.minYValue	Float	DER Parameter min value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.nominalYValue	Float	DER Parameter nominal value.	Populated by External system	Float	ASIGVAL_VALUE
Payload	**DERGroupStatuses.EndDeviceGroup.DERMonitorableParameter.DerCurveData.timestamp**	DateTime	Timestamp that corresponds to the current DER Parameter values.	Populated by External system	DateTime	SIGVAL_TIMESTAMP
Payload	**DerGroupStatuses.EndDeviceGroup.Names.name**	String	DER Group name in EcoStruxure GridOps.	Populated by External system	String	IDOBJ_NAME

5.1.5.2. Response

The *DERGroupStatusesResponse message* is defined according to the IEC 61968-5 and contains the following three sections:

- Header
- Reply
- Payload

It is depicted on Figure 5.20Figure 5.17.

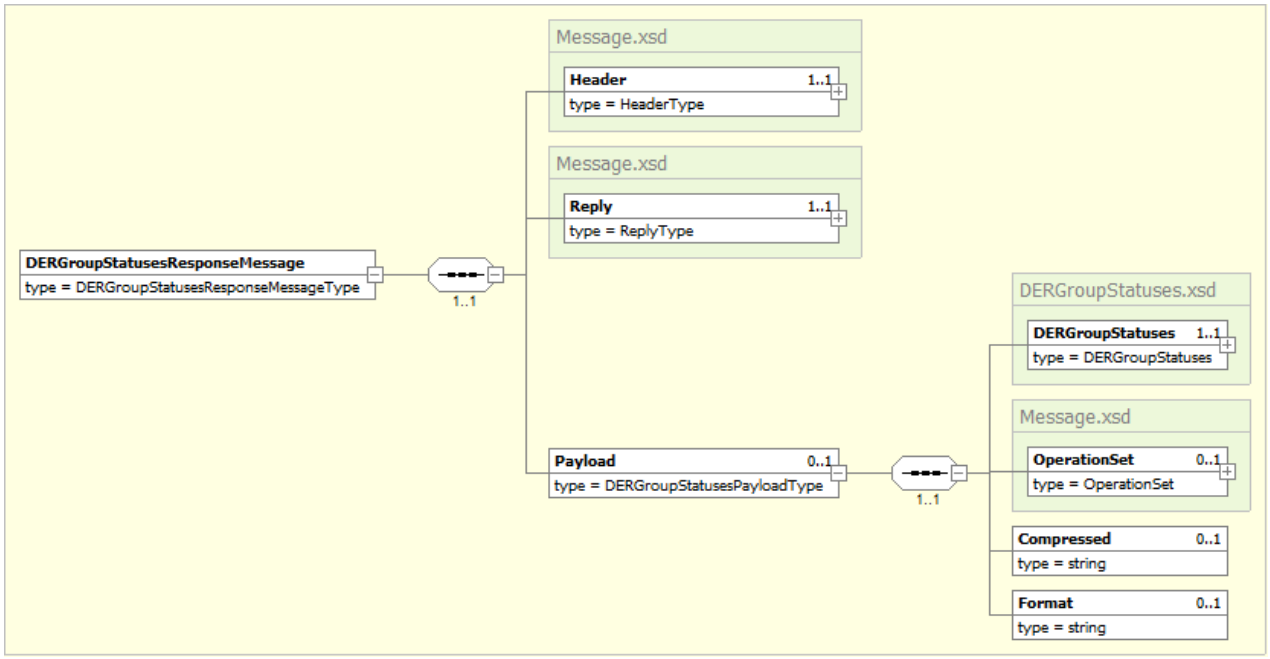

Figure 5.20 – The DERGroupStatusesResponse Message

5.1.5.3. Fault

The *DerGroupStatusesFault* message is depicted in Figure 5.21.

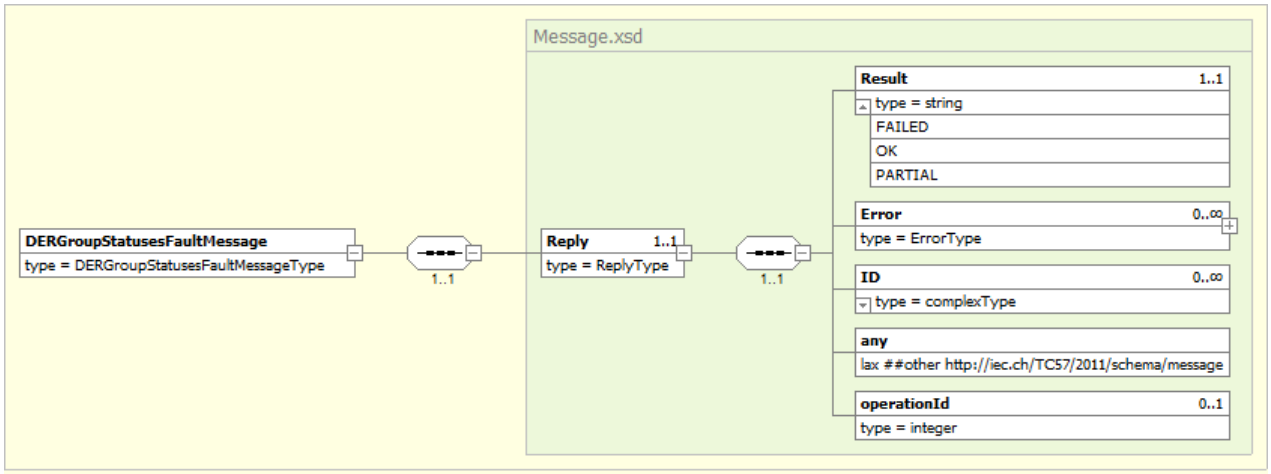

Figure 5.21 – The DerGroupStatusesFault Message

5.1.6. CreatedDERGroupForecasts Operation Messages

The operation definition:

DERGroupForecastsResponseMessage CreatedDERGroupForecasts (*DERGroupForecastsEventMessage*)

5.1.6.1. Event

The *DERGroupForecastsEvent message* is defined according to the IEC 61968-5 and contains the following two sections:

- Header
- Payload

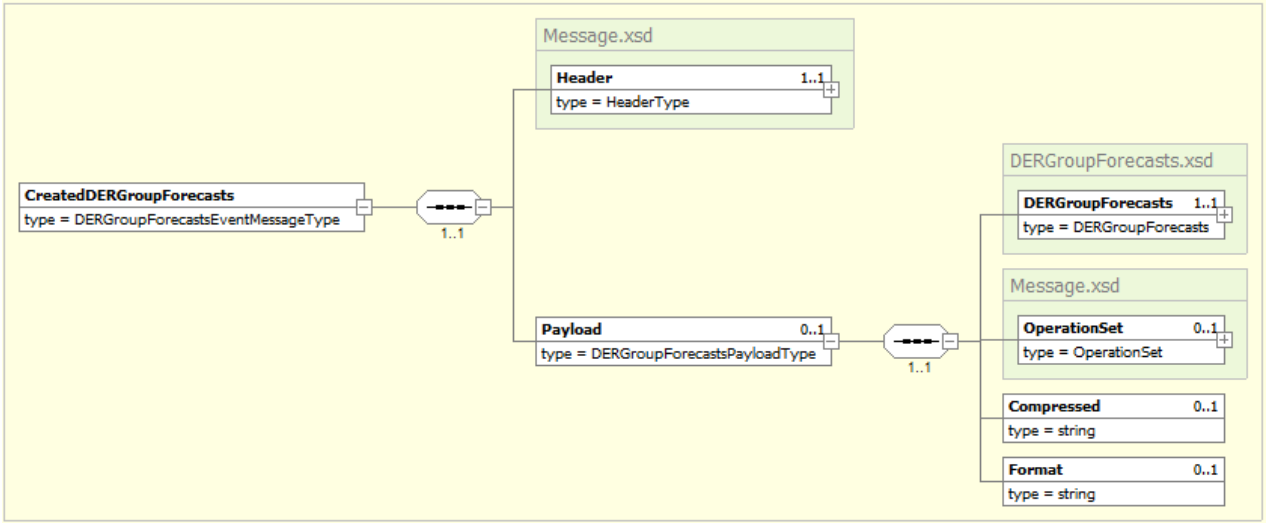

Figure 5.22 – The DERGroupForecastsEvent Message

The Payload sections carries the CIM defined profile (*DerGroupForecasts.xsd*) for transferring the data on DER group forecasts. The visual representation of the *DerGroupForecasts.xsd* schema is given in Figure 5.11 and Figure 5.12.

Table 5.8 defines the mapping between the DERGroupForecastsMessage.xsd and the appropriate entities in the network model.

Table 5.8 – The DERGroupForecastsEvent message → network model mapping

DERGroupForecastsEvent message			Description	Network model / Network dynamics		
Section	**Property**	**Type**		**Property**	**Type**	**Model Code**
Header	**Verb**	String	Identifier for a specific action to be taken. For this message, Verb should be created.	Populated by External system	N/A	N/A
Header	**Noun**	String	Identifier for the subject of the action and/or the type of the payload. For this message, Noun should be DERGroupForecasts.	Populated by External system	N/A	N/A
Header	Revision	String	Revision of CIM standard used. Default value is 2.0.	Populated by External system	N/A	N/A
Header	**Timestamp**	DateTime	Timestamp when message was produced. Example: 2015-12-31T12:34:56+02:00	Populated by External system	N/A	N/A
Header	Source	String	Source system or application that sends the message. For this message, Source is EcoStruxure GridOps.	Populated by External system	N/A	N/A
Header	**MessageID**	String	Unique message ID to be used for tracking messages.	Populated by External system	N/A	N/A
Header	**CorrelationID**	String	Same as message ID.	Populated by External system	N/A	N/A
Payload	DERGroupForecast.mrID	String	GUID custom identifier of the Forecasted measurement	Populated by External system	N/A	N/A
Payload	DERGroupForecast.predictionCreationDate	Datetime	Timestamp when the forecast is created.	Populated by External system	N/A	N/A
Payload	DERGroupForecast.EndDeviceGroup.mrID	String	Custom Identifier of the DER Group	Populated by External system	String	IDOBJ_CUSTOMID
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DERParameter**	Enum	DER Paremeter. Represents the Measurement type in EcoStruxure GridOps. Possible values are activePower, reactivePower, etc.	Populated by External system	Enum	MEASUREMENT_TYPE

DERGroupForecastsEvent message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Paylaod	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.yMultiplier**	Enum	DER Parameter value unit multiplier. Default unit multiplier in EcoStruxure GridOps is kilo.	Populated by External system	N/A	N/A
Paylaod	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.yUnit**	Enum	DER Parameter value unit. DER Parameter units (Measurement types in EcoStruxure GridOps) are predefined. Entering the wrong measurement unit does not affect the process execution.	Populated by External system	N/A	N/A
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.curveStyleKind**	Enum	Curve style. Possible values: ConstantYValues, StraightLineYValues.	Populated by External system	N/A	N/A
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.startTime**	Datetime	Starting time of the forecast measurement	Populated by External system	Datetime	TIMESERSIGVAL_STARTTIME
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalDuration**	Int	Interval between two consecutive measurement values.	Populated by External system	Timespan	TIMESERSIGVAL_TIMESTEP
Payload	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.timeIntervalUnit**	Enum	Time interval unit. Together with timeinterval duration, they form the corresponding timespan attribute in EcoStruxure GridOps.	Populated by External system	Timespan	TIMESERSIGVAL_TIMESTEP
Paylaod	**DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DispatchSchedule.DerCurveData.intervalNumber**	Int	Interval number that defines its position in the sequence of intervals that are contained in forecast measurement	Populated by External system	N/A	N/A

DERGroupForecastsEvent message			Description	Network model / Network dynamics		
Section	Property	Type		Property	Type	Model Code
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.maxYValue	Float	DER Parameter max value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.minYValue	Float	DER Parameter min value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Payload	DERGroupForecast.EndDeviceGroup.DERMonitorableParameter.DerCurveData.nominalYValue	Float	DER Parameter nominal value.	Populated by External system	Float	TIMESERSIGVAL_VALUES1
Paylaod	**DERGroupForecast.Names.name**	String	DER Group name in EcoStruxure GridOps.	Populated by External system	String	IDOBJ_NAME

5.1.6.2. Response

The *DERGroupForecastsResponse message* is defined according to the IEC 61968-5 and contains the following three sections:

- Header
- Reply
- Payload

It is depicted on Figure 5.23Figure 5.17.

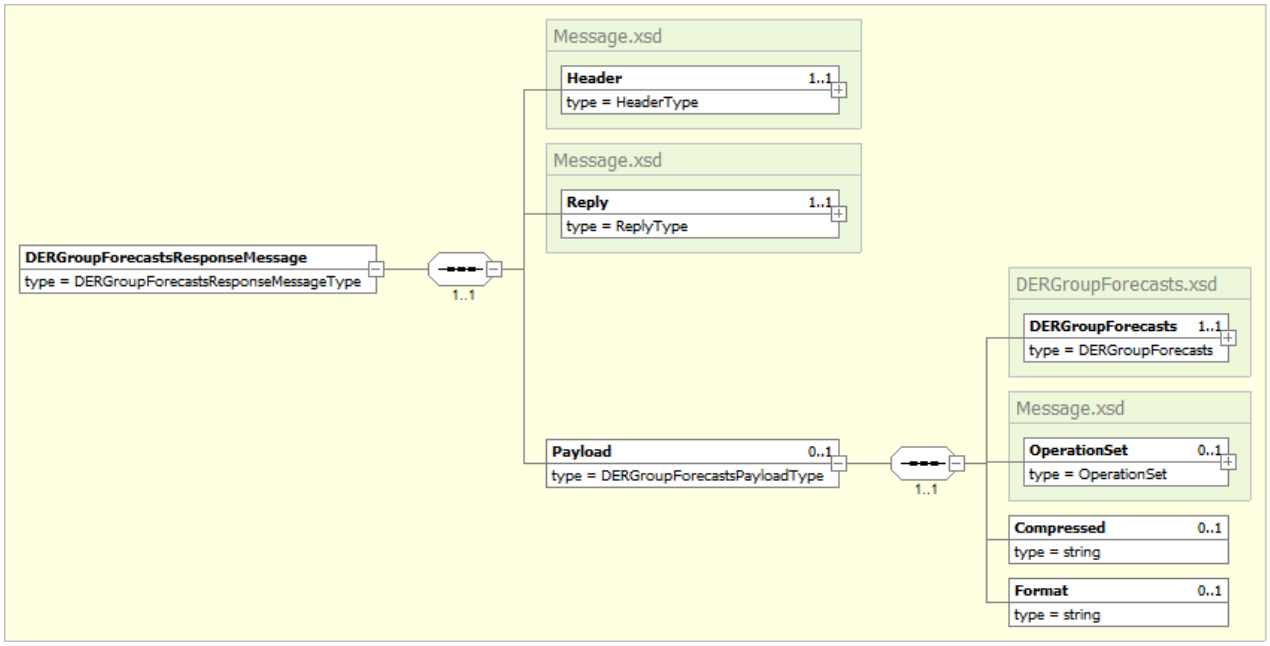

Figure 5.23 – The DERGroupForecastsResponse Message

5.1.6.3. Fault

The *DerGroupForecastsFault* message is depicted in Figure 5.24.

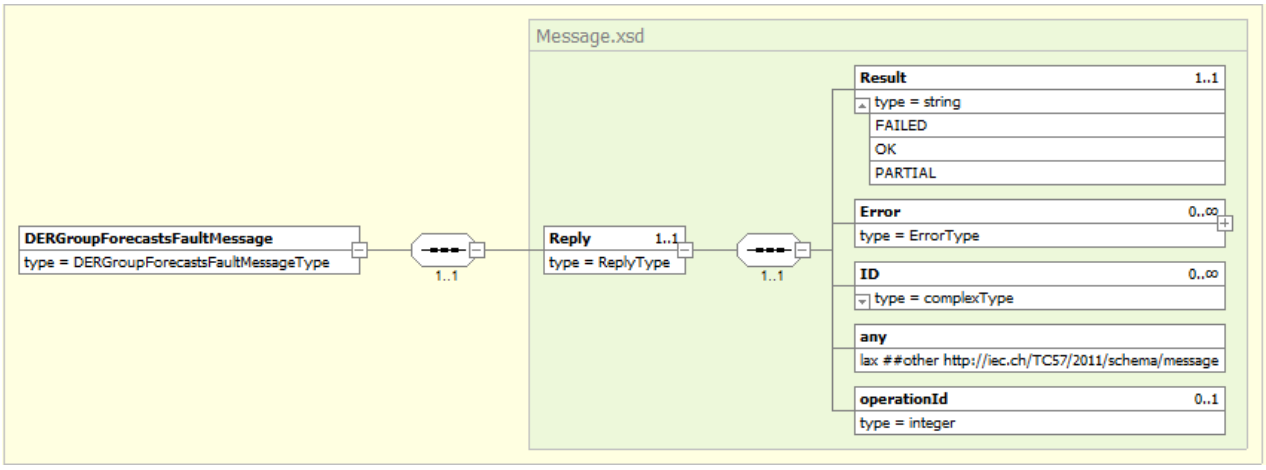

Figure 5.24 – The DerGroupForecastsFault Message

6. DEPLOYMENT SPECIFICATION

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

The deployment specification is provided in the following table:

Table 6.1 – The deployment specification

Deployment Specification	
Application	AdapterDermsClient
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

6.1. Interface Configuration

DERMS Client 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 DERMS Client adapter.

Table 6.2 – The configuration files specification

Name of the config file	Configuration File Description
AdapterDermsClient	Registry configuration xml file
ErrorConfiguration_DermsClientAdapter	Error configuration xml file
DermsClient_WebServiceConfiguration	Web service configuration xml file

Details about the structure and shared content of common interface configuration files are located in *EcoStruxure GridOps Management Suite 3.10 Enterprise Integration Platform - Functional Specification* [1]

Detailed content of above-mentioned configuration files is provided within the *Configuration* folder in the *EcoStruxure GridOps Management Suite 3.10 DERMS Interface.zip* file [2].

7. APPENDIX

7.1. WSDL

The WSDL file, XSD schemas and sample messages defined according to the IEC61968-5 and IEC 61968-100 for all DERMS web services provided within the *Web Service Definitions* folder in the *EcoStruxure GridOps Management Suite 3.10 DERMS Interface.zip* file [2].

7.2. Message Examples

Message examples for several use cases are provided within the *Message Examples* folder in the *EcoStruxure GridOps Management Suite 3.10 DERMS Interface.zip* file [2].

8. RELEASE NOTES

The following new features related to the Product DERMS Interfaces were introduced in the software, starting from version 3.8 SP1.

9. DEFINITIONS AND ABBREVIATIONS

Definition/Abbreviation	Description
ADMS	Advanced Distribution Management System
DER	Distributed Energy Resource
DERMS	Distributed Energy Resource Management System
DMD	Dynamic Mimic Diagram
DMZ	Demilitarized Zone
DNS	Domain Name Server
DRMS	Demand Response Management System
ESB	Enterprise Service Bus
IEC	International Electrotechnical Commission
NDS	Network Dynamics Service
NMC	Network Management Console
NMS	Network Model Service
SOAP	Simple Object Access Protocol
WCF	Windows Communication Foundation
WS	Web Service
XML	Extensible Markup Language
XSD	XML Schema Definition