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Test Script for International Electrotechnical Commission 61968-5 Distributed Energy Optimization, Third Edition

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EPRI Project Manager

G. Gray

ELECTRIC POWER RESEARCH INSTITUTE
3420 Hillview Avenue, Palo Alto, California 94304-1338 ▪ PO Box 10412, Palo Alto, California 94303-0813 ▪ USA
800.313.3774 ▪ 650.855.2121 ▪ askepri@epri.com ▪ www.epri.com

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ABSTRACT

Technology advancements in solar photovoltaics (PV) and energy storage have driven increases in their evaluation and employment by utilities, consumers, and third parties. These distributed energy resources (DER) are often connected to the grid at the distribution level where their presence in large scale or volume could be disruptive if not designed, integrated, and managed properly. There is also a growing trend to understand how these resources might be leveraged as part of a microgrid.

Inverters—power converter circuits that integrate solar PV and battery resources to the grid—are highly capable devices with fast power controls and no inherent inertia so that they can respond quickly to commands and local conditions. If these inverter capabilities can be properly exposed and integrated into traditional utility system operations, high-penetration DER can be transformed from problematic uncertainties to beneficial tools for distribution management. To achieve these potential benefits, it must be possible not only to communicate with individual DER devices using standard protocols, but also for the systems that manage DER—DER management system, or DERMS—to effectively inform other software applications of available resources and to exchange information that allows the DER to be managed effectively.

Since 2012, EPRI has been working with the DOE SunShot program and the National Institute of Standards and Technology (NIST) Distributed Renewables, Generation, and Storage-Domain Expert Working Group (DRGS-DEWG) and the International Electrotechnical Commission (IEC) to facilitate a focus group of industry experts working to develop appropriate enterprise-level functions for the integration of DER. These functions are intended to work in conjunction with the common functions for smart inverters that have previously been defined.

This report represents the next phase in EPRI's efforts to formalize the prior work in the form of an international standard. It is EPRI's intent to submit the material and artifacts contained in this report to IEC to advance the development of a Committee Draft for Vote (CDV) International Standard for DER-related messaging. This report also details the use of two XSDs from the IEC 61968-9:2013 Meter Reading and Control standard to perform connection and disconnection of DER Groups from the grid.

Keywords

Distributed energy resource management system (DERMS)
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PRIMARY AUDIENCE: Enterprise architects, applications architects, solution architects, integration architects

SECONDARY AUDIENCE: Software developers

KEY RESEARCH QUESTION

What are the requirements for common information model (CIM) compliance testing relative to the forthcoming International Electrotechnical Commission (IEC) Planning and Optimization standard, IEC 61968-5?

RESEARCH OVERVIEW

This research was an attempt to take changes that have been reflected in the CIM to support a portion of the use cases described by EPRI in the distributed energy resources (DER) enterprise integration functional requirements. Although the CIM describes a data model that shows the classes, attributes, and associations of the data to support a use case, and the functional requirements describe what should be done, it remains both to describe how the functional requirements are implemented and how that implementation can be tested for compliance with the associated standards (IEC 61968-100:2013 Application Integration at Utilities and the forthcoming IEC 61968-5 Distributed Energy Optimization). This effort created standards-compliant web services definition languages (WSDLs), eXtensible markup language (XML) schema definitions (XSDs), and a test script that can be used to verify compliance.

KEY FINDINGS

- XSDs and WSDLs are now available that conform to the IEC 61968-100:2013 international standard and the data model changes that have been reflected in the CIM to support enterprise integration of DER.
- The XSDs and WSDLs conform to RFC standards for web services specifications for simple object access protocol (SOAP) over HTTP integration.
- This test script can be used to determine not only compliance, but also interoperability requirements for the DER enterprise integration messages.

WHY THIS MATTERS

System integration is expensive. Having a test script addresses a gap in standards development that provides the interpretation of the standard in how it is applied in a specific integration context. This specification reduces confusion within those portions of the standard that are optional or open to interpretation, providing clarity and reducing the effort to integrate systems.

HOW TO APPLY RESULTS

This report includes WSDLs and XSDs that can be used to develop standards-compliant web services that conform to the international IEC standards for application integration and to support enterprise integration of functionality of DER management systems, or DERMS. The test script can then be used to test whatever software is developed using the WSDL and XSD artifacts to ensure that it is in fact compliant with the standard.

This report can also be used to specify standards compliance. For example, it can be used when acquiring a DERMS or distribution management system (DMS) that includes DERMS functionality, or systems that would interface with a DERMS, to verify vendor claims of standards compliance.

LEARNING AND ENGAGEMENT OPPORTUNITIES

- Integration and other architecture-related issues are discussed in the Enterprise Architecture Collaboration Group, a supplemental activity of the P161E program.
- The findings in this report will be a valuable contribution to the International Electrotechnical Commission's Working Group 14 in support of IEC standard 61968-100:2013, which describes utility application integration, and to the CIM Compliance Testing Task Force.

EPRI CONTACT: Gerald Gray, Sr. Program Manager, ggray@epri.com

PROGRAM: Enterprise Architecture and Integration, P161E

Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
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1
INTRODUCTION

Technology advancements in solar photovoltaics (PV) and energy storage have driven increases in their evaluation and employment by utilities, consumers, and third parties. These distributed energy resources (DER) are often connected to the grid at the distribution level where their presence in large scale or volume could be disruptive if not designed, integrated, and managed properly. There is also a growing trend to understand how these resources might be leveraged as part of a microgrid.

Inverters—power converter circuits that integrate solar PV and battery resources to the grid—are highly capable devices with fast power controls and no inherent inertia so that they can respond quickly to commands and local conditions. Even small-scale inverters tend to have substantial processing and memory resources and can support a variety of communication protocols and advanced functions. Over the last few years, industry efforts have defined a wide range of standard grid-supportive functions that inverters may provide as well as standard communication protocols that allow these functions to be remotely monitored and managed.[1]

If these inverter capabilities can be properly exposed and integrated into traditional utility system operations, high-penetration DER can be transformed from problematic uncertainties to beneficial tools for distribution management. To achieve these potential benefits, it must be possible not only to communicate with individual DER devices using standard protocols, but also for the systems that manage DER—DER management system, or DERMS—to effectively inform other software applications of available resources and to exchange information that allows the DER to be managed effectively.

Traditionally, distribution systems have been operated without extensive controls or centralized management. More advanced systems may have on-load tap changing transformers (LTCs) at substations, line regulators, and/or capacitor banks that help optimize distribution voltage and reactive power flow. In many cases, these devices may be fixed or configured to operate autonomously. In a growing number of cases, however, a more central distribution management system (DMS) has been used to coordinate these devices' behavior for a more optimized overall effect. DMS functionality may reside at the utility operations center—where a single large-scale software solution manages many circuits—or it may reside in a more limited fashion at the substation or other level, where smaller scale systems manage individual feeders or circuits.

Regardless of the scenario, the current generation of DMS is still evolving to take advantage of the capabilities that DER may offer. In most cases, DER support within a DMS is limited to monitoring the output of utility-scale DER (>1 megawatt). In addition, industry standards define advanced functions for DER only at the individual device level and lack the more aggregated, feeder-level representations useful for enterprise integration.

[1] *Common Functions for Smart Inverters.* EPRI, Palo Alto, CA: 2011. 1023059.

Since 2012, the Electric Power Research Institute (EPRI) has been working with the DOE SunShot program and the National Institute of Standards and Technology (NIST) Distributed Renewables, Generation, and Storage-Domain Expert Working Group (DRGS-DEWG) to facilitate a focus group of industry experts working to develop appropriate enterprise-level functions for the integration of DER. These functions are intended to work in conjunction with the common functions for smart inverters that have previously been defined.

A workshop was held in September 2012 to launch the initiative for group-based management and monitoring of DER. The workshop, held in Washington, D.C., was attended by 50 industry experts, representing utilities, DMS software providers, DER management experts, inverter manufacturers, universities, and researchers worldwide.

The results of the initial workshop were published in EPRI report 1026789[2] and made publicly available. The participants identified a range of useful functions for enterprise integration of DER and prioritized these functions in terms of value to the industry and achievability. Following are the top five priorities identified in the Phase 1 initiative:

- DER group status monitoring
- DER group capabilities discovery
- DER group dispatch (active power)
- DER group forecast
- DER group dispatch (reactive power)

Consensus methods were documented for these initial functions; implementations were then performed by interested parties using a test harness set up by EPRI. The testing was conducted at the National Renewable Energy Laboratory's (NREL) Energy Systems Integration Facility (ESIF) in Golden, Colorado, in fall 2014. The test plan[3] and test results[4] from this event have been published and made publicly available.

This report represents the next phase in EPRI's efforts to formalize the prior work in the form of an international standard. It is EPRI's intent to submit the material and artifacts contained in this report to the International Electrotechnical Commission (IEC) to advance the development of a Committee Draft for Vote (CDV) International Standard for DER-related messaging. The formal designation for the draft IEC standard will be as follows:

> IEC 61968-5:CDV Application integration at electric utilities – System interfaces for distribution management – Part 5: Interfaces for distributed energy resource management systems

Consistent with the scope of this report, the IEC 61968-5:CDV will detail seven DER-related Extensible Markup Language (XML) Schema Definition (XSD) files, also referred to as *profiles*, that inform the interactions of DER-related systems:

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[2] *Collaborative Initiative to Advance Enterprise Integration of DER: Workshop Results.* EPRI, Palo Alto, CA: 2012. 1026789.

[3] *Enterprise Integration Functions Test Plan for Distributed Energy Resources, Phase 1.* EPRI, Palo Alto, CA: 2014. 3002004681.

[4] *DER Enterprise Integration, Interoperability Workshop Results.* EPRI, Palo Alto, CA: 2014. 3002003035.

- DERGroups
- DERGroupStatuses
- DERGroupForecasts
- DERGroupDispatches
- DERGroupQueries
- DERGroupStatusQueries
- DERGroupForecastQueries

In addition, this report will detail the use of two XSDs from the IEC 61968-9:2013 Meter Reading and Control standard to perform connection and disconnection of DER Groups from the grid:

- EndDeviceControls
- EndDeviceEvents

To perform IEC messaging, the domain-specific DER profiles listed above must be "wrapped" in a Message envelope defined by an existing IEC International Standard that is formally designated as follows:

> IEC 61968-100:2013 Application integration at electric utilities – System interfaces for distribution management – Part 100: Implementation profiles

Note: It is possible for an application to conform to IEC 61968-5 without using and conforming to IEC 61968-100; however, the EPRI-sponsored testing that will use the test scripts in this report will require conformance with IEC 61968-100:2013.

IEC 61968-100:2013 defines both the Message envelope and transport-specific requirements for IEC 61968 messaging. It is applicable to messages used in all IEC 61968 business domains (for example, Meter Reading and Control, Network Operations, and Customer Systems) and is not specific to IEC 61968-5 DER-related messaging. The Message.xsd Message envelope is described in Appendix B.

IEC profiles tend to have many optional classes and attributes and, for the novice, it may not be clear how to construct messages in a way that will enable interoperability. The issue is further complicated by the fact that IEC 61968-100:2013 supports implementation of the messaging using multiple protocols, including the following:

- Java Message Service (JMS)
- Generic Web Services
- Strongly Typed Web Services

Section 4 of this report provides explanatory material concerning the usage, similarities, and differences of these three messaging protocols.

To help close gaps in understanding, this report describes how the IEC 61968-5:CDV and IEC 61968-100:2013 profiles and integration guidance are to be used to support DER-related

messaging. Unified Modeling Language (UML) sequence diagrams and extensive sample Extensible Markup Language (XML) are provided in further support of this goal.

This report will assume that the EPRI Test Harness will be used as a component in the testing. The EPRI Test Harness uses soapUI to emulate systems that use these messages. A vendor can send a request message to the EPRI Test Harness and, if it is well-formed, receive an appropriate response. Or, the EPRI Test Harness can send an unsolicited notification message to the vendor application. These examples—in which the EPRI Test Harness is functioning in a Server role—are illustrated in Figure 1-1.

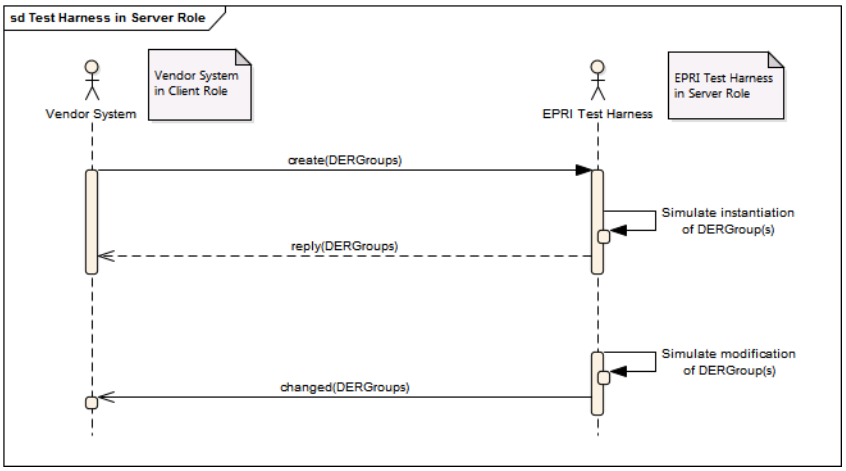


Figure 1-1
Example message exchanges with the EPRI Test Harness acting in a Server role

Conversely, the EPRI Test Harness can also be used to initiate requests, and the vendor can test whether its software can appropriately consume or act on the message that it receives. These examples—in which the EPRI Test Harness is functioning in a Client role—are illustrated in Figure 1-2.

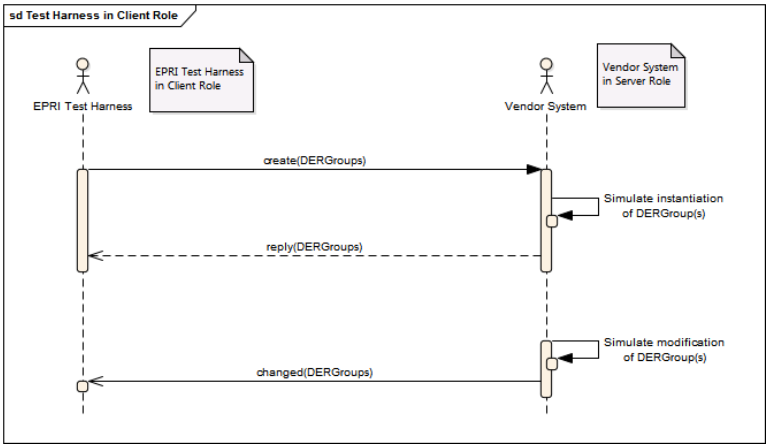


Figure 1-2
Example message exchanges with the EPRI Test Harness acting in a Client role

In these figures, *create* and *changed* are examples of common information model (CIM) verbs supported by IEC 61968-100:2013. Present tense verbs (for example, *create* and *change*) are used to initiate a request in a request/reply interaction pattern. In such a pattern, the verb for the response is always *reply*.

Past tense verbs (for example, *changed* and *created*) are used when one system sends an unsolicited message to another system. In this case, there is no response at the CIM messaging level (although there is generally a transport-level acknowledgment in Web Services implementations).

In these figures, *DERGroups* is referred to as the *noun* in IEC 61968-100:2013, and the DERGroups.xsd (also known as the *DERGroups profile*) is used to instantiate or change a DER Group.

Note: As will be illustrated in this report, there is no DERGroup object in the CIM. DERGroups are represented in the CIM and in the various IEC 61968-5 profiles as EndDeviceGroups. In other words, a DERGroup is a variant of an EndDeviceGroup and contains one or more EndDevices that provide DER Functions.

The combination of verb-noun is used in the naming convention for the methods that appear in, for example, a Web Services Definition Language (WSDL) file. This naming convention facilitates understanding and predictability required to quickly integrate utility systems.

This report addresses the usage of the following subset of verbs and nouns in various verb-noun combinations:

CIM Verbs	
create	created
change	changed
delete	deleted
execute	executed
get	
reply	

IEC 61968-5:CDV Nouns
DERGroups
DERGroupStatuses
DERGroupForecasts
DERGroupDispatches

IEC 61968-9:2013 Nouns
EndDeviceControls
EndDeviceEvents

The scope of this report is intended to support the testing and illustrate the use of the DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches profiles that are expected to be defined and published in IEC 61968-5:CDV as well as the EndDeviceControls and EndDeviceEvents profiles defined in IEC 61968-9:2013 and used to support messaging related to connection and disconnection of DER Groups to/from the electrical grid.

In addition, IEC 61968-5:CDV will define and publish a set of profiles that can be used in conjunction with the "get" verb to identify the "query parameters" for the "get" transactions. These profiles are as follows:

IEC 61968-5:CDV Query Profiles
DERGroupQueries
DERGroupStatusQueries
DERGroupForecastQueries

Note: In other IEC 61968 standards, the profiles used with the "get" verb have a different naming convention than those defined in this report. For example, the DERGroupQueries profile, if it were to follow the pattern used in the other IEC 61968 standards, would be called *GetDERGroups*.

Many of the IEC WG 14 team members have raised objections to the inclusion of the word *get* in the names of the profiles that supply the query parameters. Consequently, the IEC has indicated that the old naming convention will be replaced, most likely by the naming convention used in this report. Therefore, all examples documented in this report will use query profiles using the new naming convention: DERGroupQueries, DERGroupStatusQueries, and DERGroupForecastQueries.

Supplemental Resources File

A Supplemental Resources zip file is available from EPRI to support this report. This zip file contains XSDs, XSD templates, WSDLs, WSDL templates, and XML instance files for each test case in the report. A full description of the contents of this zip file can be found in Appendix A.

In addition, there are various references within this report to specific locations within the zip file.

2
BACKGROUND INFORMATION

Definitions and Acronyms

Term	Definition or Explanation
Back-Office System	For this report, a Back-Office System is an Enterprise System other than a Head-End System. *(See also Enterprise System.)*
CIM	Common Information Model; standard developed by the electric power industry that has been officially adopted by IEC and aims to allow application software to exchange information about the configuration and status of an electrical network. The CIM and associated standards also provide limited support for gas and water commodities and networks.
CIM-compliant	A term signifying compliance with the IEC CIM. For this report, CIM-compliant also signifies compliance with the forthcoming IEC 61968-5:CDV and 61968-100:2013 standards.
DER	Distributed Energy Resources: smaller power sources that can be aggregated to provide power necessary to meet regular demand. As the electricity grid continues to modernize, DER such as storage and advanced renewable technologies can help facilitate the transition to a smarter grid. Types of DER can include photovoltaics, battery storage, fuel cells, wind, thermal, hydro, biogas, biomass, and cogeneration. In the CIM and IEC 61968-5:CDV profiles, there is no CIM object called *DER*; instead the DER are represented by an EndDevice object.
DER Group	A logical grouping of DER. A DER Group can consist of one or more DER of any DER Type. In the CIM and IEC 61968-5:CDV profiles, there is no CIM object called DERGroup; instead the DER Group is represented by an EndDeviceGroup object.
DER Group Dispatch	For IEC 61968 Part 5 and this report, a DER Group Dispatch is a control command issued to or by a Distributed Energy Resource Management System (DERMS) to cause a certain level of active (real), reactive, or apparent power to be provided to the grid by a DER Group. A DER Group Dispatch can also include other capabilities to be provided to the grid, for example, a certain output voltage or a voltage ramp rate curve.
DER Group Forecast	For IEC 61968 Part 5 and this report, a DER Group Forecast provides one or more predictions of the minimum and maximum active (real), reactive, and apparent power expected to be available to the grid for a specified time interval in the future. DER Group Forecasts can also include prediction of the ability of the DER Group to provide other capabilities, for example, a certain output voltage or a voltage ramp rate curve.
DER Group Status	For IEC 61968 Part 5 and this report, the status of a DER Group is characterized by the capacity of the DER Group to provide active (real), reactive, and apparent power to the grid. DER Group Status can also include the ability of the DER Group to provide other capabilities, for example, a certain output voltage or a voltage ramp rate curve.
DERMS	Distributed Energy Resource Management System. For the test cases documented in this report, the DERMS is a Back-Office System whose function is to track the creation and maintenance of DER Groups, provide DER Group Statuses and DER Group Forecasts, and carry out DER Group Dispatches.

Term	Definition or Explanation
Enterprise System	A system in the utility enterprise dedicated to the support of one or more business functions. Examples include distributed energy resource management systems, work management systems, asset management systems, mobile work dispatching systems, metering systems, and outage management systems.
IEC	International Electrotechnical Commission.
JMS	Java Message Service is a messaging standard that allows application components based on the Java 2 Platform, Enterprise Edition to create, send, receive, and read messages.
OperationSet	A special construct used with the Payload of a CIM-compliant message to request execution of multiple CIM-based transactions in a single request or to handle special transactions that call for deletion of attributes or instances of associated classes. Can also be used to report the results of OperationSet requests.
SOAP	Simple Object Access Protocol.
UUID	A universally unique identifier, a UUID is a unique reference number used as an identifier in computer software. The value of a UUID is represented as a 32-character hexadecimal string, such as {21EC2020-3AEA-1069-A2DD-08002B30309D}, and is usually stored as a 128-bit integer. The total number of unique keys is 2^{128} or 3.4×10^{38}. This number is so large that the probability of the same number being generated randomly twice is negligible. Nevertheless, certain techniques have been developed to help ensure that UUIDs are not duplicated.
XML	eXtensible Markup Language, a method of organizing data so that individual data items are delimited by descriptive tags (see http://www.w3.org/XML/).
XSD	XML Schema Definition.

Assumptions and Conventions

ID	Assumption/Convention Description
1	It is assumed that primary users of this report are sufficiently skilled in the use of XML, XSDs, WSDLs, and associated integration technologies.
2	In the CIM-Compliant XML Schema Definitions (XSDs), certain fields are required; others are optional. Fields designated as optional in the XSDs may or may not appear in the examples in this report. Some such fields may be optional in the XSD yet required in specific test case scenarios. For the test cases described in this report, any fields appearing in the XSDs but not mentioned in the examples can be ignored; however, to pass the tests requires that the messages sent by the application being tested can pass validation against the applicable IEC 61968-100:2013 and IEC 61968-5:CDV XSDs (profiles).
3	Within XML messages, CIM verbs must be in lower case.
4	The sequence (order) of elements in CIM-compliant XML messages must match the sequence of elements in the XSDs. Every attempt has been made to ensure that the sequence of elements appearing in Sample XML within this report is consistent with the applicable XSDs; however, in case of conflict between the sequence in the XSDs and the sequence in the test case steps in this report, the sequence in the XSDs shall take precedence.
5	Timestamps (to convey dates and/or times) in XML messages shall be formatted consistent with International Standard ISO-8601 (2004). Two formats are supported: • Times are expressed in UTC (Coordinated Universal Time), with a special UTC designator ("Z"). • Times are expressed in local time, together with a time zone offset in hours and minutes. A time zone offset of "+hh:mm" indicates that the date/time uses a local time zone that is "hh" hours and "mm" minutes ahead of UTC. A time zone offset of "-hh:mm" indicates that the date/time uses a local time zone that is "hh" hours and "mm" minutes behind UTC. For example, the following are valid representations of 8:15:30 am, U.S. Central Standard Time on November 15, 1994: 1994-11-15T14:15:30Z 1994-11-15T08:15:30-06:00 A time stamp of 00:00:00 refers to midnight at the beginning of the specified day. For example, 1994-11-15T00:00:00-06:00 refers to midnight U.S. Central Standard Time at the first moment of November 15, 1994. The following midnight (24 hours later) may be referred to in any of the following ways: 1994-11-16T06:00:00Z 1994-11-16T00:00:00-06:00 1994-11-15T24:00:00-06:00 Situations can arise in which it is desirable to express a time independent of a date. In such cases, follow the above examples, but delete the date portion of the string and the "T" separator.
6	When deleting an attribute from a CIM object using an Operation (within an OperationSet) where the elementOperation Boolean is "true" and the Operation verb is "delete," it is necessary to supply a value for the attribute that will pass XML schema validation. In these instances, the actual value supplied is ignored and therefore may be any value that is of the proper data type to pass validation.
7	When required to fully qualify a reply to an OperationSet request, the operationID element for the relevant Operation in the request message is supplied in the reply message(s). This is used, in conjunction with the overall CorrelationID in the message Header, to correlate replies with their corresponding requests. If an operationID is not supplied in a reply, the reply is interpreted as applying to the entire OperationSet.

ID	Assumption/Convention Description
8	In the XSD diagrams generated by XMLSpy®, solid lines indicate mandatory elements and dashed lines indicate optional elements.
9	In a request/response messaging pattern involving CIM verbs other than "get," it is common practice to omit the Payload element from the response messages when the content of the Payload would be identical to that of the Payload in the request message. Most examples in this report assume that this is the case; consequently, the Payload elements have been so omitted in most of the sample reply XML provided. Nevertheless, including the Payload in the response message is an acceptable practice, and the presence or absence of these optional Payload elements shall have no bearing on whether a test case is deemed to have passed or failed. The only requirement is that when a Payload element is included, it can be successfully validated against the applicable XSD.
10	The IEC 61968-5:CDV profiles contain elements specifying active, reactive, and apparent power. The units of measure for these quantities are kW, kVAR, and kVA, respectively. It is likely that future versions of the IEC 61968-5 profiles will provide an ability to specify the multiplier (k for x1000) explicitly.
11	*Real power* (used in DERFunctions) and *active power* (used in DERParameters) are synonymous.

IEC 61968-100:2013 Considerations

IEC 61968-100:2013 provides a normative Message.xsd that serves as a "message wrapper" for domain-specific messages such as the DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches messages defined in the forthcoming IEC 61968-5:CDV Distributed Energy Resource Management Systems standard. The normative Message.xsd is described in Appendix B.

This report is not intended to be an extensive primer on the use of IEC 61968-100:2013; however, a discussion of basic IEC 61968-100:2013 fundamentals is presented here to facilitate understanding of the test cases and Sample XML contained in this report.

Test cases in this report involve two distinct messaging patterns. The first is a request/response pattern that involves a request message (referred to as a *Request Stereotype* message) and a response message (referred to as a *Response Stereotype* message). In the UML sequence diagrams throughout this report, a Request Stereotype message is depicted as a synchronous request using a solid line and a solid arrowhead. A Response Stereotype message is depicted as a synchronous return using a dashed line and an open arrowhead.

The second message pattern is a notification message (referred to as an *Event Stereotype* message). An Event Stereotype message is considered an asynchronous message and is depicted using a solid line and an open arrowhead.

As indicated in Appendix B, a Request Stereotype message can have a Header structure, a Request structure, and a Payload structure. The Header is mandatory; the Request and Payload structures are optional. As a rule and for all test cases documented in this report:

- Request Stereotype messages involving the "get" CIM verb have a Header structure and a Request structure.
- Request Stereotype messages involving any CIM verb other than "get" have a Header structure and a Payload structure.

- Response Stereotype messages for a "get" operation have a Header structure and a Payload structure.
- Response Stereotype messages for all operations other than "get" have a Header structure and a Reply structure (although, in accordance with Assumption 9 above, an optional Payload structure is allowed; two examples have been provided in selected test cases to illustrate the responding system providing an mRID for a DER Group and a DER Group Dispatch, respectively).
- Event Stereotype messages have a Header structure and a Payload structure.

IEC 61968-5:CDV introduces the use of the IEC 61968-9:2013 EndDeviceControls and EndDeviceEvents XSDs to connect and disconnect DER Groups from the grid. Consistent with their use in IEC 61968-9, these profiles are used in a hybrid messaging pattern. A request/reply pattern is used to convey the request to connect or disconnect, and then a publish pattern (Event Stereotype message) is used to convey the actual connection or disconnection event(s). This is illustrated in the test cases in Section 13. For additional elaboration, refer to IEC 61968-100:2013 and IEC 61968-9:2013.

IEC 61968-100:2013 also supports both JMS and Web Services messaging protocols; for Web Services, there are Generic and Strongly Typed variants. Section 4 discusses some of the differences between these protocols; however, except for the discussion in Section 4, everything in this report is based on the use of Strongly Typed Web Services—the technology implemented in the EPRI Test Harness.

To the extent that anything concerning IEC 61968-100:2013 can be considered intuitive, the test cases involving the use of *create*, *created*, *delete*, *deleted*, and *get* verbs are relatively straightforward.

When creating a DER Group or a DER Group Dispatch or when getting a DER Group, DER Group Status, or DER Group Forecast, the Payload of either the request or the reply message specifies the entire content of the object (except for an mRID in two of the *create* test cases). When deleting a DER Group, the Payload identifies the instance(s) of DER Group to be deleted.

Test cases involving the modification (verbs *change* or *changed*) of a DER Group or DER Group Status are not as straightforward. A given DER Group or DER Group Status can have a variety of simple attributes as well as one or more instances of associated CIM classes (for example, DERGroups.xsd defines that there can be multiple EndDevices (DER) assigned to the group). If the value of an attribute or associated CIM class is being changed, or if a new attribute or instance of an associated CIM class is being added, this can be accomplished using a CIM verb of *change* (or *changed*), with the Payload element containing only the new or changed information. However, if the intent is to delete the value of an attribute or to delete an instance of an associated CIM class, it is necessary to use an OperationSet construct. This is, regrettably, far less intuitive. See Appendix C and the specific test cases involving this type of transaction for further elaboration.

Test Case and Sequence Diagram Conventions

The test cases in this report assume that messages are being communicated between a DERMS acting in a Server role and an unspecified Client system that issues commands/requests to the DERMS and/or receives unsolicited information from the DERMS.

As stated, the EPRI Test Harness can play either the Server role or the Client role, with the vendor Application Being Tested playing the other role. For brevity, the actors for the test cases in this report are described generically as *Client* and *Server*. The forms for recording test results provide checkboxes for indicating which system is acting in each role.

Object Identifiers in Messages

Figure 2-1 shows the CIM model used for identifiers of CIM objects. In Figure 2-2, the model is seen from the perspective of an example XML structure that would be realized within a message profile.

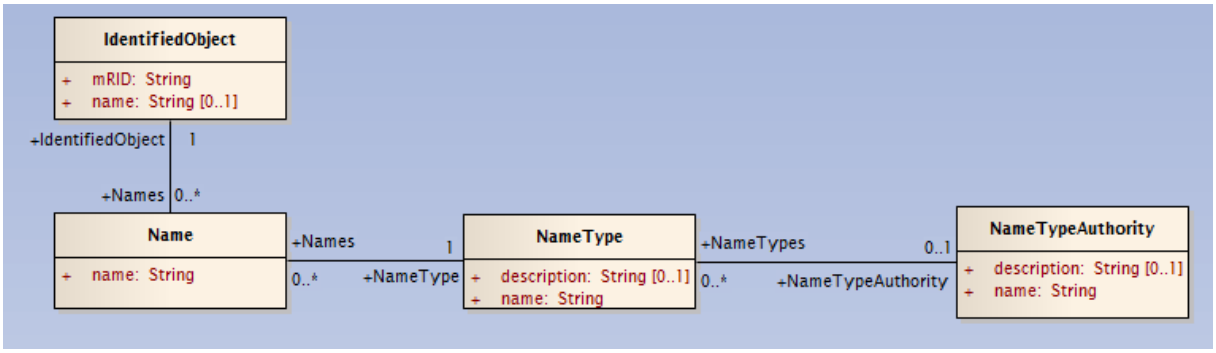


Figure 2-1
CIM naming

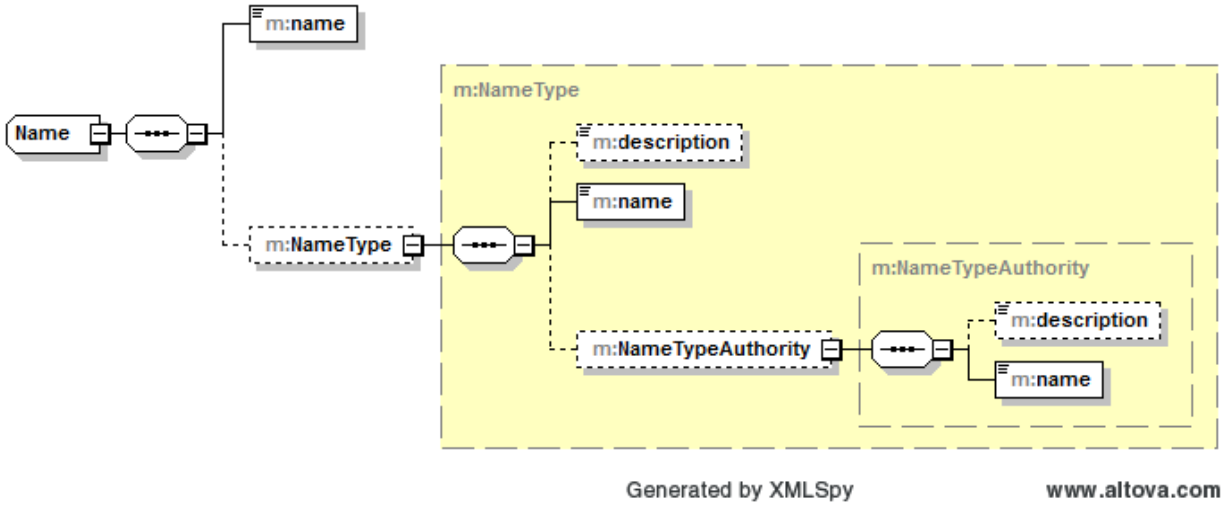


Figure 2-2
Example XML structure for names

Using the example shown in Figure 2-2 as a reference, several important rules must be followed:

- An object (for example, an EndDevice or EndDeviceGroup) may be identified using a globally unique mRID.
- When used, an mRID must be a UUID, as defined by RFC 4122.
- An object may be identified using one or more instances of the Names class, with Names.name values.
- An object may have both an mRID and Names.name identifiers.
- If more than one Names.name value is supplied, each name should have a corresponding Names.NameType.name.
- A Names.NameType.NameTypeAuthority.name must be specified if two objects have identical Names.name and Names.NameType.name values and there is a need for them to be identified uniquely.
- Although the IdentifiedObject.name attribute is defined in the CIM, it is not used within IEC 61968 profiles. This is to avoid ambiguities in which a producer could choose to use IdentifiedObject.name, but a consumer could expect IdentifiedObject.Names.name. Therefore, from the perspective of IEC 61968, IdentifiedObject.name is deprecated.
- In implementation cases in which multiple consumers may exist, a producer may need to supply multiple Names.name values—each with a different Names.NameType.name—to support the specific needs of each consumer.

Uniqueness Requirements for Object Identifiers

When mRIDs are used, the mRID for a given instance of a CIM class must, by definition, be globally unique (this is accomplished using UUIDs).

The uniqueness constraints on Names class identifiers are usage-dependent. Names.name instances may be any of the following:

- Globally unique across all IEC messages
- Globally unique across all IEC messages when combined with a Names.NameType.name and/or a Names.NameTypeAuthority.name
- Unique within the context of a single IEC message
- Unique within the context of a single IEC message when combined with a Names.NameType.name and/or a Names.NameTypeAuthority.name
- Non-unique

Although instances of the Names class may be non-unique, every CIM object referenced by Names class in an IEC message must be referenced unambiguously.

Message Headers and Message Correlation

The following XML snippet illustrates the content of the Header structure for all messages appearing in this report.

```
<Header>
      <Verb>get</verb>
      <Noun>DERGroups</noun>
      <Timestamp>2016-07-20T16:07:02-06:00</msg:Timestamp>
      <MessageID>4503ba7a-f577-4254-aac2-ce3ab247d8b2</msg:MessageID>
      <CorrelationID>300942bb-1850-4ab7-aece-5df37bbd4d71</CorrelationID>
</Header>
```

Verbs and *nouns* are as previously described.

Timestamps are in ISO 8601 format and support a time zone offset.

Every message must have a unique MessageID.

The CorrelationID is used to enable a requesting system to correlate responses with the originating request. Every message that is part of a request/response message pattern must have a CorrelationID unique to the specific request/response message exchange.

Best Practices for Assignment of MessageIDs and CorrelationIDs

Depending on the specifics of any given use case involving CIM-compliant transactions, a system may function as a either a Client or a Server (or both). Such a system may initiate requests, respond to requests, publish information, or receive published information. Some systems may also receive messages from one system and relay them to another system.

All CIM-compliant messages must have a MessageID in the IEC 61968-100:2013 Message Header. Messages following a Request/Response pattern will have also have a CorrelationID in the IEC 61968-100:2013 Message Header.

The best practices for the generation and use of MessageIDs and CorrelationIDs are as follows:

- Every message, whether sent or received, should have a MessageID that is a non-intelligent, machine-generated string guaranteed to be unique. Use of UUIDs as defined in RFC 4122 is recommended. MessageIDs are generated by the system originating the message.
- Request messages will also include a CorrelationID. For a request message, the MessageID of the request may also be used as the CorrelationID; however, it more common to generate a different unique string. Either way, CorrelationIDs should also be non-intelligent, machine-generated strings that are generated by the system originating the original request message.
- Response (verb = reply) messages will also include a CorrelationID. The CorrelationID in the response (reply) message must be the same as the CorrelationID from the original (corresponding) request message.

  Note 1: Although no such cases are documented in this report, CIM messaging may involve multiple response messages to a given request message. In this case, the CorrelationID in each such response message will be identical.

Note 2: Although no such cases are documented in this report, in cases in which a System C is acting as an intermediary in receiving requests from System A—forwarding requests to System B, receiving responses from System B, and forwarding the responses to System A—the MessageIDs and CorrelationIDs used in the communications between System C and System A should be different from and entirely independent of the MessageIDs and CorrelationIDs used in the communications between System C and System B.

Strict compliance with these best practices is highly recommended but not required.

3
IEC 61968-5:CDV AND IEC 61968-9:2013 XSDS AND WSDLS

Domain-Specific IEC 61968-5:CDV (DER) XSDs

As described in Section 1, EPRI has collaborated with IEC Working Group 14 and the IEC WG14 Model Manager to generate official IEC-produced and endorsed domain-specific DER profiles (XSDs) to be used both in the forthcoming IEC 61968-5:CDV and in this EPRI report. The version of the IEC CIM used to generate these profiles is *iec61970cim17v16_iec61968cim13v11_iec62325cim03v14.eap*.

The IEC-generated IEC 61968-5:CDV DER profiles include the following:

IEC 61968-5:CDV Profiles	
DERGroups.xsd	DERGroupQueries.xsd
DERGroupStatuses.xsd	DER GroupStatusQueries.xsd
DERGroupForecasts.xsd	DERGroupForecastQueries.xsd
DERGroupDispatches.xsd	

The profiles in the left column are the "base" DER profiles and appear in the Payload section of IEC messages. Those in the right column are the "query" profiles that appear in the Request section of IEC messages and are used to specify the query parameters when using the "get" CIM verb.

Significant changes from the IEC 61968-5:CD versions of the DER-related profiles and the first edition of this report include the following:

- The capabilities of each DER Group are now represented as DERFunctions and are specified using Boolean elements in the DERGroups XSD (see Figure 3-1).
- Analog values that represent monitored or requested levels of DER Group performance are now expressed as DERMonitorableParameters in the DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches XSDs. Furthermore, the IEC 61968-5:CDV versions of these XSDs support the ability to specify these monitorable or requested parameters using a time-based curve (see Figures 3-2 through 3-4).

In addition, in a departure from other IEC 61968 series standards published to date, IEC has tentatively adopted a practice first introduced by EPRI in the 2015 report 3002006862, *Program on Technology Innovation: Test Script for International Electrotechnical Commission 61968-6:FDIS Messages*.

This practice involves the creation of both a "constrained" and an "unconstrained" version of each of the "base" profiles. The constrained versions have a greater number of mandatory (non-optional) XSD elements and are intended for use with the "create," "created," and "get" CIM verbs. The unconstrained versions have all or almost all of the CIM elements defined as optional,

which is required to support operations involving the “change,” “changed,” “delete,” and “deleted” CIM verbs.

Note: Any XML that validates against the constrained version of an XSD will also validate against the unconstrained version. Consequently, if the approach to use both constrained and unconstrained versions of the profiles is not ultimately adopted, all test cases and all Sample XML in this report will remain valid; it will be necessary only to substitute the unconstrained version of the XSDs in place of the constrained versions.

Figures 3-1 through 3-4 illustrate the high-level structure of the constrained version each of the base IEC 61968-5:CDV profiles (DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches).

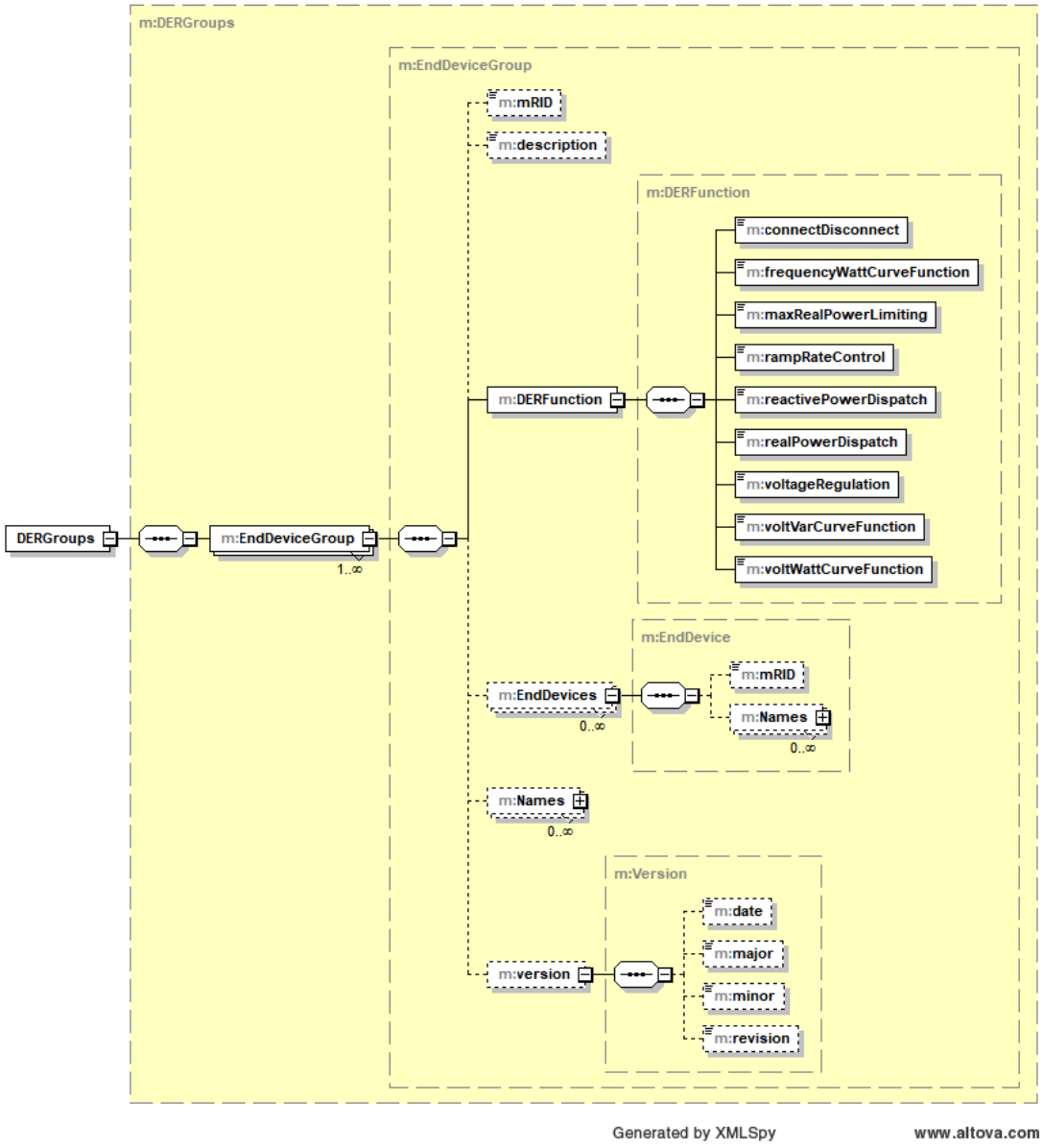


Figure 3-1
IEC 61968-5:CDV DERGroups.xsd (constrained version)

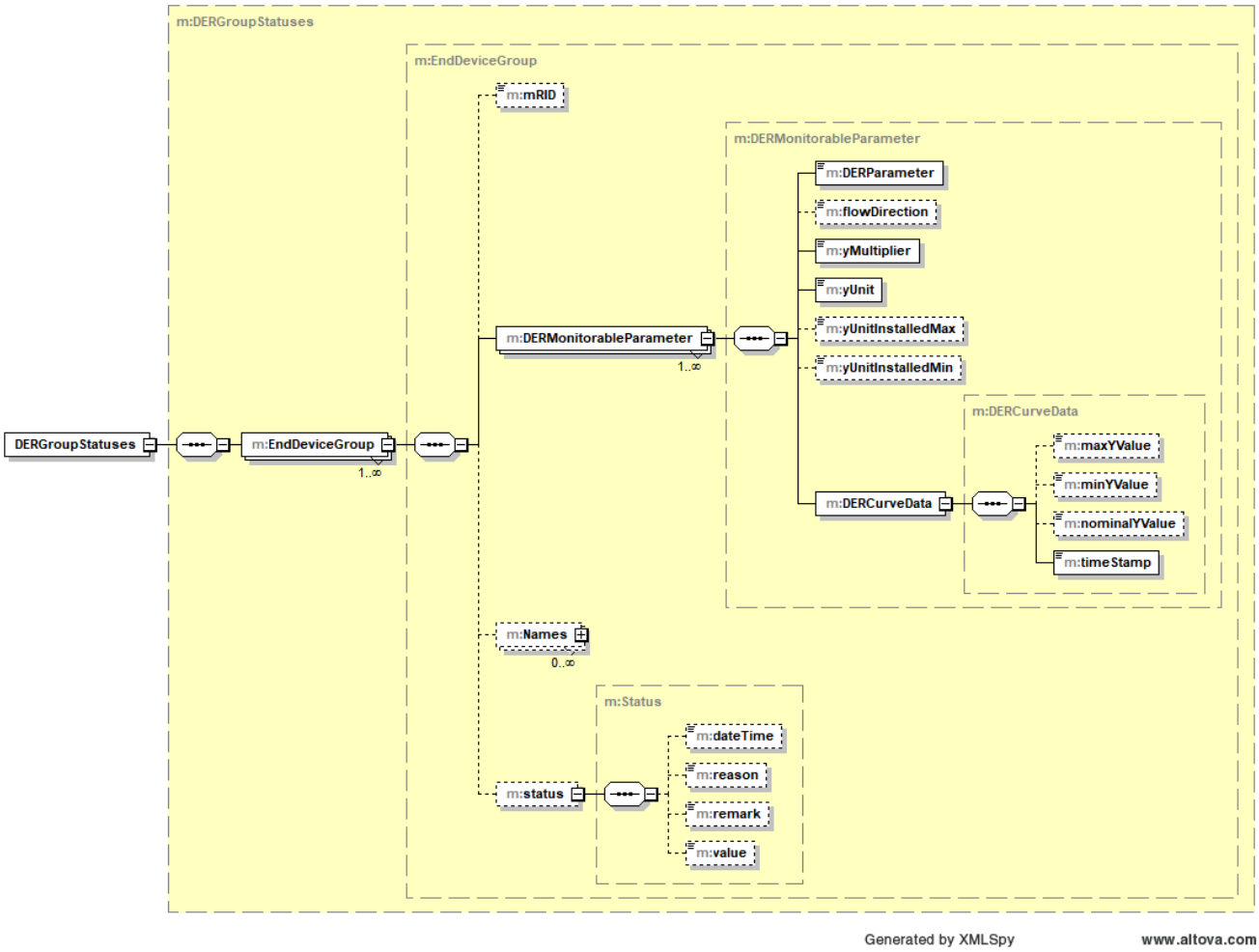


Figure 3-2
IEC 61968-5:CDV DERGroupStatuses.xsd (constrained version)

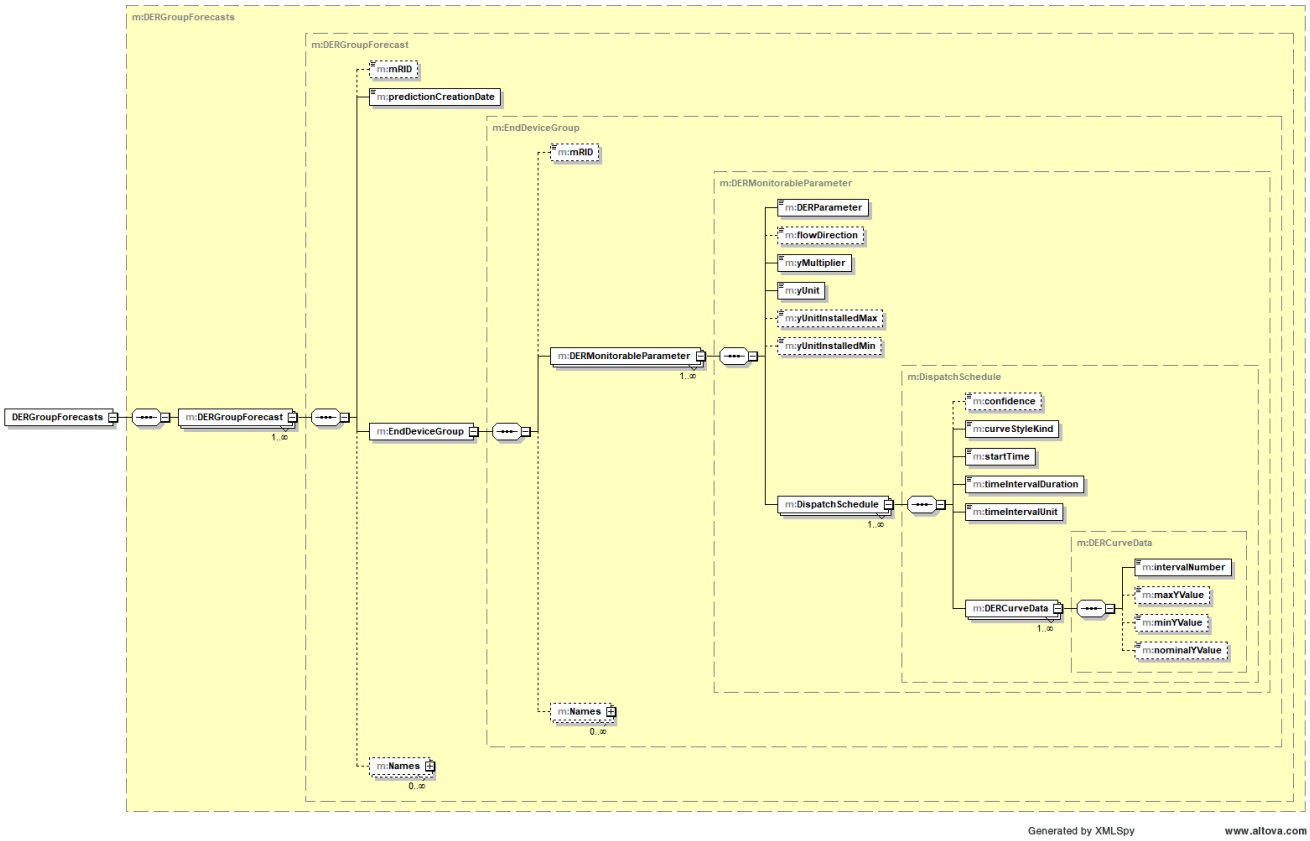


Figure 3-3
IEC 61968-5:CDV DERGroupForecasts.xsd (constrained version)

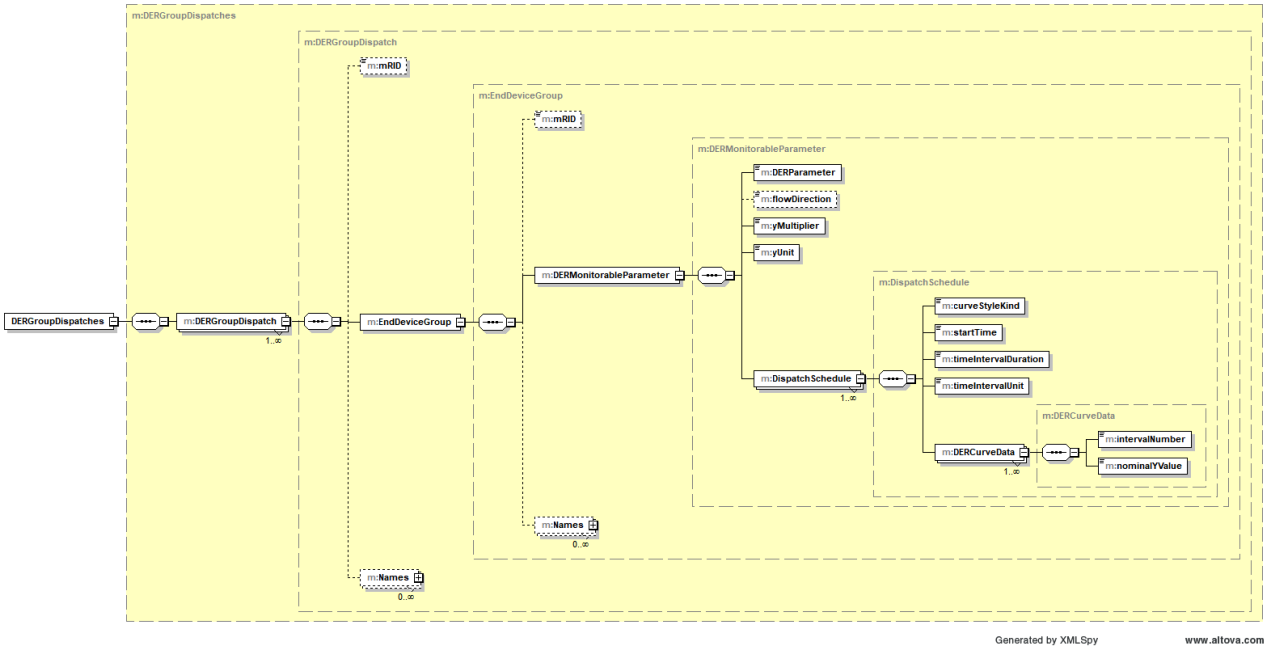


Figure 3-4
IEC 61968-5:CDV DERGroupDispatches.xsd (constrained version)

Figures 3-5 through 3-7 illustrate the IEC 61969-5:CDV "Query" profiles that, although they use a different naming convention, are patterned after the "Get" profiles in IEC 61968-9:2013.

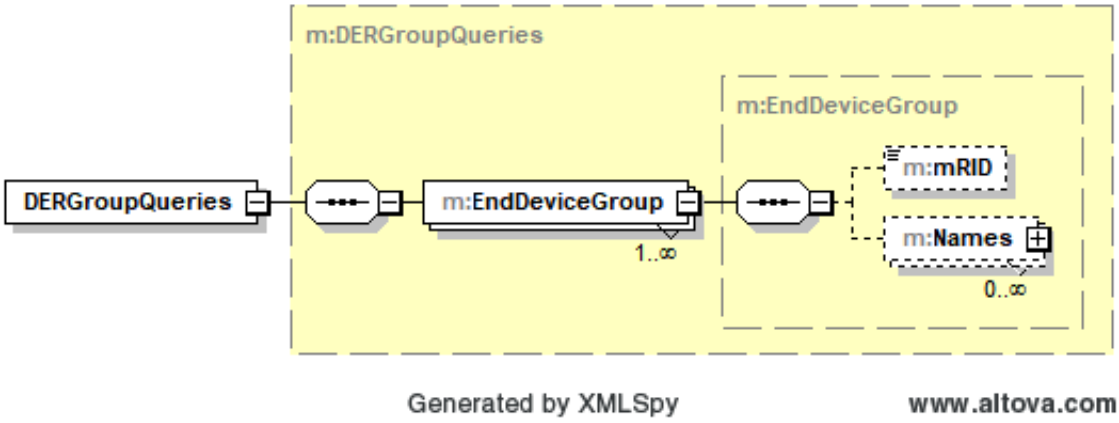


Figure 3-5
IEC 61968-5:CDV DERGroupQueries.xsd

Note: Because the DERGroups profile specifies the list of DERFunctions supported by a DER Group, performing a "get/DERGroups" operation is synonymous with DER Group Capability Discovery (a function commonly referred to in the industry).

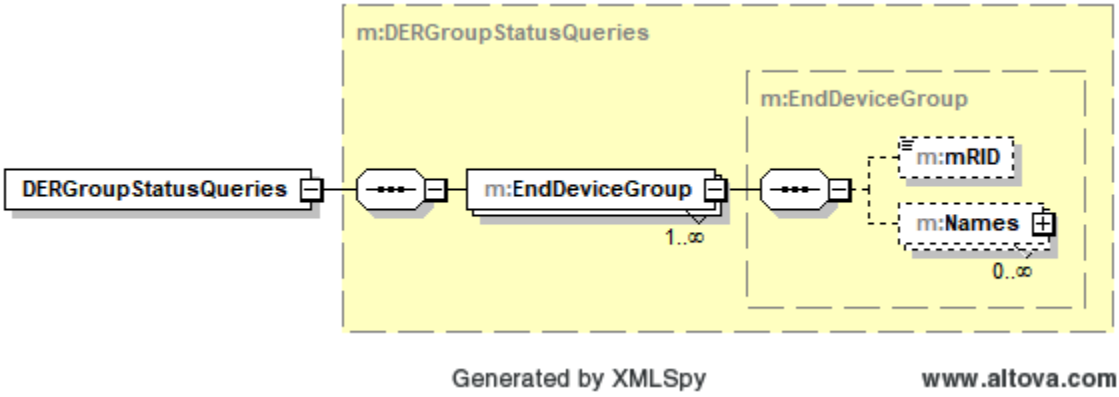


Figure 3-6
IEC 61968-5:CDV DERGroupStatusQueries.xsd

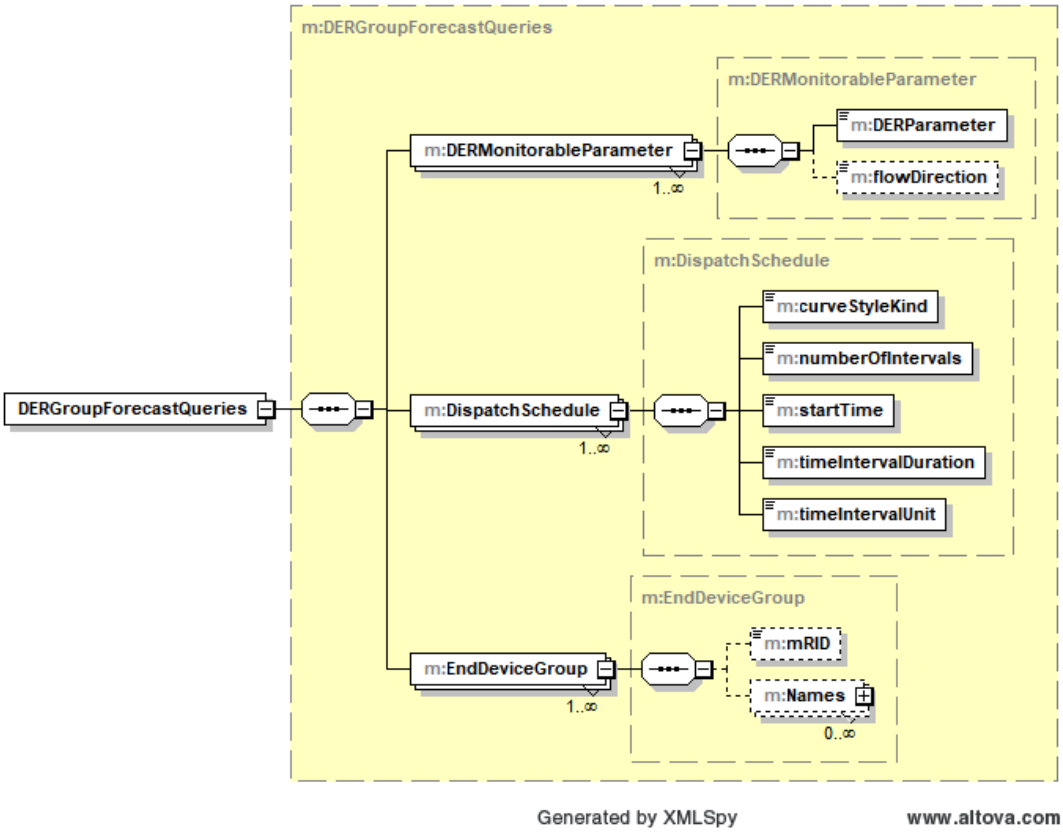


Figure 3-7
IEC 61968-5:CDV DERGroupForecastQueries.xsd

Note: The query profiles used in conjunction with the "get" verb appear in the Request section (as opposed to the Payload section) of the IEC 61968-100:2013 message.xsd envelope.

In messages using the verb "get," the noun in the Message Header specifies the XSD/profile that will be used to return the results of the query.

For example, the request message to get the membership and functions of a DER Group will have a verb of "get" and a noun of "DERGroups," even though the Request section of the message conforms to the DERGroupQueries profile (not the DERGroups profile).

The response message will have a verb of "reply" and a noun of "DERGroups," and the Payload section of the message will conform to the DERGroups profile.

Copies of the IEC 61968-5:CDV domain-specific DER profiles, including both constrained and unconstrained versions, can be found in the Supplemental Resources File described in Appendix A.

Enumerated Values in DER Profiles (XSDs)

The IEC 61968-5:CDV profiles contain several elements for which allowable values are enumerated in the XSDs. These include elements specifying DER monitorable parameters, units of measure, unit multipliers, and flow directions. The lists of allowable values include some that are not likely to be used in DER messaging. This is because the lists are shared with other functions and uses in the CIM.

DERCurveData and the curveStyleKind Element

The IEC 61968-5:CDV profiles use the DERCurveData class to convey values of DER monitorable parameters both for a single point in time (in the DERGroupStatuses profile) as well as for a series of points in time (in the DERGroupForecasts and DERGroupDispatches profiles). For the case of a series of points in time, the curveStyleKind element specifies the way in which the time series data points are to be interpreted:

- A curveStyleKind of "straightLineYValues" indicates that data over a time interval are to be linearly interpolated between the Y value at the start of the time interval and the Y value at the end of the time interval.
- A curveStyleKind of "constantYValue" indicates that data over a time interval remain at the Y value at the beginning of the time interval and takes a step change to a new value at the end of the time interval (which is also the start of the next time interval).

Note: Interval numbering starts at 1. For curveStyleKind = straightLineYValues, to specify n intervals, it is necessary to specify n+1values, with the (n+1)th Y value being for the start time of the (n+1)th interval. For curveStyleKind = constantYValue, to specify n intervals, it is necessary only to specify n values, with each Y value being the value at both the start and end of the interval.

As an illustration of this, consider the following data:

DERParameter: activePower

yMultiplier: k (for x1000)

yUnit: W (for watts)

startTime: 6/12/2017 14:00

timeIntervalDuration: 15

timeIntervalUnit: m (for minutes)

numberOfIntervals: 4

intervalNumber	Start Date/Time	EndDateTime	nominalYValue
1	6/12/2017 14:00	6/12/2017 14:15	20
2	6/12/2017 14:15	6/12/2017 14:30	30
3	6/12/2017 14:30	6/12/2017 14:45	25
4	6/12/2017 14:45	6/12/2017 15:00	35
5	6/12/2017 15:00	6/12/2017 15:15	30

If the curveStyleKind is "straightLineYValues," these data are to be interpreted as depicted in Figure 3-8.

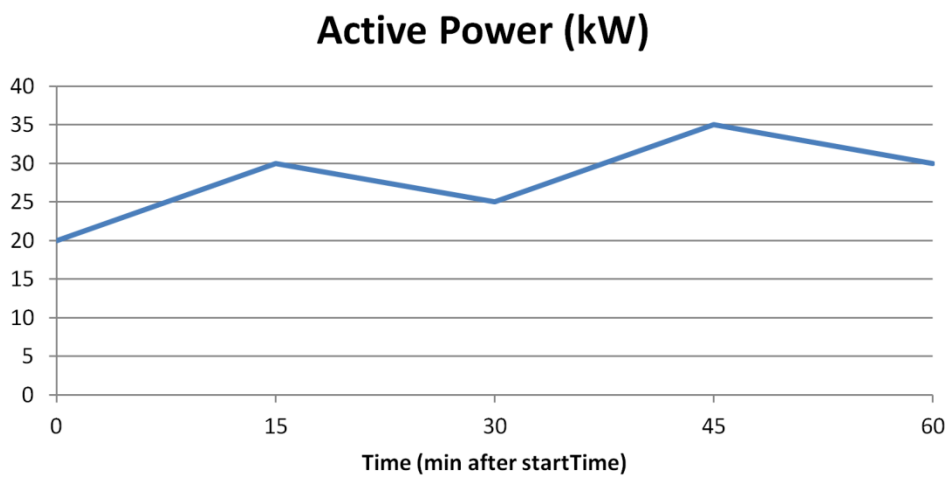


Figure 3-8
Interpretation of data with curveStyleKind = straightLineYValues

Alternatively, if the curveStyleKind is "constantYValue," these data are to be interpreted as depicted in Figure 3-9.

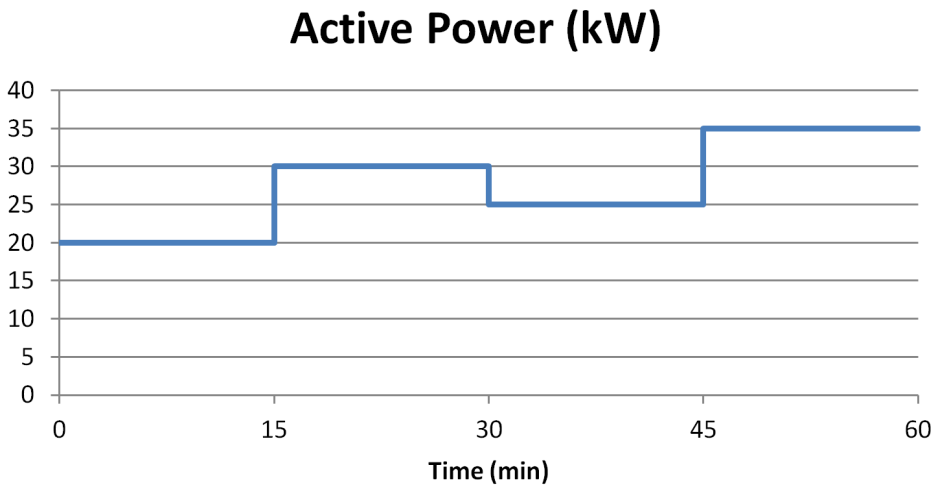


Figure 3-9
Interpretation of data with curveStyleKind = constantYValue

Domain-Specific IEC 61968-9:2013 (Meter Reading and Control) XSDs

As described in Section 1, two profiles (XSDs) from the IEC 61968-9:2013 (Meter Reading and Control) standard are used to support connecting and disconnecting DER Groups to/from the grid. The applicable IEC 61968-9 profiles include the following:

IEC 61968-9:2013 CDV Profiles
EndDeviceControls.xsd
EndDeviceEvents.xsd

IEC 61968-9:2013 does not embody the concept of constrained vs. unconstrained profiles; therefore, these can be considered unconstrained.

Figures 3-10 and 3-11 illustrate the high-level structure of these IEC 61968-9:2013 profiles.

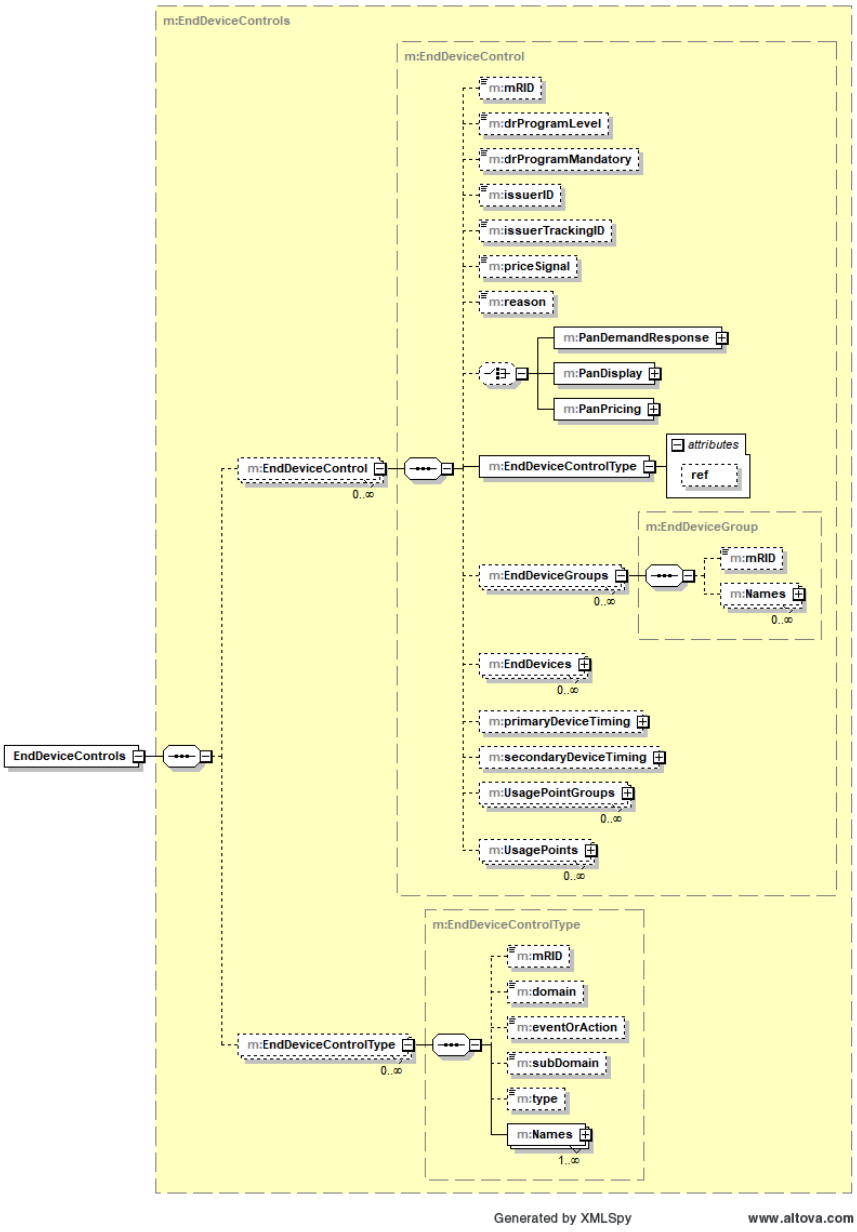


Figure 3-10
IEC 61968-9:2013 EndDeviceControls.xsd

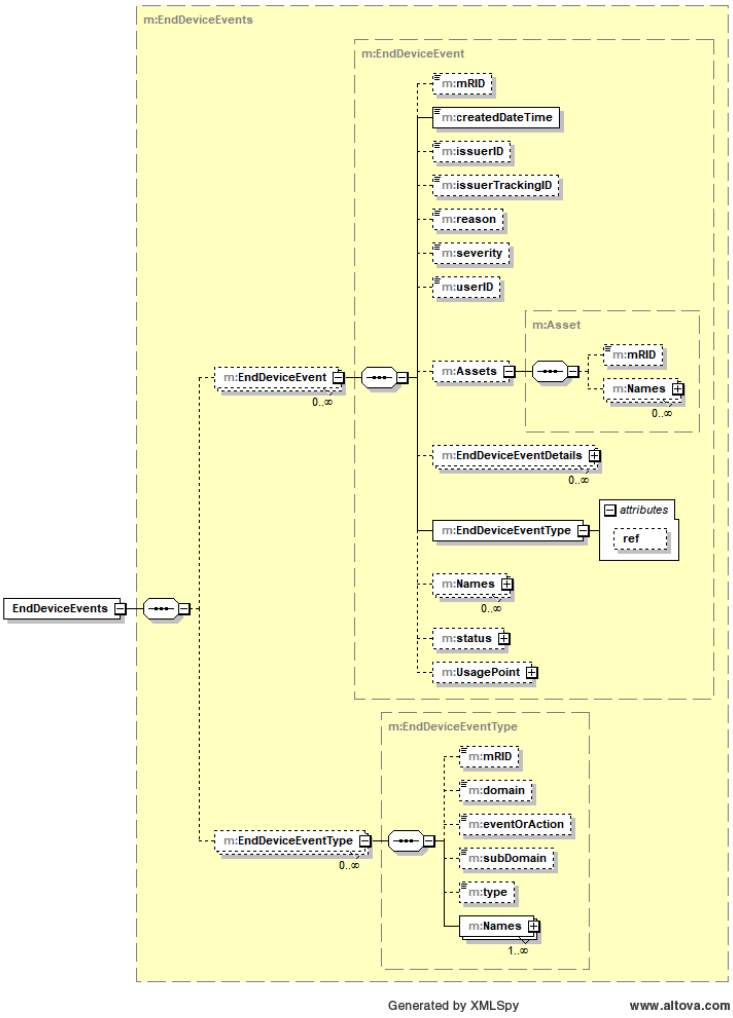


Figure 3-11
IEC 61968-9:2013 EndDeviceEvents.xsd

The EndDeviceControls profile is used to request connection or disconnection of DER Groups (technically, the DER Devices in the DER Group) to/from the grid. Similarly, the EndDeviceEvents profile is used to signal that a DER Device has connected to or disconnected from the grid.

Control codes and event codes used to request/reflect connection or disconnection of a DER Groups and DER Devices to/from the grid are taken from the IEC 61968-9:2013 standard and are also contained in Appendices G and H. The four-part decimal-delimited code (corresponding to type, domain, subDomain, and eventOrAction) is placed in the message where the "ref" element is shown for the EndDeviceControlType or EndDeviceEventType in Figures 3-10 and 3-11, respectively.

The "expanded" EndDeviceControlType and EndDeviceEventType elements appearing at the bottom of each of these figures allows decomposition of the codes into their respective parts in order to "resolve the reference." However, standard practice in IEC 61968 messaging is to omit the expansion of the four-part code when such codes are normatively defined by the standard; this practice is reflected in the test cases in Section 13.

Strongly Typed DER Message XSDs and WSDLs

As noted, the EPRI Test Harness used to support the testing in this report uses what the IEC refers to as *Strongly Typed WSDLs*.

For DER-related messages to be communicated between systems using Strongly Typed WSDLs, the domain-specific DER profiles identified above must undergo a two-step process:

1. Creation of a set of Strongly Typed Message XSDs that wrap the domain-specific profiles in the Message.xsd envelope defined by IEC 61968-100:2013.
2. Creation of the Strongly Typed WSDLs that incorporate these Message XSDs.

To achieve these objectives, a structured process was followed to generate the artifacts needed to support the EPRI-sponsored testing. Inputs to this process included the following:

- The domain-specific IEC 61968-5:CDV and IEC 61968-9:2013 profiles identified previously
- The Message.xsd Message envelope defined by IEC 61968-100:2013
- Templates, instructions, and guidance concerning generation of Strongly Typed Message XSDs and WSDLs from IEC 61968-100:2013.

  Note: Since the time of its publication, several errors and omissions have been discovered in the IEC 61968-100:2013 templates and instructions for creation of the Strongly Typed Message XSDs and Strongly Typed WSDLs. The 2015 EPRI report 3002006862, *Program on Technology Innovation: Test Script for International Electrotechnical Commission 61968-6:FDIS Messages*, documented corrected versions of these templates and instructions. This report introduces additional modifications required to reflect the naming conventions for the query profiles and updates the year specified in the namespaces to 2017.

The structured process that was followed is depicted in Figure 3-12 and can be generally described as follows:

- Strongly Typed Message XSDs (DERGroupsMessage.xsd, DERGroupStatusesMessage.xsd, DERGroupForecastsMessage.xsd, DERGroupDispatchesMessage.xsd, EndDeviceControlsMessage.xsd, and EndDeviceEventsMessage.xsd) were created using the Message.xsd and modified Strongly Typed Message templates in IEC 61968-100:2013.
- Strongly Typed Query Message XSDs (DERGroupQueriesMessage.xsd, DERGroupStatusQueriesMessage.xsd, and DERGroupForecastQueriesMessage.xsd) were created using the Message.xsd and modified Strongly Typed Message templates in IEC 61968-100:2013.

  Only a single version of each of these Strongly Typed Message XSDs exists; however, they import the corresponding constrained and unconstrained domain-specific IEC 61968-5:CDV XSDs. Consequently, importing constrained versions of the profiles results in constrained versions of the Strongly Typed Message XSDs. Similarly, importing unconstrained versions of these profiles results in unconstrained versions of the Strongly Typed Message XSDs.

- A Strongly Typed OperationSet Message XSD (DERGroupsOperationSetMessage.xsd) was created to support the test cases involving the deletion of attributes and/or instances of associated CIM objects as described in Section 2 and Appendix C of this report.

Note: IEC 61968-100:2013 does not include templates for creation of Strongly Typed artifacts involving OperationSets. This is a deficiency that presumably will be addressed in a future revision of that standard.

- Strongly Typed WSDLs were created by using the various Strongly Typed Message XSDs and the modified WSDL templates from IEC 61968-100:2013. The WSDLs generated include the following:
  - ExecuteDERGroups.wsdl and ExecuteDERGroupDispatches.wsdl to support request/reply use cases involving "create," "change," and "delete" (entire object) CIM verbs
  - ExecuteDERGroupsOperationSet.wsdl to support request/reply use cases involving the "delete" (attributes and/or associated classes) CIM verb
  - ExecuteEndDeviceControls.wsdl to support request/reply use cases involving connection or disconnection of DER Groups to/from the grid
  - QueryDERGroups.wsdl, QueryDERGroupStatuses.wsdl, and QueryDERGroupForecasts.wsdl to support request/reply use cases involving the "get" CIM verb
  - ReceiveDERGroups.wsdl, ReceiveDERGroupStatuses.wsdl, and ReceiveDERGroupForecasts.wsdl to support publish (Event Stereotype) use cases involving "created," "changed," and "deleted" (entire object) CIM verbs
  - ReceiveDERGroupsOperationSet.wsdl to support publish (Event Stereotype) use cases involving the "delete" (attributes and/or associated classes) CIM verb
  - ReceiveEndDeviceEvents.wsdl to support publish (Event Stereotype) use cases that signal actual success or failure of a request to connect or disconnect a DERGroup to/from the grid (referred to as a *consequential event*)

  Only a single version of each of these Strongly Typed WSDLs exists; however, they import the corresponding Strongly Typed DERGroupsMessage.xsd, DERGroupStatusesMessage.xsd, DERGroupForecastsMessage.xsd, and DERGroupDispatchesMessage.xsd, respectively. Consequently, importing constrained versions of these message profiles results in constrained versions of the Strongly Typed WSDLS. Similarly, importing unconstrained versions of these profiles results in unconstrained versions of the Strongly Typed WSDLs.

- Corrected versions of the IEC 61968-100:2013 Message XSD and WSDL templates are also provided in the Supplemental Resources File accompanying this report and will be shared with the IEC 61968-100 team for potential inclusion in a future revision of the standard.

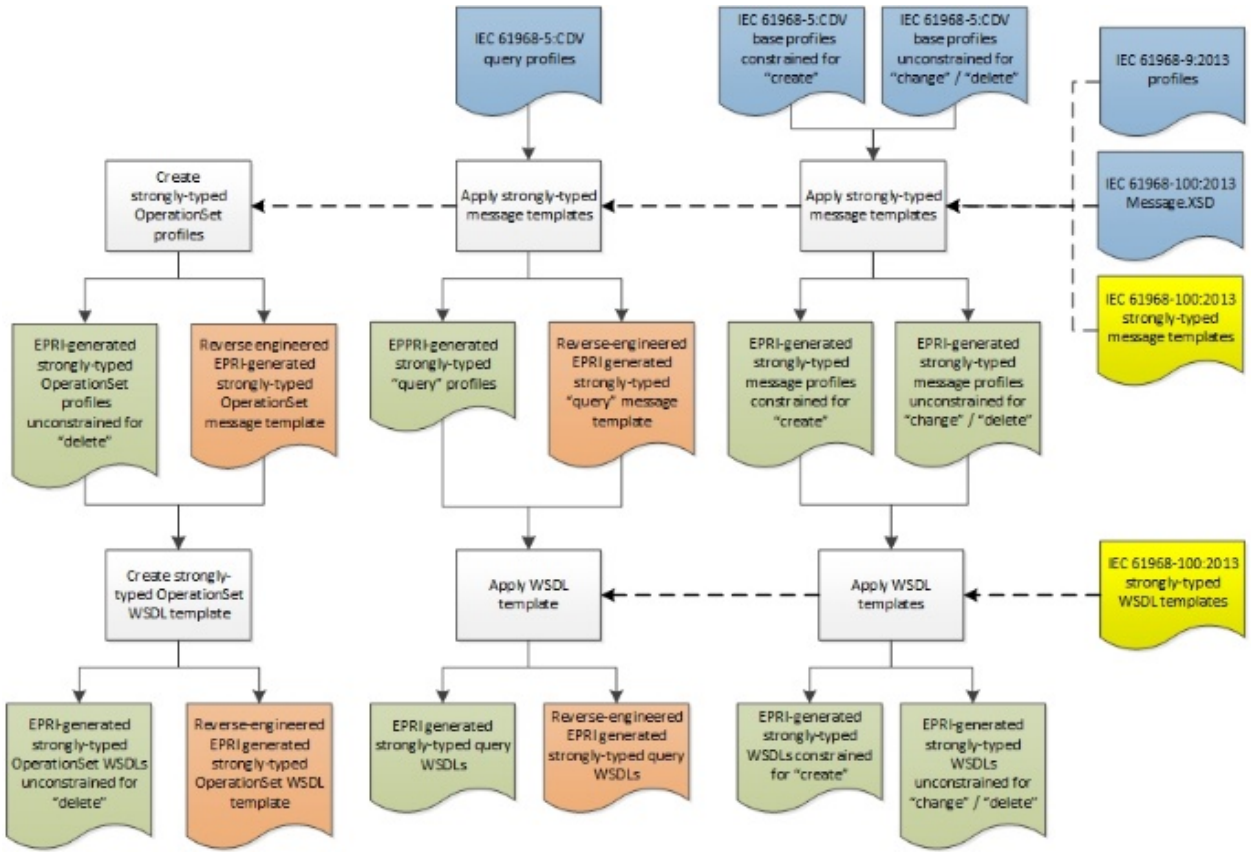


Figure 3-12
Artifact generation flowchart

Figure 3-13 illustrates one of the various Strongly Typed Message XSDs created as described in this section. Although not shown in the diagram, this XSD incorporates the constrained version of DERGroups.xsd because it is for use in “create” use cases.

See Appendices A and D for copies of this and other Strongly Typed Message XSDs.

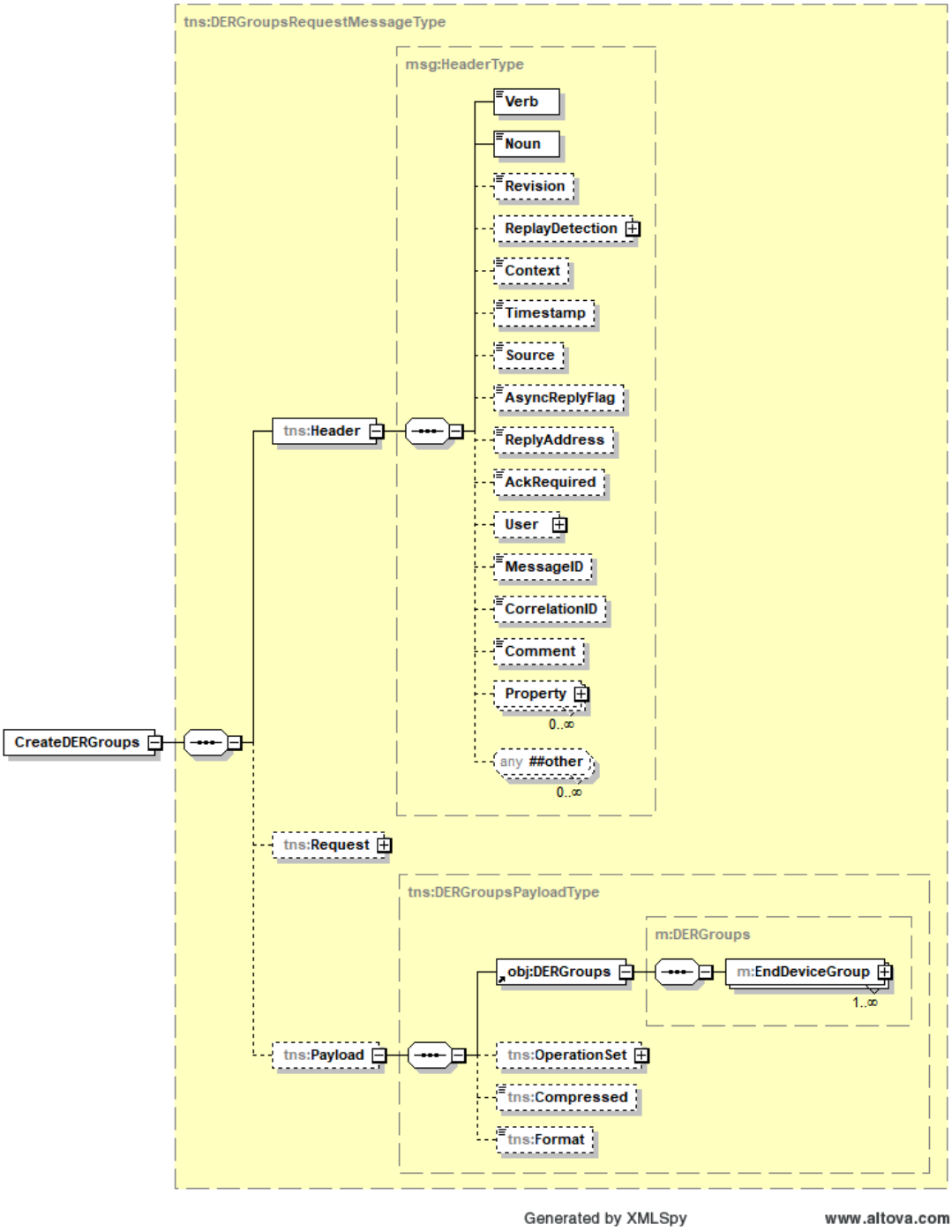


Figure 3-13
CreateDERGroups root in DERGroupsMessage.xsd

Figures 3-14 and 3-15 illustrate the high-level structure of the constrained and unconstrained versions of the Strongly Typed ExecuteDERGroups WSDLs created as described in this section.

See Appendices A and E for copies of these and other Strongly Typed DER-related WSDLs.

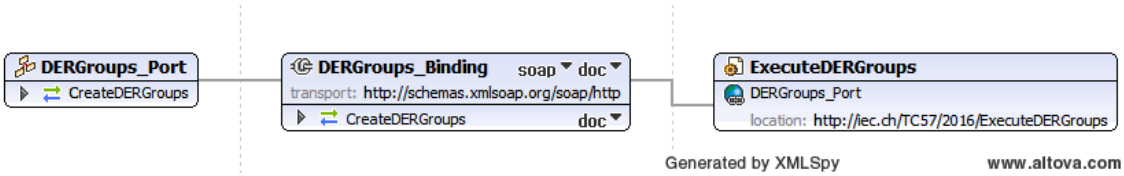


Figure 3-14
ExecuteDERGroups.wsdl (constrained version)

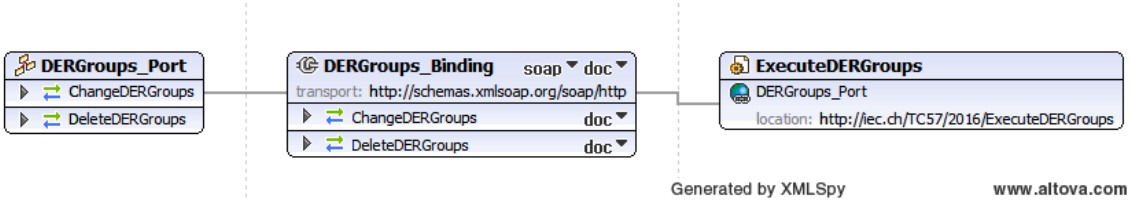


Figure 3-15
ExecuteDERGroups.wsdl (unconstrained version)

Copies of the IEC 61968-5:CDV and DER-related IEC 61968-9:2013 Message XSDs and WSDLs can be found in the Supplemental Resources File described in Appendix A.

4
USE OF JMS, GENERIC WEB SERVICES, AND STRONGLY TYPED WEB SERVICES

As stated in Section 1, IEC 61968-100:2013 supports implementation of messaging using a variety of protocols, including the following:

- Java Message Service (JMS)
- Generic Web Services
- Strongly Typed Web Services

Each of these protocols uses messages constructed by combining the Message.xsd Message envelope defined by IEC 61968-100:2013 and illustrated in Figure 4-1 with an IEC 61968 domain-specific profile (XSD). For this report, these domain-specific XSDs are the IEC 61968-5:CDV DERGroups, DERGroupStatuses, DERGroupForecasts, DERGroupDispatches, DERGroupQueries, DERGroupStatusQueries, and DERGroupForecastQueries profiles and the IEC 61968-9:2013 EndDeviceControls and EndDeviceEvents profiles, all as described in Section 3.

When using JMS, these messages are placed on and consumed from JMS topics or queues. However, when using Generic or Strongly Typed Web Services, another level of complexity and message wrapping exists.

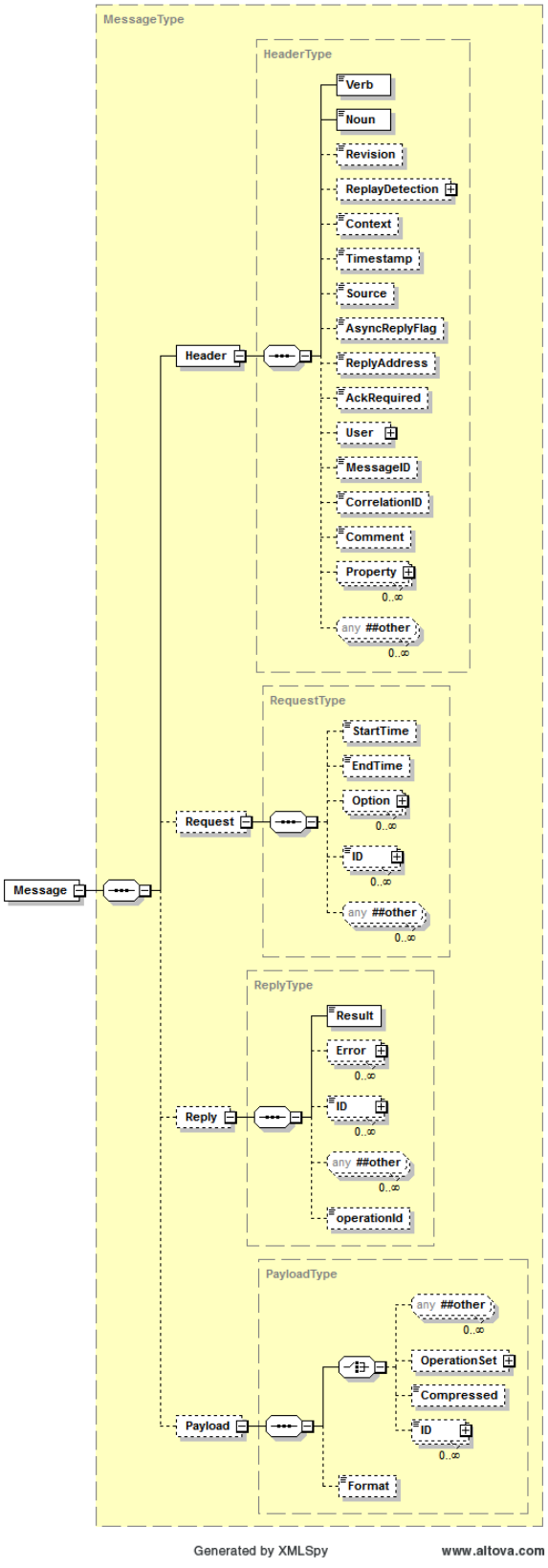


Figure 4-1
IEC 61968-100:2013 Message.xsd

In the IEC 61968 domain-specific standards—including the forthcoming IEC 61969-5:CDV—use cases typically contain sequence diagrams that describe the message exchanges only in terms of a CIM verb and the applicable domain-specific XSDs. Such sequence diagrams are generally adequate to illustrate implementation with JMS. To a significant extent, they are also adequate to illustrate messaging using Generic Web Services because the Payload portion of a Generic Web Services message is the same as the corresponding JMS message, and there exists only a single WSDL—the Generic.wsdl illustrated in Figure 4-2.

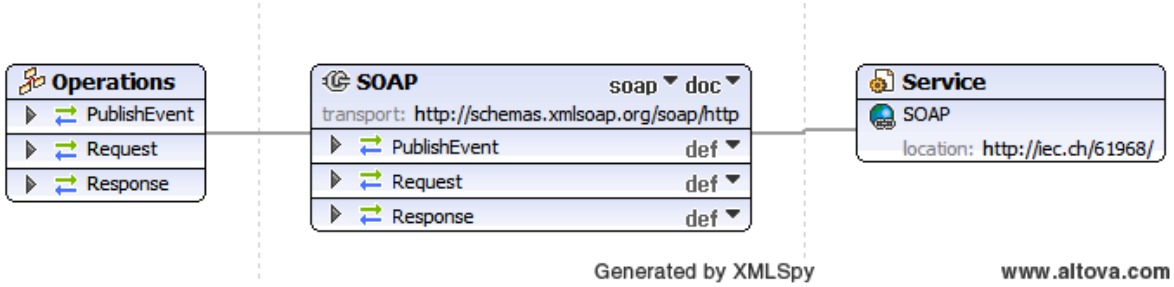


Figure 4-2
IEC 61968-100:2013 Generic.wsdl

However, when Strongly Typed Web Services are involved, the level of detail expressed in the use cases and sequence diagrams is insufficient to convey an adequate understanding of the messaging interaction.

The IEC 61968-5:CDV testing described in this report is intended to be conducted using the EPRI Test Harness, which supports only Strongly Typed Web Services. Consequently, the test case descriptions that appear in Sections 9–13 include sequence diagrams and message metadata that explicitly identify the specific Strongly Typed WSDLs and Message XSDs (described in Section 3) that are required to implement the documented messaging exchanges.

The following examples are included to assist the reader in better understanding some of the differences between using Strongly Typed Web Services and JMS or Generic Web Services.

JMS or Generic Web Services Variant

The sequence diagram in Figure 4-3 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through JMS or Generic Web Services as defined in IEC 61968-100:2013.

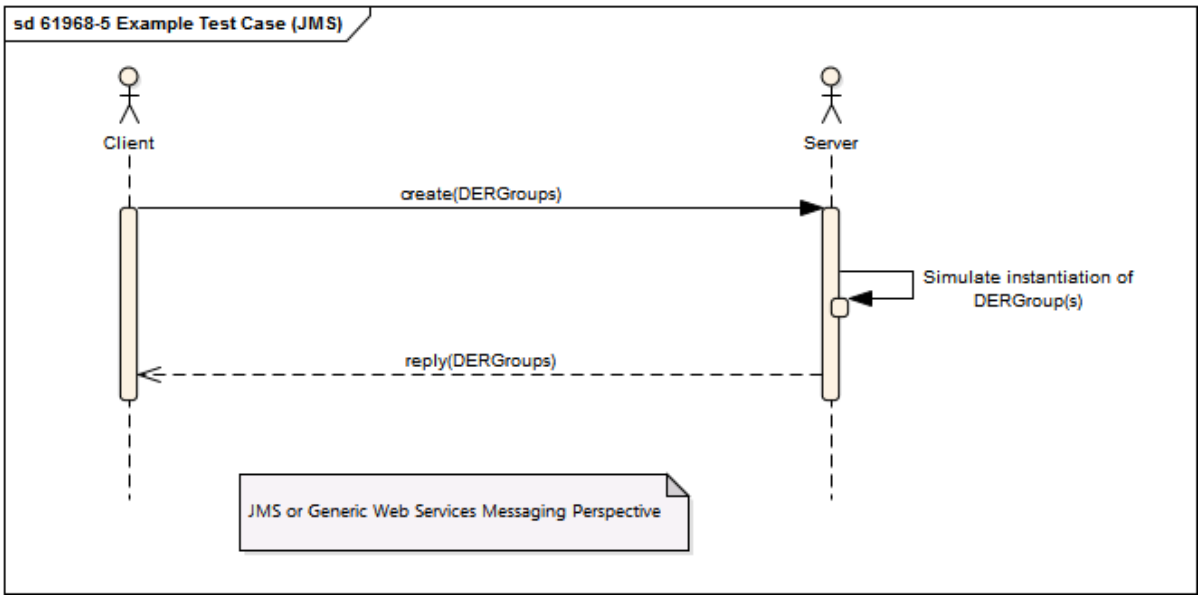


Figure 4-3
Example message exchange using JMS

Sample XML for the JMS or Generic Web Services variant of the create/DERGroups test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message Envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV and IEC 61968-9:2013) XSD profiles contained in this report.

Step 1 (Message Stereotype = Request Message)

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<RequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<Header>
		<Verb>create</Verb>
		<Noun>DERGroups</Noun>
		<Revision>String</Revision>
		<Timestamp>2017-05-26T10:54:03-06:00</Timestamp>
		<MessageID>93b32316-c752-4092-9969-69ece85105b8</MessageID>
		<CorrelationID>06c7c9b3-c52e-4bbb-bbd4-bd5e1cfec756</CorrelationID>
	</Header>
	<Payload>
		<DERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroups# DERGroups.xsd">
			<EndDeviceGroup>
				<mRID>0a7af0a5-e254-4763-87d1-08e9336b4396</mRID>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>false</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>01e9c77a-4baa-4ce4-8d2f-b6026700dcaa</mRID>
				</EndDevices>
				<version>
					<date>2017-05-26T10:53:43-06:00</date>
					<major>1</major>
					<minor>0</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
		</DERGroups>
	</Payload>
</RequestMessage>
```

Step 2 (Message Stereotype = Response Message)

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<ResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-05-26T10:54:05-06:00</Timestamp>
		<MessageID>2a7171f9-ca9d-4acb-b016-f768d28d3f96</MessageID>
		<CorrelationID>06c7c9b3-c52e-4bbb-bbd4-bd5e1cfec756</CorrelationID>
	</Header>
	<Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</Reply>
</ResponseMessage>
```

Strongly Typed Web Services Variant

Implementing the previous example using Strongly Typed Web Services requires creation of a Strongly Typed Message XSD and a Strongly Typed WSDL.

The Strongly Typed Message XSD for this example is DERGroupsMessage.xsd, as illustrated in Figure 4-4 and described in Section 3 of this report.

Within the DERGroupsMessage.xsd are several root elements, which correspond to the CIM verbs that can be used in conjunction with this XSD. This example involves the creation of a DERGroup; consequently, the branch (root) of the XSD displayed is CreateDERGroups, and the obj:DERGroups embedded in the Payload portion of the Message XSD is the constrained version of the IEC 61968-5:CDV DERGroups.xsd.

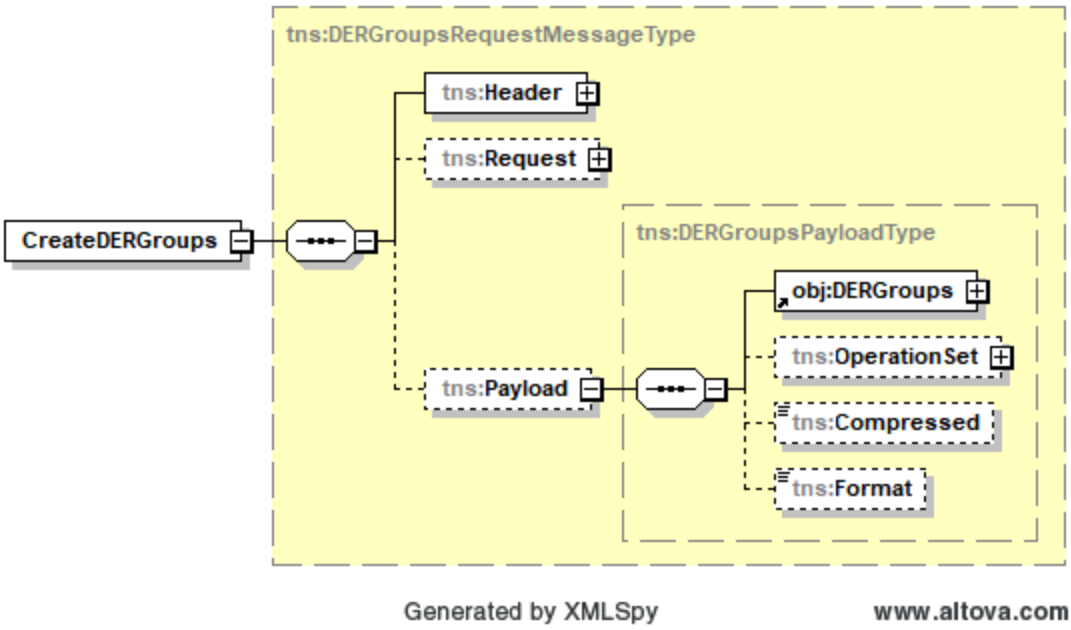


Figure 4-4
CreateDERGroups root in (Strongly Typed) DERGroupsMessage.xsd

The Strongly Typed WSDL for this example is ExecuteDERGroups.wsdl, as illustrated in Figure 4-5 and described in Section 3. This WSDL incorporates the CreateDERGroups branch of the DERGroupsMessage.xsd described previously; therefore, it is a version of the WSDL that is constrained for the create use case.

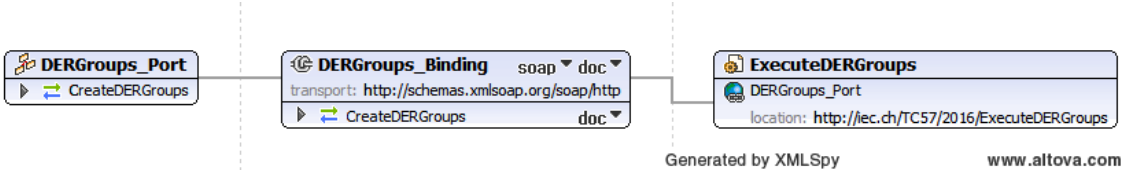


Figure 4-5
ExecuteDERGroups.wsdl (constrained version)

The sequence diagram in Figure 4-6 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

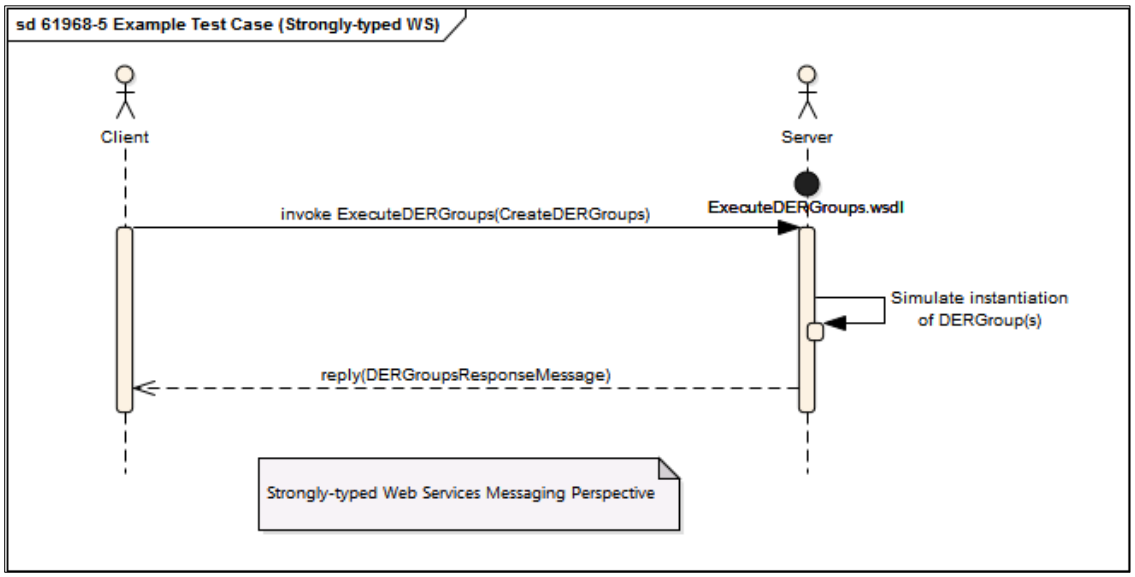


Figure 4-6
Example message exchange using Strongly Typed Web Services

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. As is the case with the previously documented JMS and Generic Web Services variant, Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 (Message Stereotype = Request Message)

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-05-26T11:37:22-06:00</msg:Timestamp>
		<msg:MessageID>45ae84e3-876a-4472-9dc8-009095b93784</msg:MessageID>
		<msg:CorrelationID>426c34ab-2c72-4327-86f8-
a7ce404ec0f7</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<mRID>e1461193-f910-40e0-a424-1a4c52442da4</mRID>
				<DERFunction>
					<connectDisconnect>false</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>true</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>de048152-8412-46cb-85b8-e156285da590</mRID>
				</EndDevices>
				<version>
					<date>2017-05-26T11:37:11-06:00</date>
					<major>1</major>
					<minor>0</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:CreateDERGroups>
```

Step 2 (Message Stereotype = Response Message)

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-05-26T11:37:28-06:00</Timestamp>
		<MessageID>432982f7-2bf6-4d32-8aab-5e6a5a5bdd24</MessageID>
		<CorrelationID>426c34ab-2c72-4327-86f8-a7ce404ec0f7</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

5
GENERATION OF SAMPLE XML FOR TEST CASES

This report contains explicit Sample XML for each documented test case. The actual Sample XML files can be found in the "06- Sample XML" subdirectory of the Supplemental Resources File described in Section 1 and Appendix A of this report.

Each Sample XML file appearing in the zip file was created using the XSDs appearing in the same subdirectory of the zip file. In addition, each Sample XML file has been checked to ensure that it validates against these applicable XSDs.

The remainder of this section describes the tool and procedures used to generate the Sample XML.

The Sample XML files were created using the Enterprise Edition of Altova XMLSpy 2015; however, earlier or later and less full-featured editions of the XMLSpy product are also capable of generating the same Sample XML.

The procedure used to generate the Sample XML is as follows:

1. In XMLSpy, open the XSD file from which the Sample XML is to be generated. As an example, Figure 5-1 illustrates the CreateDERGroups element within the DERGroupsMessage.xsd, displayed graphically within XMLSpy.

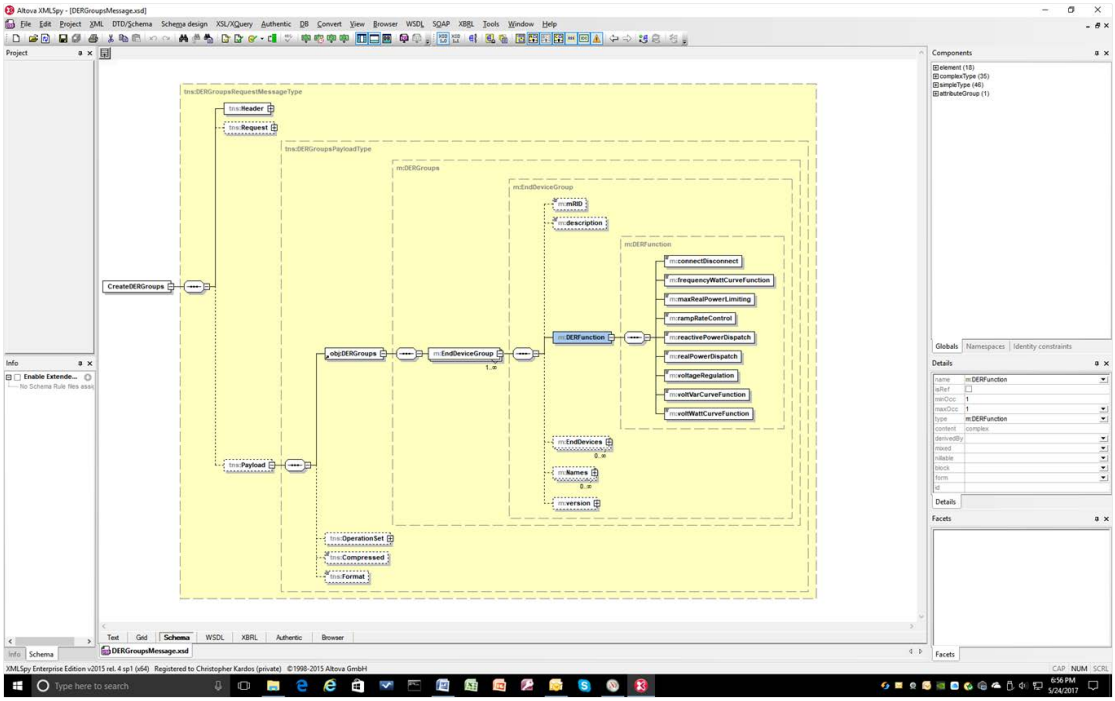


Figure 5-1
XMLSpy diagram illustrating CreateDERGroups

2. From the DTD/Schema Menu, select the “Generate Sample XML File” option, as illustrated in Figure 5-2.

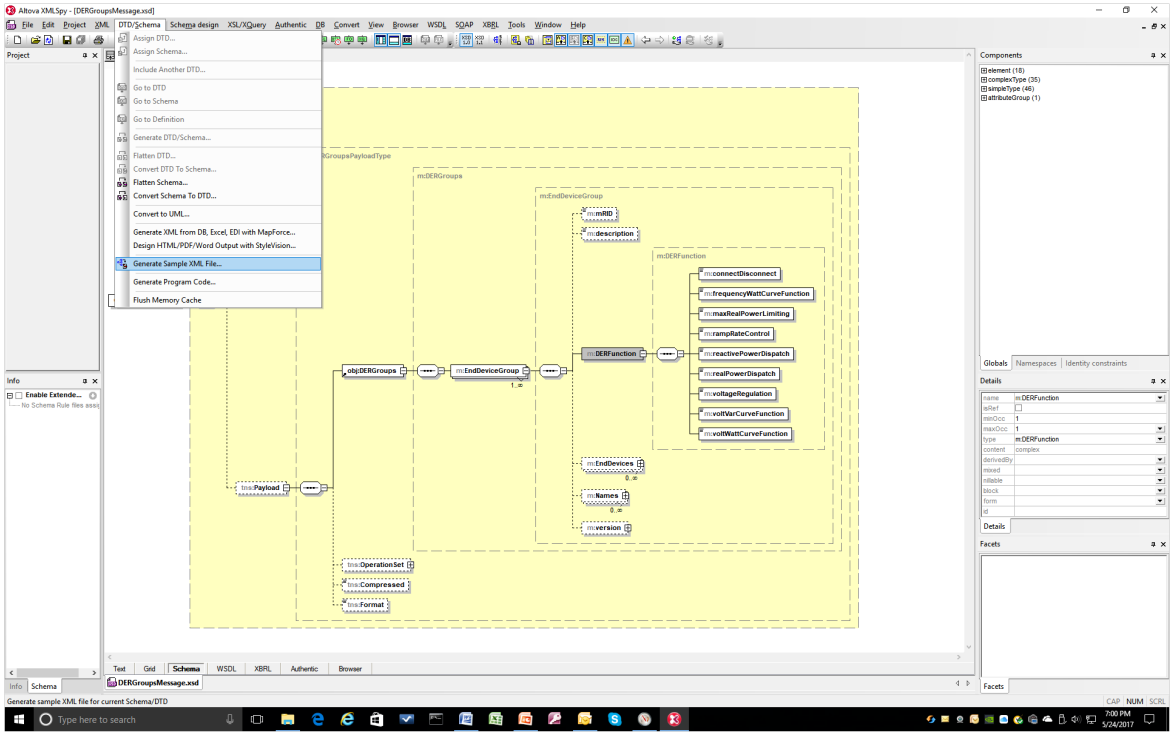


Figure 5-2
XMLSpy Generate Sample XML File menu option

3. In the lower portion of the pop-up menu, select the root element corresponding to the stereotype of the desired message (in this case, “CreateDERGroups”), and set the other options as illustrated in Figure 5-3. Then click the “OK” button.

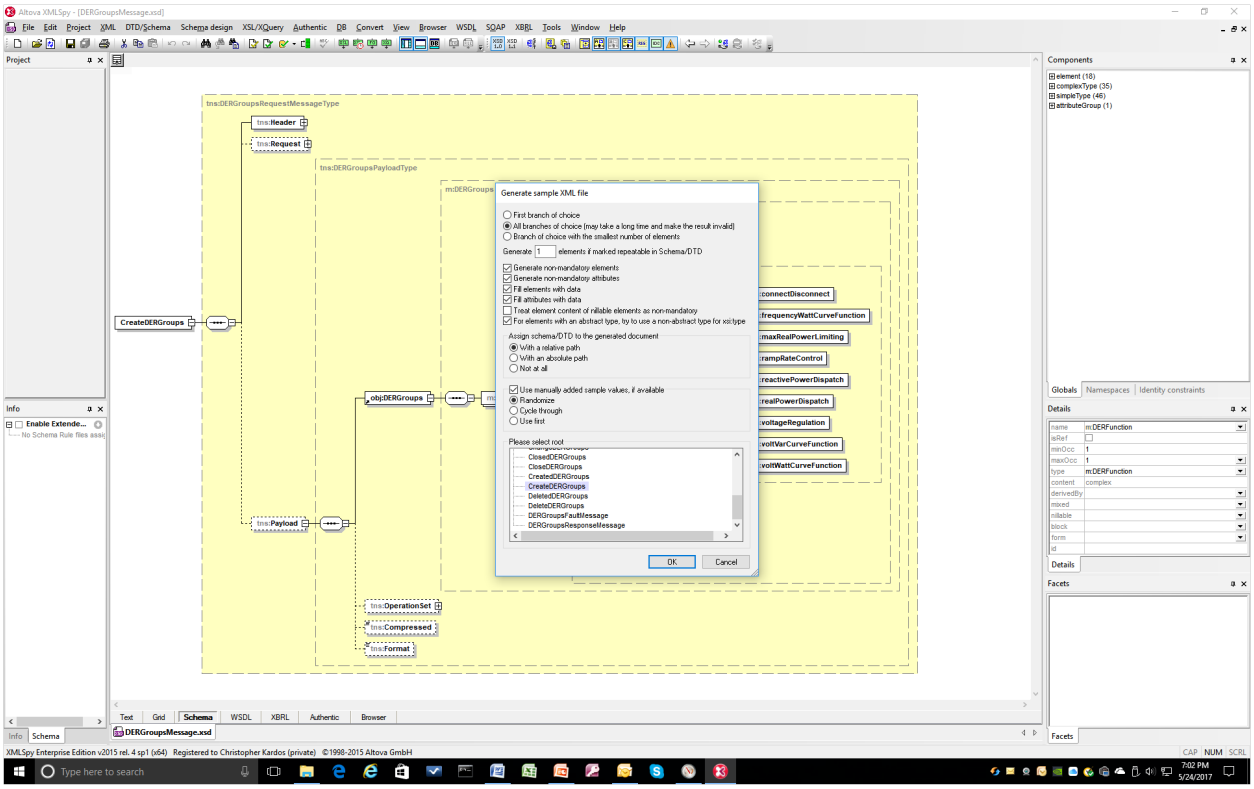


Figure 5-3
Selection of options for creation of Sample XML

4. A new window with Sample XML will appear as illustrated in Figure 5-4. XMLSpy can then be used to manually tailor the XML as necessary for the specific test case. In general, this involves deleting unnecessary elements, adding instances of certain elements (if necessary), and providing business-appropriate values for all included elements. Once edits are complete, the Sample XML can be reformatted using the illustrated "Pretty-print" menu button and then saved to a desired location by selecting File-Save As from the menu bar.

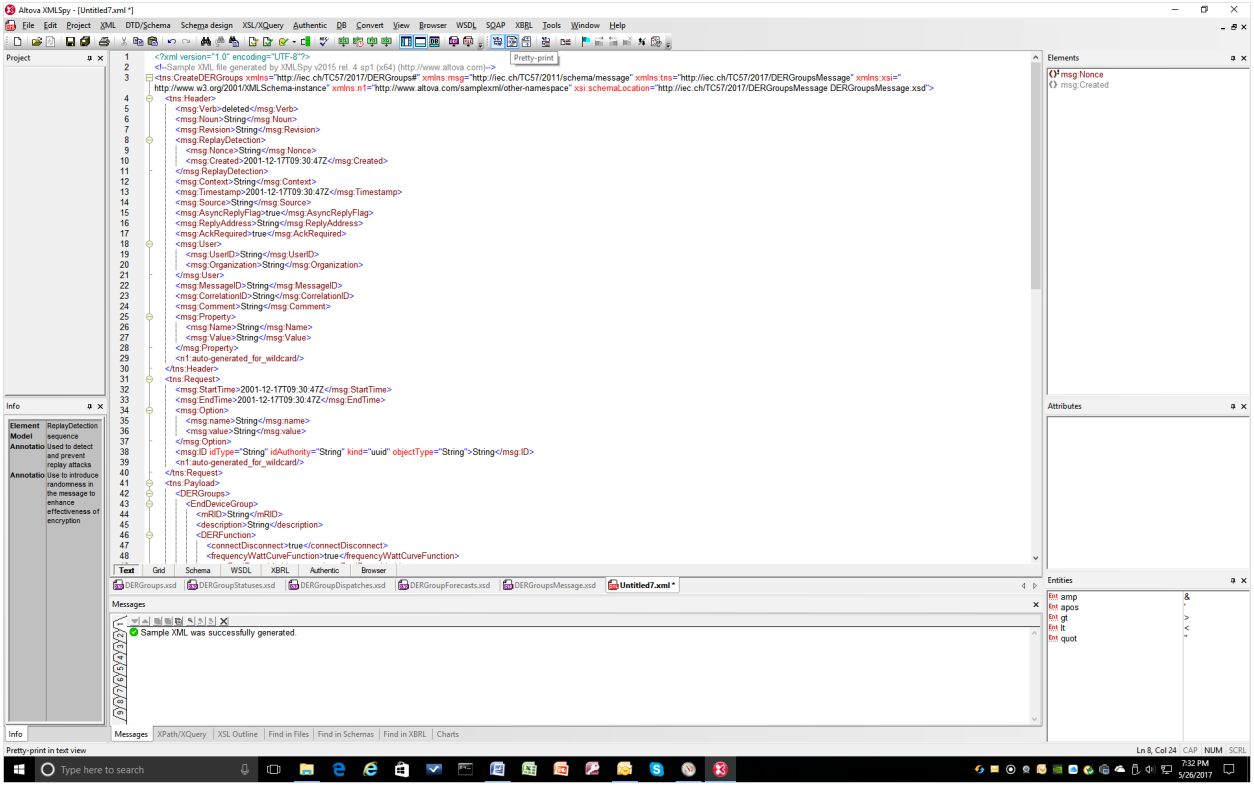


Figure 5-4
Illustration of Sample XML and Pretty-print button

6
TEST CASE OVERVIEW

This report presents a variety of test cases intended to demonstrate the use of the IEC 61968-5:CDV profiles (XSDs).

Setting the Test Plan Context

Building on the prior EPRI work described in Section 1, the test cases in this report support system-to-system messaging for five major DER-related functions. Table 6-1 summarizes these five functions and describes how each of these functions is supported by using the CIM profiles (XSDs) defined in the IEC 61968-5:CDV and IEC 61968-9:2013 standards.

Table 6-1
DER Function to message profile mapping

DER Function	CIM Verb(s)	IEC 61968-5:CDV Profile	Description
DER Group Management and DER Group Capability Discovery	create/created	DERGroups	Used to create or publish the creation of identified/named DERGroup(s), specify the individual distributed energy resources that are members of the group, and identify the DER Functions provided by the DER Group.
	change/changed	DERGroups	Used to update or publish the update of DERGroup(s) by adding members and/or changing the aggregated capabilities of the group.
	delete/deleted	DERGroups	Used to delete or publish the deletion of entire DERGroup(s) or to delete or publish deletion of members or capabilities of DERGroup(s).
	get	DERGroups	Used to query the membership and capabilities of DERGroups. This also constitutes DER Group Capability Discovery.
DER Group Status Determination	get	DERGroupStatuses	Used to query the currently available dispatchable power and other capabilities of DERGroup(s).
	changed	DERGroupStatuses	Used to publish the currently available dispatchable power and other capabilities of DERGroup(s).

Table 6-1 (continued)
DER Function to message profile mapping

DER Function	CIM Verb(s)	IEC 61968-5:CDV Profile	Description
DER Group Forecasting	get	DERGroupForecasts	Used to query the expected ranges of dispatchable power and other capabilities of DERGroup(s) at specific future time(s).
	created	DERGroupForecasts	Used to publish the expected ranges of dispatchable power and other capabilities of DERGroup(s) at specific future time(s).
DER Group Dispatching	create	DERGroupDispatches	Used to request that specific quantities of dispatchable power or other capabilities be provided to the grid by the identified/named DERGroup(s).
DER Group Connection/ Disconnection from the Grid	create	EndDeviceControls *(from IEC 61968-9:2013)*	Used to request connection or disconnection of the DER Group to/from the grid.
	created	EndDeviceEvents *(from IEC 61968-9:2013)*	Used to provide notification that one or more DER Devices that are members of a DERGroup have connected to or disconnected from the grid.

Summary of Test Cases

The test cases, which are described in Sections 9–13 of this report, are divided into five groups—one for each of the four base IEC 61968-5:CDV profiles and one for the two DER-related IEC 61969-9:2013 profiles:

- DERGroups
- DERGroupStatuses
- DERGroupForecasts
- DERGroupDispatches
- EndDeviceControls and EndDeviceEvents

These test cases are not intended to be an exhaustive set; nevertheless, a sufficient number and variety are presented to fully characterize the following:

- The content of both the IEC 61968-100:2013 message wrapper as well as the IEC 61968-5:CDV or IEC 61968-9:2013 profile(s) for each test case
- Population of the IEC 61968-5:CDV or IEC 61968-9:2013 profiles with business-appropriate data
- Request and response message content for request/reply message exchanges that support the full life cycle of creating, modifying, retrieving, and deleting DERGroups, including examples involving multiple DERGroups in a single message (retrieving a DERGroup also serves as DER Group Capability Discovery)

- Request/reply message exchanges using the OperationSet construct to delete attributes or instances of associated CIM classes from DERGroups
- Request and response message content for request/reply message exchanges that support the exchange of information concerning DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches, including examples involving multiple DERGroups in a single message
- Request and response message content for request/reply message exchanges that support success, failure, and combination success and failure scenarios
- Event Stereotype message content for messages that support the full life cycle of creating, modifying, and deleting DERGroups, including examples involving multiple DERGroups in a single message
- Event Stereotype messages using the OperationSet construct to provide notification of deletion of attributes or instances of associated CIM classes from DERGroups
- Event Stereotype message content for notification messages that support the exchange of information concerning DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches, including examples involving multiple DERGroups in a single message
- Combined request/response and Event Stereotype messages for requesting and providing notification of connection or disconnection of a DER Group and its associated DER Devices to/from the grid
- References to CIM objects, including DERGroups, DERGroupForecasts, and DERGroupDispatches by mRID, by Names, or both

Within each section (Section 9 for DERGroups, Section 10 for DER Group Statuses, Section 11 for DER Group Forecasts, Section 12 for DER Group Dispatches, and Section 13 for DER Group Connect/Disconnect), the test cases are generally intended to be performed in the sequence in which they are presented. This is because in certain cases, one or more test cases may establish preconditions for subsequent test cases. Refer to the detailed test cases for specifics on preconditions.

DER Group Test Cases

Table 6-2 summarizes the DER Group test cases in Section 9.

Table 6-2
DER Group test case list

Test Case	Test Case Description
DERG-1a	Client requests creation of a DER Group and Server replies. (Success - Single DER Group) *This test case creates DER Group DG1 with three members (DER) and two DER Functions.*
DERG-1b	Client requests creation of a DER Group and Server replies. (Failure - Single DER Group) *This test case fails creation of duplicate DER Group DG1.*
DERG-1c	Client requests creation of two DER Groups and Server replies. (Success - Two DER Groups in a single message) *This test case:* • *Creates DERGroup DG2 with two members and two DER Functions.* • *Creates DER Group DG3 with four members and three DER Functions.*
DERG-1d	Client requests creation of two DER Groups and Server replies. (Two DER Groups in a single message - One succeeds and one fails) This test case: • *Creates DER Group DG4 with two members and three DER Functions.* • *Fails creation of DER Group DG5 with one member and four DER Functions.*
DERG-1e	Client requests creation of a DER Group and Server replies. (Success - Single DER Group; Responder supplies mRID) *This test case creates DER Group DG6 with one member and three DER Functions; Responder supplies mRID.*
DERG-2a	Client requests modification of an existing DER Group and Server replies. (Success - Change supported DER Functions to include voltage regulation) *This test case updates the list of DER Functions for existing DER Group DG1 from Test Case DERG-1a to include voltage regulation.*
DERG-2b	Client requests modification of an existing DER Group and Server replies. (Success - Add an additional DER) *This test case adds another member to existing DER Group DG2 from Test Case DERG-1c.*
DERG-3	Client requests modification of an existing DER Group and Server replies. (Success - Delete a DER) *This test case deletes one of the members from existing DER Group DG3 from Test Case DERG-1c.*
DERG-4	Client requests deletion of an existing DER Group and Server replies. (Success) *This test case deletes DER Group DG1 from Test Case DERG-1a.*

Table 6-2 (continued)
DER Group test case list

Test Case	Test Case Description
DERG-5a	Client requests retrieval of an existing DER Group and Server replies. (Success - Single DER Group) *This test case gets (retrieves) DER Group DG2 from Test Case DERG-1c and Test Case DERG-2b.* *This also constitutes DER Group Capability Discovery.*
DERG-5b	Client requests retrieval of two DER Groups and Server replies. (Success - Two DER Groups in a single message) *This test case gets (retrieves):* • *DER Group DG2 from Test Case DERG-1c and Test Case DERG-2b.* • *DER Group DG4 from Test Case DERG-1d.* *This also constitutes DER Group Capability Discovery.*
DERG-6	Server informs Client of the creation of two DER Groups. (Two DER Groups in a single message) *This test case provides notification of:* • *Creation of DER Group DG7 with three members and three DER Functions.* • *Creation of DER Group DG8 with two members and three DER Functions.*
DERG-7	Server informs Client of modification of an existing DER Group. (Change list of supported DER Functions to include ramp rate control) *This test case provides notification of change to the list of DER Functions supported by DER Group DG7 from Test Case DERG-6.*
DERG-8	Server informs Client of modification of an existing DER Group. (Deletion of a member) *This test case provides notification of deletion of a member of DER Group DG8 from Test Case DERG-6.*
DERG-9	Server informs Client of the deletion of an existing DER Group. *This test case provides notification of deletion of DER Group DG7 from Test Cases DERG-6 and DERG-7.*

DER Group Status Test Cases

Table 6-3 summarizes the DER Group Status test cases in Section 10.

Table 6-3
DER Group Status test case list

Test Case	Test Case Description
DERGS-1a	Client requests status of a DER Group and Server replies. (Success - Single DER Group) *This test case is a successful query of the current status of DER Group DG2.*
DERGS-1b	Client requests status of a DER Group and Server replies. (Failure - Single DER Group) *This test case is a failed query of the current status of DER Group DG1.*
DERGS-1c	Client requests status of two DER Groups and Server replies. (Success - Two DER Groups in a single message) *This test case is a successful query of the current status of DER Groups DG3 and DG4.*
DERGS-1d	Client requests status of two DER Groups and Server replies. (Two DER Groups in a single message - One succeeds and one fails) *This test case is the following:* • *A successful query of the current status of DER Group DG6.* • *A failed query of the current status of DER Group DG7.*
DERGS-2	Server informs Client of a change in DER Group Status. (Change in current active, apparent, and reactive power) *This test case provides notification of a change in the status of DER Group DG8.*

DER Group Forecast Test Cases

Table 6-4 summarizes the DER Group Forecast test cases in Section 11.

Table 6-4
DER Group Forecast test case list

Test Case	Test Case Description
DERGF-1a	Client requests a forecast for a DER Group and Server replies. (Success - Single DER Group) *This test case is a successful query of a forecast for DER Group DG2.*
DERGF-1b	Client requests a forecast for a DER Group and Server replies. (Failure - Single DER Group) *This test case is a failed query of a forecast for DER Group DG1.*
DERGF-1c	Client requests forecasts for two DER Groups and Server replies. (Success - Two DER Groups in a single message) *This test case is a successful query of forecasts for DER Groups DG3 and DG4.*
DERGF-1d	Client requests forecasts for two DER Groups and Server replies. (Two DER Groups in a single message - One succeeds and one fails) *This test case is the following:* • *A successful query of a forecast for DER Group DG6.* • *A failed query of a forecast for DER Group DG7.*
DERGF-2	Server informs Client of creation of a DER Group Forecast. *This test case provides notification of a creation of a forecast for DER Group DG8.*

DER Group Dispatch Test Cases

Table 6-5 summarizes the DER Group Dispatch test cases in Section 12.

Table 6-5
DER Group Dispatch test case list

Test Case	Test Case Description
DERGD-1a	Client requests creation of a DER Group Dispatch and Server replies. (Success - Single DER Group) *This test case is successful creation of a DER Group Dispatch for DER Group DG2. It also illustrates setting a voltage ramp rate curve for the dispatch.*
DERGD-1b	Client requests creation of a DER Group Dispatch and Server replies. (Failure - Single DER Group) *This test case is failed creation of DER Group Dispatch for DER Group DG1.*
DERGD-1c	Client requests creation of two DER Group Dispatches and Server replies. (Success - Two DER Groups in a single message) *This test case is successful creation of DER Group Dispatches for DER Groups DG3 and DG4.*
DERGD-1d	Client requests creation of two DER Group Dispatches and Server replies. (Two DER Group in a single message - One succeeds and one fails) *This test case is the following:* • *Successful creation of a DER Group Dispatch for DER Group DG6.* • *Failed creation of a DER Group Dispatch for DER Group DG7.*
DERGD-1e	Client requests creation of a DER Group Dispatch and Server replies. (Success - Single DER Group; Responder supplies mRID) *This test case is successful creation of a DER Group Dispatch for DER Group DG8; Responder supplies mRID.*

DER Group Connect/Disconnect Test Cases

Table 6-6 summarizes the DER Group Connect/Disconnect test cases in Section 13.

Table 6-6
DER Group Connect/Disconnect test case list

Test Case	Test Case Description
DERGCD-1a	Client requests connection of a DER Group and Server replies. (Full success - Single DER Group) *This test case is successful connection of DER Group DG2 (with three associated DER Devices) to the grid.*
DERGCD-1b	Client requests connection of a DER Group and Server replies. (Failure - Single DER Group; Request rejected) *This test case is rejection of a request to connect DER Group DG1 to the grid.*
DERGCD-1c	Client requests connection of a DER Group and Server replies. (Partial failure - Single DER Group; One DER Device fails to connect) *This test case is a request to connect DER Group DG4 (with two associated DER Devices) to the grid. The command is accepted, but only one of the DER Devices is successfully connected. The other fails to connect.*
DERGCD-1d	Client requests disconnection of two DER Groups and Server replies. (Full success - Two DER Groups in a single message) *This test case is successful disconnection of DER Groups DG2 (with three associated DER Devices) and DG6 (with one associated DER Device) from the grid.*

Note: Each of these DER Group Connect/Disconnect test cases can be altered from a connect to a disconnect or from a disconnect to a connect by simply changing the EndDeviceControlType codes (see Appendix G) and EndDeviceEventType codes (see Appendix H).

7
TEST ENVIRONMENT

Test Environment Description and Requirements

The environment for the testing to be conducted in accordance with this report will be provided, managed, and operated by EPRI.

EPRI will furnish an EPRI Test Harness that can function in either the Server or Client role of each of the test cases described in Sections 9–13 of this report.

The EPRI Test Harness will generate and receive messages (as defined in each test case) using the Strongly Typed WSDLs defined in this report.

A placeholder exists in the test results section of each test case to record the http addresses of the Web Services endpoints used in the test. These http addresses will be designated at test time.

The EPRI Test Harness will provide, at a minimum, the following additional functionality:

- The ability to generate unique MessageIDs and CorrelationIDs to be placed into the CIM Headers of the messages it generates. These IDs shall be UUIDs as defined by RFC 4122.
- The ability to correlate request messages with response messages using the CorrelationIDs.
- The ability to create and insert timestamps into the CIM Headers of the messages it generates, reflecting the actual current time at which each message is generated. The timestamps shall conform to ISO 8601 and support the inclusion of a time zone offset.
- The ability to refer to objects (elements) within the messages using either mRIDs, Names, or a combination of mRIDs and Names.
- The ability to validate both sent and received messages using the appropriate versions of the domain-specific XSDs, Strongly Typed Message XSDs, and Strongly Typed WSDLs as identified in each test case. **Note:** DERGroupsOperationSet.xsd contains an “any ##other” element into which is placed the XML for the DERGroups Payload. This will likely necessitate a two-step validation to ensure that both the Message envelope and the Payload message itself are both validated.
- The ability to load and use the Sample XML messages furnished for each test case documented in this report. The actual Sample XML files can be found in the Supplemental Resources File described in Appendix A. When using the Sample XML files, it is expected that MessageIDs, CorrelationIDs, and timestamps will be adjusted as described previously.
- The ability to capture and record the exact content of every sent and received message, along with an accurate timestamp of when each message was sent or received.

In executing the test cases, it is acceptable to deviate from the specific content in the Sample XML that has been provided. When deviating from the Sample XML, it is particularly important to ensure that the intent of the test case is satisfied and that all messages validate properly against the applicable XSDs and WSDLs.

Using the EPRI Test Harness

In soapUI, to change the URL for control type messages, simply bring up each test case by double clicking; then click the pulldown bar for the url as indicated in Figure 7-1.

Note: The screenshots in this section are taken from a previous EPRI report and are intended to illustrate the use of the EPRI Test Harness. Close examination will reveal that they contain snippets of MultiSpeak DER-related messages that have been deprecated in this report. This MultiSpeak-related content should be ignored.

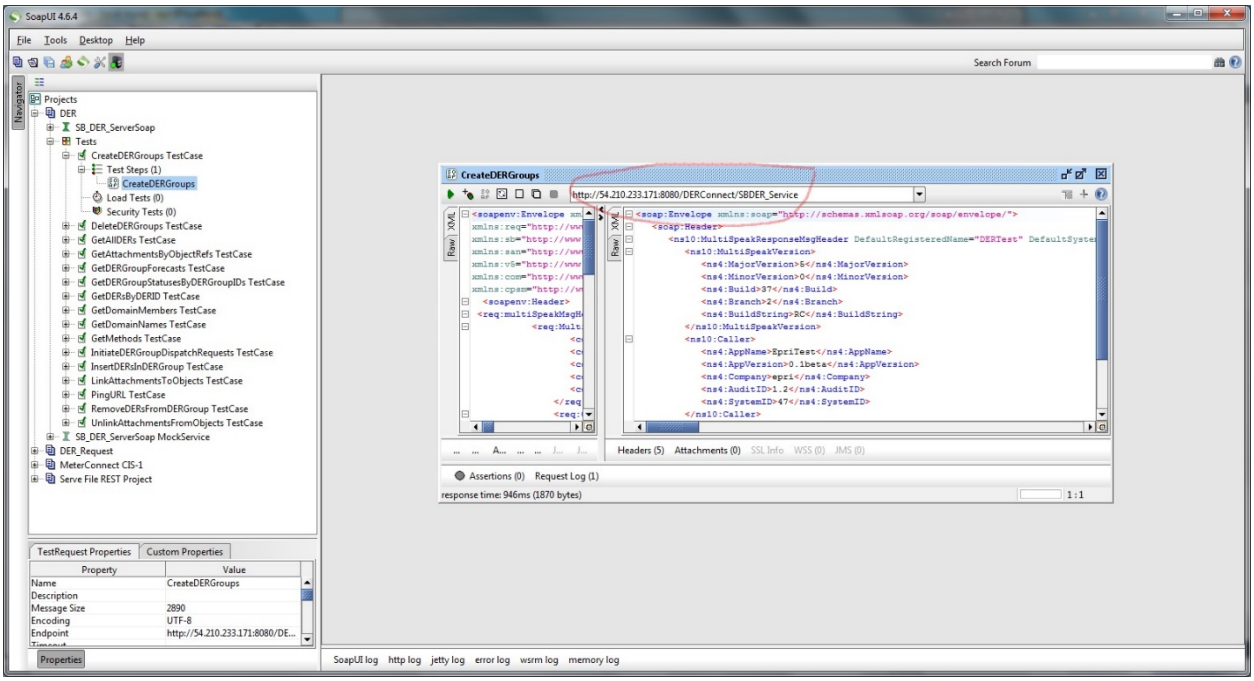


Figure 7-1
soapUI screenshot with the URL example

Then select “add new endpoint” and change the IP/hostname to the EPRI EC2 instance, which is 54.210.233.171 in these screenshots, as shown in Figure 7-2.

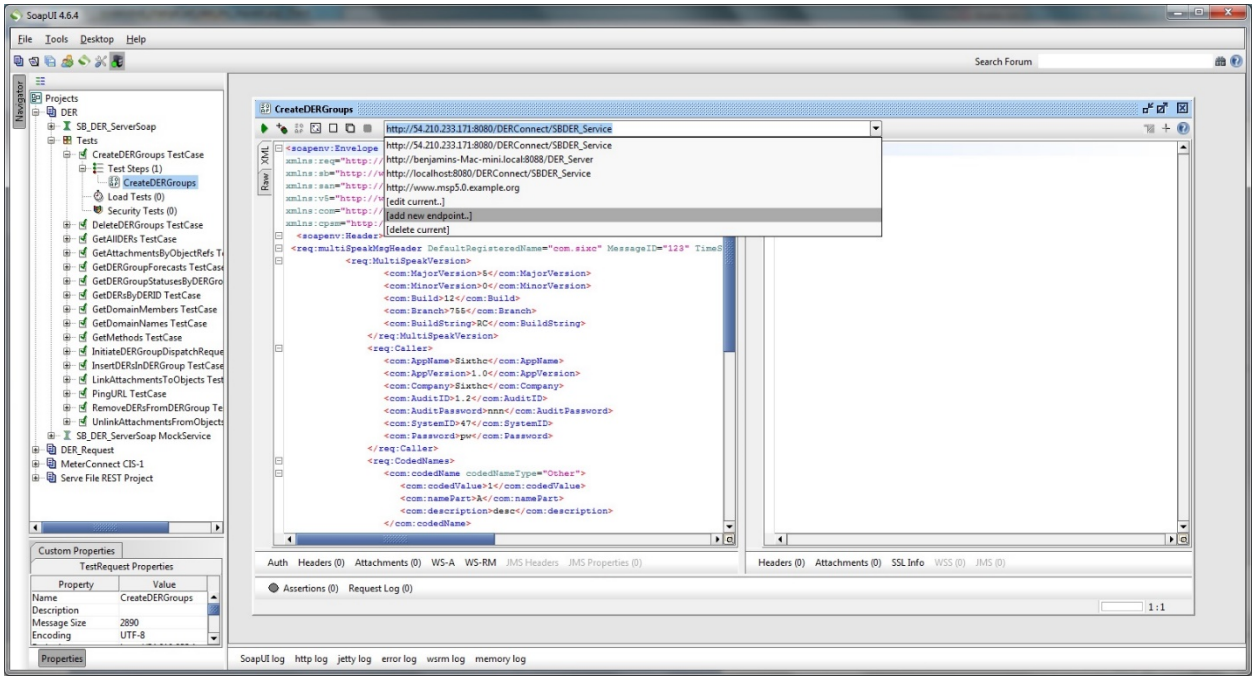


Figure 7-2
soapUI screenshot for the request type example

For request type messages, edit the URL as above, but also supply the response URL. The response URL is the endpoint that the test harness will use when sending the test message. You could point it back to the server for a sort of loopback test, but each customer will be pointing that at their own receiving server/code.

Using soapUI variables will make the exchanges easier to manage. Clicking on the high-level project (DER Request in the screenshot below), then clicking on Custom Properties will bring up the variable list as illustrated in Figure 7-3. Editing these should change settings for all the test cases. The user can still change them in the individual messages by direct edit, however.

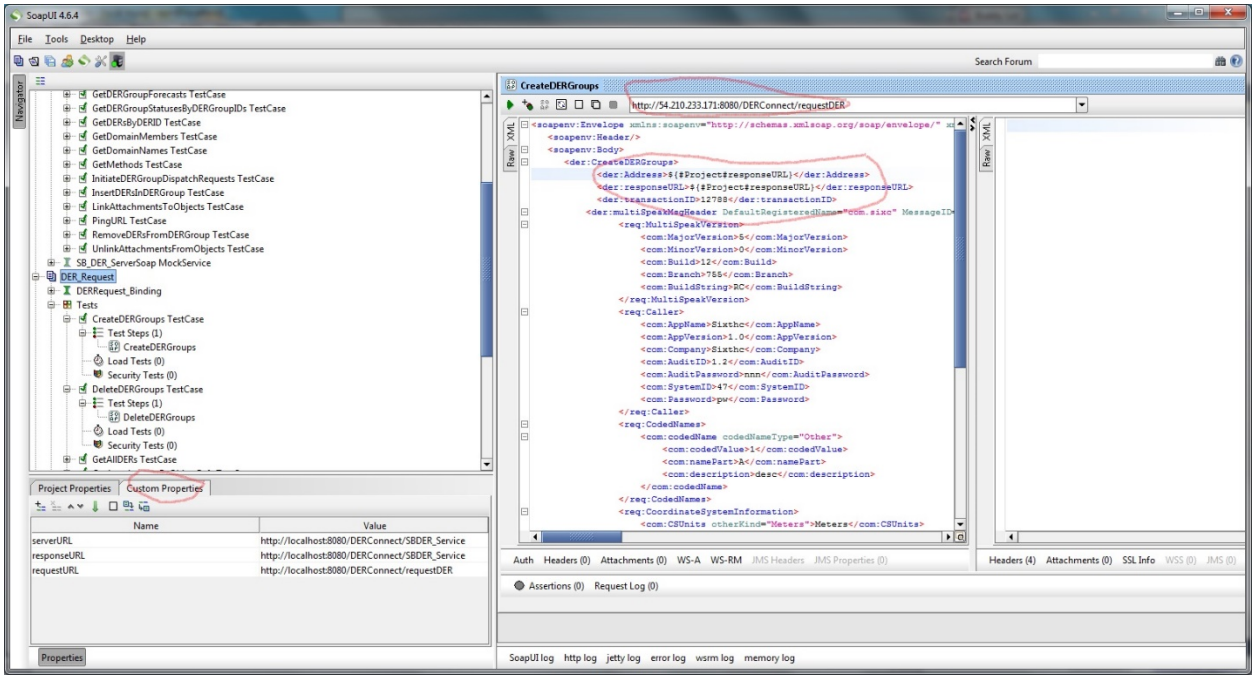


Figure 7-3
soapUI example illustrating how to change variables

8
TEST ACCEPTANCE CRITERIA

Primary objectives of this Test Script report include the following:

1. To demonstrate the proper use of the IEC 61968-5:CDV DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches profiles and the IEC 61968-9:2013 EndDeviceControls and EndDeviceEvents profiles to exchange messages using Strongly Typed Web Services that are compliant with both IEC 61968-5:CDV or IEC 61968-9:2013 and IEC 61968-100:2013 for a variety of DER-related use cases using both request/response and publish messaging patterns.
2. To enable third-party applications supporting these IEC 61968-5:CDV and IEC 61968-9:2013 profiles to be tested against the EPRI Test Harness to validate that they can generate and consume messages compliant with the referenced standards.

The first objective is satisfied by this report through the provision of substantial background information, well-documented test cases, and Sample XML for each step of each test case.

The second objective—testing of third-party applications—requires that acceptance criteria be defined to determine whether the third-party application passes or fails each test. The minimum acceptance criteria that will be used to determine whether each test case is deemed to have succeeded or failed are as follows:

- For each applicable test case, the third-party application must successfully consume the standards-compliant messages sent by the EPRI Test Harness for the test case.
- For each applicable test case, the third-party application must successfully generate standards-compliant messages that the EPRI Test Harness can successfully validate against the applicable XSDs and WSDLs defined for the test case.
- For each applicable test case, the third-party application must use UUIDs as defined by RFC 4122 in all instances in which Message IDs, Correlation IDs, and mRIDs appear in the messages the application consumes or generates.
- For each applicable test case, the third-party application must use timestamps that conform to ISO-8601 in all messages the application consumes or generates.
- For each applicable test case, the third-party application must populate messages that it generates with a unique Message ID and a current timestamp.
- For each applicable test case in which the third-party application generates a response message (for a request message it receives from the EPRI Test Harness), the Correlation ID in the response message must match the Correlation ID in the request message.
- For each applicable test case, the third-party application must demonstrate—using methods and criteria mutually agreed to by the third-party vendor and the EPRI test administrators—that it is able to parse and store or display the information content in the standards-compliant messages it receives from the EPRI Test Harness.
- For each applicable test case, the third-party application must demonstrate—using methods and criteria mutually agreed to by the third-party vendor and the EPRI test administrators—

that it populates the standards-compliant messages that it generates with the minimum information content specified in the test case and Sample XML. It is perfectly acceptable for the third-party application to include in the messages it sends more information than exists in the test case description and Sample XML, if the messages can be successfully validated against the applicable normative profiles.

Additional acceptance criteria may be established by agreement of the third-party application vendors and EPRI test administrators prior to conducting the tests. Such additional acceptance criteria may include the following:

- For each applicable test case, the third-party application must demonstrate the ability to seamlessly handle mixtures of mRIDs and multiple Names to identify CIM objects.
- For each applicable test case, the third-party application must be able to demonstrate that DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches are properly instantiated, modified, and deleted in accordance with the intent of each test case.
- For all applicaple test cases, the third-party application must demonstrate that the content it provides in each of the messages it generates is consistent with and sufficient to satisfy the conditions and intent of the test case.

9
DER GROUP TEST CASES

DERG-1a: Client requests creation of a DER Group and Server replies (Success - Single DER Group)

In this test case, the Client requests the Server to instantiate a single DER Group: DG1 with three EndDevice members and two DERFunctions (connectDisconnect and realPowerDispatch). In this example, an mRID identifier is also assigned to the DER Group. The Server returns a response message indicating success with no errors.

If the Server were in fact a true DERMS, then upon success of this messaging interchange, the DER Group would be known to the DERMS and could be subsequently changed or deleted. Subsequent test cases in this report will assume the persistence of specific DERGroups and refer to them by the mRIDs and/or Names assigned in the "create" test cases. See the Pre-Condition(s) section of subsequent test cases for additional information.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

As noted, this test case also illustrates the successful creation of a single DER Group. Subsequent test cases will illustrate attempts to create multiple DER Groups through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	None
Post-Condition(s)	A new DER Group is created with the mRID and Names identifier(s) that were passed in the request message

The Sequence Diagram in Figure 9-1 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported using Strongly Typed Web Services as defined in IEC 61968-100:2013.

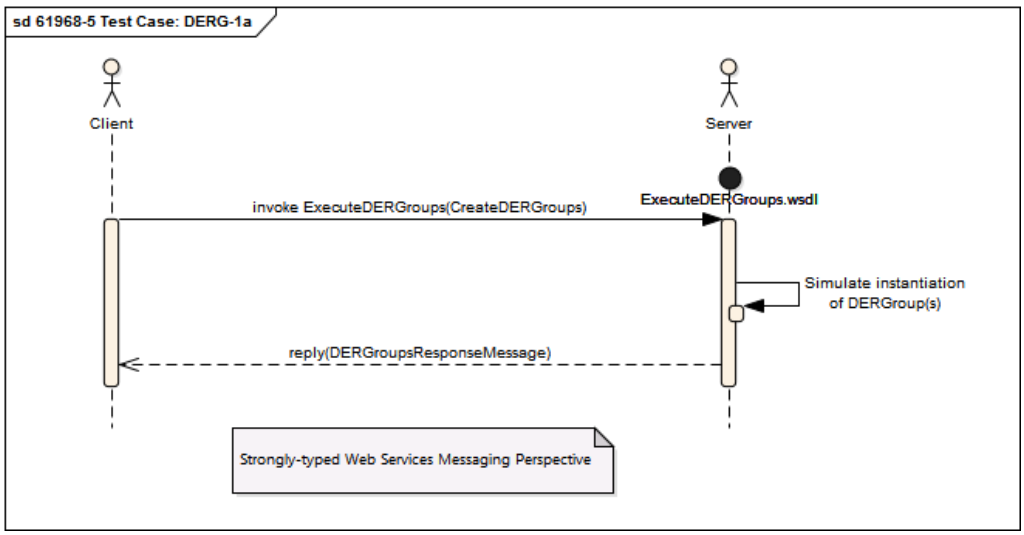


Figure 9-1
Sequence Diagram for Test Case DERG-1a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-05-31T13:55:27-06:00</msg:Timestamp>
		<msg:MessageID>bc9b3eaa-bdc0-4d61-9577-0c78515fee65</msg:MessageID>
		<msg:CorrelationID>bb9a2075-e2e1-43ba-a234-
e5d800bfff6e</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<mRID>a20c559c-dda3-41e5-98b7-41afeb63ae5b</mRID>
				<description>DER Group 1</description>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>false</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>23cbd502-128a-4c4e-b7cd-5eaf6d9ae275</mRID>
				</EndDevices>
				<EndDevices>
					<mRID>7fc50292-2e8a-4e9c-80ae-9105f50ce3ea</mRID>
				</EndDevices>
				<EndDevices>
					<mRID>63d092b7-baed-4bfe-ad97-5709f2ce4ec9</mRID>
				</EndDevices>
				<Names>
					<name>DG1</name>
				</Names>
				<version>
					<date>2017-05-31T13:55:01-06:00</date>
					<major>1</major>
					<minor>0</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:CreateDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-05-31T13:58:44-06:00</Timestamp>
		<MessageID>1ff7fd0a-1e68-4f1e-b347-3a8c77c1ef70</MessageID>
		<CorrelationID>bb9a2075-e2e1-43ba-a234-e5d800bfff6e</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group	http://xx.xxx.xxx.xxx/	create	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-1b: Client requests creation of a DER Group and Server replies (Failure - Single DER Group)

In this test case, the Client requests the Server to instantiate a single DER Group with two members and one DERFunction; however, the IDs (mRIDs and Names) of the DER Group are the same as in Test Case DERG-1a. Consequently, the Server returns a response message indicating a failure based on a business rule prohibiting multiple DER Groups with the same mRID or Name(s). (See Appendix F for error codes.)

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

As noted, this test case also illustrates a failure of a request to create a single DER Group. Subsequent test cases will illustrate attempts to create multiple DER Groups through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	Assumed completion of Test Case DERG-1a
Post-Condition(s)	Creation of the DER Group failed as indicated in the Step 2 response message

The Sequence Diagram in Figure 9-2 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

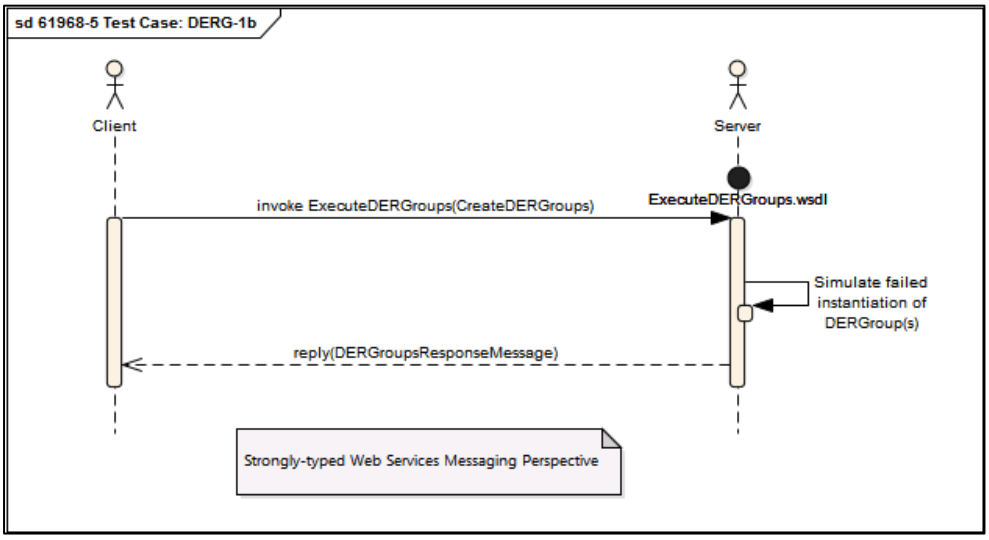


Figure 9-2
Sequence Diagram for Test Case DERG-1b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope

(IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-05-31T14:37:02-06:00</msg:Timestamp>
		<msg:MessageID>d6ad7d26-21f5-4b3a-8646-29dd2bd07c0d</msg:MessageID>
		<msg:CorrelationID>ab2841cf-4388-435b-b3f6-
4ee8144fbf79</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<mRID>a20c559c-dda3-41e5-98b7-41afeb63ae5b</mRID>
				<description>DER Group 1</description>
				<DERFunction>
					<connectDisconnect>false</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>false</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>646bd360-9519-4c60-8c1f-c4d225e806f7</mRID>
				</EndDevices>
```

```
                        <EndDevices>
                                <mRID>8b0e2733-0c5d-4d69-be89-c8ed1d8564b7</mRID>
                        </EndDevices>
                        <Names>
                                <name>DG1</name>
                        </Names>
                        <version>
                                <date>2017-05-31T13:36:33-06:00</date>
                                <major>1</major>
                                <minor>0</minor>
                                <revision>0</revision>
                        </version>
                </EndDeviceGroup>
        </DERGroups>
    </tns:Payload>
</tns:CreateDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
        <tns:Header>
                <Verb>reply</Verb>
                <Noun>DERGroups</Noun>
                <Timestamp>2017-05-31T14:37:45-06:00</Timestamp>
                <MessageID>78da84bc-02a3-4bfc-97f9-cb5fd52b612d</MessageID>
                <CorrelationID>ab2841cf-4388-435b-b3f6-4ee8144fbf79</CorrelationID>
        </tns:Header>
        <tns:Reply>
                <Result>FAILED</Result>
                <Error>
                        <code>6.1</code>
                        <level>FATAL</level>
                        <reason>Request cancelled per business rule</reason>
                        <ID kind="uuid" objectType="DERGroup">a20c559c-dda3-41e5-98b7-
41afeb63ae5b</ID>
                </Error>
        </tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: □ Client Role □ Server Role

EPRI Test Harness: □ Client Role □ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group	http://xx.xxx.xxx.xxx/	create	DERGroups	
2	Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-1c: Client requests creation of two DER Groups and Server replies (Success - Two DER Groups in a single message)

In this test case, the Client requests the Server to instantiate two DER Groups: DG2 with two members and two DERFunctions and DG3 with four members and three DERFunctions. The Server returns a response message indicating success with no errors.

If the Server were in fact a true DERMS, then upon success of this messaging interchange, the DER Groups would be known to the DERMS and could be subsequently changed or deleted. Subsequent test cases in this report will assume the persistence of specific DER Groups and refer to them by the mRIDs and/or Names assigned in the "create" test cases. See the Pre-Condition(s) section of subsequent test cases for additional information.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	None
Post-Condition(s)	Two new DER Groups are created with the Names identifiers that were passed in the request message

The Sequence Diagram in Figure 9-3 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

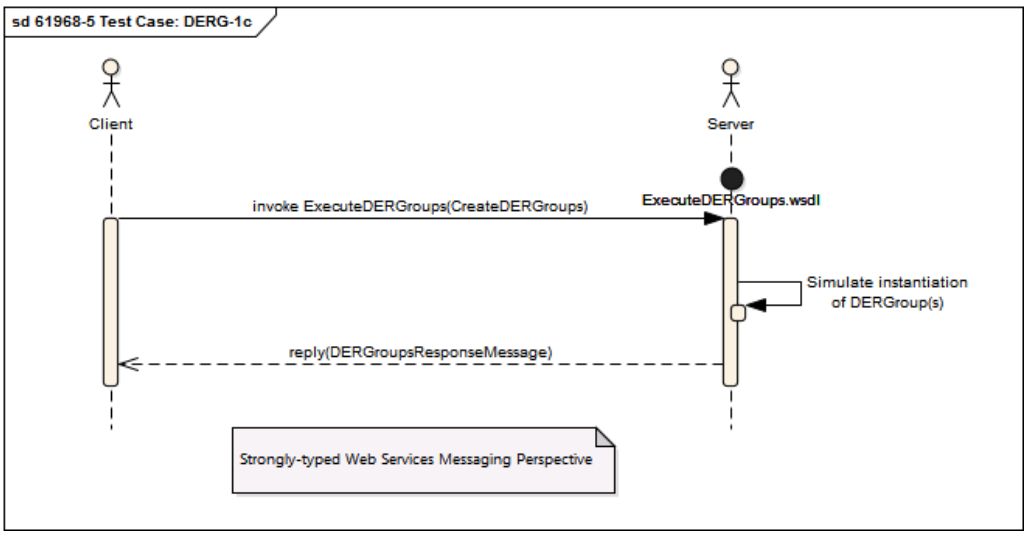


Figure 9-3
Sequence Diagram for Test Case DERG-1c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
      <tns:Header>
            <msg:Verb>create</msg:Verb>
            <msg:Noun>DERGroups</msg:Noun>
            <msg:Timestamp>2017-06-02T10:04:29-06:00</msg:Timestamp>
            <msg:MessageID>1c6c3e7e-8a67-48cf-8d7c-af9164863baa</msg:MessageID>
```

```
            <msg:CorrelationID>d151d469-d8b2-492c-b352-
4a175e73f8cf</msg:CorrelationID>
      </tns:Header>
      <tns:Payload>
            <DERGroups>
                  <EndDeviceGroup>
                        <mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</mRID>
                        <description>DER Group 2</description>
                        <DERFunction>
                              <connectDisconnect>true</connectDisconnect>

      <frequencyWattCurveFunction>false</frequencyWattCurveFunction>
                              <maxRealPowerLimiting>false</maxRealPowerLimiting>
                              <rampRateControl>false</rampRateControl>
                              <reactivePowerDispatch>false</reactivePowerDispatch>
                              <realPowerDispatch>true</realPowerDispatch>
                              <voltageRegulation>false</voltageRegulation>
                              <voltVarCurveFunction>false</voltVarCurveFunction>
                              <voltWattCurveFunction>false</voltWattCurveFunction>
                        </DERFunction>
                        <EndDevices>
                              <mRID>46029b51-8d94-4a06-b242-74d4a3fc2390</mRID>
                        </EndDevices>
                        <EndDevices>
                              <mRID>13a801e1-b45d-4dbe-960f-84f04ef39fcb</mRID>
                        </EndDevices>
                        <Names>
                              <name>DG2</name>
                        </Names>
                        <version>
                              <date>2017-06-02T10:04:10-06:00</date>
                              <major>1</major>
                              <minor>0</minor>
                              <revision>0</revision>
                        </version>
                  </EndDeviceGroup>
                  <EndDeviceGroup>
                        <mRID>6b3241b8-a0f1-429b-b163-459122b5672e</mRID>
                        <description>String</description>
                        <DERFunction>
                              <connectDisconnect>true</connectDisconnect>

      <frequencyWattCurveFunction>false</frequencyWattCurveFunction>
                              <maxRealPowerLimiting>false</maxRealPowerLimiting>
                              <rampRateControl>false</rampRateControl>
                              <reactivePowerDispatch>true</reactivePowerDispatch>
                              <realPowerDispatch>true</realPowerDispatch>
                              <voltageRegulation>false</voltageRegulation>
                              <voltVarCurveFunction>false</voltVarCurveFunction>
                              <voltWattCurveFunction>false</voltWattCurveFunction>
                        </DERFunction>
                        <EndDevices>
                              <mRID>c3af4062-e6a9-4a05-bbac-e0215875fda2</mRID>
```

```
                        </EndDevices>
                        <EndDevices>
                                <mRID>7195c25f-4b54-4714-a90e-710dd7b1bcdd</mRID>
                        </EndDevices>
                        <EndDevices>
                                <mRID>9d6b55b4-e320-45d5-8ff8-6f947afa4b02</mRID>
                        </EndDevices>
                        <EndDevices>
                                <mRID>d1062c85-a938-4d11-af45-9ba97d444d5e</mRID>
                        </EndDevices>
                        <Names>
                                <name>DG3</name>
                        </Names>
                        <version>
                                <date>2017-06-02T10:04:12-06:00</date>
                                <major>1</major>
                                <minor>0</minor>
                                <revision>0</revision>
                        </version>
                </EndDeviceGroup>
        </DERGroups>
    </tns:Payload>
</tns:CreateDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
        <tns:Header>
                <Verb>reply</Verb>
                <Noun>DERGroups</Noun>
                <Timestamp>2017-06-02T10:04:41-06:00</Timestamp>
                <MessageID>aeaa09a7-f6fd-4621-a8fb-3144061b34aa</MessageID>
                <CorrelationID>d151d469-d8b2-492c-b352-4a175e73f8cf</CorrelationID>
```

```
        </tns:Header>
        <tns:Reply>
                <Result>OK</Result>
                <Error>
                        <code>0.0</code>
                </Error>
        </tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group	http://xx.xxx.xxx.xxx/	create	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-1d: Client requests creation of two DER Groups and Server replies (Two DER Groups in a single message - One succeeds and one fails)

In this test case, the Client requests the Server to instantiate two DER Groups: DG4 and DG5. The Server returns a response message indicating that instantiation of the second DER Group (DG5) failed because of a business rule. Because no error is reported for the first DER Group (DG4), the interpretation of the response message is that the instantiation of the first DER Group (DG4) succeeded. (See Appendix F for error codes.)

If the Server were in fact a true DERMS, then upon success of this messaging interchange, the first of the two DER Groups would be known to the DERMS and could be subsequently changed or deleted. Subsequent test cases in this report will assume the persistence of specific DER Groups and refer to them by the mRIDs and/or Names assigned in the “create” test cases. See the Pre-Condition(s) section of subsequent test cases for additional information.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	Assumed completion of Test Case DERG-1c.
Post-Condition(s)	One new DER Group is created with the Names identifier that was passed in the request message. An error is returned, indicating that instantiation of the second DER Group failed.

The Sequence Diagram in Figure 9-4 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

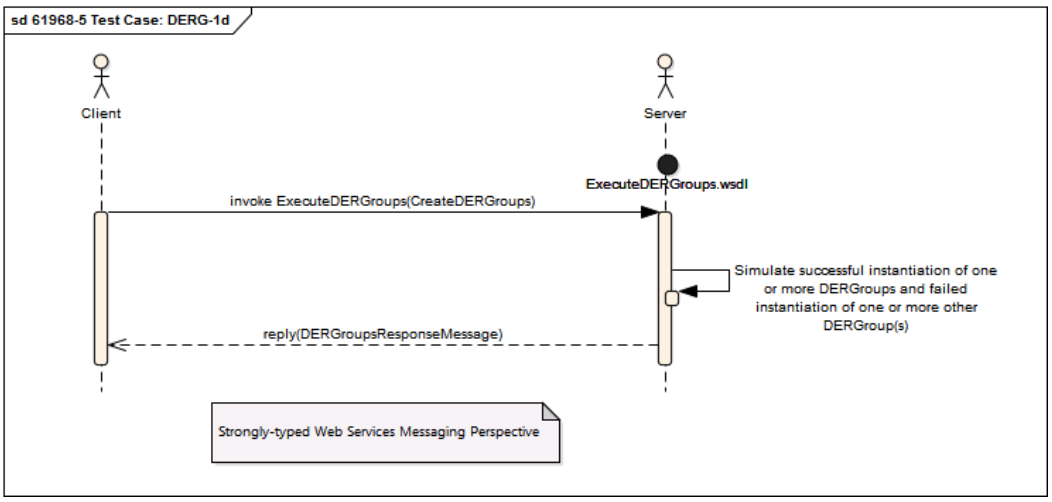


Figure 9-4
Sequence Diagram for Test Case DERG-1d

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
       <tns:Header>
              <msg:Verb>create</msg:Verb>
              <msg:Noun>DERGroups</msg:Noun>
              <msg:Timestamp>2017-06-02T10:52:50-06:00</msg:Timestamp>
              <msg:MessageID>221aa996-3c96-4729-a845-54bec6892089</msg:MessageID>
              <msg:CorrelationID>01943d53-c111-4924-8e92-
e487296c88b0</msg:CorrelationID>
```

```
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>false</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>true</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>c378df3a-294c-4743-ad78-65f970231b5b</mRID>
				</EndDevices>
				<EndDevices>
					<mRID>6de3d770-6087-45bc-a5c8-6fca25f5a318</mRID>
				</EndDevices>
				<Names>
					<name>DG4</name>
				</Names>
				<version>
					<date>2017-06-02T10:52:31-06:00</date>
					<major>1</major>
					<minor>0</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
			<EndDeviceGroup>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>true</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>true</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>8e5439f8-e95a-43ca-8b95-7bc176fa8a35</mRID>
				</EndDevices>
				<Names>
					<name>DG5</name>
				</Names>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:CreateDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T10:52:59-06:00</Timestamp>
		<MessageID>6eb9a15d-ba79-4c58-ba0a-4c74e8879703</MessageID>
		<CorrelationID>01943d53-c111-4924-8e92-e487296c88b0</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>FAILED</Result>
		<Error>
			<code>6.1</code>
			<level>FATAL</level>
			<reason>Request cancelled per business rule</reason>
			<ID kind="name" objectType="DERGroup">DG5</ID>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group	http://xx.xxx.xxx.xxx/	create	DERGroups	
2	Mixed Success/Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-1e: Client requests creation of a DER Group and Server replies (Success - Single DER Group; Responder supplies mRID)

In this test case, the Client requests the Server to instantiate a single DER Group (DG6) by specifying a valid Names identifier for the DERGroup. The Server returns a response message indicating success with no errors. The Server (because of an assumed business rule) also assigns an mRID identifier to the DER Group; consequently, the response message in Step 2 includes a Payload section that adds the mRID identifier to the Payload of the Step 1 request message.

If the Server were in fact a true DERMS, then upon success of this messaging interchange, the DER Group would be known to the DERMS and could be subsequently changed or deleted. Subsequent test cases in this report will assume the persistence of specific DER Groups and refer to them by the mRIDs and/or Names assigned in the "create" test cases. See the Pre-Condition(s) section of subsequent test cases for additional information.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	None.
Post-Condition(s)	A new DER Group is created with the Names identifier that was passed in the request message. The server responds with an indication of success and adds the mRID identifier in the Payload section of the response message.

The Sequence Diagram in Figure 9-5 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

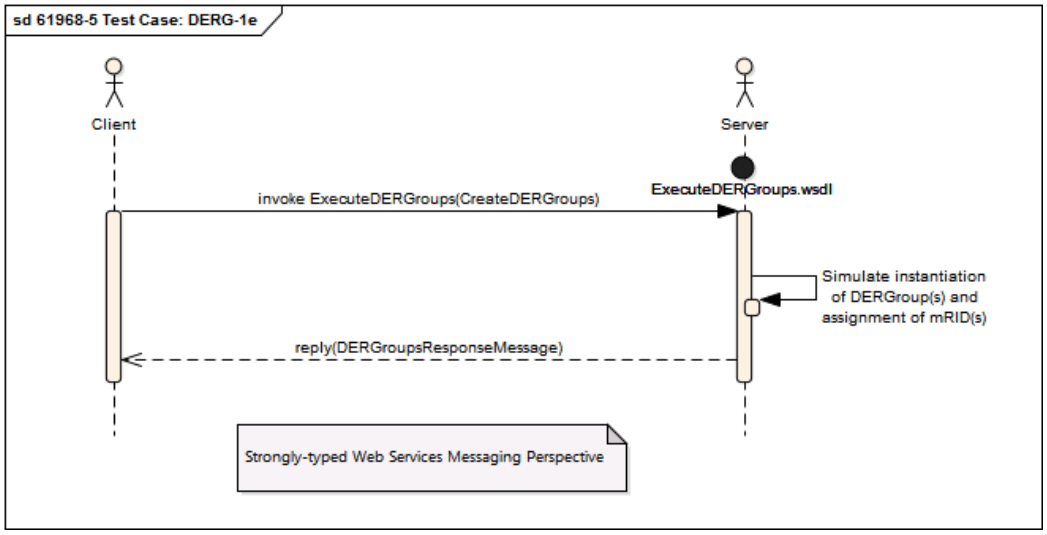


Figure 9-5
Sequence Diagram for Test Case DERG-1e

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T11:20:42-06:00</msg:Timestamp>
		<msg:MessageID>d83c8b6a-91df-441d-9bda-4ceb19066a15</msg:MessageID>
		<msg:CorrelationID>ddce82e7-c3a3-48d9-816e-
6cc6a3cfe619</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>true</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>e8a2f05b-aca9-46dc-971b-be22fcedc00b</mRID>
```

```
                        </EndDevices>
                        <Names>
                                <name>DG6</name>
                        </Names>
                        <version>
                                <date>2017-06-02T11:20:28-06:00</date>
                                <major>1</major>
                                <minor>0</minor>
                                <revision>0</revision>
                        </version>
                </EndDeviceGroup>
        </DERGroups>
    </tns:Payload>
</tns:CreateDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
        <tns:Header>
                <Verb>reply</Verb>
                <Noun>DERGroups</Noun>
                <Timestamp>2017-06-02T11:20:52-06:00</Timestamp>
                <MessageID>e2fd30cd-afbb-4089-a56c-98c8f2028383</MessageID>
                <CorrelationID>ddce82e7-c3a3-48d9-816e-6cc6a3cfe619</CorrelationID>
        </tns:Header>
        <tns:Reply>
                <Result>OK</Result>
                <Error>
                        <code>0.0</code>
                </Error>
        </tns:Reply>
        <tns:Payload>
                <obj:DERGroups>
```

```
                        <obj:EndDeviceGroup>
                                <obj:mRID>854d906-1f5d-40fe-9db3-2fb76bc43499</obj:mRID>
                                <obj:DERFunction>
                                        <obj:connectDisconnect>true</obj:connectDisconnect>

        <obj:frequencyWattCurveFunction>false</obj:frequencyWattCurveFunction>

        <obj:maxRealPowerLimiting>false</obj:maxRealPowerLimiting>
                                        <obj:rampRateControl>false</obj:rampRateControl>

        <obj:reactivePowerDispatch>true</obj:reactivePowerDispatch>
                                        <obj:realPowerDispatch>true</obj:realPowerDispatch>
                                        <obj:voltageRegulation>false</obj:voltageRegulation>

        <obj:voltVarCurveFunction>false</obj:voltVarCurveFunction>

        <obj:voltWattCurveFunction>false</obj:voltWattCurveFunction>
                                </obj:DERFunction>
                                <obj:EndDevices>
                                        <obj:mRID>e8a2f05b-aca9-46dc-971b-
be22fcedc00b</obj:mRID>
                                </obj:EndDevices>
                                <obj:Names>
                                        <obj:name>DG6</obj:name>
                                </obj:Names>
                                <obj:version>
                                        <obj:date>2017-06-02T11:20:28-06:00</obj:date>
                                        <obj:major>1</obj:major>
                                        <obj:minor>0</obj:minor>
                                        <obj:revision>0</obj:revision>
                                </obj:version>
                        </obj:EndDeviceGroup>
                </obj:DERGroups>
        </tns:Payload>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group	http://xx.xxx.xxx.xxx/	create	DERGroups	
2	Success Response including Payload with mRID	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-2a: Client requests modification of an existing DER Group and Server replies (Success - Change supported DER Functions to include voltage regulation)

In this test case, the Client requests the Server to modify an existing DER Group (DG1) by changing the list of supported DER Functions to include voltage regulation. The Server returns a response message indicating success with no errors.

Note: Because all of the attributes of DERFunction are mandatory in the DERGroups.xsd profile, it is necessary to specify all of the attributes (changing voltageRegulation to "true" while specifying the remaining function attributes with the values assigned when the group was last created or modified). In this case, DER Group DG1 was created in Test Case DERG-1 and has not been previously modified.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with a Names.name identifier DG1, as created in Test Case DERG-1a, is assumed to exist.
Post-Condition(s)	The subject DER Group is modified to support the voltage regulation DER Function.

The Sequence Diagram in Figure 9-6 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

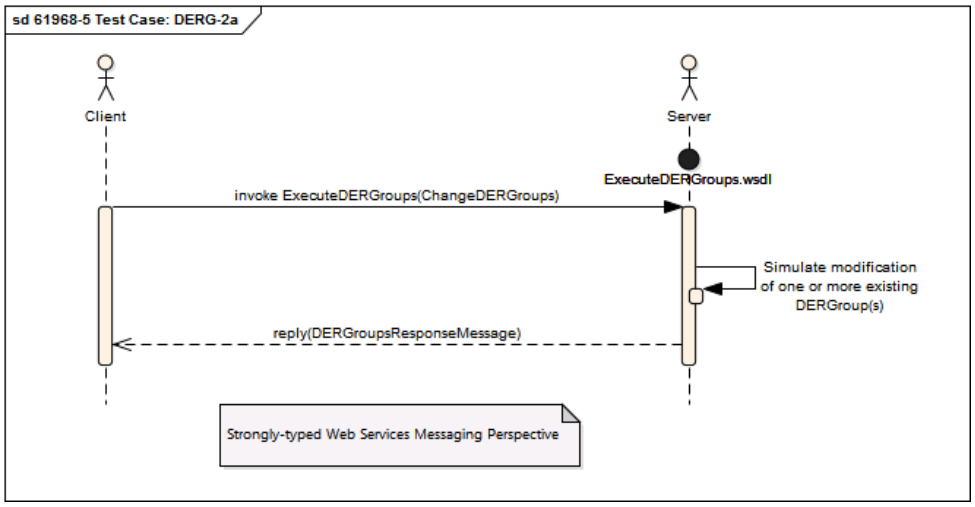


Figure 9-6
Sequence Diagram for Test Case DERG-2a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope

(IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ChangeDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ChangeDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>change</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T12:21:19-06:00</msg:Timestamp>
		<msg:MessageID>439feabd-fb5f-451c-81dd-89b8bde37e30</msg:MessageID>
		<msg:CorrelationID>fb30f952-73a4-49bd-833e-
a5cc7d4ea310</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>false</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>true</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<Names>
					<name>DG1</name>
				</Names>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:ChangeDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T12:21:24-06:00</Timestamp>
		<MessageID>b92605a2-f7d3-40ee-8b30-ae276ff07a01</MessageID>
		<CorrelationID>fb30f952-73a4-49bd-833e-a5cc7d4ea310</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Change DER Group	http://xx.xxx.xxx.xxx/	change	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-2b: Client requests modification of an existing DER Group and Server replies (Success - Add an additional DER)

In this test case, the Client requests the Server to modify an existing DER Group (DG2, but referencing it by its mRID of 228650bf-7f77-44fa-9576-db4bbce8a07f) by adding an additional DER member (EndDevice) to the DER Group (bringing the total number of members to three). The Server returns a response message indicating success with no errors.

Note 1: To add an additional DER member, the only required content normally in the Payload is the identifier of the DERGroup plus the identifier(s) for the new member. However, because this group was originally created with version information, this test case also illustrates the change in the versioning information.

Note 2: If the intent had been to remove an existing DER member and substitute a new member, it would be necessary to leverage the OperationSet technique illustrated in Test Case DERG-3 to remove the existing DER member. A second transaction, similar to the one illustrated in this test case, could then be performed to add the new DER member. If desired, the two operations (deleting one member and adding another member) could be combined in one request message using an OperationSet with two operations.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with an mRID of 228650bf-7f77-44fa-9576-db4bbce8a07f as created in Test Case DERG-1c is assumed to exist.
Post-Condition(s)	The subject DER Group is modified to have a third member.

The Sequence Diagram in Figure 9-7 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

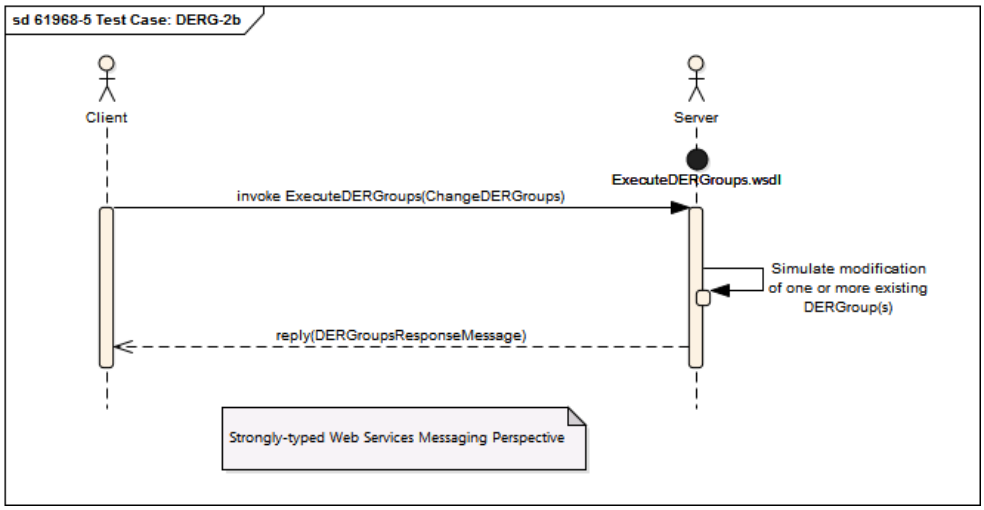


Figure 9-7
Sequence Diagram for Test Case DERG-2b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ChangeDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ChangeDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
       <tns:Header>
              <msg:Verb>change</msg:Verb>
              <msg:Noun>DERGroups</msg:Noun>
              <msg:Timestamp>2017-06-02T12:30:44-06:00</msg:Timestamp>
              <msg:MessageID>e032908a-50df-4b7a-a177-e3944d228fad</msg:MessageID>
              <msg:CorrelationID>fc493167-bb9d-46c4-9018-
95c0691a0b08</msg:CorrelationID>
```

```
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</mRID>
				<EndDevices>
					<mRID>7a02c3a5-606e-4d0e-adaf-0e1b98757512</mRID>
				</EndDevices>
				<version>
					<date>2017-06-02T12:30:21-06:00</date>
					<major>1</major>
					<minor>1</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:ChangeDERGroups>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T12:30:57-06:00</Timestamp>
		<MessageID>5ca13572-70f7-48dd-b39d-88a857ce3ff6</MessageID>
		<CorrelationID>fc493167-bb9d-46c4-9018-95c0691a0b08</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: □ Client Role □ Server Role

EPRI Test Harness: □ Client Role □ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Change DER Group	http://xx.xxx.xxx.xxx/	change	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-3: Client requests modification of an existing DER Group and Server replies (Success - Delete a DER)

In this test case, the Client requests the Server to modify an existing DER Group by deleting one of the DER members (EndDevice with mRID of 7195c25f-4b54-4714-a90e-710dd7b1bcdd) from DER Group DG3. The Server returns a response message indicating success with no errors.

Because the intent is to remove an existing DER member, it is necessary to leverage the OperationSet technique. Refer to the subsection "IEC 61968-100:2013 Considerations" in Section 2 as well as Appendix C for a more complete discussion of the use of OperationSets to accomplish the deletion of attributes and/or association classes. A DER member (EndDevice) is an example of an association class—in the UML an EndDevice is a separate CIM object associated with a DERGroup. Attributes, in contrast, are just that: they appear in the UML as an attribute of a CIM class (sometimes inherited from a parent class).

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group DG3, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist.
Post-Condition(s)	The subject DER Group is modified to have the DER member (EndDevice) with mRID of 7195c25f-4b54-4714-a90e-710dd7b1bcdd removed.

The Sequence Diagram in Figure 9-8 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

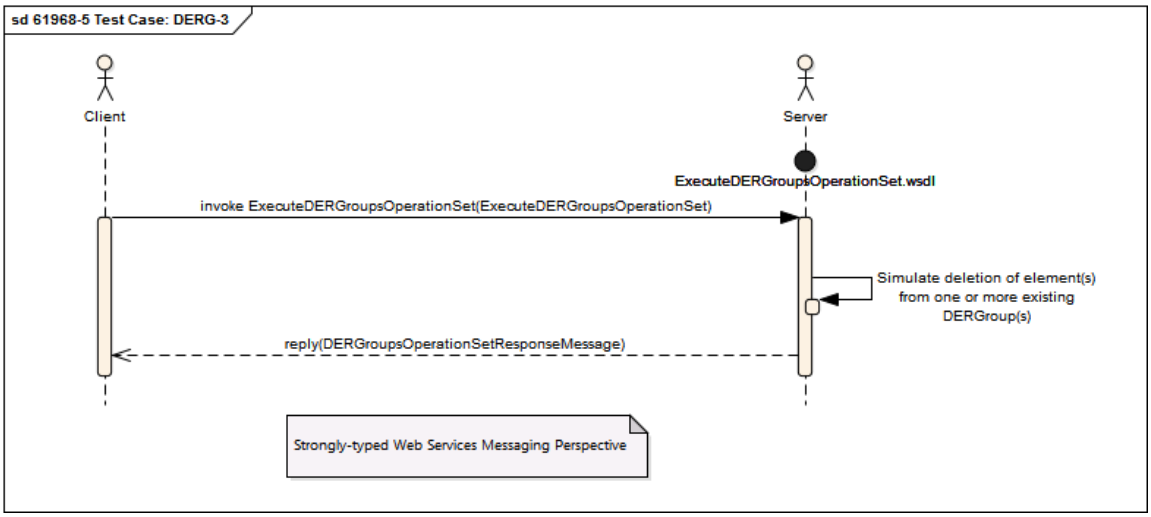


Figure 9-8
Sequence Diagram for Test Case DERG-3

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupsOperationSet.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsOperationSetMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ExecuteDERGroupsOperationSet	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ExecuteDERGroupsOperationSet xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage
DERGroupsOperationSetMessage.xsd">
	<tns:Header>
		<Verb>execute</Verb>
		<Noun>OperationSet</Noun>
		<Timestamp>2017-06-02T12:42:19-06:00</Timestamp>
		<MessageID>958e7f6e-f0e5-490f-922b-3e51ef8eed7b</MessageID>
		<CorrelationID>bde49d7f-e87e-4496-b98b-2ed4785dfdbc</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<tns:OperationSet>
			<Operation>
				<operationId>1</operationId>
				<noun>DERGroups</noun>
				<verb>delete</verb>
				<elementOperation>true</elementOperation>
				<DERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroups# DERGroups.xsd">
					<EndDeviceGroup>
						<EndDevices>
							<mRID>7195c25f-4b54-4714-a90e-
710dd7b1bcdd</mRID>
						</EndDevices>
						<Names>
							<name>DG3</name>
						</Names>
					</EndDeviceGroup>
				</DERGroups>
			</Operation>
		</tns:OperationSet>
	</tns:Payload>
</tns:ExecuteDERGroupsOperationSet>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupsOperationSet.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsOperationSetMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DERGroupsOperationSetResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsOperationSetResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage
DERGroupsOperationSetMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>OperationSet</Noun>
		<Timestamp>2017-06-02T12:42:36-06:00</Timestamp>
		<MessageID>9929802c-ce2a-4573-87fa-fcebde886d1d</MessageID>
		<CorrelationID>bde49d7f-e87e-4496-b98b-2ed4785dfdbc</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
			<operationId>0</operationId>
		</Error>
		<ID idType="String" idAuthority="String" kind="other"
objectType="String">String</ID>
		<n1:auto-generated_for_wildcard/>
		<operationId>0</operationId>
	</tns:Reply>
	<tns:Payload>
		<tns:OperationSet>
			<enforceMsgSequence>true</enforceMsgSequence>

	<enforceTransactionalIntegrity>true</enforceTransactionalIntegrity>
			<Operation>
				<operationId>0</operationId>
			</Operation>
		</tns:OperationSet>
	</tns:Payload>
</tns:DERGroupsOperationSetResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Delete Details from existing DER Group	http://xx.xxx.xxx.xxx/	execute	OperationSet*	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	OperationSet*	

*The OperationSet includes a single Operation having:

- verb = delete
- noun = DERGroups
- elementOperation = true

DERG-4: Client requests deletion of an existing DER Group and Server replies (Success)

In this test case, the Client requests the Server to delete an existing DER Group (DG1) (in its entirety). The Server returns a response message indicating success with no errors.

This test case is included to distinguish the deletion of a DER Group in its entirety from the deletion of attributes or associated classes from an existing DER Group (as illustrated in Test Case DERG-3).

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group with a Names.name identifier of DG1, as created in Test Case DERG-1a, is assumed to exist.
Post-Condition(s)	The subject DER Group is deleted.

The Sequence Diagram in Figure 9-9 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

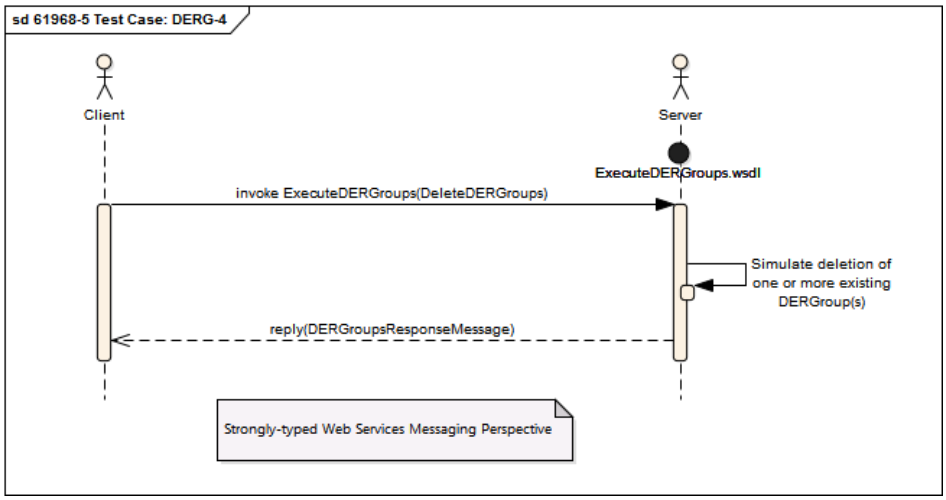


Figure 9-9
Sequence Diagram for Test Case DERG-4

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DeleteDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DeleteDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>delete</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T13:00:58-06:00</msg:Timestamp>
		<msg:MessageID>d0a3ac3b-f903-4e87-824c-89fb3af420e1</msg:MessageID>
		<msg:CorrelationID>765a69ee-f7ab-41ba-a731-
defbba676710</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<Names>
					<name>DG1</name>
				</Names>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:DeleteDERGroups
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DERGroupsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupsResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T13:01:08-06:00</Timestamp>
		<MessageID>0e250533-deba-422d-a0eb-4059377c8825</MessageID>
		<CorrelationID>765a69ee-f7ab-41ba-a731-defbba676710</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Delete existing DER Group	http://xx.xxx.xxx.xxx/	delete	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-5a: Client requests retrieval of an existing DER Group and Server replies (Success - Single DER Group)

In this test case, the Client requests the Server to provide the details of a single DER Group identified by its Names.name identifier of DG2. This DER Group was previously created in Test Case DERG-1c and modified in Test Case DERG-2b. The Server returns a response message indicating success with no errors and including the details of the current state of the DER Group in the Payload section of the response message.

This message exchange can also be characterized as DER Group Capability Discovery because the response message contains (and is required to contain) the list of DER Functions supported by the DER Group.

Note 1: The parameters for the request query (in this case, the Names.name identifier of the DER Group whose details are being requested) are supplied using XML generated using the DERGroupQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Groups will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroups.xsd used for "create" scenarios and not the unconstrained version used for "change or delete" scenarios.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the applications being tested may contain any of the request and Payload elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with a Names.name identifier of DG2, as created in Test Case DERG-1c and modified in DERG-2b, is assumed to exist.
Post-Condition(s)	The full content of the subject DER Group is returned in response to the query.

The Sequence Diagram in Figure 9-10 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

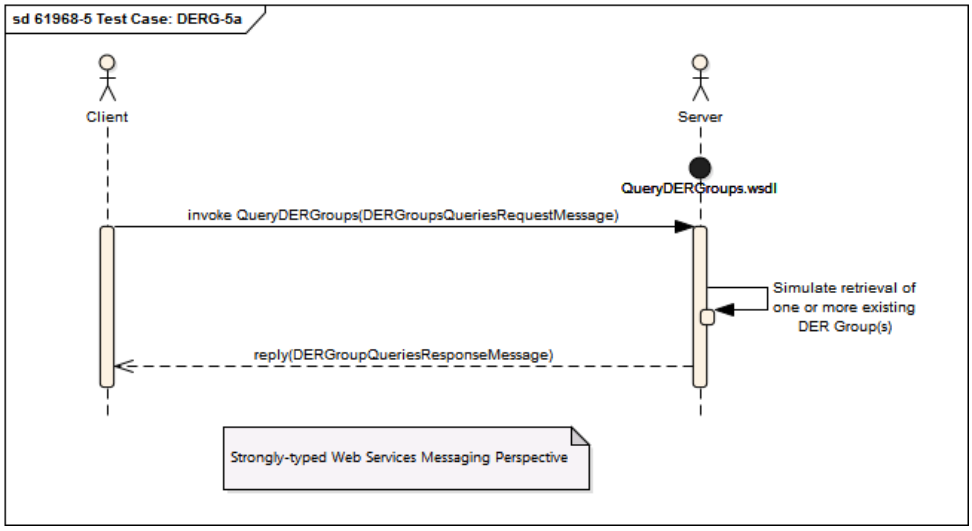


Figure 9-10
Sequence Diagram for Test Case DERG-5a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesRequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupQueries#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T13:22:38-06:00</Timestamp>
		<MessageID>836a18cd-d8f9-4c34-a144-7d3f59f34229</MessageID>
		<CorrelationID>37d7b6e7-8098-4960-a297-4b2cb49ca81f</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupQueries>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG2</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupQueries>
	</tns:Request>
</tns:DERGroupQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T13:22:45-06:00</Timestamp>
		<MessageID>16f37e9e-be26-40be-a9b8-4d7855391565</MessageID>
		<CorrelationID>37d7b6e7-8098-4960-a297-4b2cb49ca81f</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
	<tns:Payload>
		<m:DERGroups>
			<m:EndDeviceGroup>
				<m:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</m:mRID>
				<m:description>DER Group 2</m:description>
				<m:DERFunction>
					<m:connectDisconnect>true</m:connectDisconnect>

	<m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

	<m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
					<m:rampRateControl>false</m:rampRateControl>

	<m:reactivePowerDispatch>false</m:reactivePowerDispatch>
					<m:realPowerDispatch>true</m:realPowerDispatch>
					<m:voltageRegulation>false</m:voltageRegulation>
```

```
        <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

        <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                                </m:DERFunction>
                                <m:EndDevices>
                                        <m:mRID>46029b51-8d94-4a06-b242-74d4a3fc2390</m:mRID>
                                </m:EndDevices>
                                <m:EndDevices>
                                        <m:mRID>13a801e1-b45d-4dbe-960f-84f04ef39fcb</m:mRID>
                                </m:EndDevices>
                                <m:EndDevices>
                                        <m:mRID>7a02c3a5-606e-4d0e-adaf-0e1b98757512</m:mRID>
                                </m:EndDevices>
                                <m:Names>
                                        <m:name>DG2</m:name>
                                </m:Names>
                                <m:version>
                                        <m:date>2017-06-02T12:30:21-06:00</m:date>
                                        <m:major>1</m:major>
                                        <m:minor>1</m:minor>
                                        <m:revision>0</m:revision>
                                </m:version>
                        </m:EndDeviceGroup>
                </m:DERGroups>
        </tns:Payload>
</tns:DERGroupQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Groups	http://xx.xxx.xxx.xxx/	get	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-5b: Client requests retrieval of two DER Groups and Server replies (Success - Two DER Groups in a single message)

In this test case, the Client requests the Server to provide the details of two DER Groups (DG2 and DG4). The Server returns a response message indicating success with no errors and including the details of the current state of the two DER Groups in the Payload section of the response message.

Note 1: The parameters for the request query (in this case, the Names.name identifier of the DER Group whose details are being requested) are supplied using XML generated using the DERGroupQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Groups will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroups.xsd used for "create" scenarios and not the unconstrained version used for "change or delete" scenarios.

Pre-Condition(s)	DER Groups with Names.name identifiers of DG2 (as created in Test Case DERG-1c and modified in Test Case DERG-2b) and DG4 (as created in Test Case DERG-1d) are assumed to exist.
Post-Condition(s)	The full contents of the subject DER Groups are returned in response to the query.

The Sequence Diagram in Figure 9-11 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

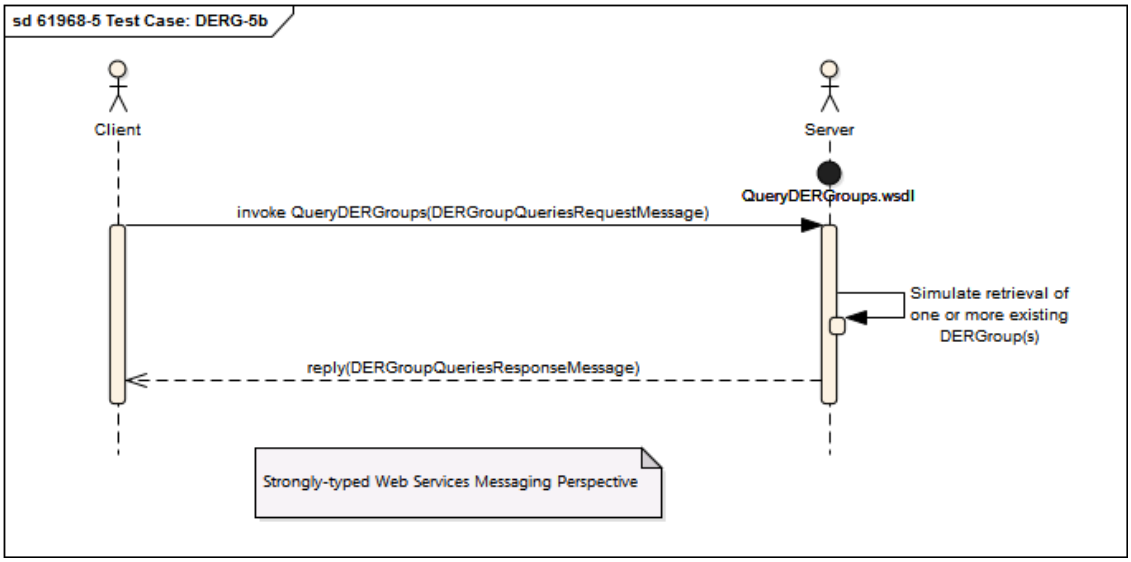


Figure 9-11
Sequence Diagram for Test Case DERG-5b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesRequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupQueries#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T13:43:10-06:00</Timestamp>
		<MessageID>cc632a80-f51c-41c6-b7fc-dd42abae295c</MessageID>
		<CorrelationID>407112d5-e8a5-4967-a475-cc3a9c393a9c</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupQueries>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG2</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG4</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupQueries>
	</tns:Request>
</tns:DERGroupQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroups</Noun>
		<Timestamp>2017-06-02T13:22:45-06:00</Timestamp>
		<MessageID>16f37e9e-be26-40be-a9b8-4d7855391565</MessageID>
		<CorrelationID>37d7b6e7-8098-4960-a297-4b2cb49ca81f</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
	<tns:Payload>
		<m:DERGroups>
			<m:EndDeviceGroup>
				<m:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</m:mRID>
				<m:description>DER Group 2</m:description>
				<m:DERFunction>
					<m:connectDisconnect>true</m:connectDisconnect>

	<m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

	<m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
					<m:rampRateControl>false</m:rampRateControl>

	<m:reactivePowerDispatch>false</m:reactivePowerDispatch>
					<m:realPowerDispatch>true</m:realPowerDispatch>
```

```
                              <m:voltageRegulation>false</m:voltageRegulation>

      <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

      <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                        </m:DERFunction>
                        <m:EndDevices>
                              <m:mRID>46029b51-8d94-4a06-b242-74d4a3fc2390</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>13a801e1-b45d-4dbe-960f-84f04ef39fcb</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>7a02c3a5-606e-4d0e-adaf-0e1b98757512</m:mRID>
                        </m:EndDevices>
                        <m:Names>
                              <m:name>DG2</m:name>
                        </m:Names>
                        <m:version>
                              <m:date>2017-06-02T12:30:21-06:00</m:date>
                              <m:major>1</m:major>
                              <m:minor>1</m:minor>
                              <m:revision>0</m:revision>
                        </m:version>
                  </m:EndDeviceGroup>
                  <m:EndDeviceGroup>
                        <m:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</m:mRID>
                        <m:description>DER Group 2</m:description>
                        <m:DERFunction>
                              <m:connectDisconnect>true</m:connectDisconnect>

      <m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

      <m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
                              <m:rampRateControl>false</m:rampRateControl>

      <m:reactivePowerDispatch>false</m:reactivePowerDispatch>
                              <m:realPowerDispatch>true</m:realPowerDispatch>
                              <m:voltageRegulation>true</m:voltageRegulation>

      <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

      <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                        </m:DERFunction>
                        <m:EndDevices>
                              <m:mRID>c378df3a-294c-4743-ad78-65f970231b5b</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>6de3d770-6087-45bc-a5c8-6fca25f5a318</m:mRID>
                        </m:EndDevices>
                        <m:Names>
                              <m:name>DG4</m:name>
                        </m:Names>
                        <m:version>
```

```
                                <m:date>2017-06-02T10:52:31-06:00</m:date>
                                <m:major>1</m:major>
                                <m:minor>0</m:minor>
                                <m:revision>0</m:revision>
                            </m:version>
                        </m:EndDeviceGroup>
                    </m:DERGroups>
                </tns:Payload>
</tns:DERGroupQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Groups	http://xx.xxx.xxx.xxx/	get	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroups	

DERG-5c: Client requests retrieval of all DER Groups and Server replies (Success - All DER Groups in a single message)

In this test case, the Client requests the Server to provide the details of all DER Groups by sending nothing at all. The Server returns a response message indicating success with no errors and including the details of the current state of all the DER Groups in the Payload section of the response message. DER Group DG1 was created in Test Case DERG-1a and then was deleted in Test Case DERG-4. DER Groups DG2 and DG3 were previously created in Test Case DERG-1c. DER Group DG4 was created in Test Case DERG-1d; however, DG5 was not created because of an error. Lastly, DER Group DG6 was created in Test Case DERG-1e. Only those groups that were successfully created and not deleted in previous test cases will be present in this query.

Pre-Condition(s)	DER Groups with Names.name identifiers of DG2 (as created in Test Case DERG-1c and modified in Test Case DERG-2b), DG3 (as created in Test Case DERG-1c and later modified in DERG-3), DG4 (as created in Test Case DERG-1d), and DG6 (as created in Test Case DERG-1e) are assumed to exist.
Post-Condition(s)	The full contents of the subject DER Groups are returned in response to the query.

The Sequence Diagram in Figure 9-12 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

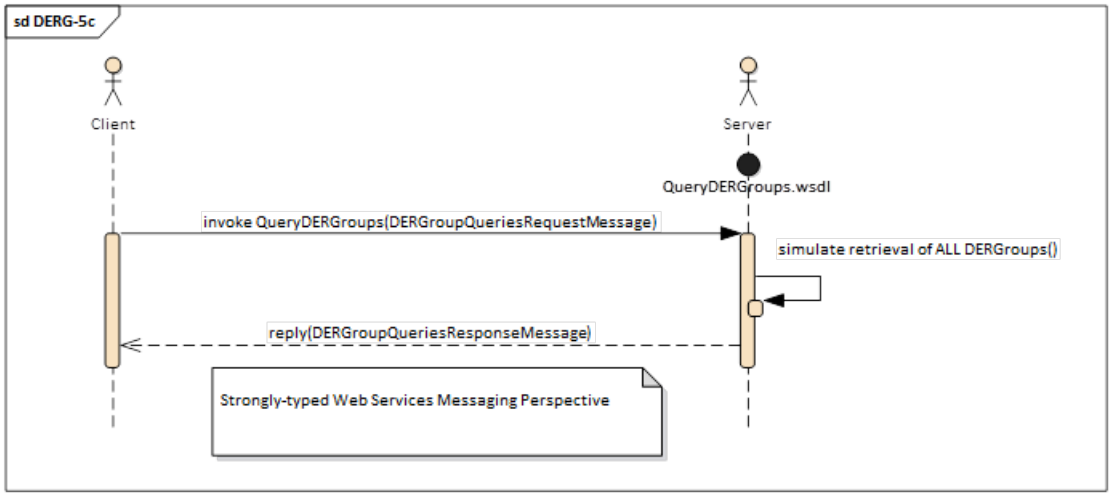


Figure 9-12
Sequence Diagram for Test Case DERG-5c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesRequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupQueries#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
       <tns:Header>
              <Verb>get</Verb>
              <Noun>DERGroups</Noun>
              <Timestamp>2018-09-27T14:30:10-06:00</Timestamp>
```

```
            <MessageID>8f2dd684-a736-4068-97e6-6167b4fff406</MessageID>
            <CorrelationID>30488987-17f9-46a2-b0bc-a4e4db825e8f</CorrelationID>
      </tns:Header>
      <tns:Request>
            <obj2:DERGroupQueries>
       <obj2:EndDeviceGroup>
       </obj2:EndDeviceGroup>
            </obj2:DERGroupQueries>
      </tns:Request>
</tns:DERGroupQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupQueriesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:m="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupQueriesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupQueriesMessage
DERGroupQueriesMessage.xsd">
      <tns:Header>
            <Verb>reply</Verb>
            <Noun>DERGroups</Noun>
            <Timestamp>2018-09-27T14:30:12-06:00</Timestamp>
            <MessageID>6a804cb1-54c9-4a43-baa8-cd901a299ede </MessageID>
            <CorrelationID>30488987-17f9-46a2-b0bc-a4e4db825e8f </CorrelationID>
      </tns:Header>
      <tns:Reply>
            <Result>OK</Result>
            <Error>
                  <code>0.0</code>
            </Error>
      </tns:Reply>
      <tns:Payload>
            <m:DERGroups>
                  <m:EndDeviceGroup>
                        <m:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</m:mRID>
                        <m:description>DER Group 2</m:description>
                        <m:DERFunction>
                              <m:connectDisconnect>true</m:connectDisconnect>
```

```
      <m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

      <m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
                              <m:rampRateControl>false</m:rampRateControl>

      <m:reactivePowerDispatch>false</m:reactivePowerDispatch>
                              <m:realPowerDispatch>true</m:realPowerDispatch>
                              <m:voltageRegulation>false</m:voltageRegulation>

      <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

      <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                        </m:DERFunction>
                        <m:EndDevices>
                              <m:mRID>46029b51-8d94-4a06-b242-
74d4a3fc2390</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>13a801e1-b45d-4dbe-960f-
84f04ef39fcb</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>7a02c3a5-606e-4d0e-adaf-
0e1b98757512</m:mRID>
                        </m:EndDevices>
                        <m:Names>
                              <m:name>DG2</m:name>
                        </m:Names>
                        <m:version>
                              <m:date>2017-06-02T12:30:21-06:00</m:date>
                              <m:major>1</m:major>
                              <m:minor>1</m:minor>
                              <m:revision>0</m:revision>
                        </m:version>
                  </m:EndDeviceGroup>
                  <m:EndDeviceGroup>
                        <m:mRID>6b3241b8-a0f1-429b-b163-459122b5672e</m:mRID>
                        <m:description>String</m:description>
                        <m:DERFunction>
                              <m:connectDisconnect>true</m:connectDisconnect>

      <m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

      <m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
                              <m:rampRateControl>false</m:rampRateControl>

      <m:reactivePowerDispatch>true</m:reactivePowerDispatch>
                              <m:realPowerDispatch>true</m:realPowerDispatch>
                              <m:voltageRegulation>false</m:voltageRegulation>

      <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

      <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                        </m:DERFunction>
                        <m:EndDevices>
                              <m:mRID>c3af4062-e6a9-4a05-bbac-
e0215875fda2</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>9d6b55b4-e320-45d5-8ff8-
6f947afa4b02</m:mRID>
                        </m:EndDevices>
```

```
                        <m:EndDevices>
                              <m:mRID>d1062c85-a938-4d11-af45-
9ba97d444d5e</m:mRID>
                        </m:EndDevices>
                        <m:Names>
                              <m:name>DG3</m:name>
                        </m:Names>
                        <m:version>
                              <m:date>2017-06-02T10:04:12-06:00</m:date>
                              <m:major>1</m:major>
                              <m:minor>0</m:minor>
                              <m:revision>0</m:revision>
                        </m:version>
                  </m:EndDeviceGroup>
                  <m:EndDeviceGroup>
                        <m:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</m:mRID>
                        <m:description>DER Group 2</m:description>
                        <m:DERFunction>
                              <m:connectDisconnect>true</m:connectDisconnect>

      <m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

      <m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
                              <m:rampRateControl>false</m:rampRateControl>

      <m:reactivePowerDispatch>false</m:reactivePowerDispatch>
                              <m:realPowerDispatch>true</m:realPowerDispatch>
                              <m:voltageRegulation>true</m:voltageRegulation>

      <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

      <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                        </m:DERFunction>
                        <m:EndDevices>
                              <m:mRID>c378df3a-294c-4743-ad78-
65f970231b5b</m:mRID>
                        </m:EndDevices>
                        <m:EndDevices>
                              <m:mRID>6de3d770-6087-45bc-a5c8-
6fca25f5a318</m:mRID>
                        </m:EndDevices>
                        <m:Names>
                              <m:name>DG4</m:name>
                        </m:Names>
                        <m:version>
                              <m:date>2017-06-02T10:52:31-06:00</m:date>
                              <m:major>1</m:major>
                              <m:minor>0</m:minor>
                              <m:revision>0</m:revision>
                        </m:version>
                  </m:EndDeviceGroup>
                  <m:EndDeviceGroup>
                        <m:mRID>854d906-1f5d-40fe-9db3-2fb76bc43499</m:mRID>
                        <m:DERFunction>
                              <m:connectDisconnect>true</m:connectDisconnect>

      <m:frequencyWattCurveFunction>false</m:frequencyWattCurveFunction>

      <m:maxRealPowerLimiting>false</m:maxRealPowerLimiting>
                              <m:rampRateControl>false</m:rampRateControl>

      <m:reactivePowerDispatch>true</m:reactivePowerDispatch>
                              <m:realPowerDispatch>true</m:realPowerDispatch>
```

```
                                    <m:voltageRegulation>false</m:voltageRegulation>

        <m:voltVarCurveFunction>false</m:voltVarCurveFunction>

        <m:voltWattCurveFunction>false</m:voltWattCurveFunction>
                                </m:DERFunction>
                                <m:EndDevices>
                                        <m:mRID>e8a2f05b-aca9-46dc-971b-
be22fcedc00b</m:mRID>
                                </m:EndDevices>
                                <m:Names>
                                        <m:name>DG6</m:name>
                                </m:Names>
                                <m:version>
                                        <m:date>2017-06-02T11:20:28-06:00</m:date>
                                        <m:major>1</m:major>
                                        <m:minor>0</m:minor>
                                        <m:revision>0</m:revision>
                                </m:version>
                        </m:EndDeviceGroup>
                </m:DERGroups>
        </tns:Payload>
</tns:DERGroupQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Groups	http://xx.xxx.xxx.xxx/	Get	DERGroups	
2	Success Response	http://xx.xxx.xxx.xxx/	Reply	DERGroups	

DERG-6: Server informs Client of the creation of two DER Groups (Two DER Groups in a single message)

In this test case, the Server informs the Client of the creation of two DER Groups: DG7 with three members (EndDevices) and three DER Functions and DG8 with two members and four DER Functions. Such a notification may occur if the Client is not the original requestor but instead is being notified of the DER Groups instantiated directly within the Server or because of a request by a third system. The notification may occur immediately upon instantiation or at some later date/time. This is an asynchronous notification using an Event Stereotype message. There is no response message.

If the Server were in fact a true DERMS, then upon success of this messaging interchange, the DER Groups would be known to the DERMS and could be subsequently changed or deleted. Subsequent test cases in this report will assume the persistence of specific DER Groups and refer to them by the mRIDs and/or Names assigned in the “created” test cases. See the Pre-Condition(s) section of subsequent test cases for additional information.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	It is assumed that DER Groups DG7 and DG8 were created at different times earlier in the day.
Post-Condition(s)	The Client is informed of the details of two DER Groups created earlier in the day.

The Sequence Diagram in Figure 9-13 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

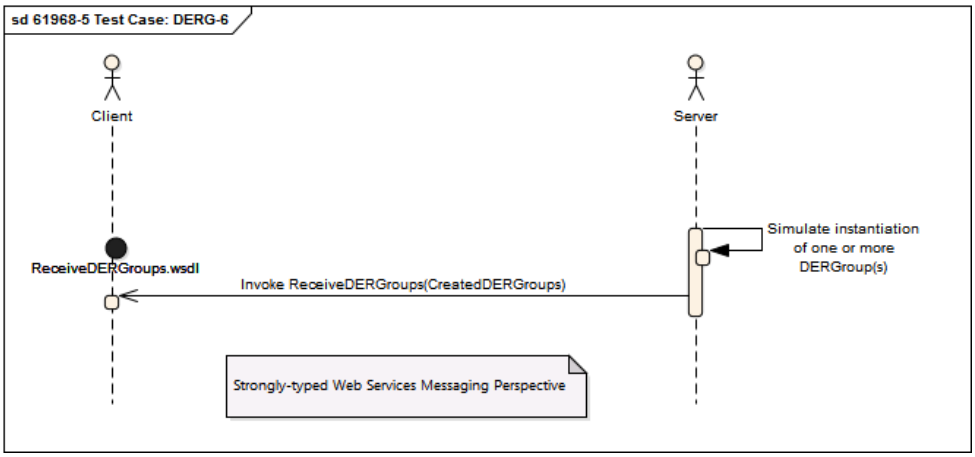


Figure 9-13
Sequence Diagram for Test Case DERG-6

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>created</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T13:58:11-06:00</msg:Timestamp>
		<msg:MessageID>d11e23fb-9183-46fb-bd5a-8e4693e02aa9</msg:MessageID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<mRID>6c42f1ee-d5d9-4d93-8249-3ad11afdcc67</mRID>
				<description>DER Group 7</description>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>false</rampRateControl>
					<reactivePowerDispatch>true</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<EndDevices>
					<mRID>727294db-354f-4343-b2cd-acbf5a23297f</mRID>
				</EndDevices>
				<EndDevices>
					<mRID>9392b37c-1882-4fcc-905a-2d29c769b1c2</mRID>
				</EndDevices>
				<EndDevices>
					<mRID>e2665091-8a1c-469d-9056-6371db5beb4b</mRID>
				</EndDevices>
				<Names>
					<name>DG7</name>
				</Names>
				<version>
					<date>2017-06-02T09:31:17</date>
					<major>1</major>
					<minor>0</minor>
					<revision>0</revision>
				</version>
			</EndDeviceGroup>
			<EndDeviceGroup>
				<mRID>5a3a8b59-42fe-4989-9622-6f4206e9579e</mRID>
				<description>DER Group 8</description>
```

```
                        <DERFunction>
                                <connectDisconnect>true</connectDisconnect>

        <frequencyWattCurveFunction>false</frequencyWattCurveFunction>
                                <maxRealPowerLimiting>false</maxRealPowerLimiting>
                                <rampRateControl>false</rampRateControl>
                                <reactivePowerDispatch>true</reactivePowerDispatch>
                                <realPowerDispatch>true</realPowerDispatch>
                                <voltageRegulation>true</voltageRegulation>
                                <voltVarCurveFunction>false</voltVarCurveFunction>
                                <voltWattCurveFunction>false</voltWattCurveFunction>
                        </DERFunction>
                        <EndDevices>
                                <mRID>d9db9ab9-6dba-4d09-a889-f5a55946e515</mRID>
                        </EndDevices>
                        <EndDevices>
                                <mRID>29896015-ce74-4594-9f68-593ac8b58762</mRID>
                        </EndDevices>
                        <Names>
                                <name>DG8</name>
                        </Names>
                        <version>
                                <date>2017-06-02T09:35:40</date>
                                <major>1</major>
                                <minor>0</minor>
                                <revision>0</revision>
                        </version>
                </EndDeviceGroup>
        </DERGroups>
        </tns:Payload>
```


Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Created DER Groups Notification	http://xx.xxx.xxx.xxx/	created	DERGroups	

DERG-7: Server informs Client of modification of an existing DER Group (Change list of supported DER Functions to include ramp rate control)

In this test case, the Server informs the Client that ramp rate control has been added to the list of DER Functions supported by DER Group DG7. Such a notification may occur if the Client is not the original requestor of the change but instead is being notified of the change made directly within the Server or because of a request by a third system. The notification may occur immediately at the time of the change or at some later date/time. This is an asynchronous notification using an Event Stereotype message. There is no response message.

Note: Because all of the attributes of DERFunction are mandatory in the DERGroups.xsd profile, it is necessary to specify all of the attributes (changing rampRateControl to “true” while specifying the remaining function attributes with the values assigned when the group was last created or modified). In this case, DER Group DG7 was created in Test Case DERG-6 and has not been previoulsy modified.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group with a Names.name identifier of DG7, as created in Test Case DERG-6, is assumed to exist.
Post-Condition(s)	The Client is provided with the updated list of supported DER Functions.

The Sequence Diagram in Figure 9-14 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

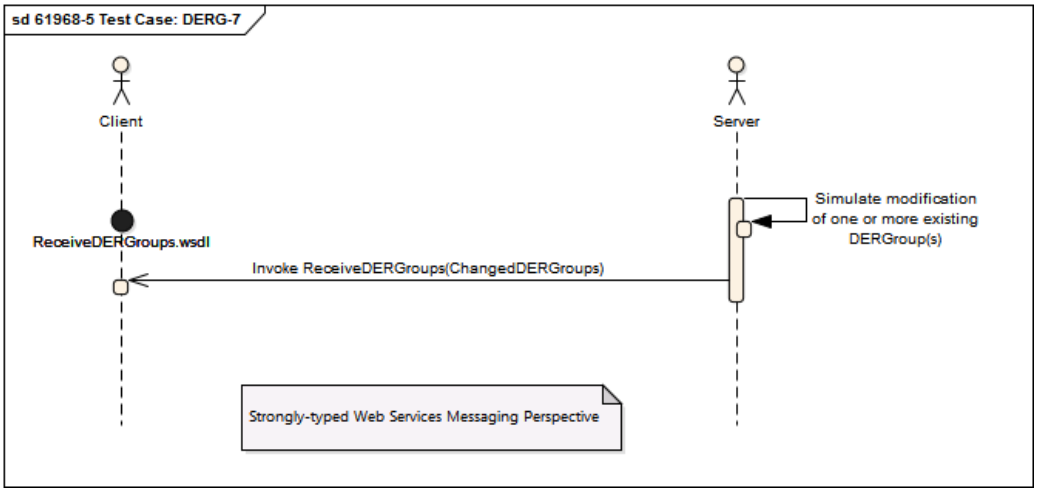


Figure 9-14
Sequence Diagram for Test Case DERG-7

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ChangedDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ChangedDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>changed</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T14:30:18-06:00</msg:Timestamp>
		<msg:MessageID>91771168-df25-4395-96ec-f5ca253dcff3</msg:MessageID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<DERFunction>
					<connectDisconnect>true</connectDisconnect>

	<frequencyWattCurveFunction>false</frequencyWattCurveFunction>
					<maxRealPowerLimiting>false</maxRealPowerLimiting>
					<rampRateControl>true</rampRateControl>
					<reactivePowerDispatch>true</reactivePowerDispatch>
					<realPowerDispatch>true</realPowerDispatch>
					<voltageRegulation>false</voltageRegulation>
					<voltVarCurveFunction>false</voltVarCurveFunction>
					<voltWattCurveFunction>false</voltWattCurveFunction>
				</DERFunction>
				<Names>
					<name>DG7</name>
				</Names>
			</EndDeviceGroup>
		</DERGroups>
	</tns:Payload>
</tns:ChangedDERGroups>
```

Test Results

Application Being Tested: □ Client Role □ Server Role

EPRI Test Harness: □ Client Role □ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Changed DER Group Notification	http://xx.xxx.xxx.xxx/	changed	DERGroups	

DERG-8: Server informs Client of modification of an existing DER Group (Deletion of a member)

In this test case, the Server informs the Client of the deletion of a member (EndDevice) from DER Group DG8, which was previously created in Test Case DERG-6. This is an asynchronous notification using an Event Stereotype message. There is no response message.

Because the intent is to remove an existing element (DER member), it is necessary to leverage the OperationSet technique. Refer to the subsection "IEC 61968-100:2013 Considerations" in Section 2 as well as Appendix C for a more complete discussion of the use of OperationSets to accomplish the deletion of attributes and/or association classes. A member (EndDevice) is an example of an association class.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with a Names.name identifier of DG8 and two members, as created in Test Case DERG-6, is assumed to exist.
Post-Condition(s)	The Client is informed that one of the two members of the subject DER Group has been deleted from the DER Group.

The Sequence Diagram in Figure 9-15 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

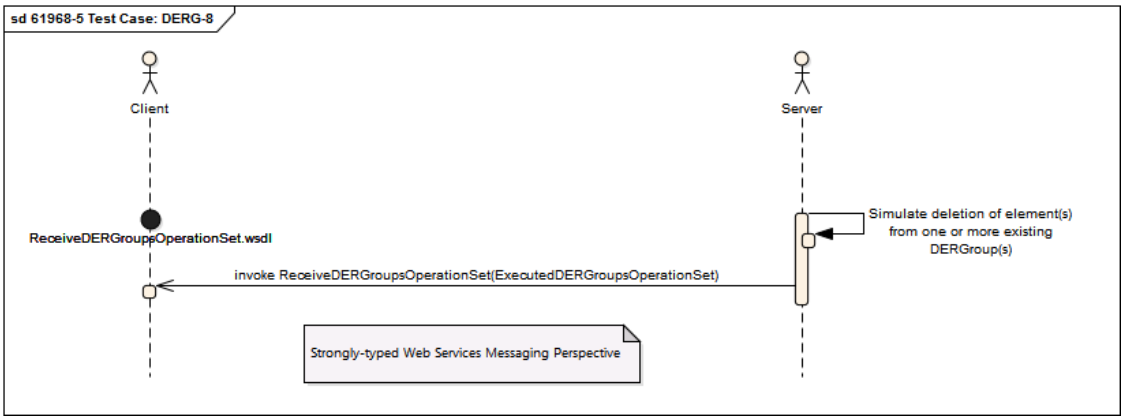


Figure 9-15
Sequence Diagram for Test Case DERG-8

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroupsOperationSet.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsOperationSetMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ExecutedDERGroupsOperationSet	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ExecutedDERGroupsOperationSet xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsOperationSetMessage
DERGroupsOperationSetMessage.xsd">
	<tns:Header>
		<Verb>executed</Verb>
		<Noun>OperationSet</Noun>
		<Timestamp>2017-06-02T14:43:10-06:00</Timestamp>
		<MessageID>ba6f89bf-f10f-4058-b743-8404e368e358</MessageID>
	</tns:Header>
	<tns:Payload>
		<tns:OperationSet>
			<Operation>
				<operationId>1</operationId>
				<noun>deleted</noun>
				<verb>DERGroups</verb>
				<elementOperation>true</elementOperation>
				<DERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroups# DERGroups.xsd">
					<EndDeviceGroup>
						<EndDevices>
							<mRID>d9db9ab9-6dba-4d09-a889-
f5a55946e515</mRID>
						</EndDevices>
						<Names>
							<name>DG8</name>
						</Names>
						<version>
							<date>2017-06-02T14:42:58-06:00</date>
							<major>1</major>
							<minor>1</minor>
```

```
                                        <revision>0</revision>
                                    </version>
                                </EndDeviceGroup>
                            </DERGroups>
                        </Operation>
                    </tns:OperationSet>
                </tns:Payload>
</tns:ExecutedDERGroupsOperationSet>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Deleted Details from existing DER Group Notification	http://xx.xxx.xxx.xxx/	Executed	OperationSet*	

*The OperationSet includes a single Operation having:

- verb = deleted
- noun = DERGroups
- elementOperation = true

DERG-9: Server informs Client of the deletion of an existing DER Group

In this test case, the Server informs the Client of the deletion of existing DER Group. This is an asynchronous notification using an Event Stereotype message. There is no response message.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

In this test case, DER Group DG7, which was previously created in Test Case DERG-6 and modified in Test Case DERG-7, is deleted.

Pre-Condition(s)	A DER Group with a Names.name identifier of DG7, as created in Test Case DERG-6 and modified in Test Case DERG-7, is assumed to exist.
Post-Condition(s)	The Client is informed that the subject DER Group has been deleted.

The Sequence Diagram in Figure 9-16 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

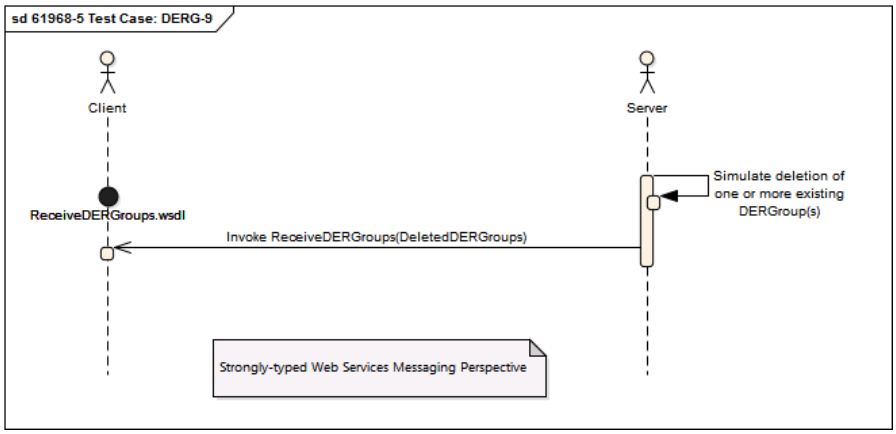


Figure 9-16
Sequence Diagram for Test Case DERG-9

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroups.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroups.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	DeletedDERGroups	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DeletedDERGroups xmlns="http://iec.ch/TC57/2017/DERGroups#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupsMessage"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupsMessage DERGroupsMessage.xsd">
	<tns:Header>
		<msg:Verb>deleted</msg:Verb>
		<msg:Noun>DERGroups</msg:Noun>
		<msg:Timestamp>2017-06-02T14:49:40-06:00</msg:Timestamp>
		<msg:MessageID>232663b4-1fcf-4364-8f9d-b936361a015a</msg:MessageID>
	</tns:Header>
	<tns:Payload>
		<DERGroups>
			<EndDeviceGroup>
				<Names>
```

```
                                <name>DG7</name>
                            </Names>
                        </EndDeviceGroup>
                    </DERGroups>
                </tns:Payload>
</tns:DeletedDERGroups>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Deleted Details from existing DER Group Notification	http://xx.xxx.xxx.xxx/	deleted	DERGroups	

10
DER GROUP STATUS TEST CASES

DERGS-1a: Client requests status of a DER Group and Server replies (Success - Single DER Group)

In this test case, the Client requests the Server to provide the status of a single DER Group as identified by its Names.name identifier of DG2. This DER Group was previously created in Test Case DERG-1c and modified in Test Case DERG-2b. The Server returns a response message indicating success with no errors and including the details of the status of the DER Group in the Payload section of the response message.

Note 1: The parameters for the request query (in this case, the Names.name identifier of the DER Group whose status is being requested) are supplied using XML generated using the DERGroupStatusQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Statuses will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupStatuses profile and not the unconstrained version that is used for "changed" scenarios.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the applications being tested may contain any of the request and Payload elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with a Names.name identifier of DG2, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist.
Post-Condition(s)	The status of the subject DER Group is returned in response to the query.

The Sequence Diagram in Figure 10-1 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

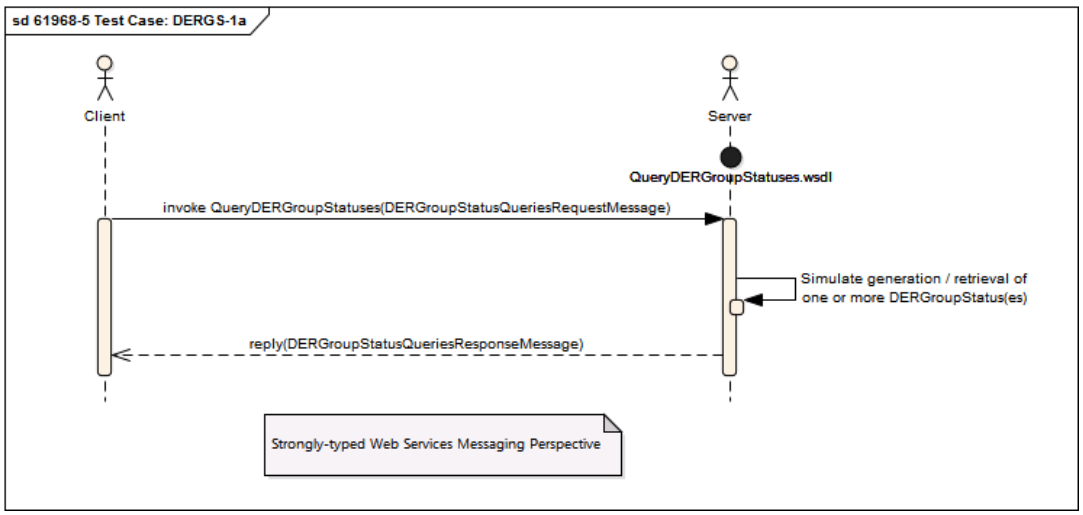


Figure 10-1
Sequence Diagram for Test Case DERGS-1a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatusQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupStatusQueries#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
      <tns:Header>
            <Verb>get</Verb>
```

```
            <Noun>DERGroupStatuses</Noun>
            <Timestamp>2017-06-12T15:54:29-06:00</Timestamp>
            <MessageID>9e78323f-7ae5-4aee-aaa7-53130f5da8dd</MessageID>
            <CorrelationID>125981da-6a49-4e14-9f9c-c4aa3bafaf08</CorrelationID>
      </tns:Header>
      <tns:Request>
            <obj2:DERGroupStatusQueries>
                  <obj2:EndDeviceGroup>
                        <obj2:Names>
                              <obj2:name>DG2</obj2:name>
                        </obj2:Names>
                  </obj2:EndDeviceGroup>
            </obj2:DERGroupStatusQueries>
            <n1:auto-generated_for_wildcard/>
      </tns:Request>
</tns:DERGroupStatusQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatuses.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:m="http://iec.ch/TC57/2017/DERGroupStatuses#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
      <tns:Header>
            <Verb>reply</Verb>
            <Noun>DERGroupStatuses</Noun>
            <Timestamp>2017-06-12T15:54:36-06:00</Timestamp>
            <MessageID>d996b1c0-1d5a-45b9-9ad0-2457e2615244</MessageID>
            <CorrelationID>125981da-6a49-4e14-9f9c-c4aa3bafaf08</CorrelationID>
      </tns:Header>
      <tns:Reply>
            <Result>OK</Result>
            <Error>
                  <code>0.0</code>
            </Error>
```

```
        </tns:Reply>
        <tns:Payload>
                <m:DERGroupStatuses>
                        <m:EndDeviceGroup>
                                <m:mRID>String</m:mRID>
                                <m:DERMonitorableParameter>
                                        <m:DERParameter>activePower</m:DERParameter>
                                        <m:yMultiplier>k</m:yMultiplier>
                                        <m:yUnit>W</m:yUnit>
                                        <m:DERCurveData>
                                                <m:nominalYValue>41.2</m:nominalYValue>
                                                <m:timeStamp>2017-12-06T15:54:35-
06:00</m:timeStamp>
                                        </m:DERCurveData>
                                </m:DERMonitorableParameter>
                                <m:Names>
                                        <m:name>DG2</m:name>
                                </m:Names>
                        </m:EndDeviceGroup>
                </m:DERGroupStatuses>
        </tns:Payload>
</tns:DERGroupStatusQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Status	http://xx.xxx.xxx.xxx/	get	DERGroupStatuses	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupStatuses	

DERGS-1b: Client requests status of a DER Group and Server replies (Failure - Single DER Group)

In this test case, the Client requests the Server to provide the status of a single DER Group as identified by its Names.name identifier of DG1. This DER Group was previously deleted in Test Case DERG-4. Consequently, the Server returns a response message indicating a failure because no such DER Group exists. (See Appendix F for error codes.)

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

In addition, as noted, this test case illustrates a failure of a request for the status of a single DER Group. Subsequent test cases will illustrate requests for the statuses of multiple DER Groups through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	DER Group DG1 is assumed not to exist.
Post-Condition(s)	The request fails because DER Group DG1 does not exist.

The Sequence Diagram in Figure 10-2 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

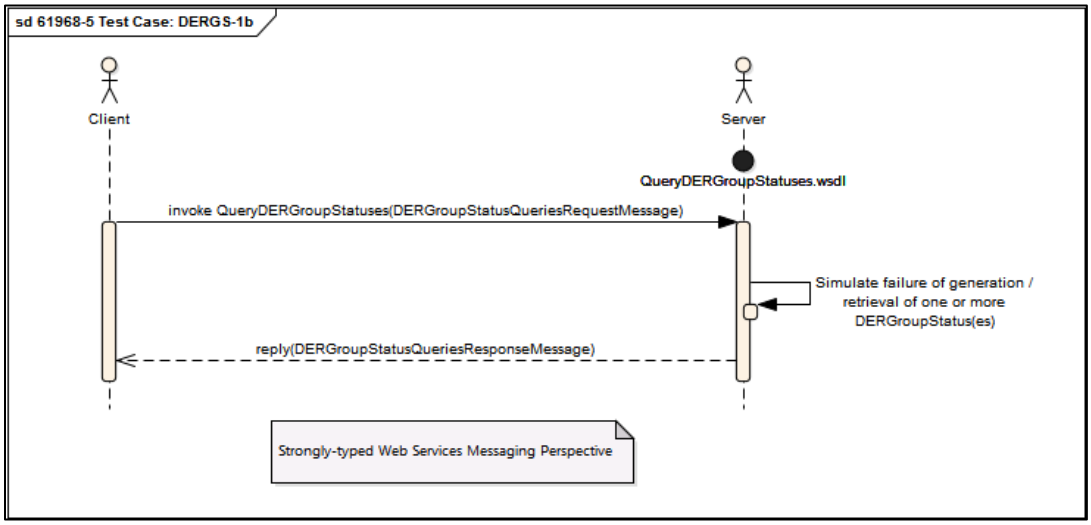


Figure 10-2
Sequence Diagram for Test Case DERGS-1b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatusQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupStatusQueries#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:25:20-06:00</Timestamp>
		<MessageID>9f45c50a-6a81-4319-89db-55e484f93e32</MessageID>
		<CorrelationID>a7dad3bd-5d2a-48a7-9500-ad40acc0713f</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupStatusQueries>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG1</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupStatusQueries>
	</tns:Request>
</tns:DERGroupStatusQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatuses.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:obj1="http://iec.ch/TC57/2017/DERGroupStatuses#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:25:24-06:00</Timestamp>
		<MessageID>6b04ffc7-28b4-4961-83a8-abb4e4652268</MessageID>
		<CorrelationID>a7dad3bd-5d2a-48a7-9500-ad40acc0713f</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>FAILED</Result>
		<Error>
			<code>99.1</code>
			<level>FATAL</level>
			<details>DERGroup does not exist</details>
			<ID kind="name" objectType="DERGroup">DG1</ID>
		</Error>
	</tns:Reply>
</tns:DERGroupStatusQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Status	http://xx.xxx.xxx.xxx/	get	DERGroupStatuses	
2	Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupStatuses	

DERGS-1c: Client requests status of two DER Groups and Server replies (Success - Two DER Groups in a single message)

In this test case, the Client requests the Server to provide the status of two DER Groups as identified by their Names.name identifiers of DG3 and DG4, respectively. DER Group DG3 was created in Test Case DERG-1c and modified in Test Case DERG-3. DER Group DG4 was created in Test Case DERG-1d. The Server returns a response message indicating success with no errors and including the details of the status of the two DER Groups in the Payload section of the response message.

Note 1: The parameters for the request query (in this case, the Names.name identifier of the DER Groups whose statuses are being requested) are supplied using XML generated using the DERGroupStatusQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Statuses will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupStatuses profile and not the unconstrained version used for "changed" scenarios.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the applications being tested may contain any of the request and Payload elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Groups with Names.name identifiers of DG3 and DG4, as created and/or modified in test cases DERG-1c, DERG-1d, and DERG-3, are assumed to exist.
Post-Condition(s)	The statuses of the subject DER Groups are returned in response to the query.

The Sequence Diagram in Figure 10-3 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

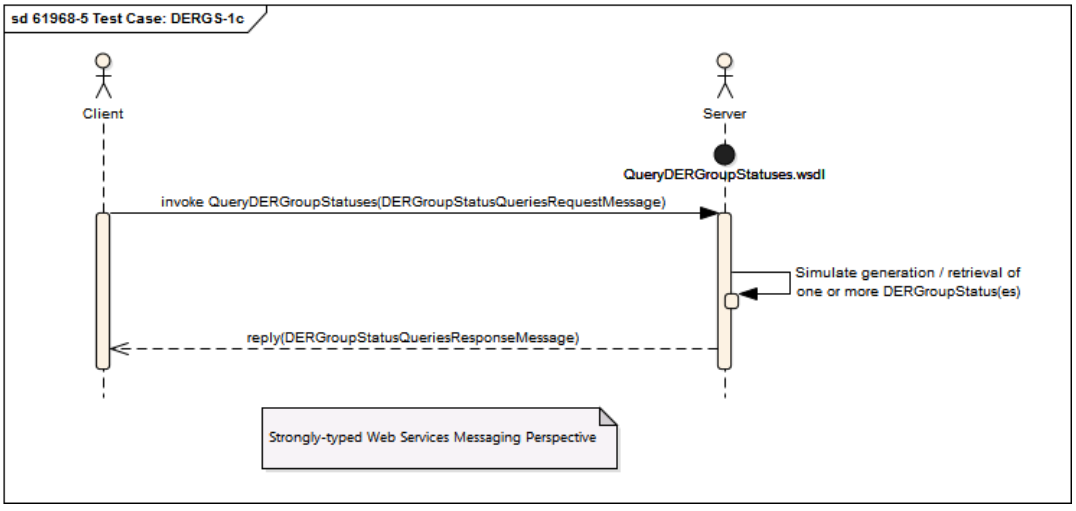


Figure 10-3
Sequence Diagram for Test Case DERGS-1c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatusQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupStatusQueries#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:34:54-06:00</Timestamp>
		<MessageID>21b6f9bd-49fd-4a28-9e5b-f541924d81c9</MessageID>
		<CorrelationID>4bf02e07-6cdd-430d-a318-965838d58b9d</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupStatusQueries>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG3</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG4</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupStatusQueries>
	</tns:Request>
</tns:DERGroupStatusQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatuses.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:obj1="http://iec.ch/TC57/2017/DERGroupStatuses#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:35:23-06:00</Timestamp>
		<MessageID>11beae4e-d615-416c-921f-b0a65ef0af7e</MessageID>
		<CorrelationID>4bf02e07-6cdd-430d-a318-965838d58b9d</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
	<tns:Payload>
		<obj1:DERGroupStatuses>
			<obj1:EndDeviceGroup>
				<obj1:mRID>6b3241b8-a0f1-429b-b163-459122b5672e</obj1:mRID>
				<obj1:DERMonitorableParameter>
					<obj1:DERParameter>activePower</obj1:DERParameter>
					<obj1:yMultiplier>k</obj1:yMultiplier>
					<obj1:yUnit>W</obj1:yUnit>
					<obj1:DERCurveData>
						<obj1:nominalYValue>114.2</obj1:nominalYValue>
						<obj1:timeStamp>2017-06-12T16:35:11-
06:00</obj1:timeStamp>
					</obj1:DERCurveData>
				</obj1:DERMonitorableParameter>
				<obj1:Names>
					<obj1:name>DG3</obj1:name>
```

```
                        </obj1:Names>
                    </obj1:EndDeviceGroup>
                    <obj1:EndDeviceGroup>
                        <obj1:DERMonitorableParameter>
                            <obj1:DERParameter>activePower</obj1:DERParameter>
                            <obj1:yMultiplier>k</obj1:yMultiplier>
                            <obj1:yUnit>W</obj1:yUnit>
                            <obj1:DERCurveData>
                                <obj1:nominalYValue>88.65</obj1:nominalYValue>
                                <obj1:timeStamp>2017-06-12T16:35:18-
06:00</obj1:timeStamp>
                            </obj1:DERCurveData>
                        </obj1:DERMonitorableParameter>
                        <obj1:DERMonitorableParameter>
                            <obj1:DERParameter>voltage</obj1:DERParameter>
                            <obj1:yMultiplier>none</obj1:yMultiplier>
                            <obj1:yUnit>V</obj1:yUnit>
                            <obj1:DERCurveData>

      <obj1:nominalYValue>240.09</obj1:nominalYValue>
                                <obj1:timeStamp>2017-06-12T16:35:18-
06:00</obj1:timeStamp>
                            </obj1:DERCurveData>
                        </obj1:DERMonitorableParameter>
                        <obj1:Names>
                            <obj1:name>DG4</obj1:name>
                        </obj1:Names>
                    </obj1:EndDeviceGroup>
                </obj1:DERGroupStatuses>
            </tns:Payload>
</tns:DERGroupStatusQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Statuses	http://xx.xxx.xxx.xxx/	get	DERGroupStatuses	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupStatuses	

DERGS-1d: Client requests status of two DER Groups and Server replies (Two DER Groups in a single message - One succeeds and one fails)

In this test case, the Client requests the Server to provide the status of two DER Groups as identified by their Names.name identifiers of DG6 and DG7, respectively. DER Group DG6 was created in Test Case DERG-1e. DER Group DG7 was created in Test Case DERG-6 and modified in Test Case DERG-7 but was subsequently deleted in Test Case DERG-9. Consequently, the Server returns a response message indicating a failure of the request for DER Group DG7. Because no error is reported for DER Group DG6, the interpretation of the response message is that the request for DER Group DG6 was successful; accordingly, the status for DER Group DG6 is returned in the Payload section of the response message. (See Appendix F for error codes.)

Note 1: The parameters for the request query (in this case, the Names.name identifier of the DER Groups whose statuses are being requested) are supplied using XML generated using the DERGroupStatusQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Statuses will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupStatuses profile and not the unconstrained version used for "changed" scenarios.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	The DER Group with a Names.name identifier of DG6, as created in Test Case DERG-1e, is assumed to exist. A DER Group with a Names.name identifier of DG7 is assumed not to exist because it was deleted in Test Case DERG-9.
Post-Condition(s)	The response message contains the status of DER Group DG6 and an indication of an error for DER Group DG7.

The Sequence Diagram in Figure 10-4 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

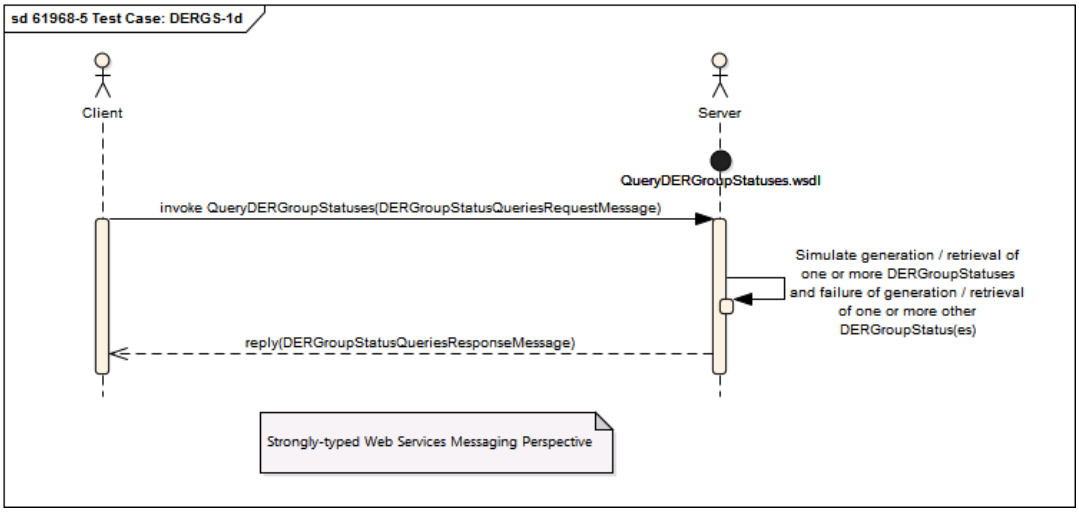


Figure 10-4
Sequence Diagram for Test Case DERGS-1d

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatusQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupStatusQueries#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:56:21-06:00</Timestamp>
		<MessageID>c3b0823f-8fcd-4f2f-a37d-b91adf711498</MessageID>
		<CorrelationID>9debb17b-d579-4917-8c5e-7f386c68ea40</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupStatusQueries>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG6</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG7</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupStatusQueries>
	</tns:Request>
</tns:DERGroupStatusQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupStatuses.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupStatusQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupStatusQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupStatusQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:obj1="http://iec.ch/TC57/2017/DERGroupStatuses#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusQueriesMessage
DERGroupStatusQueriesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupStatuses</Noun>
		<Timestamp>2017-06-12T16:56:55-06:00</Timestamp>
		<MessageID>3e58c71d-0303-4346-89db-c14b4121e39b</MessageID>
		<CorrelationID>9debb17b-d579-4917-8c5e-7f386c68ea40</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>FAILED</Result>
		<Error>
			<code>99.1</code>
			<level>FATAL</level>
			<details>DERGroup does not exist</details>
			<ID kind="name" objectType="DERGroup">DG7</ID>
		</Error>
	</tns:Reply>
	<tns:Payload>
		<obj1:DERGroupStatuses>
			<obj1:EndDeviceGroup>
				<obj1:DERMonitorableParameter>
					<obj1:DERParameter>activePower</obj1:DERParameter>
					<obj1:yMultiplier>k</obj1:yMultiplier>
					<obj1:yUnit>W</obj1:yUnit>
					<obj1:DERCurveData>
						<obj1:nominalYValue>102.0</obj1:nominalYValue>
						<obj1:timeStamp>2017-06-12T16:56:45-
06:00</obj1:timeStamp>
					</obj1:DERCurveData>
				</obj1:DERMonitorableParameter>
```

```
                        <obj1:DERMonitorableParameter>
                              <obj1:DERParameter>reactivePower</obj1:DERParameter>
                              <obj1:yMultiplier>k</obj1:yMultiplier>
                              <obj1:yUnit>VAr</obj1:yUnit>
                              <obj1:DERCurveData>
                                    <obj1:nominalYValue>105.0</obj1:nominalYValue>
                                    <obj1:timeStamp>2017-06-12T16:56:45-
06:00</obj1:timeStamp>
                              </obj1:DERCurveData>
                        </obj1:DERMonitorableParameter>
                        <obj1:Names>
                              <obj1:name>DG6</obj1:name>
                        </obj1:Names>
                  </obj1:EndDeviceGroup>
            </obj1:DERGroupStatuses>
      </tns:Payload>
</tns:DERGroupStatusQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Statuses	http://xx.xxx.xxx.xxx/	create	DERGroupStatuses	
2	Mixed Success/Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupStatuses	

DERGS-2: Server informs Client of a change in DER Group Status (Change in current active, apparent, and reactive power)

In this test case, the Server informs the Client that the status of DER Group DG8 has changed, and the Server provides the new values for the current active, reactive, and apparent power. In addition, the time at which this change occurred appears in the status element. Such a notification may occur if the Client has not asked for the status but instead is being notified of the change detected by the Server. The notification may occur immediately at the time of the change or at some short time thereafter. This is an asynchronous notification using an Event Stereotype message. There is no response message.

In this test case, DER Group DG8 was created in Test Case DERG-6 and modified in Test Case DERG-8.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group with a Names.name identifier of DG8, as created in Test Case DERG-6 and modified in Test Case DERG-8, is assumed to exist.
Post-Condition(s)	The updated status of DER Group DG8 is sent to the Client by the Server.

The Sequence Diagram in Figure 10-5 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

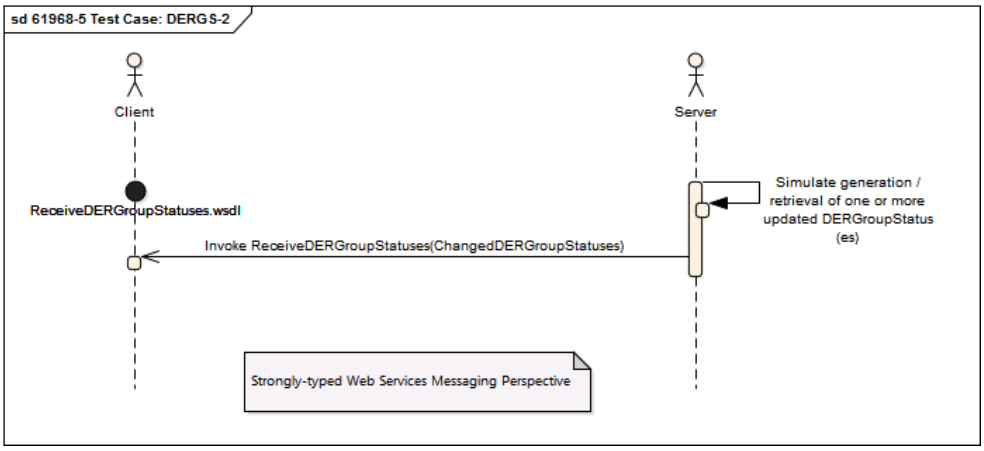


Figure 10-5
Sequence Diagram for Test Case DERGS-2

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroupStatuses.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}
Part 5 XSD	DERGroupStatuses.xsd	{02- IEC 61968-5 XSDs\Unconstrained Profiles}
Strongly Typed Message XSD	DERGroupStatusesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}
Message Stereotype	ChangedDERGroupStatuses	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:ChangedDERGroupStatuses xmlns="http://iec.ch/TC57/2017/DERGroupStatuses#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupStatusesMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupStatusesMessage
DERGroupStatusesMessage.xsd">
	<tns:Header>
		<msg:Verb>changed</msg:Verb>
		<msg:Noun>DERGroupStatuses</msg:Noun>
		<msg:Timestamp>2017-06-12T18:43:43-06:00</msg:Timestamp>
		<msg:MessageID>10c58e78-1045-45c4-aa7e-f9707ec4d620</msg:MessageID>
	</tns:Header>
	<tns:Payload>
		<DERGroupStatuses>
			<EndDeviceGroup>
				<DERMonitorableParameter>
					<DERParameter>activePower</DERParameter>
					<yMultiplier>M</yMultiplier>
					<yUnit>W</yUnit>
					<DERCurveData>
						<nominalYValue>2.52</nominalYValue>
						<timeStamp>2017-06-12T18:43:40-
06:00</timeStamp>
					</DERCurveData>
				</DERMonitorableParameter>
				<DERMonitorableParameter>
					<DERParameter>reactivePower</DERParameter>
					<yMultiplier>M</yMultiplier>
					<yUnit>VAr</yUnit>
					<DERCurveData>
						<nominalYValue>2.43</nominalYValue>
						<timeStamp>2017-06-12T18:43:40-
06:00</timeStamp>
					</DERCurveData>
				</DERMonitorableParameter>
				<Names>
```

```
                        <name>DG8</name>
                    </Names>
                    <status>
                        <dateTime>2017-06-12T18:43:40-06:00</dateTime>
                        <value>Online</value>
                    </status>
                </EndDeviceGroup>
            </DERGroupStatuses>
        </tns:Payload>
</tns:ChangedDERGroupStatuses>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Changed DER Group Status	http://xx.xxx.xxx.xxx/	changed	DERGroupStatuses	

11
DER GROUP FORECAST TEST CASES

DERGF-1a: Client requests forecast for a DER Group and Server replies (Success - Single DER Group)

In this test case, the Client requests the Server to provide a forecast for a single DER Group. The DER Group, with an mRID of 228650bf-7f77-44fa-9576-db4bbce8a07f and a Names.name identifier of DG2, was created in Test Case DERG-1c and modified in Test Case DERG-2b. It supports the realPowerDispatch DERFunction.

In the Sample XML for this test case, the query (request) for the forecast is made using the mRID for illustration purposes. Reformulating the query using the Names.name identifier is equally valid; the remaining DER Group Forecast test cases in this report are formulated using the Names.name identifier(s). Note that normal practice is to specify either the mRID or a Names.name identifier when referring to a previously created CIM object; however, specifying both is permissible.

The Server returns a response message indicating success with no errors and including the details of the forecast for the DER Group in the Payload section of the response message. Normal practice is for the Server to refer to CIM objects by both mRID and Names.name identifiers (presuming the Server knows both), as shown in the response XML for this test case. However, in all cases, the Server should include in the response the identifier (mRID or Names.name) used in the request message.

Note 1: The parameters for the request query are supplied using XML generated using the DERGroupForecastQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Forecasts will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupForecasts profile.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the applications being tested may contain any of the request and Payload elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	A DER Group with a Names.name identifier of DG2, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist.
Post-Condition(s)	The forecast for the subject DER Group is returned in response to the query.

The Sequence Diagram in Figure 11-1 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in

messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

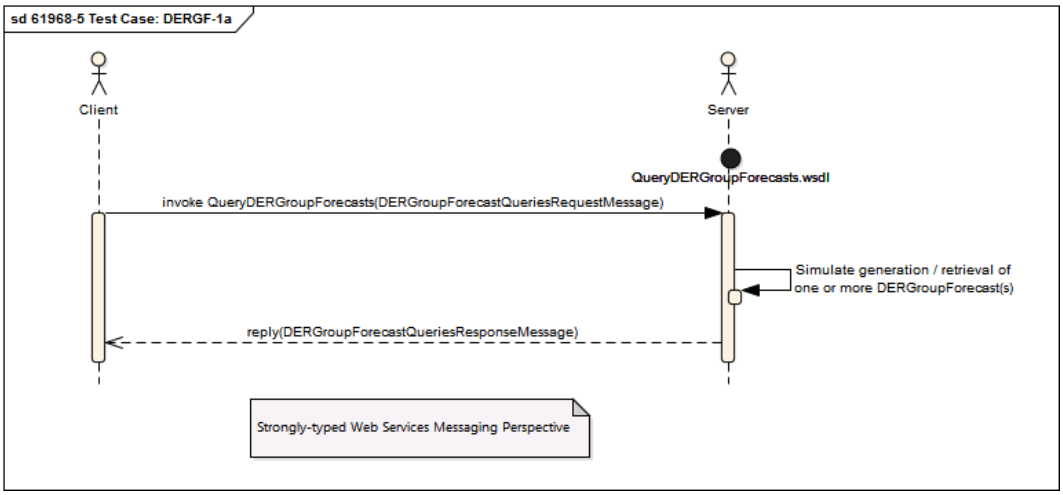


Figure 11-1
Sequence Diagram for Test Case DERGF-1a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecastQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupForecastQueries#"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
```

```
        <tns:Header>
                <Verb>get</Verb>
                <Noun>DEGroupForecasts</Noun>
                <Timestamp>2017-06-14T15:45:00-06:00</Timestamp>
                <MessageID>8e13f6fe-27a8-4686-bcaa-5176ce460486</MessageID>
                <CorrelationID>12668dce-4005-4acf-bcc0-d81194a5d3f1</CorrelationID>
        </tns:Header>
        <tns:Request>
                <obj2:DERGroupForecastQueries>
                        <obj2:DERMonitorableParameter>
                                <obj2:DERParameter>activePower</obj2:DERParameter>
                        </obj2:DERMonitorableParameter>
                        <obj2:DispatchSchedule>

        <obj2:curveStyleKind>straightLineYValues</obj2:curveStyleKind>
                                <obj2:numberOfIntervals>4</obj2:numberOfIntervals>
                                <obj2:startTime>2017-06-15T15:00:00-06:00</obj2:startTime>
                                <obj2:timeIntervalDuration>15</obj2:timeIntervalDuration>
                                <obj2:timeIntervalUnit>m</obj2:timeIntervalUnit>
                        </obj2:DispatchSchedule>
                        <obj2:EndDeviceGroup>
                                <obj2:mRID>228650bf-7f77-44fa-9576-db4bbce8a07f</obj2:mRID>
                        </obj2:EndDeviceGroup>
                </obj2:DERGroupForecastQueries>
        </tns:Request>
</tns:DERGroupForecastQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecasts.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj1="http://iec.ch/TC57/2017/DERGroupForecasts#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
```

```
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupForecasts</Noun>
		<Timestamp>2017-06-14T13:03:19-06:00</Timestamp>
		<MessageID>3c6f308f-653b-49cd-92b0-620cbb5a7169</MessageID>
		<CorrelationID>12668dce-4005-4acf-bcc0-d81194a5d3f1</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
	<tns:Payload>
		<obj1:DERGroupForecasts>
			<obj1:DERGroupForecast>
				<obj1:mRID>035ab91a-a826-4b8b-86fd-fb28da52514c</obj1:mRID>
				<obj1:predictionCreationDate>2017-06-14T13:03:16-
06:00</obj1:predictionCreationDate>
				<obj1:EndDeviceGroup>
					<obj1:mRID>228650bf-7f77-44fa-9576-
db4bbce8a07f</obj1:mRID>
					<obj1:DERMonitorableParameter>

	<obj1:DERParameter>activePower</obj1:DERParameter>
						<obj1:yMultiplier>k</obj1:yMultiplier>
						<obj1:yUnit>W</obj1:yUnit>
						<obj1:DispatchSchedule>

	<obj1:curveStyleKind>straightLineYValues</obj1:curveStyleKind>
							<obj1:startTime>2017-06-15T15:00:00-
06:00</obj1:startTime>

	<obj1:timeIntervalDuration>15</obj1:timeIntervalDuration>

	<obj1:timeIntervalUnit>m</obj1:timeIntervalUnit>
							<obj1:DERCurveData>

	<obj1:intervalNumber>1</obj1:intervalNumber>

	<obj1:maxYValue>145.0</obj1:maxYValue>

	<obj1:minYValue>100.0</obj1:minYValue>

	<obj1:nominalYValue>134.5</obj1:nominalYValue>
							</obj1:DERCurveData>
							<obj1:DERCurveData>

	<obj1:intervalNumber>2</obj1:intervalNumber>

	<obj1:maxYValue>147.0</obj1:maxYValue>

	<obj1:minYValue>100.0</obj1:minYValue>

	<obj1:nominalYValue>135.3</obj1:nominalYValue>
```

```
                                                </obj1:DERCurveData>
                                                <obj1:DERCurveData>

            <obj1:intervalNumber>3</obj1:intervalNumber>

            <obj1:maxYValue>141.0</obj1:maxYValue>

            <obj1:minYValue>98.0</obj1:minYValue>

            <obj1:nominalYValue>129.5</obj1:nominalYValue>
                                                </obj1:DERCurveData>
                                                <obj1:DERCurveData>

            <obj1:intervalNumber>4</obj1:intervalNumber>

            <obj1:maxYValue>145.0</obj1:maxYValue>

            <obj1:minYValue>100.00</obj1:minYValue>

            <obj1:nominalYValue>135.2</obj1:nominalYValue>
                                                </obj1:DERCurveData>
                                                <obj1:DERCurveData>

            <obj1:intervalNumber>5</obj1:intervalNumber>

            <obj1:maxYValue>153.0</obj1:maxYValue>

            <obj1:minYValue>105.00</obj1:minYValue>

            <obj1:nominalYValue>139.7</obj1:nominalYValue>
                                                </obj1:DERCurveData>
                                          </obj1:DispatchSchedule>
                                    </obj1:DERMonitorableParameter>
                                    <obj1:Names>
                                          <obj1:name>DG2</obj1:name>
                                    </obj1:Names>
                              </obj1:EndDeviceGroup>
                        </obj1:DERGroupForecast>
                  </obj1:DERGroupForecasts>
            </tns:Payload>
</tns:DERGroupForecastQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Forecast	http://xx.xxx.xxx.xxx/	get	DERGroupForecasts	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupForecasts	

DERGF-1b: Client requests forecast for a DER Group and Server replies (Failure - Single DER Group)

In this test case, the Client requests the Server to provide a forecast for a single DER Group as identified by its Names.name identifier of DG1. This DER Group was deleted in Test Case DERG-4. Consequently, the Server returns a response message indicating a failure because no such DER Group exists. (See Appendix F for error codes.)

Note 1: The parameters for the request query are supplied using XML generated using the DERGroupForecastQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Forecasts will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupForecasts profile.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

In addition, as noted, this test case illustrates a failure of a request for the status of a single DER Group. Subsequent test cases will illustrate requests for the statuses of multiple DER Groups through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	DER Group DG1 is assumed not to exist.
Post-Condition(s)	The request fails because DER Group DG1 does not exist.

The Sequence Diagram in Figure 11-2 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

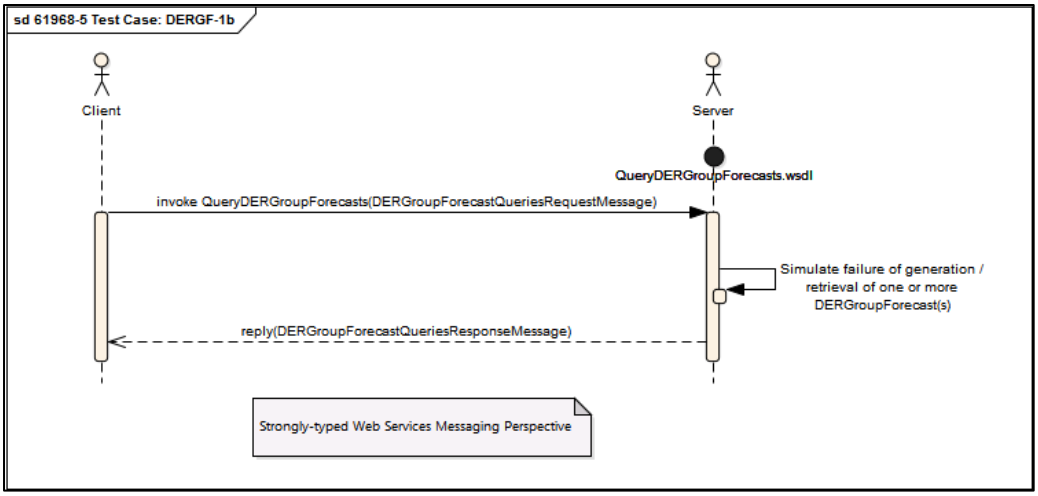


Figure 11-2
Sequence Diagram for Test Case DERGF-1b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecastQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupForecastQueries#"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
      <tns:Header>
            <Verb>get</Verb>
            <Noun>DEGroupForecasts</Noun>
```

```
            <Timestamp>2017-06-14T14:20:01-06:00</Timestamp>
            <MessageID>b7aff1b9-2ca7-4251-a2d9-91485211cc21</MessageID>
            <CorrelationID>1f237f4f-661b-42ad-8483-19330a3d7d88</CorrelationID>
      </tns:Header>
      <tns:Request>
            <obj2:DERGroupForecastQueries>
                  <obj2:DERMonitorableParameter>
                        <obj2:DERParameter>activePower</obj2:DERParameter>
                  </obj2:DERMonitorableParameter>
                  <obj2:DispatchSchedule>

      <obj2:curveStyleKind>straightLineYValues</obj2:curveStyleKind>
                        <obj2:numberOfIntervals>4</obj2:numberOfIntervals>
                        <obj2:startTime>2017-06-15T13:00:00-06:00</obj2:startTime>
                        <obj2:timeIntervalDuration>1</obj2:timeIntervalDuration>
                        <obj2:timeIntervalUnit>h</obj2:timeIntervalUnit>
                  </obj2:DispatchSchedule>
                  <obj2:EndDeviceGroup>
                        <obj2:Names>
                              <obj2:name>DG1</obj2:name>
                        </obj2:Names>
                  </obj2:EndDeviceGroup>
            </obj2:DERGroupForecastQueries>
      </tns:Request>
</tns:DERGroupForecastQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecasts.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesResponseMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj1="http://iec.ch/TC57/2017/DERGroupForecasts#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
      <tns:Header>
            <Verb>reply</Verb>
            <Noun>DERGroupForecasts</Noun>
```

```
            <Timestamp>2017-06-14T14:20:05-06:00</Timestamp>
            <MessageID>a5e65f21-5c2b-40ee-98e6-8ecfe786420d</MessageID>
            <CorrelationID>1f237f4f-661b-42ad-8483-19330a3d7d88</CorrelationID>
      </tns:Header>
      <tns:Reply>
            <Result>FAILED</Result>
            <Error>
                  <code>99.1</code>
                  <level>FATAL</level>
                  <details>DERGroup does not exist</details>
                  <ID kind="name" objectType="DERGroup">DG1</ID>
            </Error>
      </tns:Reply>
</tns:DERGroupForecastQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Forecast	http://xx.xxx.xxx.xxx/	get	DERGroupForecasts	
2	Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupForecasts	

DERGF-1c: Client requests forecasts for two DER Groups and Server replies (Success - Two DER Groups in a single message)

In this test case, the Client requests the Server to provide forecasts for two DER Groups as identified by their Names.name identifiers of DG3 and DG4, respectively. DER Group DG3 was created in Test Case DERG-1c and modified in Test Case DERG-3 and supports the realPowerDispatch DER Function. DER Group DG4 was created in Test Case DERG-1d and supports the realPowerDispatch and voltageRegulation DER Functions. The Server returns a response message indicating success with no errors and including the details of the forecasts for the two DER Groups in the Payload section of the response message.

Note 1: The parameters for the request query are supplied using XML generated using the DERGroupForecastQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Forecasts will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupForecasts profile.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the applications being tested may contain any of the request and Payload elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Groups with a Names.name identifier of DG3 and DG4, as created and/or modified in test cases DERG-1c, DERG-1d, and DERG-3, are assumed to exist.
Post-Condition(s)	The forecasts for the subject DER Groups are returned in response to the query.

The Sequence Diagram in Figure 11-3 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

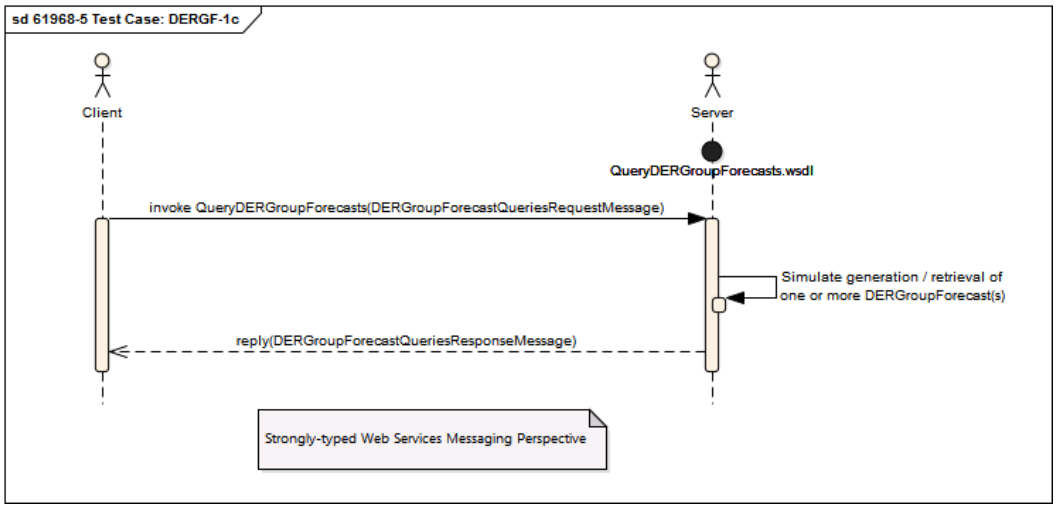


Figure 11-3
Sequence Diagram for Test Case DERGF-1c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecastQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupForecastQueries#"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DEGroupForecasts</Noun>
		<Timestamp>2017-06-14T14:46:33-06:00</Timestamp>
		<MessageID>18b0ed39-34fd-4c31-9ace-7d56d57beb81</MessageID>
		<CorrelationID>977cbce0-53c5-4587-9306-ebb57d3b8b1a</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupForecastQueries>
			<obj2:DERMonitorableParameter>
				<obj2:DERParameter>activePower</obj2:DERParameter>
			</obj2:DERMonitorableParameter>
			<obj2:DERMonitorableParameter>
				<obj2:DERParameter>voltage</obj2:DERParameter>
			</obj2:DERMonitorableParameter>
			<obj2:DispatchSchedule>

	<obj2:curveStyleKind>straightLineYValues</obj2:curveStyleKind>
				<obj2:numberOfIntervals>4</obj2:numberOfIntervals>
				<obj2:startTime>2017-06-15T08:00:00-06:00</obj2:startTime>
				<obj2:timeIntervalDuration>1</obj2:timeIntervalDuration>
				<obj2:timeIntervalUnit>h</obj2:timeIntervalUnit>
			</obj2:DispatchSchedule>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG3</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG4</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupForecastQueries>
	</tns:Request>
</tns:DERGroupForecastQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecasts.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesResponseMessage
xmlns="http://iec.ch/TC57/2017/DERGroupForecasts#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
	<tns:Header>
		<msg:Verb>reply</msg:Verb>
		<msg:Noun>DERGroupForecasts</msg:Noun>
		<msg:Timestamp>2017-06-14T15:45:20-06:00</msg:Timestamp>
		<msg:MessageID>c0ae415d-ecf6-4041-9eec-4b16f13b4a09</msg:MessageID>
		<msg:CorrelationID>977cbce0-53c5-4587-9306-
ebb57d3b8b1a</msg:CorrelationID>
	</tns:Header>
	<tns:Reply>
		<msg:Result>OK</msg:Result>
		<msg:Error>
			<msg:code>0.0</msg:code>
		</msg:Error>
	</tns:Reply>
	<tns:Payload>
		<DERGroupForecasts>
			<DERGroupForecast>
				<mRID>c8df7792-7ea7-4d7d-aeed-761e2d2853be</mRID>
				<predictionCreationDate>2017-06-14T15:45:12-
06:00</predictionCreationDate>
				<EndDeviceGroup>
					<DERMonitorableParameter>
						<DERParameter>activePower</DERParameter>
						<yMultiplier>k</yMultiplier>
						<yUnit>W</yUnit>
						<DispatchSchedule>

	<curveStyleKind>straightLineYValues</curveStyleKind>
							<startTime>2017-06-15T08:00:00-
06:00</startTime>
```

```
      <timeIntervalDuration>1</timeIntervalDuration>
                                          <timeIntervalUnit>h</timeIntervalUnit>
                                          <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                <maxYValue>26.0</maxYValue>
                                                <minYValue>11.0</minYValue>

      <nominalYValue>19.0</nominalYValue>
                                          </DERCurveData>
                                          <DERCurveData>

      <intervalNumber>2</intervalNumber>
                                                <maxYValue>27.5</maxYValue>
                                                <minYValue>11.5</minYValue>

      <nominalYValue>21.0</nominalYValue>
                                          </DERCurveData>
                                          <DERCurveData>

      <intervalNumber>3</intervalNumber>
                                                <maxYValue>29.8</maxYValue>
                                                <minYValue>15.2</minYValue>

      <nominalYValue>24.0</nominalYValue>
                                          </DERCurveData>
                                          <DERCurveData>

      <intervalNumber>4</intervalNumber>
                                                <maxYValue>31.0</maxYValue>
                                                <minYValue>13.5</minYValue>

      <nominalYValue>25.3</nominalYValue>
                                          </DERCurveData>
                                          <DERCurveData>

      <intervalNumber>5</intervalNumber>
                                                <maxYValue>22.0</maxYValue>
                                                <minYValue>8.4</minYValue>

      <nominalYValue>14.9</nominalYValue>
                                          </DERCurveData>
                                    </DispatchSchedule>
                              </DERMonitorableParameter>
                              <Names>
                                    <name>DG3</name>
                              </Names>
                        </EndDeviceGroup>
                  </DERGroupForecast>
                  <DERGroupForecast>
                        <mRID>dcee5dff-00a3-4c3b-945c-de72d2981939</mRID>
                        <predictionCreationDate>2017-06-14T15:45:16-
06:00</predictionCreationDate>
                        <EndDeviceGroup>
                              <DERMonitorableParameter>
                                    <DERParameter>activePower</DERParameter>
                                    <yMultiplier>k</yMultiplier>
```

```
                                        <yUnit>W</yUnit>
                                        <DispatchSchedule>

      <curveStyleKind>straightLineYValues</curveStyleKind>
                                              <startTime>2017-06-15T08:00:00-
06:00</startTime>

      <timeIntervalDuration>1</timeIntervalDuration>
                                              <timeIntervalUnit>h</timeIntervalUnit>
                                              <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                    <maxYValue>576.0</maxYValue>
                                                    <minYValue>250.7</minYValue>

      <nominalYValue>562.0</nominalYValue>
                                              </DERCurveData>
                                              <DERCurveData>

      <intervalNumber>2</intervalNumber>
                                                    <maxYValue>570.0</maxYValue>
                                                    <minYValue>545.4</minYValue>

      <nominalYValue>556.1</nominalYValue>
                                              </DERCurveData>
                                              <DERCurveData>

      <intervalNumber>3</intervalNumber>
                                                    <maxYValue>572.0</maxYValue>
                                                    <minYValue>549.3</minYValue>

      <nominalYValue>561.0</nominalYValue>
                                              </DERCurveData>
                                              <DERCurveData>

      <intervalNumber>4</intervalNumber>
                                                    <maxYValue>579.0</maxYValue>
                                                    <minYValue>562.0</minYValue>

      <nominalYValue>570.6</nominalYValue>
                                              </DERCurveData>
                                              <DERCurveData>

      <intervalNumber>5</intervalNumber>
                                                    <maxYValue>582.4</maxYValue>
                                                    <minYValue>550.2</minYValue>

      <nominalYValue>567.1</nominalYValue>
                                              </DERCurveData>
                                        </DispatchSchedule>
                                  </DERMonitorableParameter>
                                  <DERMonitorableParameter>
                                        <DERParameter>voltage</DERParameter>
                                        <yMultiplier>none</yMultiplier>
                                        <yUnit>V</yUnit>
                                        <DispatchSchedule>

      <curveStyleKind>straightLineYValues</curveStyleKind>
```

```
                                                <startTime>2017-06-15T08:00:00-
06:00</startTime>

      <timeIntervalDuration>1</timeIntervalDuration>
                                                <timeIntervalUnit>h</timeIntervalUnit>
                                                <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                      <maxYValue>240.8</maxYValue>
                                                      <minYValue>239.2</minYValue>

      <nominalYValue>240.2</nominalYValue>
                                                </DERCurveData>
                                                <DERCurveData>

      <intervalNumber>2</intervalNumber>
                                                      <maxYValue>240.8</maxYValue>
                                                      <minYValue>239.2</minYValue>

      <nominalYValue>239.9</nominalYValue>
                                                </DERCurveData>
                                                <DERCurveData>

      <intervalNumber>3</intervalNumber>
                                                      <maxYValue>240.8</maxYValue>
                                                      <minYValue>239.2</minYValue>

      <nominalYValue>240.4</nominalYValue>
                                                </DERCurveData>
                                                <DERCurveData>

      <intervalNumber>4</intervalNumber>
                                                      <maxYValue>240.8</maxYValue>
                                                      <minYValue>239.2</minYValue>

      <nominalYValue>240.3</nominalYValue>
                                                </DERCurveData>
                                                <DERCurveData>

      <intervalNumber>5</intervalNumber>
                                                      <maxYValue>240.8</maxYValue>
                                                      <minYValue>239.2</minYValue>

      <nominalYValue>239.8</nominalYValue>
                                                </DERCurveData>
                                          </DispatchSchedule>
                                    </DERMonitorableParameter>
                                    <Names>
                                          <name>DG4</name>
                                    </Names>
                              </EndDeviceGroup>
                        </DERGroupForecast>
                  </DERGroupForecasts>
      </tns:Payload>
</tns:DERGroupForecastQueriesResponseMessage>
```

Test Results

Application Being Tested: □ Client Role □ Server Role

EPRI Test Harness: □ Client Role □ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Forecasts	http://xx.xxx.xxx.xxx/	get	DERGroupForecasts	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupForecasts	

DERGF-1d: Client requests forecasts for two DER Groups and Server replies (Two DER Groups in a single message - One succeeds and one fails)

In this test case, the Client requests the Server to provide forecasts for two DER Groups as identified by their Names.name identifiers of DG6 and DG7, respectively.

DER Group DG6 was created in Test Case DERG-1e and supports the realPowerDispatch and reactivePowerDispatch DERFunctions; however, for this test case, only the forecast for the reactive power is requested.

DER Group DG7 was created in Test Case DERG-6 and modified in Test Case DERG-7 but was subsequently deleted in Test Case DERG-9. Consequently, the Server returns a response message indicating a failure of the request for DER Group DG7.

Because no error is reported for DER Group DG6, the interpretation of the response message is that the request for DER Group DG6 was successful; accordingly, the forecast for DER Group DG6 is returned in the Payload section of the response message. (See Appendix F for error codes.)

Note 1: The parameters for the request query are supplied using XML generated using the DERGroupForecastQueries profile. The XML for this request is placed in the Request section of the Message envelope and not in the Payload section of the Message envelope.

Note 2: Not all response messages will contain a Payload; only those for which the query returns one or more DER Group Forecasts will have contents in the Payload section. In response messages that contain a Payload, the Payload must validate against the constrained version of the DERGroupForecasts profile.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	The DER Group with a Names.name identifier of DG6, as created in Test Case DERG-1e, is assumed to exist. A DER Group with a Names.name identifier of DG7 is assumed not to exist because it was previously deleted in Test Case DERG-9.
Post-Condition(s)	The response message contains the forecast for DER Group DG6 and an indication of an error for DER Group DG7.

The Sequence Diagram in Figure 11-4 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

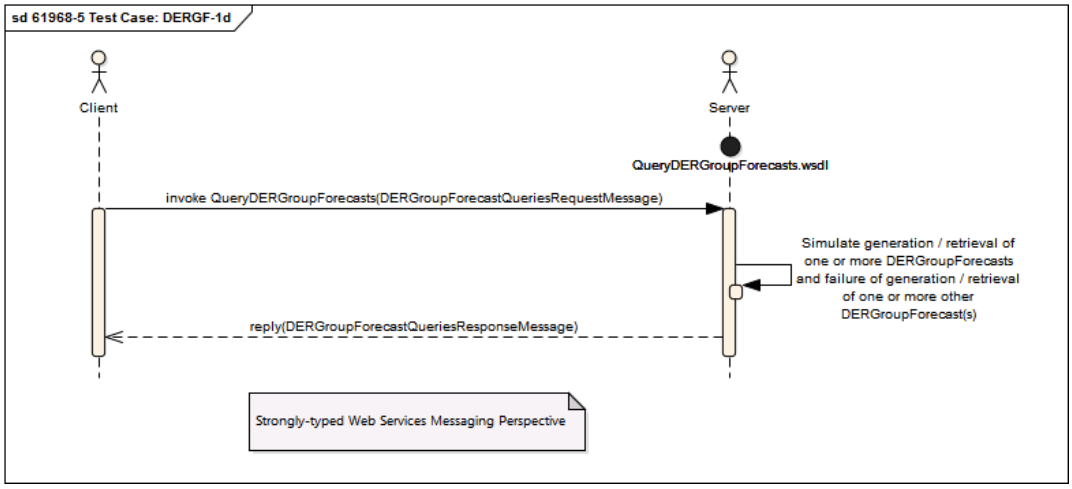


Figure 11-4
Sequence Diagram for Test Case DERGF-1d

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecastQueries.xsd	{02- IEC 61968-5 XSDs\Query Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesRequestMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesRequestMessage
xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:obj2="http://iec.ch/TC57/2017/DERGroupForecastQueries#"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
	<tns:Header>
		<Verb>get</Verb>
		<Noun>DEGroupForecasts</Noun>
		<Timestamp>2017-06-14T16:43:18-06:00</Timestamp>
		<MessageID>3972b6f0-ff1e-45ae-b5c5-ca64ee807249</MessageID>
		<CorrelationID>bdb8fadf-73e6-471f-9cdd-dce3f9e254b0</CorrelationID>
	</tns:Header>
	<tns:Request>
		<obj2:DERGroupForecastQueries>
			<obj2:DERMonitorableParameter>
				<obj2:DERParameter>reactivePower</obj2:DERParameter>
			</obj2:DERMonitorableParameter>
			<obj2:DispatchSchedule>
				<obj2:curveStyleKind>constantYValue</obj2:curveStyleKind>
				<obj2:numberOfIntervals>2</obj2:numberOfIntervals>
				<obj2:startTime>2017-06-16T12:00:00-06:00</obj2:startTime>
				<obj2:timeIntervalDuration>1</obj2:timeIntervalDuration>
				<obj2:timeIntervalUnit>h</obj2:timeIntervalUnit>
			</obj2:DispatchSchedule>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG6</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
			<obj2:EndDeviceGroup>
				<obj2:Names>
					<obj2:name>DG7</obj2:name>
				</obj2:Names>
			</obj2:EndDeviceGroup>
		</obj2:DERGroupForecastQueries>
	</tns:Request>
</tns:DERGroupForecastQueriesRequestMessage>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	QueryDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}
Part 5 XSD	DERGroupForecasts.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupForecastQueriesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}
Message Stereotype	DERGroupForecastQueriesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupForecastQueriesResponseMessage
xmlns="http://iec.ch/TC57/2017/DERGroupForecasts#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastQueriesMessage
DERGroupForecastQueriesMessage.xsd">
       <tns:Header>
              <msg:Verb>reply</msg:Verb>
              <msg:Noun>DERGroupForecasts</msg:Noun>
              <msg:Timestamp>2017-06-14T16:43:41-06:00</msg:Timestamp>
              <msg:MessageID>a8092269-c748-4ece-ae1f-7de7a276828b</msg:MessageID>
              <msg:CorrelationID>bdb8fadf-73e6-471f-9cdd-
dce3f9e254b0</msg:CorrelationID>
       </tns:Header>
       <tns:Reply>
              <msg:Result>FAILED</msg:Result>
              <msg:Error>
                     <msg:code>99.1</msg:code>
                     <msg:level>FATAL</msg:level>
                     <msg:details>does not exist</msg:details>
                     <msg:ID idType="String" idAuthority="String" kind="uuid"
objectType="String">String</msg:ID>
              </msg:Error>
       </tns:Reply>
       <tns:Payload>
              <DERGroupForecasts>
                     <DERGroupForecast>
                            <mRID>65ed8258-756c-43c8-b571-75c5addc41d3</mRID>
                            <predictionCreationDate>2017-06-14T16:43:35-
06:00</predictionCreationDate>
                            <EndDeviceGroup>
                                   <DERMonitorableParameter>
                                          <DERParameter>reactivePower</DERParameter>
                                          <yMultiplier>k</yMultiplier>
                                          <yUnit>VAr</yUnit>
                                          <DispatchSchedule>

       <curveStyleKind>constantYValue</curveStyleKind>
                                                 <startTime>2017-06-16T12:00:00-
06:00</startTime>

       <timeIntervalDuration>2</timeIntervalDuration>
                                                 <timeIntervalUnit>h</timeIntervalUnit>
                                                 <DERCurveData>

       <intervalNumber>1</intervalNumber>
                                                        <maxYValue>115.6</maxYValue>
                                                        <minYValue>87.7</minYValue>

       <nominalYValue>102.4</nominalYValue>
                                                 </DERCurveData>
                                                 <DERCurveData>
```

```
      <intervalNumber>2</intervalNumber>
                                                    <maxYValue>119.2</maxYValue>
                                                    <minYValue>89.9</minYValue>

      <nominalYValue>105.1</nominalYValue>
                                                </DERCurveData>
                                            </DispatchSchedule>
                                        </DERMonitorableParameter>
                                        <Names>
                                            <name>DG6</name>
                                        </Names>
                                    </EndDeviceGroup>
                                </DERGroupForecast>
                            </DERGroupForecasts>
      </tns:Payload>
</tns:DERGroupForecastQueriesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Get DER Group Forecasts	http://xx.xxx.xxx.xxx/	get	DERGroupForecasts	
2	Mixed Success/Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupForecasts	

DERGF-2: Server informs Client of creation of a DER Group Forecast

In this test case, the Server informs the Client that a forecast for DER Group DG8 has been created and the Server provides the new forecast. Such a notification may occur if the Client has not asked for the forecast but instead is being notified of the forecast that was created by the Server. The notification may occur immediately at the time of the forecast or at some short time thereafter. This is an asynchronous notification using an Event Stereotype message. There is no response message.

In this test case, DER Group DG8 was previously created in Test Case DERG-6 and modified in Test Case DERG-8.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group with a Names.name identifier of DG8, as created in Test Case DERG-6 and modified in Test Case DERG-8, is assumed to exist.
Post-Condition(s)	The new forecast for DER Group DG8 is sent to the Client by the Server.

The Sequence Diagram in Figure 11-5 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in

messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

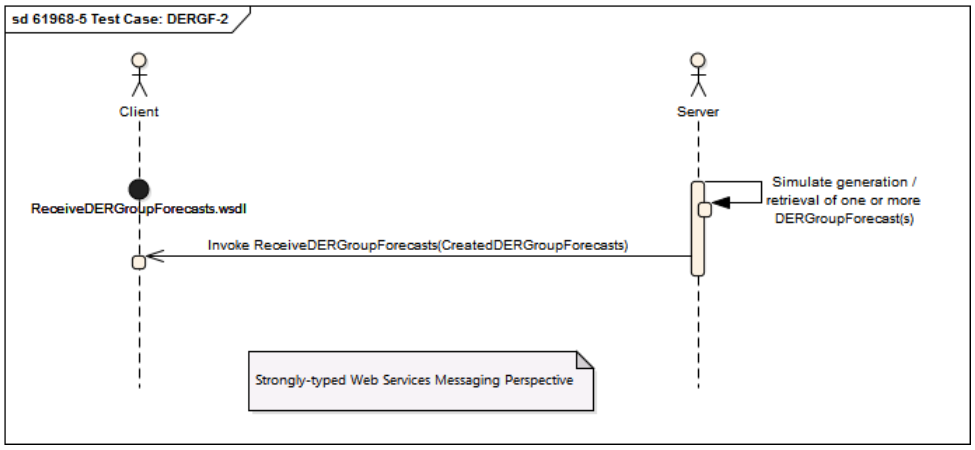


Figure 11-5
Sequence Diagram for Test Case DERGF-2

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Event Message (Notification Message)

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveDERGroupForecasts.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupForecasts.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupForecastsMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedDERGroupForecasts	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedDERGroupForecasts xmlns="http://iec.ch/TC57/2017/DERGroupForecasts#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupForecastsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupForecastsMessage
DERGroupForecastsMessage.xsd">
      <tns:Header>
            <msg:Verb>created</msg:Verb>
```

```
            <msg:Noun>DERGroupForecasts</msg:Noun>
            <msg:Timestamp>2017-06-14T17:15:02-06:00</msg:Timestamp>
            <msg:MessageID>42d206dd-2aa2-4eb3-83b6-ea931ac4f7cd</msg:MessageID>
      </tns:Header>
      <tns:Payload>
            <DERGroupForecasts>
                  <DERGroupForecast>
                        <mRID>bf4283ad-ca68-4044-9d5f-27ac63d10c30</mRID>
                        <predictionCreationDate>2017-06-14T17:14:48-
06:00</predictionCreationDate>
                        <EndDeviceGroup>
                              <DERMonitorableParameter>
                                    <DERParameter>activePower</DERParameter>
                                    <yMultiplier>k</yMultiplier>
                                    <yUnit>W</yUnit>
                                    <DispatchSchedule>

      <curveStyleKind>constantYValue</curveStyleKind>
                                          <startTime>2017-06-14T18:00:00-
06:00</startTime>

      <timeIntervalDuration>1</timeIntervalDuration>
                                          <timeIntervalUnit>h</timeIntervalUnit>
                                          <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                <maxYValue>160.2</maxYValue>
                                                <minYValue>153.3</minYValue>

      <nominalYValue>156.7</nominalYValue>
                                          </DERCurveData>
                                    </DispatchSchedule>
                              </DERMonitorableParameter>
                              <DERMonitorableParameter>
                                    <DERParameter>reactivePower</DERParameter>
                                    <yMultiplier>k</yMultiplier>
                                    <yUnit>VAr</yUnit>
                                    <DispatchSchedule>

      <curveStyleKind>constantYValue</curveStyleKind>
                                          <startTime>2017-06-14T18:00:00-
06:00</startTime>

      <timeIntervalDuration>1</timeIntervalDuration>
                                          <timeIntervalUnit>h</timeIntervalUnit>
                                          <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                <maxYValue>190.1</maxYValue>
                                                <minYValue>178.8</minYValue>

      <nominalYValue>183.7</nominalYValue>
                                          </DERCurveData>
                                    </DispatchSchedule>
                              </DERMonitorableParameter>
                              <DERMonitorableParameter>
                                    <DERParameter>voltage</DERParameter>
                                    <yMultiplier>none</yMultiplier>
```

```
                                        <yUnit>V</yUnit>
                                        <DispatchSchedule>

      <curveStyleKind>constantYValue</curveStyleKind>
                                              <startTime>2017-06-14T18:00:00-
06:00</startTime>

      <timeIntervalDuration>1</timeIntervalDuration>
                                              <timeIntervalUnit>h</timeIntervalUnit>
                                              <DERCurveData>

      <intervalNumber>1</intervalNumber>
                                                    <maxYValue>122.0</maxYValue>
                                                    <minYValue>118.0</minYValue>

      <nominalYValue>120.2</nominalYValue>
                                              </DERCurveData>
                                        </DispatchSchedule>
                                  </DERMonitorableParameter>
                                  <Names>
                                        <name>DG8</name>
                                  </Names>
                            </EndDeviceGroup>
                      </DERGroupForecast>
                </DERGroupForecasts>
      </tns:Payload>
</tns:CreatedDERGroupForecasts>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Created DER Group Forecast	http://xx.xxx.xxx.xxx/	changed	DERGroupForecasts	

12
DER GROUP DISPATCH TEST CASES

DERGD-1a: Client requests creation of a DER Group Dispatch and Server replies (Success - Single DER Group)

In this test case, the Client requests the Server to create a single DER Group Dispatch for the DER Group having a Names.name identifier of DG2. DER Group DG2 was created in Test Case DERG-1c and modified in Test Case DERG-2b. The Server returns a response message indicating success with no errors.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

In addition, as noted, this test case illustrates the successful creation of a single DER Group Dispatch. Subsequent test cases will illustrate attempts to create multiple DER Group Dispatches through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	DER Group DG2, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist.
Post-Condition(s)	A new DER Group Dispatch is created with the mRID and Names identifiers that were passed in the request message.

The Sequence Diagram in Figure 12-1 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

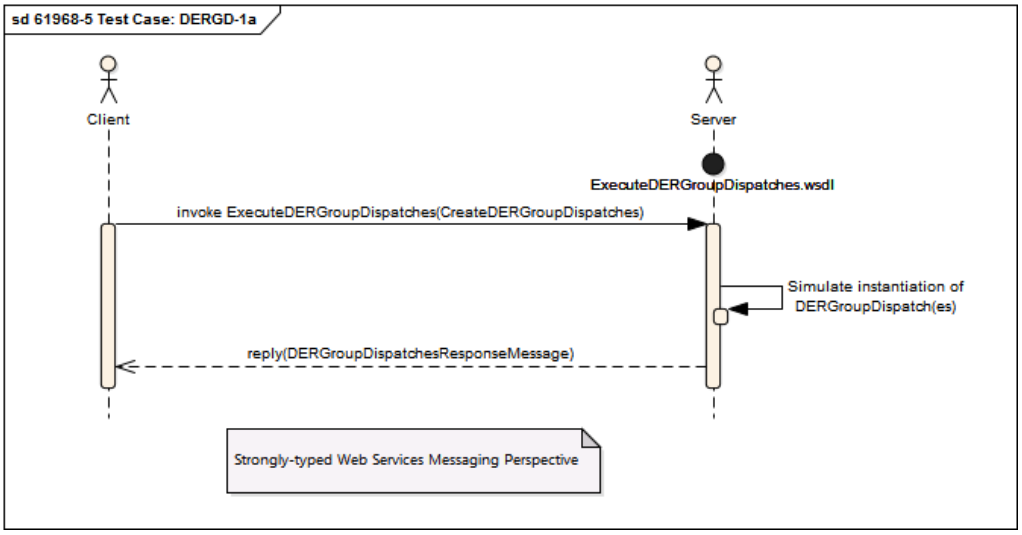


Figure 12-1
Sequence Diagram for Test Case DERGD-1a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroupDispatches	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroupDispatches xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:m="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>create</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T16:23:33-06:00</Timestamp>
		<MessageID>d463ff88-7625-46f7-b8f4-64665b7484b2</MessageID>
		<CorrelationID>5d0a1857-9e68-405a-afbe-9b5f6d3165d3</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<m:DERGroupDispatches>
			<m:DERGroupDispatch>
				<m:mRID>016cf0c9-4eb6-4e6c-b6d8-d50e5746f54e</m:mRID>
				<m:EndDeviceGroup>
					<m:DERMonitorableParameter>
						<m:DERParameter>activePower</m:DERParameter>
						<m:yMultiplier>k</m:yMultiplier>
						<m:yUnit>W</m:yUnit>
						<m:DispatchSchedule>

	<m:curveStyleKind>straightLineYValues</m:curveStyleKind>
							<m:startTime>2017-06-16T17:00:00-
06:00</m:startTime>

	<m:timeIntervalDuration>15</m:timeIntervalDuration>

	<m:timeIntervalUnit>m</m:timeIntervalUnit>
							<m:DERCurveData>
```

```
        <m:intervalNumber>1</m:intervalNumber>

        <m:nominalYValue>190.0</m:nominalYValue>
                                                </m:DERCurveData>
                                                <m:DERCurveData>

        <m:intervalNumber>2</m:intervalNumber>

        <m:nominalYValue>200.0</m:nominalYValue>
                                                </m:DERCurveData>
                                                <m:DERCurveData>

        <m:intervalNumber>3</m:intervalNumber>

        <m:nominalYValue>200.0</m:nominalYValue>
                                                </m:DERCurveData>
                                                <m:DERCurveData>

        <m:intervalNumber>4</m:intervalNumber>

        <m:nominalYValue>180.0</m:nominalYValue>
                                                </m:DERCurveData>
                                                <m:DERCurveData>

        <m:intervalNumber>5</m:intervalNumber>

        <m:nominalYValue>175.0</m:nominalYValue>
                                                </m:DERCurveData>
                                        </m:DispatchSchedule>
                                </m:DERMonitorableParameter>
                                <m:Names>
                                        <m:name>DG2</m:name>
                                </m:Names>
                        </m:EndDeviceGroup>
                        <m:Names>
                                <m:name>GD-20170616-029</m:name>
                        </m:Names>
                </m:DERGroupDispatch>
        </m:DERGroupDispatches>
    </tns:Payload>
</tns:CreateDERGroupDispatches>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupDispatchesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupDispatchesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T16:23:41-06:00</Timestamp>
		<MessageID>a21fff09-ff62-413c-8ddb-7ed74d231752</MessageID>
		<CorrelationID>5d0a1857-9e68-405a-afbe-9b5f6d3165d3</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupDispatchesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group Dispatch	http://xx.xxx.xxx.xxx/	create	DERGroupDispatches	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupDispatches	

DERGD-1b: Client requests creation of a DER Group Dispatch and Server replies (Failure - Single DER Group)

In this test case, the Client requests the Server to create a single DER Group Dispatch for DER Group DG1. DER Group DG1 was created in Test Case DERG-1a and modified in Test Case DERG-2a; however, it was subsequently deleted in Test Case DERG-4. Consequently, the Server returns a response message indicating a failure because DER Group DG1 no longer exists. (See Appendix F for error codes.)

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

In addition, as noted, this test case illustrates a failure of a request to create a single DER Group Dispatch. Subsequent test cases will illustrate attempts to create multiple DER Group Dispatches through a single request message as well as responses indicating various failures as well as successes.

Pre-Condition(s)	DER Group DG1 is assumed not to exist because it was deleted in Test Case DERG-4.
Post-Condition(s)	Creation of the DER Group Dispatch failed as indicated in the Step 2 response message.

The Sequence Diagram in Figure 12-2 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

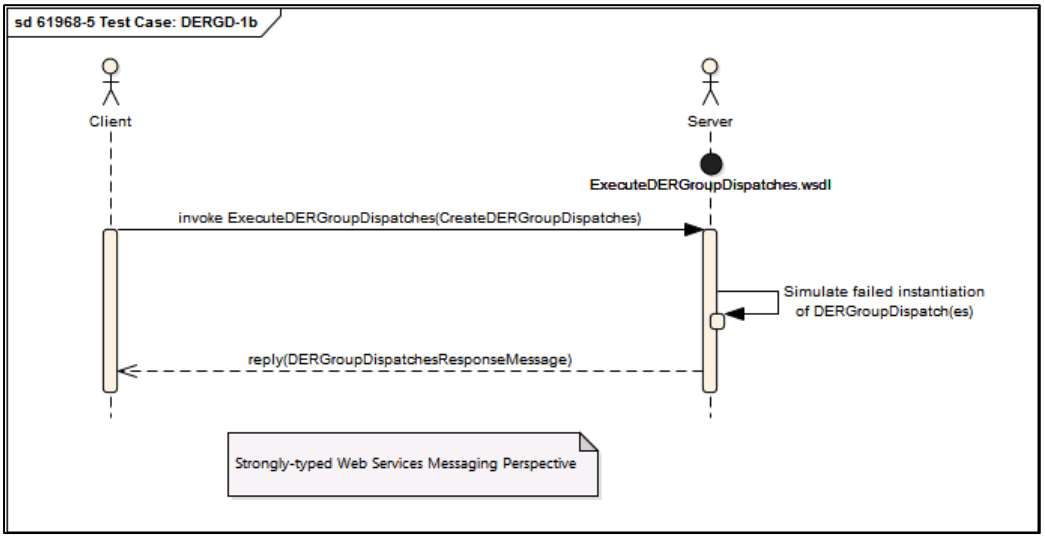


Figure 12-2
Sequence Diagram for Test Case DERGD-1b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroupDispatches	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroupDispatches xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>create</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T16:54:01-06:00</Timestamp>
		<MessageID>ca716db7-da13-4b5d-889c-03fb1013d163</MessageID>
		<CorrelationID>41cecb29-73f9-4e48-a907-e33e1848e366</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<obj:DERGroupDispatches>
			<obj:DERGroupDispatch>
				<obj:mRID>73cc9ce2-4b3c-4ba4-b3a9-8f757a9f7054</obj:mRID>
				<obj:EndDeviceGroup>
					<obj:DERMonitorableParameter>

	<obj:DERParameter>activePower</obj:DERParameter>
					<obj:yMultiplier>k</obj:yMultiplier>
					<obj:yUnit>W</obj:yUnit>
					<obj:DispatchSchedule>

	<obj:curveStyleKind>constantYValue</obj:curveStyleKind>
					<obj:startTime>2017-06-16T17:30:00-
06:00</obj:startTime>

	<obj:timeIntervalDuration>15</obj:timeIntervalDuration>

	<obj:timeIntervalUnit>m</obj:timeIntervalUnit>
					<obj:DERCurveData>

	<obj:intervalNumber>1</obj:intervalNumber>

	<obj:nominalYValue>35.5</obj:nominalYValue>
					</obj:DERCurveData>
					<obj:DERCurveData>

	<obj:intervalNumber>2</obj:intervalNumber>

	<obj:nominalYValue>38.6</obj:nominalYValue>
					</obj:DERCurveData>
				</obj:DispatchSchedule>
			</obj:DERMonitorableParameter>
			<obj:Names>
				<obj:name>DG1</obj:name>
			</obj:Names>
		</obj:EndDeviceGroup>
	</obj:DERGroupDispatch>
		</obj:DERGroupDispatches>
	</tns:Payload>
</tns:CreateDERGroupDispatches>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupDispatchesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupDispatchesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T16:54:18-06:00</Timestamp>
		<MessageID>996ee749-4e28-4c5c-8cc8-d0cfac2279e3</MessageID>
		<CorrelationID>41cecb29-73f9-4e48-a907-e33e1848e366</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>FAILED</Result>
		<Error>
			<code>99.1</code>
			<level>FATAL</level>
			<details>DERGroup does not exist</details>
			<ID kind="name" objectType="DERGroup">DG1</ID>
		</Error>
	</tns:Reply>
</tns:DERGroupDispatchesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group Dispatch	http://xx.xxx.xxx.xxx/	create	DERGroupDispatches	
2	Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupDispatches	

DERGD-1c: Client requests creation of two DER Group Dispatches and Server replies (Success - Two DER Groups in a single message)

In this test case, the Client requests the Server to create two DER Group Dispatches: one for DER Group DG3 and one for DER Group DG4. DER Group DG3 was created in Test Case DERG-1c and modified in Test Case DERG-3. DER Group DG4 was created in Test Case DERG-1d.

The Server returns a response message indicating success with no errors.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group DG3, as created in Test Case DERG-1c and modified in Test Case DERG-3, is assumed to exist. DER Group DG4, as previously created in Test Case DERG-1d, is assumed to exist.
Post-Condition(s)	Two new DER Group Dispatches are created with the mRID identifiers that were passed in the request message.

The Sequence Diagram in Figure 12-3 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

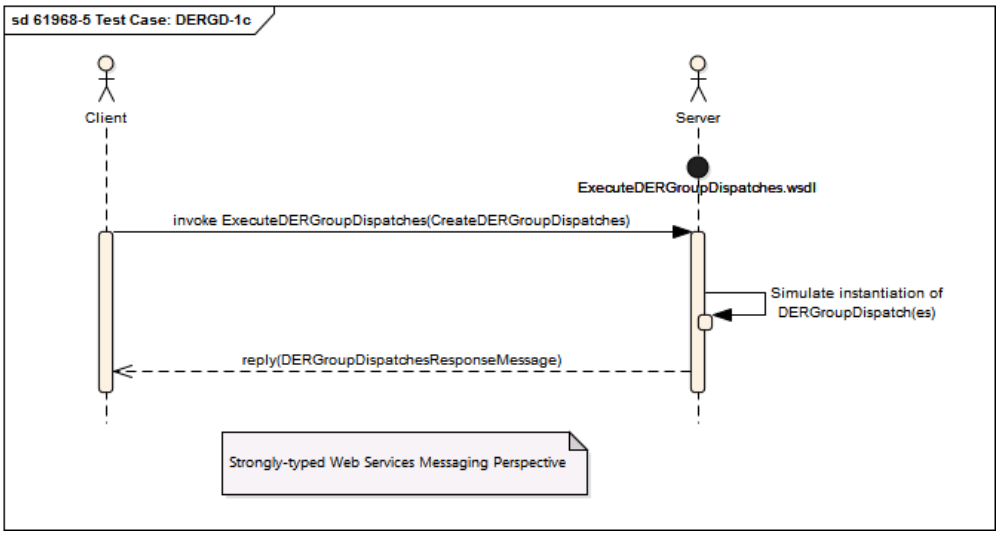


Figure 12-3
Sequence Diagram for Test Case DERGD-1c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroupDispatches	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroupDispatches xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:m="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>create</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T17:11:22-06:00</Timestamp>
		<MessageID>993e3047-5bc4-4d50-b31e-8f5850d99be7</MessageID>
		<CorrelationID>a613a3d1-c880-4f73-a90b-2c7d3f524ba1</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<m:DERGroupDispatches>
			<m:DERGroupDispatch>
				<m:mRID>cf78aff3-afcf-4304-8e70-72de5ff98801</m:mRID>
				<m:EndDeviceGroup>
					<m:DERMonitorableParameter>
						<m:DERParameter>reactivePower</m:DERParameter>
						<m:yMultiplier>k</m:yMultiplier>
						<m:yUnit>VAr</m:yUnit>
						<m:DispatchSchedule>

	<m:curveStyleKind>straightLineYValues</m:curveStyleKind>
							<m:startTime>2017-06-16T18:00:00-
06:00</m:startTime>

	<m:timeIntervalDuration>1</m:timeIntervalDuration>

	<m:timeIntervalUnit>h</m:timeIntervalUnit>
							<m:DERCurveData>

	<m:intervalNumber>1</m:intervalNumber>

	<m:nominalYValue>415.7</m:nominalYValue>
							</m:DERCurveData>
							<m:DERCurveData>

	<m:intervalNumber>2</m:intervalNumber>
```

```
      <m:nominalYValue>439.5</m:nominalYValue>
                                                </m:DERCurveData>
                                          </m:DispatchSchedule>
                                    </m:DERMonitorableParameter>
                              </m:EndDeviceGroup>
                              <m:Names>
                                    <m:name>DG3</m:name>
                              </m:Names>
                        </m:DERGroupDispatch>
                        <m:DERGroupDispatch>
                              <m:mRID>c646bd5c-9ca1-4d31-8e8e-33aba6ee2ab4</m:mRID>
                              <m:EndDeviceGroup>
                                    <m:DERMonitorableParameter>
                                          <m:DERParameter>voltage</m:DERParameter>
                                          <m:yMultiplier>k</m:yMultiplier>
                                          <m:yUnit>V</m:yUnit>
                                          <m:DispatchSchedule>

      <m:curveStyleKind>constantYValue</m:curveStyleKind>
                                                <m:startTime>2017-06-16T18:00:00-
06:00</m:startTime>

      <m:timeIntervalDuration>1</m:timeIntervalDuration>

      <m:timeIntervalUnit>h</m:timeIntervalUnit>
                                                <m:DERCurveData>

      <m:intervalNumber>2</m:intervalNumber>

      <m:nominalYValue>12.20</m:nominalYValue>
                                                </m:DERCurveData>
                                                <m:DERCurveData>

      <m:intervalNumber>2</m:intervalNumber>

      <m:nominalYValue>12.35</m:nominalYValue>
                                                </m:DERCurveData>
                                          </m:DispatchSchedule>
                                    </m:DERMonitorableParameter>
                                    <m:Names>
                                          <m:name>DG4</m:name>
                                    </m:Names>
                              </m:EndDeviceGroup>
                        </m:DERGroupDispatch>
                  </m:DERGroupDispatches>
      </tns:Payload>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupDispatchesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupDispatchesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T17:11:43-06:00</Timestamp>
		<MessageID>8478ec44-4871-4216-86f2-5fcd84d21cae</MessageID>
		<CorrelationID>a613a3d1-c880-4f73-a90b-2c7d3f524ba1</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>OK</Result>
		<Error>
			<code>0.0</code>
		</Error>
	</tns:Reply>
</tns:DERGroupDispatchesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group Dispatches	http://xx.xxx.xxx.xxx/	create	DERGroupDispatches	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupDispatches	

DERGD-1d: Client requests creation of two DER Group Dispatches and Server replies (Two DER Group in a single message - One succeeds and one fails)

In this test case, the Client requests the Server to create two DER Group Dispatches: one for DER Group DG6 and one for DER Group DG7. DER Group DG6 was created in Test Case DERG-1e. DER Group DG7 was created in Test Case DERG-6 and modified in Test Case DERG-7 but was subsequently deleted in Test Case DERG-9. Consequently, the Server returns a response message indicating that creation of the second DER Group Dispatch failed. Because no error is reported for the first DER Group Dispatch, the interpretation of the response message is that the creation of the first DER Group Dispatch succeeded. (See Appendix F for error codes.)

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group DG6, as created in Test Case DERG-1e, is assumed to exist. DER Group DG7, as created in Test Case DERG-6 and modified in Test Case DERG-7, is assumed not to exist because it was subsequently deleted in Test Case DERG-9.
Post-Condition(s)	One new DER Group Dispatch (for DER Group DG6) is created with the mRID identifier that was passed in the request message. An error is returned, indicating that creation of the DER Group Dispatch for DER Group DG7 failed.

The Sequence Diagram in Figure 12-4 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

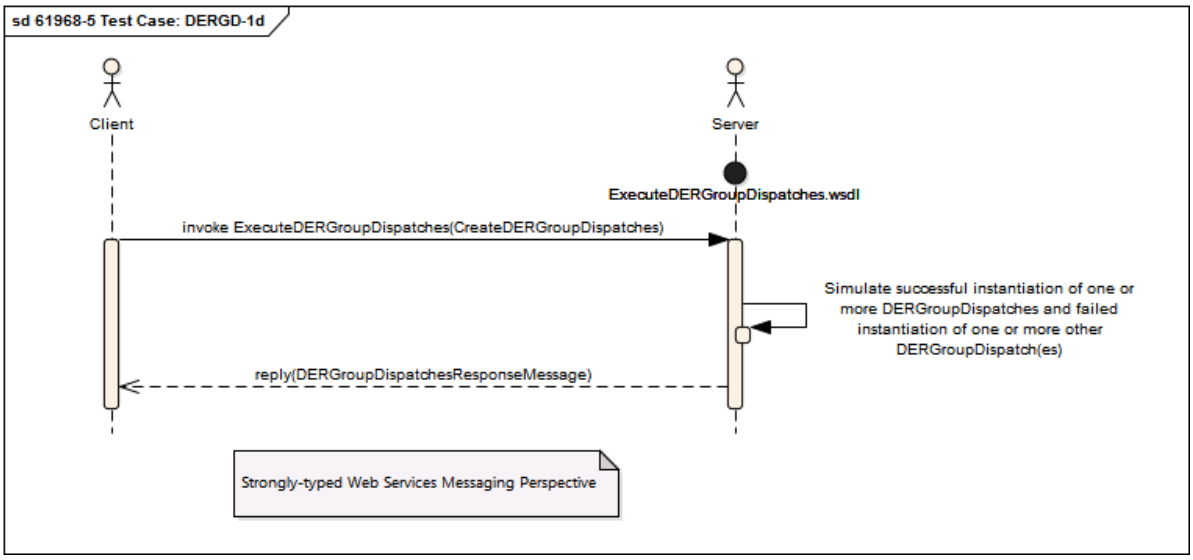


Figure 12-4
Sequence Diagram for Test Case DERGD-1d

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate

the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroupDispatches	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroupDispatches xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>create</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T17:27:18-06:00</Timestamp>
		<MessageID>352946bb-f19b-4480-abd4-ba56e479b5c3</MessageID>
		<CorrelationID>fa172999-de6d-4264-bbed-1798458e3fda</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<obj:DERGroupDispatches>
			<obj:DERGroupDispatch>
				<obj:mRID>124d7edb-5e4b-4128-bf09-7647a6244fc1</obj:mRID>
				<obj:EndDeviceGroup>
					<obj:DERMonitorableParameter>

	<obj:DERParameter>reactivePower</obj:DERParameter>
					<obj:yMultiplier>k</obj:yMultiplier>
					<obj:yUnit>VAr</obj:yUnit>
					<obj:DispatchSchedule>

	<obj:curveStyleKind>straightLineYValues</obj:curveStyleKind>
					<obj:startTime>2017-06-16T17:30:00-
06:00</obj:startTime>

	<obj:timeIntervalDuration>10</obj:timeIntervalDuration>

	<obj:timeIntervalUnit>m</obj:timeIntervalUnit>
					<obj:DERCurveData>

	<obj:intervalNumber>1</obj:intervalNumber>
```

```
      <obj:nominalYValue>332.2</obj:nominalYValue>
                                          </obj:DERCurveData>
                                          <obj:DERCurveData>

      <obj:intervalNumber>2</obj:intervalNumber>

      <obj:nominalYValue>355.3</obj:nominalYValue>
                                          </obj:DERCurveData>
                                          <obj:DERCurveData>

      <obj:intervalNumber>3</obj:intervalNumber>

      <obj:nominalYValue>361.9</obj:nominalYValue>
                                          </obj:DERCurveData>
                                          <obj:DERCurveData>

      <obj:intervalNumber>4</obj:intervalNumber>

      <obj:nominalYValue>351.8</obj:nominalYValue>
                                          </obj:DERCurveData>
                                    </obj:DispatchSchedule>
                              </obj:DERMonitorableParameter>
                        </obj:EndDeviceGroup>
                        <obj:Names>
                              <obj:name>DG6</obj:name>
                        </obj:Names>
                  </obj:DERGroupDispatch>
                  <obj:DERGroupDispatch>
                        <obj:mRID>700c4f22-071a-4f8b-b633-ce867f2ffe4a</obj:mRID>
                        <obj:EndDeviceGroup>
                              <obj:DERMonitorableParameter>

      <obj:DERParameter>activePower</obj:DERParameter>
                                    <obj:yMultiplier>k</obj:yMultiplier>
                                    <obj:yUnit>W</obj:yUnit>
                                    <obj:DispatchSchedule>

      <obj:curveStyleKind>constantYValue</obj:curveStyleKind>
                                          <obj:startTime>2017-06-16T17:30:00-
06:00</obj:startTime>

      <obj:timeIntervalDuration>30</obj:timeIntervalDuration>

      <obj:timeIntervalUnit>m</obj:timeIntervalUnit>
                                          <obj:DERCurveData>

      <obj:intervalNumber>1</obj:intervalNumber>

      <obj:nominalYValue>14.1</obj:nominalYValue>
                                          </obj:DERCurveData>
                                    </obj:DispatchSchedule>
                              </obj:DERMonitorableParameter>
                              <obj:Names>
                                    <obj:name>DG7</obj:name>
                              </obj:Names>
                        </obj:EndDeviceGroup>
                  </obj:DERGroupDispatch>
            </obj:DERGroupDispatches>
      </tns:Payload>
</tns:CreateDERGroupDispatches>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupDispatchesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupDispatchesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>reply</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T17:27:34-06:00</Timestamp>
		<MessageID>09c5f99c-0b90-44c4-926e-79372e56cc27</MessageID>
		<CorrelationID>fa172999-de6d-4264-bbed-1798458e3fda</CorrelationID>
	</tns:Header>
	<tns:Reply>
		<Result>FAILED</Result>
		<Error>
			<code>99.1</code>
			<level>FATAL</level>
			<details>DERGroup does not exist</details>
			<ID kind="name" objectType="DERGroup">DG1</ID>
		</Error>
	</tns:Reply>
</tns:DERGroupDispatchesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group Dispatches	http://xx.xxx.xxx.xxx/	create	DERGroupDispatches	
2	Mixed Success/Failure Response	http://xx.xxx.xxx.xxx/	reply	DERGroupDispatches	

DERGD-1e: Client requests creation of a DER Group Dispatch and Server replies (Success - Single DER Group; Responder supplies mRID)

In this test case, the Client requests the Server to create a single DER Group Dispatch for DER Group DG8. DER Group DG8 was created in Test Case DERG-6 and modified in Test Case DERG-8. The Server returns a response message indicating success with no errors. The Server (because of an assumed business rule) also assigns an mRID identifier to the DER Group Dispatch; consequently, the response message in Step 2 includes a Payload section that adds the mRID identifier to the Payload of the Step 1 request message.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Pre-Condition(s)	DER Group DG8, as created in Test Case DERG-6 and modified in Test Case DERG-8, is assumed to exist.
Post-Condition(s)	A new DER Group Dispatch is created with the Names identifier that was passed in the request message. The server responds with an indication of success and adds the mRID identifier in the Payload section of the response message.

The Sequence Diagram in Figure 12-5 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

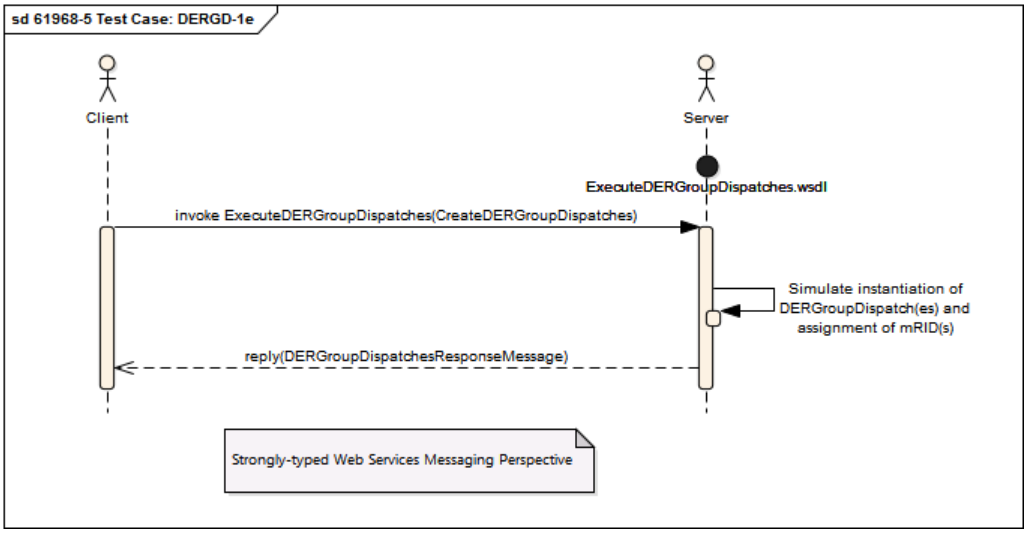


Figure 12-5
Sequence Diagram for Test Case DERGD-1e

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateDERGroupDispatches	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateDERGroupDispatches xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:m="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
	<tns:Header>
		<Verb>create</Verb>
		<Noun>DERGroupDispatches</Noun>
		<Timestamp>2017-06-16T17:56:28-06:00</Timestamp>
		<MessageID>d39015d3-0862-4828-b924-aea7b163fed9</MessageID>
		<CorrelationID>c7eada9d-b9c7-43b3-9911-f4edf5643471</CorrelationID>
	</tns:Header>
	<tns:Payload>
		<m:DERGroupDispatches>
			<m:DERGroupDispatch>
				<m:EndDeviceGroup>
					<m:DERMonitorableParameter>
						<m:DERParameter>activePower</m:DERParameter>
						<m:yMultiplier>k</m:yMultiplier>
						<m:yUnit>W</m:yUnit>
						<m:DispatchSchedule>

	<m:curveStyleKind>constantYValue</m:curveStyleKind>
							<m:startTime>2017-06-16T18:00:00-
06:00</m:startTime>

	<m:timeIntervalDuration>30</m:timeIntervalDuration>

	<m:timeIntervalUnit>m</m:timeIntervalUnit>
							<m:DERCurveData>

	<m:intervalNumber>1</m:intervalNumber>

	<m:nominalYValue>0.9</m:nominalYValue>
							</m:DERCurveData>
						</m:DispatchSchedule>
					</m:DERMonitorableParameter>
					<m:Names>
						<m:name>DG8</m:name>
```

```
                                </m:Names>
                        </m:EndDeviceGroup>
                        <m:Names>
                                <m:name>DER Dispatch Request 20170616_A543</m:name>
                        </m:Names>
                </m:DERGroupDispatch>
        </m:DERGroupDispatches>
</tns:Payload>
</tns:CreateDERGroupDispatches>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteDERGroupDispatches.wsdl	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	DERGroupDispatches.xsd	{02- IEC 61968-5 XSDs\Constrained Profiles}
Strongly Typed Message XSD	DERGroupDispatchesMessage.xsd	{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	DERGroupDispatchesResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:DERGroupDispatchesResponseMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:obj="http://iec.ch/TC57/2017/DERGroupDispatches#"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/DERGroupDispatchesMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/DERGroupDispatchesMessage
DERGroupDispatchesMessage.xsd">
        <tns:Header>
                <Verb>reply</Verb>
                <Noun>DERGroupDispatches</Noun>
                <Timestamp>2017-06-16T17:56:38-06:00</Timestamp>
                <MessageID>7d489885-29db-459d-b068-f6b53260a80e</MessageID>
                <CorrelationID>c7eada9d-b9c7-43b3-9911-f4edf5643471</CorrelationID>
        </tns:Header>
        <tns:Reply>
                <Result>OK</Result>
                <Error>
                        <code>0.0</code>
                </Error>
        </tns:Reply>
        <tns:Payload>
                <obj:DERGroupDispatches>
                        <obj:DERGroupDispatch>
                                <obj:mRID>da753558-ab8b-42c7-b0cd-cd0200493810</obj:mRID>
                                <obj:EndDeviceGroup>
                                        <obj:DERMonitorableParameter>

        <obj:DERParameter>activePower</obj:DERParameter>
                                                <obj:yMultiplier>k</obj:yMultiplier>
```

```
                                        <obj:yUnit>W</obj:yUnit>
                                        <obj:DispatchSchedule>

      <obj:curveStyleKind>constantYValue</obj:curveStyleKind>
                                            <obj:startTime>2017-06-16T18:00:00-
06:00</obj:startTime>

      <obj:timeIntervalDuration>30</obj:timeIntervalDuration>

      <obj:timeIntervalUnit>m</obj:timeIntervalUnit>
                                            <obj:DERCurveData>

      <obj:intervalNumber>1</obj:intervalNumber>

      <obj:nominalYValue>0.9</obj:nominalYValue>
                                            </obj:DERCurveData>
                                        </obj:DispatchSchedule>
                                    </obj:DERMonitorableParameter>
                                    <obj:Names>
                                        <obj:name>DG8</obj:name>
                                    </obj:Names>
                                </obj:EndDeviceGroup>
                                <obj:Names>
                                    <obj:name>DER Dispatch Request
20170616_A543</obj:name>
                                </obj:Names>
                            </obj:DERGroupDispatch>
                        </obj:DERGroupDispatches>
      </tns:Payload>
</tns:DERGroupDispatchesResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	Create DER Group Dispatch	http://xx.xxx.xxx.xxx/	create	DERGroupDispatches	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	DERGroupDispatches	

13
DER GROUP CONNECT/DISCONNECT TEST CASES

DERGCD-1a: Client Requests Connection of a DER Group and Server Replies (Full Success - Single DER Group)

In this test case, the Client uses an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG2 to the grid. DER Group DG2 was created in Test Case DERG-1c and modified in Test Case DERG-2b. There are three DER Devices in DER Group DG2.

The Server returns a response message indicating success with no errors. This means that the server has accepted and validated the connection request and will attempt to disconnect the DER Devices in the DER Group. The response message does not indicate whether the connection of each DER Device was successful.

After the Server has responded with the response message, it attempts to connect each of the DER Devices in the DER Group. For each DER Device in the DER Group, the server then issues an EndDeviceEvents consequential event message. These consequential event messages indicate whether each DER Device was or was not successfully connected. In this test case, all three DER Devices are successfully connected to the grid.

Note 1: See Appendix G for the four-digit EndDeviceControlType codes used to request connection or disconnection of DER Groups (technically the DER Devices in a DER Group) to/from the grid.

Note 2: See Appendix H for the four-digit EndDeviceEventType codes used to indicate successful or failed connection or disconnection of DER Devices from the grid.

Note 3: Even though the consequential event messages are asynchronous, the Header of each EndDeviceEvents consequential event message carries the CorrelationID of the preceding EndDeviceControls message. This provides the mechansim to link the asynchronous consequential EndDeviceEvent with the EndDeviceControl responsible for its creation.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

As noted, this test case illustrates the successful connection of a single DER Group and all its associated DER Devices to the grid. Subsequent test cases will illustrate attempts to connect or disconnect both single and multiple DER Group Dispatches as well as reflect various success and failure indications.

Note: This DER Group Connect test case can be altered from a connect to a disconnect by simply changing the EndDeviceControlType codes (see Appendix G) and EndDeviceEventType codes (see Appendix H).

Pre-Condition(s)	DER Group DG2, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist.
Post-Condition(s)	DER Group DG2 and its three associated DER Devices are connected to the grid.

The Sequence Diagram in Figure 13-1 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

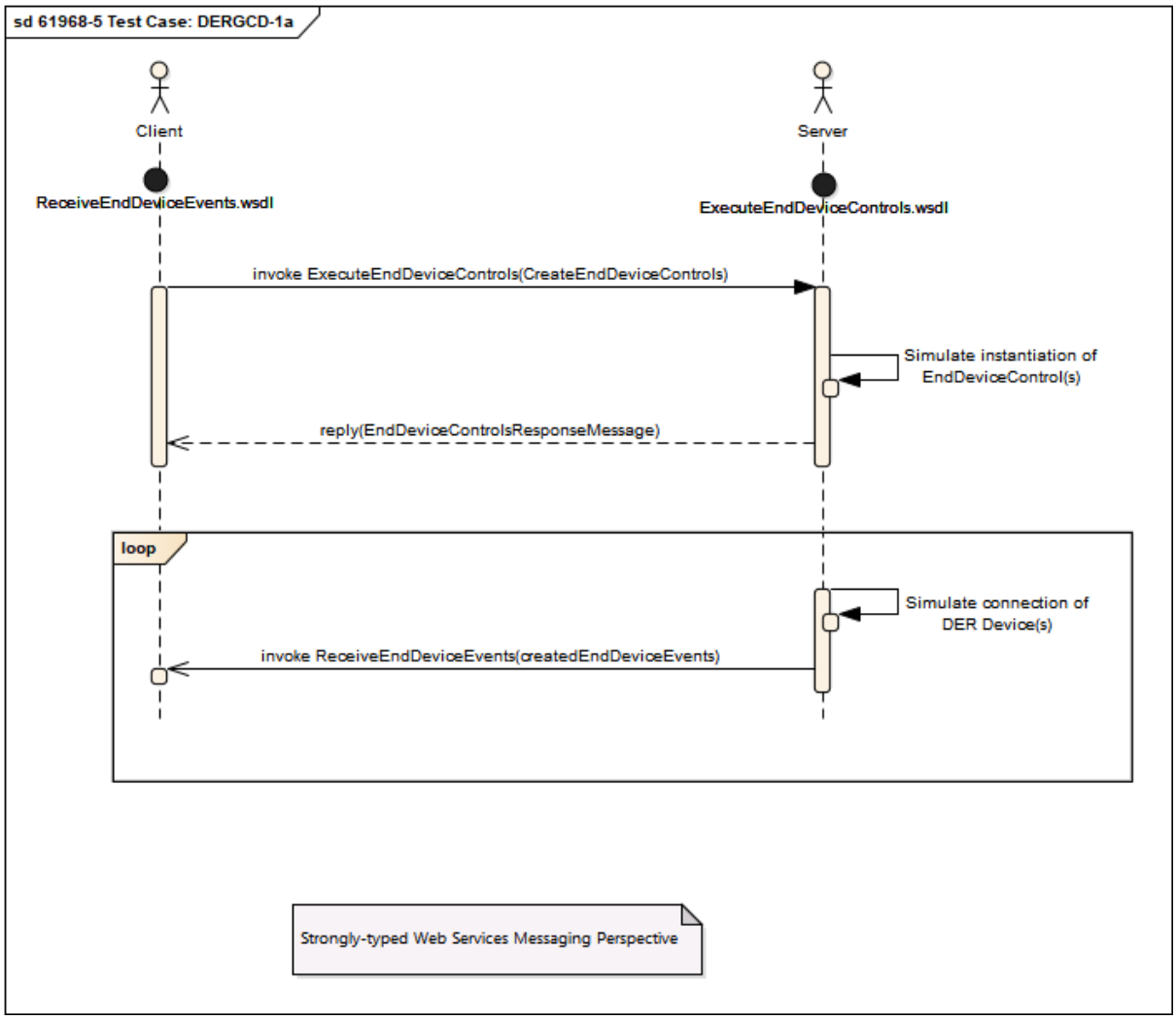


Figure 13-1
Sequence Diagram for Test Case DERGCD-1a

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Steps 1 and 2 illustrate the EndDeviceControls request and response messages.

Steps 3 through 5 illustrate the consequential EndDeviceEvents messages. These EndDeviceEvents messages may be sent in any order (sequence).

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 9 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateEndDeviceControls	N/A

```
?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateEndDeviceControls xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T11:24:04-06:00</msg:Timestamp>
		<msg:MessageID>aab72e66-d8b4-406c-8e18-4df2864cf947</msg:MessageID>
		<msg:CorrelationID>3a913c02-bc54-4a63-b82a-
b255ffa0b7da</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceControls>
			<EndDeviceControl>
				<mRID>2b928834-b538-4244-9daf-6db54f700a76</mRID>
				<EndDeviceControlType ref="2.31.0.18"/>
				<EndDeviceGroups>
					<Names>
						<name>DG2</name>
					</Names>
				</EndDeviceGroups>
			</EndDeviceControl>
		</EndDeviceControls>
	</tns:Payload>
</tns:CreateEndDeviceControls>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	EndDeviceControlsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:EndDeviceControlsResponseMessage
xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>reply</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T11:24:12-06:00</msg:Timestamp>
		<msg:MessageID>e7bdb90c-17cb-42fe-a559-19022b72a130</msg:MessageID>
		<msg:CorrelationID>3a913c02-bc54-4a63-b82a-
b255ffa0b7da</msg:CorrelationID>
	</tns:Header>
	<tns:Reply>
		<msg:Result>OK</msg:Result>
		<msg:Error>
			<msg:code>0.0</msg:code>
		</msg:Error>
	</tns:Reply>
</tns:EndDeviceControlsResponseMessage>
```

Step 3 - Event Message

Metadata for Step 3 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
	<tns:Header>
		<msg:Verb>created</msg:Verb>
		<msg:Noun>EndDeviceEvents</msg:Noun>
		<msg:Timestamp>2017-06-20T11:24:31-06:00</msg:Timestamp>
		<msg:MessageID>ca8fe4d0-00b7-4276-a185-f53e113f5802</msg:MessageID>
		<msg:CorrelationID>3a913c02-bc54-4a63-b82a-
b255ffa0b7da</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceEvents>
			<EndDeviceEvent>
				<mRID>02a4d91f-6727-4005-8f60-b523729afd16</mRID>
				<createdDateTime>2017-06-20T11:24:28-
06:00</createdDateTime>
				<Assets>
					<mRID>46029b51-8d94-4a06-b242-74d4a3fc2390</mRID>
				</Assets>
				<EndDeviceEventType ref="2.31.0.42"/>
			</EndDeviceEvent>
		</EndDeviceEvents>
	</tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 4 - Event Message

Metadata for Step 4 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
	<tns:Header>
		<msg:Verb>created</msg:Verb>
```

```
            <msg:Noun>EndDeviceEvents</msg:Noun>
            <msg:Timestamp>2017-06-20T11:24:35-06:00</msg:Timestamp>
            <msg:MessageID>ca8fe4d0-00b7-4276-a185-f53e113f5802</msg:MessageID>
            <msg:CorrelationID>3a913c02-bc54-4a63-b82a-
b255ffa0b7da</msg:CorrelationID>
      </tns:Header>
      <tns:Payload>
            <EndDeviceEvents>
                  <EndDeviceEvent>
                        <mRID>e8839736-4977-4b67-9a0a-e63b7ed9ff3f</mRID>
                        <createdDateTime>2017-06-20T11:24:29-
06:00</createdDateTime>
                        <Assets>
                              <mRID>13a801e1-b45d-4dbe-960f-84f04ef39fcb</mRID>
                        </Assets>
                        <EndDeviceEventType ref="2.31.0.42"/>
                  </EndDeviceEvent>
            </EndDeviceEvents>
      </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 5 - Event Message

Metadata for Step 5 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
      <tns:Header>
            <msg:Verb>created</msg:Verb>
            <msg:Noun>EndDeviceEvents</msg:Noun>
            <msg:Timestamp>2017-06-20T11:24:39-06:00</msg:Timestamp>
            <msg:MessageID>60631d18-3353-49b4-94be-69daf1feb9f9</msg:MessageID>
            <msg:CorrelationID>3a913c02-bc54-4a63-b82a-
b255ffa0b7da</msg:CorrelationID>
      </tns:Header>
      <tns:Payload>
            <EndDeviceEvents>
                  <EndDeviceEvent>
                        <mRID>15682227-b766-401e-ad90-52045e0901be</mRID>
```

```
                        <createdDateTime>2017-06-20T11:24:33-
06:00</createdDateTime>
                        <Assets>
                              <mRID>7a02c3a5-606e-4d0e-adaf-0e1b98757512</mRID>
                        </Assets>
                        <EndDeviceEventType ref="2.31.0.42"/>
                  </EndDeviceEvent>
            </EndDeviceEvents>
      </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	DER Group Connection Request	http://xx.xxx.xxx.xxx/	Create	EndDeviceControls	
2	Success Response	http://xx.xxx.xxx.xxx/	Reply	EndDeviceControls	
4	DER Device Connected Event	http://xx.xxx.xxx.xxx/	Created	EndDeviceEvents	
4	DER Device Connected Event	http://xx.xxx.xxx.xxx/	Created	EndDeviceEvents	
5	DER Device Connected Event	http://xx.xxx.xxx.xxx/	created	EndDeviceEvents	

DERGCD-1b: Client requests connection of a DER Group and Server replies (Failure - Single DER Group; Request rejected)

In this test case, the Client uses an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG1 to the grid. DER Group DG1 was created in Test Case DERG-1a and modified in Test Case DERG-2a; however, it was subsequently deleted in Test Case DERG-4. Consequently, the Server returns a response message indicating a failure because DER Group DG1 no longer exists. (See Appendix F for error codes.)

Note 1: See Appendix G for the four-digit EndDeviceControlType codes used to request connection or disconnection of DER Groups (technically the DER Devices in a DER Group) to/from the grid.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

As noted, this test case illustrates a failed attempt to connect a single DER Group because the DER Group no longer exists. Subsequent test cases will illustrate attempts to connect or disconnect both single and multiple DER Group Dispatches as well as reflect various success and failure indications.

Note: This DER Group Connect test case can be altered from a connect to a disconnect by simply changing the EndDeviceControlType code (see Appendix G).

Pre-Condition(s)	DER Group DG1 is assumed not to exist because it was deleted in Test Case DERG-4.
Post-Condition(s)	The request to connect DER Group DG1 to the grid was rejected as indicated in the Step 2 response message.

The Sequence Diagram in Figure 13-2 and Sample XML below illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through "Strongly Typed Web Services" as defined in IEC 61968-100:2013.

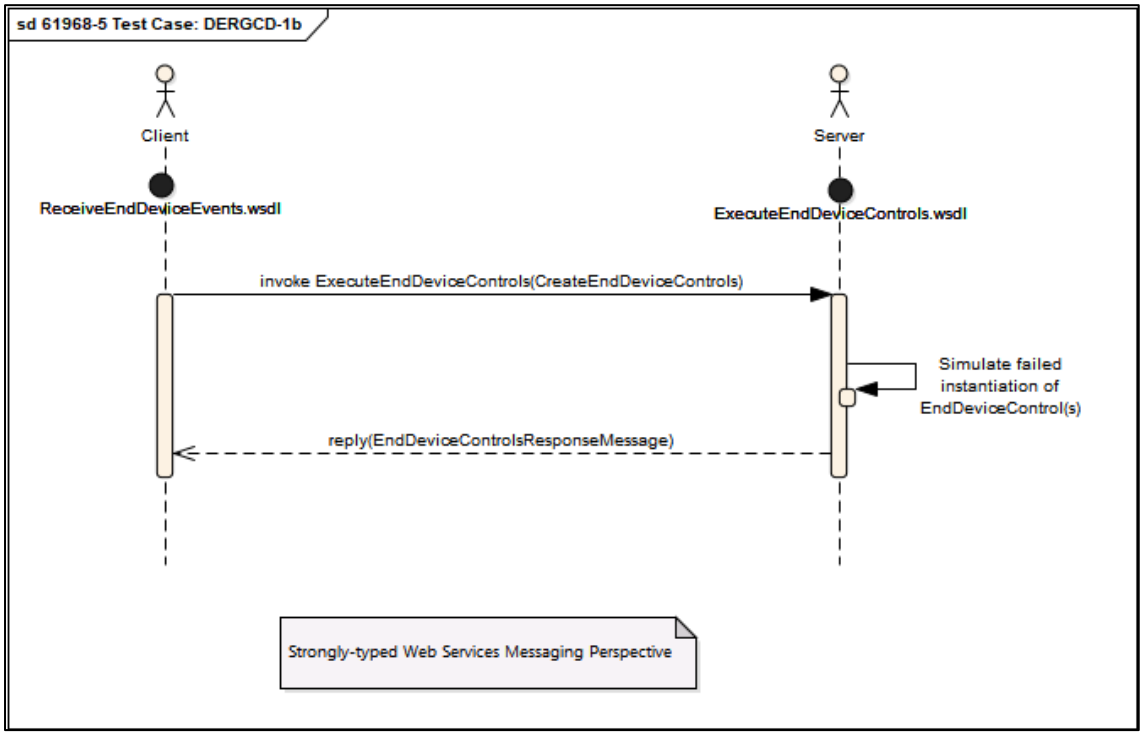


Figure 13-2
Sequence Diagram for Test Case DERGCD-1b

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Steps 1 and 2 illustrate the EndDeviceControls request and response messages.

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateEndDeviceControls	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateEndDeviceControls xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T12:40:03-06:00</msg:Timestamp>
		<msg:MessageID>e80d8963-11db-451f-a757-9e74e34df569</msg:MessageID>
		<msg:CorrelationID>3b56562c-fc74-46ea-9b0b-
97fde6055818</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceControls>
			<EndDeviceControl>
				<mRID>52d5d3e4-601b-4030-a9b8-7742bf019c88</mRID>
				<EndDeviceControlType ref="2.31.0.18"/>
				<EndDeviceGroups>
					<Names>
						<name>DG1</name>
					</Names>
				</EndDeviceGroups>
			</EndDeviceControl>
		</EndDeviceControls>
	</tns:Payload>
</tns:CreateEndDeviceControls>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	EndDeviceControlsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:EndDeviceControlsResponseMessage
xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>reply</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T12:40:08-06:00</msg:Timestamp>
		<msg:MessageID>01bd72e8-686c-456b-b441-9bb6eca84c1f</msg:MessageID>
		<msg:CorrelationID>3b56562c-fc74-46ea-9b0b-
97fde6055818</msg:CorrelationID>
	</tns:Header>
	<tns:Reply>
		<msg:Result>FAILED</msg:Result>
		<msg:Error>
			<msg:code>99.1</msg:code>
			<msg:level>FATAL</msg:level>
			<msg:details>DERGroup does not exist</msg:details>
			<msg:ID kind="name" objectType="DERGroup">DG1</msg:ID>
		</msg:Error>
	</tns:Reply>
</tns:EndDeviceControlsResponseMessage>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	DER Group Connection Request	http://xx.xxx.xxx.xxx/	create	EndDeviceControls	
2	Failure Response	http://xx.xxx.xxx.xxx/	reply	EndDeviceControls	

DERGCD-1c: Client requests connection of a DER Group and Server replies (Partial failure - Single DER Group; One DER Device fails to connect)

In this test case, the Client uses an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG4 to the grid. DER Group DG2 was created in Test Case DERG-1d. There are two DER Devices in DER Group DG4.

The Server returns a response message indicating success with no errors. This means that the server has accepted and validated the connection request and will attempt to disconnect the DER Devices in the DER Group. The response message does not indicate whether the connection of each DER Device was successful.

After the Server has responded with the response message, it attempts to connect each of the DER Devices in the DER Group. For each DER Device in the DER Group, the server then issues an EndDeviceEvents consequential event message. These consequential event messages indicate whether each DER Device was or was not successfully connected. In this test case, all three DER Devices are successfully connected to the grid.

Note 1: See Appendix G for the four-digit EndDeviceControlType codes used to request connection or disconnection of DER Groups (technically the DER Devices in a DER Group) to/from the grid.

Note 2: See Appendix H for the four-digit EndDeviceEventType codes used to indicate successful or failed connection or disconnection of DER Devices from the grid.

Note 3: Even though the consequential event messages are asynchronous, the Header of each EndDeviceEvents consequential event message carries the CorrelationID of the preceding EndDeviceControls message. This provides the mechansim to link the asynchronous consequential EndDeviceEvent with the EndDeviceControl responsible for its creation.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Note: This DER Group Connect test case can be altered from a connect to a disconnect by simply changing the EndDeviceControlType codes (see Appendix G) and EndDeviceEventType codes (see Appendix H).

Pre-Condition(s)	DER Group DG4, as previously created in Test Case DERG-1d, is assumed to exist.
Post-Condition(s)	One of the DER Devices in DER Group DG4 is connected to the grid. The other DER Device in DER Group DG4 fails to connect to the grid.

The Sequence Diagram in Figure 13-3 and Sample XML below illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through “Strongly Typed Web Services” as defined in IEC 61968-100:2013.

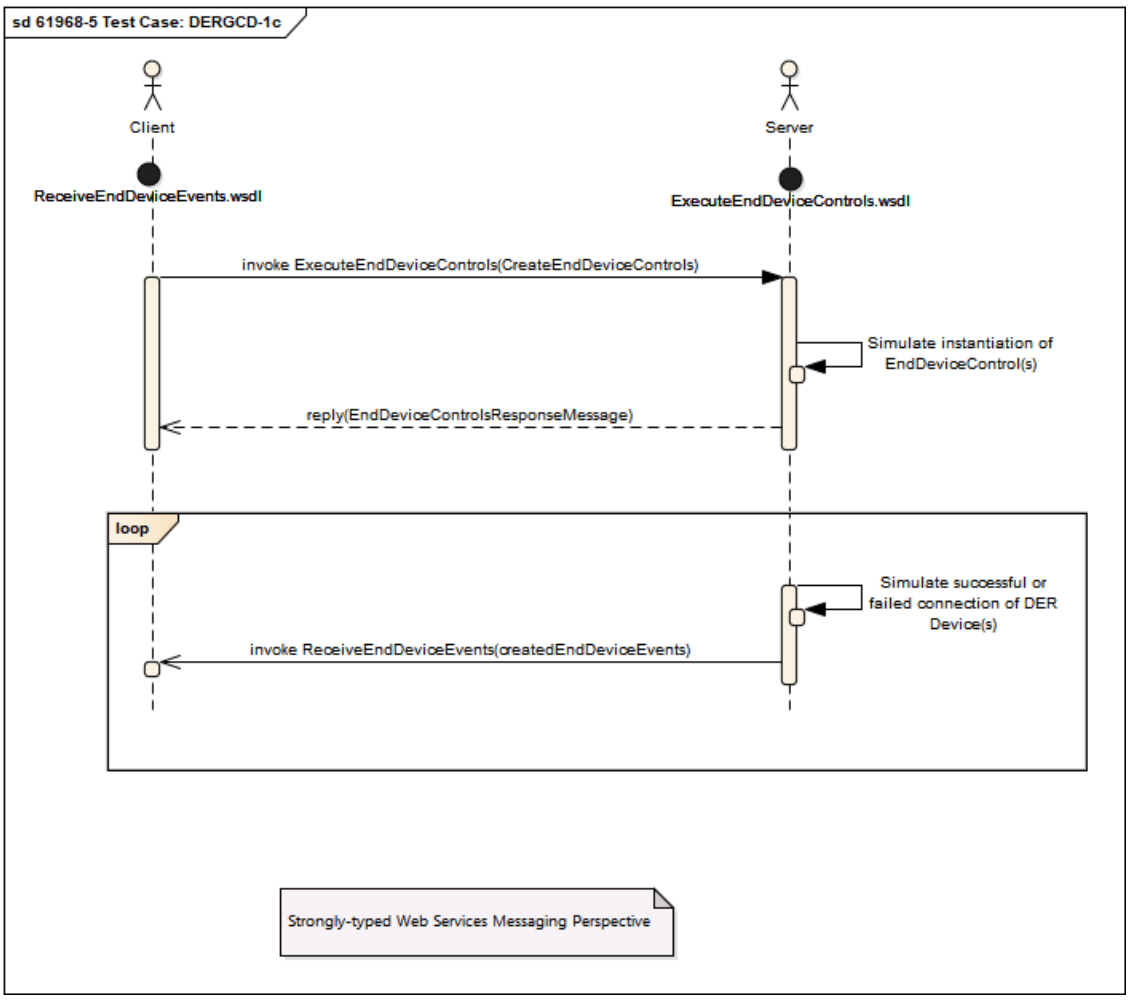


Figure 13-3
Sequence Diagram for Test Case DERGCD-1c

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Steps 1 and 2 illustrate the EndDeviceControls request and response messages.

Steps 3 and 4 illustrate the consequential EndDeviceEvents messages. These EndDeviceEvents messages may be sent in any order (sequence).

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 9 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateEndDeviceControls	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateEndDeviceControls xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T13:05:16-06:00</msg:Timestamp>
		<msg:MessageID>a9b30165-5af4-44e7-a949-5d7a1be3c6ca</msg:MessageID>
		<msg:CorrelationID>381a99a9-86c3-4b09-9603-
2ef0eb5ad584</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceControls>
			<EndDeviceControl>
				<mRID>2617cc93-b5da-4803-8974-5bd3dadd70db</mRID>
				<EndDeviceControlType ref="2.31.0.18"/>
				<EndDeviceGroups>
					<Names>
						<name>DG4</name>
					</Names>
				</EndDeviceGroups>
			</EndDeviceControl>
		</EndDeviceControls>
	</tns:Payload>
</tns:CreateEndDeviceControls>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	EndDeviceControlsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:EndDeviceControlsResponseMessage
xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>reply</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T13:05:19-06:00</msg:Timestamp>
		<msg:MessageID>29cd8d52-abd9-4cc5-8ceb-06b26c7b0f40</msg:MessageID>
		<msg:CorrelationID>381a99a9-86c3-4b09-9603-
2ef0eb5ad584</msg:CorrelationID>
	</tns:Header>
	<tns:Reply>
		<msg:Result>OK</msg:Result>
		<msg:Error>
			<msg:code>0.0</msg:code>
		</msg:Error>
	</tns:Reply>
</tns:EndDeviceControlsResponseMessage>
```

Step 3 - Event Message

Metadata for Step 3 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
	<tns:Header>
		<msg:Verb>created</msg:Verb>
		<msg:Noun>EndDeviceEvents</msg:Noun>
		<msg:Timestamp>2017-06-20T13:05:33-06:00</msg:Timestamp>
		<msg:MessageID>fe0470e3-0219-439e-a940-d28ece37f476</msg:MessageID>
		<msg:CorrelationID>381a99a9-86c3-4b09-9603-
2ef0eb5ad584</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceEvents>
			<EndDeviceEvent>
				<mRID>23bac639-0b13-4830-8f0b-4fa39e05d58c</mRID>
				<createdDateTime>2017-06-20T13:05:29-
06:00</createdDateTime>
				<Assets>
					<mRID>6de3d770-6087-45bc-a5c8-6fca25f5a318</mRID>
				</Assets>
				<EndDeviceEventType ref="2.31.0.42"/>
			</EndDeviceEvent>
		</EndDeviceEvents>
	</tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 4 - Event Message

Metadata for Step 4 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
       <tns:Header>
              <msg:Verb>created</msg:Verb>
              <msg:Noun>EndDeviceEvents</msg:Noun>
              <msg:Timestamp>2017-06-20T13:05:45-06:00</msg:Timestamp>
              <msg:MessageID>8c01b434-a0e1-424e-88d0-83aa99b3e4e5</msg:MessageID>
              <msg:CorrelationID>381a99a9-86c3-4b09-9603-
2ef0eb5ad584</msg:CorrelationID>
       </tns:Header>
       <tns:Payload>
              <EndDeviceEvents>
                     <EndDeviceEvent>
                            <mRID>b2281827-8aee-4cac-91a5-069e679450b6</mRID>
                            <createdDateTime>2017-06-20T13:05:39-
06:00</createdDateTime>
                            <Assets>
                                   <mRID>c378df3a-294c-4743-ad78-65f970231b5b</mRID>
                            </Assets>
                            <EndDeviceEventType ref="2.31.0.67"/>
                     </EndDeviceEvent>
              </EndDeviceEvents>
       </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Test Results

Application Being Tested: ☐ Client Role ☐ Server Role

EPRI Test Harness: ☐ Client Role ☐ Server Role

Step	Function	Endpoint	Verb	Noun	Pass/Fail
1	DER Group Connection Request	http://xx.xxx.xxx.xxx/	create	EndDeviceControls	
2	Success Response	http://xx.xxx.xxx.xxx/	reply	EndDeviceControls	
3	DER Device Connected Event	http://xx.xxx.xxx.xxx/	created	EndDeviceEvents	
4	DER Device Connection Failed Event	http://xx.xxx.xxx.xxx/	created	EndDeviceEvents	

DERGCD-1d: Client requests disconnection of two DER Groups and Server replies (Full Success - Two DER Groups in a single message)

In this test case, the Client uses an EndDeviceControls message to request the Server to disconnect the DER Groups with Names.name identifiers of DG2 and DG6 from the grid. DER Group DG2 was created in Test Case DERG-1c and modified in Test Case DERG-2b. There are three DER Devices in DER Group DG2. DER Group DG6 was created in Test Case DERG-1e. There is one DER Device in DER Group DG6.

The Server returns a response message indicating success with no errors. This means that the server has accepted and validated the disconnection request and will attempt to disconnect the DER Devices in the two DER Groups. The response message does not indicate whether the disconnection of each DER Device was successful.

After the Server has responded with the response message, it attempts to disconnect each of the DER Devices in the two DER Groups. For each DER Device, the server then issues an EndDeviceEvents consequential event message. These consequential event messages indicate whether each DER Device was or was not successfully disconnected. In this test case, all four of the DER Devices (three from DER Group DG2 and one from DER Group DG6) are successfully disconnected from the grid.

Note 1: See Appendix G for the four-digit EndDeviceControlType codes used to request connection or disconnection of DER Groups (technically the DER Devices in a DER Group) to/from the grid.

Note 2: See Appendix H for the four-digit EndDeviceEventType codes used to indicate successful or failed connection or disconnection of DER Devices from the grid.

Note 3: Even though the consequential event messages are asynchronous, the Header of each EndDeviceEvents consequential event message carries the CorrelationID of the preceding EndDeviceControls message. This provides the mechansim to link the asynchronous consequential EndDeviceEvent with the EndDeviceControl responsible for its creation.

The examples in this and other test cases illustrate the population of an exemplary subset of elements and attributes selected solely for illustrative purposes. Actual messages created by the Client and Server applications may contain any of the elements and attributes permitted by the XSDs found in Appendices B and D.

Note: This DER Group Connect test case can be altered from a connect to a disconnect by simply changing the EndDeviceControlType codes (see Appendix G) and EndDeviceEventType codes (see Appendix H).

Pre-Condition(s)	DER Group DG2, as created in Test Case DERG-1c and modified in Test Case DERG-2b, is assumed to exist. DER Group DG6, as created in Test Case DERG-1e, is assumed to exist.
Post-Condition(s)	DER Group DG2 and its three associated DER Devices are disconnected from the grid. DER Group DG6 and its single associated DER Device are disconnected from the grid.

The Sequence Diagram in Figure 13-4 and Sample XML that follows illustrate the messaging interaction for this test case using IEC 61968 CIM terminology that would be evident in messages being transported through Strongly Typed Web Services as defined in IEC 61968-100:2013.

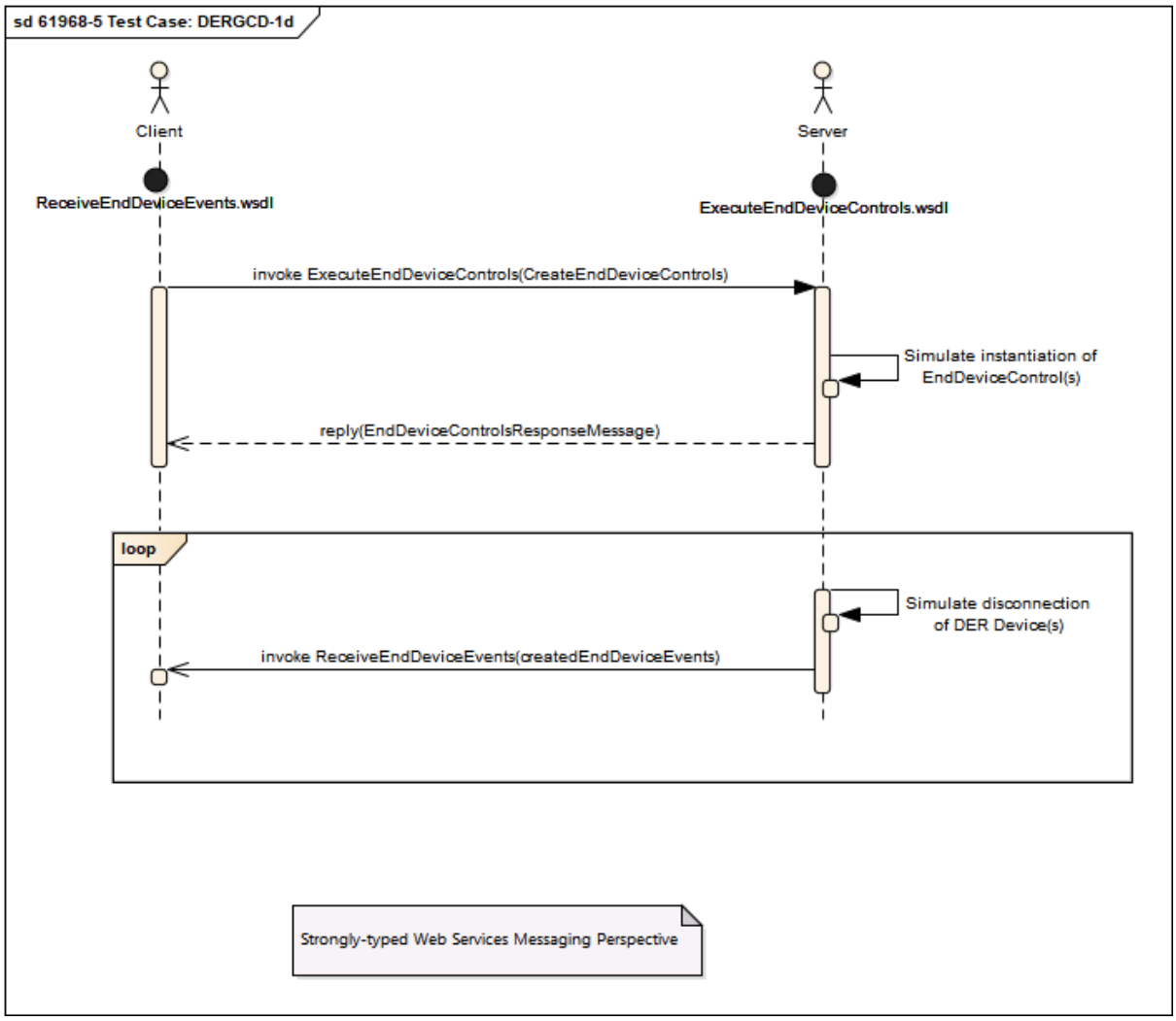


Figure 13-4
Sequence Diagram for Test Case DERGCD-1d

Sample XML for the Strongly Typed Web Services variant of this test case is as follows. Client and Server applications being tested in accordance with this test case are permitted to populate the create request message with any content that can be validated using the Message envelope (IEC 61968-100:2013) and CIM Object (IEC 61968-5:CDV) XSD profiles provided in this report.

Steps 1 and 2 illustrate the EndDeviceControls request and response messages.

Steps 3 through 6 illustrate the consequential EndDeviceEvents messages. These EndDeviceEvents messages may be sent in any order (sequence).

Step 1 - Request Message

Metadata for Step 1 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 9 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreateEndDeviceControls	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreateEndDeviceControls xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>create</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T14:16:22-06:00</msg:Timestamp>
		<msg:MessageID>8826b860-8165-4013-8b51-ce89b5a5dfaf</msg:MessageID>
		<msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceControls>
			<EndDeviceControl>
				<mRID>b9c5767a-5536-44db-84db-fa73eadc2050</mRID>
				<EndDeviceControlType ref="2.31.0.23"/>
				<EndDeviceGroups>
					<Names>
						<name>DG6</name>
					</Names>
				</EndDeviceGroups>
				<EndDeviceGroups>
					<Names>
						<name>DG2</name>
					</Names>
				</EndDeviceGroups>
			</EndDeviceControl>
		</EndDeviceControls>
	</tns:Payload>
</tns:CreateEndDeviceControls>
```

Step 2 - Response Message

Metadata for Step 2 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ExecuteEndDeviceControls.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceControls.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceControlsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	EndDeviceControlsResponseMessage	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:EndDeviceControlsResponseMessage
xmlns="http://iec.ch/TC57/2011/EndDeviceControls#"
xmlns:xml="http://www.w3.org/XML/1998/namespace"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceControlsMessage"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceControlsMessage
EndDeviceControlsMessage.xsd">
	<tns:Header>
		<msg:Verb>reply</msg:Verb>
		<msg:Noun>EndDeviceControls</msg:Noun>
		<msg:Timestamp>2017-06-20T14:16:35-06:00</msg:Timestamp>
		<msg:MessageID>c968e839-2744-4143-8208-4302472ed92d</msg:MessageID>
		<msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
	</tns:Header>
	<tns:Reply>
		<msg:Result>OK</msg:Result>
		<msg:Error>
			<msg:code>0.0</msg:code>
		</msg:Error>
	</tns:Reply>
</tns:EndDeviceControlsResponseMessage>
```

Step 3 - Event Message

Metadata for Step 3 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
	<tns:Header>
		<msg:Verb>created</msg:Verb>
		<msg:Noun>EndDeviceEvents</msg:Noun>
		<msg:Timestamp>2017-06-20T14:16:45-06:00</msg:Timestamp>
		<msg:MessageID>16788885-da56-4c7d-ae95-49427afe1182</msg:MessageID>
		<msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
	</tns:Header>
	<tns:Payload>
		<EndDeviceEvents>
			<EndDeviceEvent>
				<mRID>c9116fec-1f33-44ed-a24c-cfebb0b3f986</mRID>
				<createdDateTime>2017-06-20T14:16:28-
06:00</createdDateTime>
				<Assets>
					<mRID>46029b51-8d94-4a06-b242-74d4a3fc2390</mRID>
				</Assets>
				<EndDeviceEventType ref="2.31.0.68"/>
			</EndDeviceEvent>
		</EndDeviceEvents>
	</tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 4 - Event Message

Metadata for Step 4 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
	<tns:Header>
```

```
            <msg:Verb>created</msg:Verb>
            <msg:Noun>EndDeviceEvents</msg:Noun>
            <msg:Timestamp>2017-06-20T14:16:47-06:00</msg:Timestamp>
            <msg:MessageID>e1bf0fda-8140-4133-8dc5-260ba9e1c209</msg:MessageID>
            <msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
      </tns:Header>
      <tns:Payload>
            <EndDeviceEvents>
                  <EndDeviceEvent>
                        <mRID>0f4cad64-e8e4-44cd-b4fe-62f77c9cac37</mRID>
                        <createdDateTime>2017-06-20T14:16:29-
06:00</createdDateTime>
                        <Assets>
                              <mRID>13a801e1-b45d-4dbe-960f-84f04ef39fcb</mRID>
                        </Assets>
                        <EndDeviceEventType ref="2.31.0.68"/>
                  </EndDeviceEvent>
            </EndDeviceEvents>
      </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 5 - Event Message

Metadata for Step 5 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
      <tns:Header>
            <msg:Verb>created</msg:Verb>
            <msg:Noun>EndDeviceEvents</msg:Noun>
            <msg:Timestamp>2017-06-20T14:16:48-06:00</msg:Timestamp>
            <msg:MessageID>1da41a9b-db16-469a-96ed-75ea9c02e6b3</msg:MessageID>
            <msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
      </tns:Header>
      <tns:Payload>
            <EndDeviceEvents>
                  <EndDeviceEvent>
                        <mRID>f7e5a1e7-5f4f-466a-ac4c-02dde49737f9</mRID>
```

```
                        <createdDateTime>2017-06-20T14:16:33-
06:00</createdDateTime>
                        <Assets>
                                <mRID>7a02c3a5-606e-4d0e-adaf-0e1b98757512</mRID>
                        </Assets>
                        <EndDeviceEventType ref="2.31.0.68"/>
                </EndDeviceEvent>
        </EndDeviceEvents>
    </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

Step 6 - Event Message

Metadata for Step 5 Message

Artifact	Name	Location in Supplemental Resource File
WSDL	ReceiveEndDevceEvents.wsdl	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}
Part 5 XSD	EndDeviceEvents.xsd	{04- IEC 61968-9 XSDs}
Strongly Typed Message XSD	EndDeviceEventsMessage.xsd	{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}
Message Stereotype	CreatedEndDeviceEvents	N/A

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<tns:CreatedEndDeviceEvents xmlns="http://iec.ch/TC57/2011/EndDeviceEvents#"
xmlns:msg="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:tns="http://iec.ch/TC57/2017/EndDeviceEventsMessage"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/TC57/2017/EndDeviceEventsMessage
EndDeviceEventsMessage.xsd">
        <tns:Header>
                <msg:Verb>created</msg:Verb>
                <msg:Noun>EndDeviceEvents</msg:Noun>
                <msg:Timestamp>2017-06-20T14:16:51-06:00</msg:Timestamp>
                <msg:MessageID>472b1af2-2b65-44a3-91ff-eaaacb72ab00</msg:MessageID>
                <msg:CorrelationID>76f191ae-478c-4f73-b4c0-
e654eeeb4be8</msg:CorrelationID>
        </tns:Header>
        <tns:Payload>
                <EndDeviceEvents>
                        <EndDeviceEvent>
                                <mRID>ae128c57-d010-42f0-a556-71401f7e557d</mRID>
                                <createdDateTime>2017-06-20T14:16:33-
06:00</createdDateTime>
                                <Assets>
                                        <mRID>e8a2f05b-aca9-46dc-971b-be22fcedc00b</mRID>
                                </Assets>
                                <EndDeviceEventType ref="2.31.0.68"/>
                        </EndDeviceEvent>
                </EndDeviceEvents>
        </tns:Payload>
</tns:CreatedEndDeviceEvents>
```

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REFERENCES

The First Edition of this EPRI Technical Report, *Program on Technology Innovation: Test Script for International Electrotechnical Commission 61968-5:CD Messages*, was published October 2016.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002009276.

The EPRI Technical Update *Common Functions for Smart Inverters* was first published December 2011. The initial version is no longer available. The most recent edition, *Common Functions for Smart Inverters: 4th Edition*, was published December 2016.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002008217.

The EPRI Technical Update *Collaborative Initiative to Advance Enterprise Integration of DER* was published November 2012.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001026789.

The EPRI Technical Update *Enterprise Integration Functions Test Plan for Distributed Energy Resources, Phase 1* was published November 2014.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002004681.

The EPRI Technical Report *DER Enterprise Integration: Interoperability Workshop Results* was published December 2014.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002003035.

The EPRI Technical Update *Common Functions for DER Group Management, Third Edition* was published November 2016.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002008215.

While the EPRI Test Harness and test procedures will be updated to accommodate testing described in this report, for an understanding of the prior work that has been accomplished, the EPRI report *Common Information Model (CIM) Conformity and Interoperability Test Procedure Development*—particularly the appendices that describe the test harness setup—is informative.

Available [Online]
http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001024448.

The CIM-based messages leverage the verb-object naming convention and follow the integration guidance based on IEC 61968-100:2013, Application Integration at Electric Utilities. This international standard is available from the IEC store.

Available [Online]
https://webstore.iec.ch/publication/6198.

The use case patterns that describe how to remove an association between an element and a parent object along with the usage of the EndDeviceControls and EndDeviceEvents profiles are described in detail in IEC 61968-9:2013, Meter Reading and Control, Annex (Appendix) L.

Available [Online]
https://webstore.iec.ch/publication/6204.

The Internet Engineering Task Force standard for Universally Unique Identifiers (UUIDs) is RFC 4122.

Available [Online]
http://tools.ietf.org/html/rfc4122.

The ISO standard for Date and Time Format is ISO 8601.

Available [Online]
http://www.iso.org/iso/home/standards/iso8601.htm.

The original open source code for the EPRI Test Harness is available at SourceForge.

Available [Online]
http://usstestharness.sourceforge.net/.

A
CONTENTS OF SUPPLEMENTAL RESOURCES FILE

A zip file of supplemental resources associated with this report is available from EPRI. The contents of this zip file (Supplemental Resources File for EPRI IEC 61968 Part 5 Test Script Report.zip) are described here. In addition, various locations in this zip file are referenced throughout this report.

Following is a description of the contents in each subfolder.

01- IEC 61968-100 Message XSD

This subdirectory contains the official Message.xsd (Message envelope) and supporting files from IEC 61968-100:2013.

02- IEC 61968-5 XSDs

This subdirectory has three sub-subdirectories containing the IEC 61968-5:CDV XSDs (profiles) as provided by the IEC TC57, WG14 Model Manager. These are expected to appear in IEC 61968-5:CDV.

The first sub-subdirectory **('Constrained' Profiles)** contains "constrained" versions of the DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches XSDs that have selected elements as mandatory; these are intended for use when the CIM verb is "create." Even these XSDs have a high percentage of optional elements to support create scenarios in which only skeleton information is known at create time, and additional details are added later (for example, using the CIM "change" verb).

The second sub-subdirectory **('Query' Profiles)** contains the DERGroupQueries, DERGroupStatusQueries, and DERGroupForecastQueries XSDs for use with the CIM verb "get." These XSDs are patterned after the "get" profiles in IEC 61968-9:2013 (although a new naming convention has been adopted, as described in Sections 1 and 3 of this report). They serve to specify the "query parameters" when requesting one or more DERGroups, DERGroupStatuses, or DERGroupForecasts. Note that these "get" XSDs appear in the Request section of an IEC 61968-100:2013 Message envelope; this is contrasted to the non-get XSDs that appear in the Payload section of the IEC 61968-100:2013 Message envelope.

The third sub-subdirectory **('Unconstrained' Profiles)** contains "unconstrained" versions of the DERGroups, DERGroupStatuses, DERGroupForecasts, and DERGroupDispatches XSDs that have most elements as optional; these require the high level of optionality to support use with "change" and "delete" CIM verbs.

03- IEC 61968-5 Strongly Typed Messages and WSDLs Generated by EPRI

This subdirectory has three sub-subdirectories containing the Strongly Typed XSDs and WSDLs that will be used in the EPRI-sponsored IEC 61968-5:CDV testing. The procedures for generating these artifacts are discussed in Section 3 of this report and in Annex (Appendix) C of IEC 61968-100:2013.

The first sub-subdirectory **('change or delete')** contains the actual WSDLs to be used in the EPRI-sponsored IEC 61968-5:CDV testing. Included are the following WSDLs:

- Execute DERGroups
- ExecuteDERGroupsOperationSet
- ReceiveDERGroups
- ReceiveDERGroupOperationSet
- ReceiveDERGroupStatuses

Note: Other combinations of WSDL types and IEC 61968-5:CDV domain-specific DER profiles are certainly possible; this list is restricted to those needed to support the test cases included in this report.

Execute WSDLs are used for request/reply message interactions. Receive WSDLs are used for unidirectional Event Stereotype messages. The ExecuteDERGroupsOperationSet WSDL is used to support deleting attributes or association classes from a DERGroup. The ReceiveDERGroupsOperationSet WSDL is used to support publication of a change in DERGroupStatus.

These WSDLs were created using the methodology described in Section 3 of this report and in Annex C of IEC 61968-100:2013. They were further constrained to support only the "change," "changed," and "delete" and "deleted" CIM verbs as appropriate based on the service type. The "change" and "delete" verbs are used for request/reply messages (Execute WSDLs); the "changed" and "deleted" verbs are used for unidirectional Event Stereotype messages (Receive WSDLs).

Under this first sub-subdirectory is a folder called "WSDL Templates." This contains templates used to create the actual WSDLs using instructions contained in Section 3 of this report and supplemented by the information contained in Annex C of IEC 61968-100:2013. Where necessary, these templates have been reverse-engineered by EPRI to replace those in IEC 61968-2013 to correct previously cited deficiencies and omissions in IEC 61968-100:2013.

Also under the first sub-subdirectory is a folder called "xsd." This folder contains various files referenced by the various WSDLs at the subdirectory level. For the WSDLs to validate, the files in the "xsd" folder must be present. This folder contains three basic types of files:

- The IEC 61868-100:2013 Message.xsd and supporting files that constitute the IEC 61868-100:2013 Message envelope
- The "unconstrained" IEC 61968-5:CDV XSDs for use with "change" or "delete" verbs (see subdirectory "02- IEC 61968-5 XSDs")
- The Strongly Typed Message XSDs created using procedures contained in Section 3 of this report and Annex C of IEC 61968-100:2013. These files are as follows:
  - DERGroupsMessage.xsd
  - DERGroupsOperationSetMessage.xsd
  - DERGroupStatusesMessage.xsd

Note: Again, this list is restricted to those needed to support the test cases included in this report.

Each of these XSDs includes elements of both the IEC 61968-100:2013 and the specific IEC 61968-5:CDV Payload XSD (DERGroups and DERGroupStatuses).

Under the "xsd" folder is another folder called "XSD Templates." This contains the template used to create the actual Strongly Typed Message XSDs listed previously using instructions described in Section 3 of this report and in Annex C of IEC 61968-100:2013. Once again, where necessary, these templates have been reverse-engineered by EPRI to replace those in IEC 61968-2013 to correct previously cited deficiencies and omissions in IEC 61968-100:2013.

The second sub-subdirectory **('create')** is essentially the same as the first sub-subdirectory with the following exceptions:

- Included are the following WSDLs:
  - Execute DERGroups
  - ExecuteDERGroupDispatches
  - ReceiveDERGroups
  - ReceiveDERGroupForecasts
- The WSDLs are constrained to support only the "create" and "created" CIM verbs.
- OperationSets are not used (in the EPRI-sponsored IEC 61968-5:CDV testing) in conjunction with "create" and "created" verbs.

Note: Again, this list is restricted to those needed to support the test cases included in this report.

The third sub-subdirectory **('get')** is essentially the same as the first sub-subdirectory with the following exceptions:

- Included are the following WSDLs:
  - Query DERGroups
  - QueryDERGroupStatuses
  - QueryDERGroupForecasts
- The WSDLs are constrained to support only the "get" CIM verbs.
- OperationSets are not used (in the EPRI-sponsored IEC 61968-5:CDV testing) in conjunction with the "get" verb.

Note: Again, this list is restricted to those needed to support the test cases included in this report.

04- IEC 61968-9 XSDs

This subdirectory contains the two XSDs from IEC 61968-9:2013 (the IEC Meter Reading and Control standard) that are used to support connection and disconnection of DER Groups to/from the grid:

- EndDeviceControls
- EndDeviceEvents

The IEC 61968-9:2013 standard does not embody the concept of "constrained" and "unconstrained" profiles; however, these profiles can be considered "unconstrained."

05- IEC 61968-9 Strongly Typed Messages and WSDLs

This subdirectory contains the Strongly Typed XSDs and WSDLs derived from IEC 61968-9:2013 (the IEC Meter Reading and Control standard) that are used to support connection and disconnection of DER Groups to/from the grid. These will be used in the EPRI-sponsored IEC 61968-5:CDV testing. The procedures for generating these artifacts are discussed in Section 3 of this report and in Annex C of IEC 61968-100:2013.

The first (and only) sub-subdirectory **('create')** contains the actual WSDLs to be used in the EPRI-sponsored IEC 61968-5:CDV testing. Included are the following WSDLs:

- Execute EndDeviceControls
- ReceiveEndDeviceEvents

Note: Other combinations of WSDL types and IEC 61968-9:2013 domain-specific profiles are certainly possible; the above list is restricted to those needed to support the test cases included in this report.

Execute WSDLs are used for request/reply message interactions. Receive WSDLs are used for unidirectional Event Stereotype messages.

These WSDLs were created using the methodology described in Section 3 of this report and in Annex C of IEC 61968-100:2013. They were further constrained to support only the "create" and "created" CIM verbs as required for the test cases in this report.

Under this first sub-subdirectory is a folder called "WSDL Templates." This contains templates used to create the actual WSDLs using instructions contained in Section 3 of this report and supplemented by the information contained in Annex C of IEC 61968-100:2013. Where necessary, these templates have been reverse-engineered by EPRI to replace those in IEC 61968-2013 to correct previously cited deficiencies and omissions in IEC 61968-100:2013.

Also under the first sub-subdirectory is a folder called "xsd." This folder contains the files referenced by the various WSDLs at the subdirectory level. For the WSDLs to validate, the files in the "xsd" folder must be present. This folder contains three basic types of files:

- The IEC 61868-100:2013 Message.xsd and supporting files that constitute the IEC 61868-100:2013 Message envelope
- The IEC 61968-9:2013 XSDs (see subdirectory "04- IEC 61968-9 XSDs")

- The Strongly Typed Message XSDs created using procedures contained in Section 3 of this report and in Annex C of IEC 61968-100:2013. These files are:
  - EndDeviceControlsMessage.xsd
  - EndDeviceEventsMessage.xsd

  Note: Again, this list is restricted to those needed to support the test cases included in this report.

Each of these XSDs includes elements of both the IEC 61968-100:2013 and the specific IEC 61968-9:2013 Payload XSD (EndDeviceControls and EndDeviceEvents).

Under the "xsd" folder is another folder called "XSD Templates." This contains the template used to create the actual Strongly Typed Message XSDs listed previously using instructions described in Section 3 of this report and in Annex C of IEC 61968-100:2013. Once again, where necessary, these templates have been reverse-engineered by EPRI to replace those in IEC 61968-2013 to correct previously cited deficiencies and omissions in IEC 61968-100:2013.

06- Sample XML

This subdirectory contains Sample XML, including exact copies of the XML included in each test case in Sections 9–13 of this report.

There are three sub-subdirectories: one for CIM verb "create" (using the "constrained" version of the corresponding IEC 61968-5:CDV profile), one for the CIM verbs "change" and "delete" (using the "unconstrained" version of the corresponding IEC 61968-5:CDV profile), and one for the CIM verb "get." Included in each of these subdirectories are the appropriate versions of the XSDs used for creation and required for XSD validation of the Sample XML.

Note: The "create" subdirectory also contains the Sample XML for the Section 13 DER connect/disconnect test cases that use the EndDeviceControls and EndDeviceEvents profiles from IEC 61968-9:2013.

B
IEC 61968-100:2013 MESSAGE PROFILE (MESSAGE.XSD)

IEC 61968-100:2013 provides a normative Message.xsd that serves as an application-level Message envelope for sending and receiving the content of profiles associated with IEC 61968-5:CDV as well as other IEC 61968-series standards.

The content of this report and all specific examples within are based on the normative IEC 61968-100:2013 message.xsd with no changes.

This appendix discusses and illustrates key considerations concerning the use of Message.xsd. As shown in Figure B-1, IEC 61968-100 CIM-compliant messages have a specified message structure, with separate packages consisting of the following:

- Header for message control information
- Request for inclusion of request-specific parameters
- Reply for inclusion of response codes and any encountered error conditions
- Payload for conveying message data

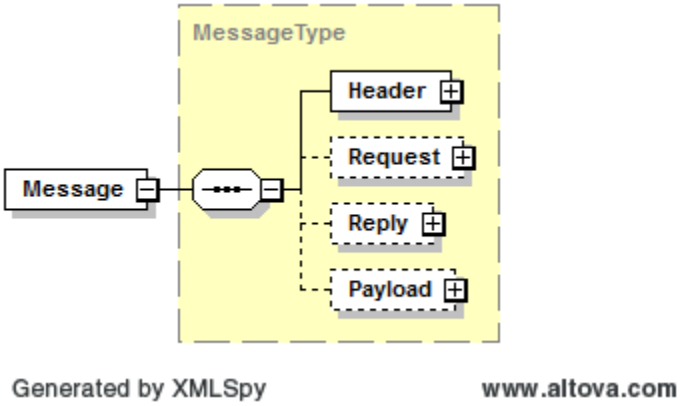


Figure B-1
CIM-compliant message format

The CIM Header includes a CIM verb and a CIM noun. The message Payloads are conveyed using predefined message structures (XSDs) referred to as *profiles*, with the name of the profile also serving as the CIM noun.

As an example of verb and noun usage, consider that an unsolicited (that is, a notification as opposed to a request/response integration pattern) DER Group creation could be conveyed from one system to another using a “created DERGroups” message, with the CIM verb being “created” and the CIM noun (Payload) being “DERGroups.” It would also be said that this transaction used the DERGroups profile.

There are approximately 14 commonly used verbs defined in the IEC 61968-100 standard. All verbs are specified as lower case. The subset of the IEC 61868-100:2013 verbs used in this

report, along with their IEC definitions, is as follows. Note that the IEC definitions may appear intimidating; the test cases in this report will help clarify the usage of these verbs

Verb	Meaning
create	The ‘create’ verb is used to publish a request to the master system to create a new object. The master system may in turn publish the new object as an event using the verb ‘created.’ The master system may also use the verb ‘reply’ to respond to the ‘create’ request, indicating whether the request has been processed successfully.
created	The ‘created’ verb is used to publish an event that is a notification of the creation of an object as a result of either an external request or an internal action within the master system of that object. This message type is usually subscribed to by interested systems and could be used for mass updates. There is no need to reply to this message type.
change	The ‘change’ verb is used to publish a request to the master system to make a change to an object based on the information in the message. The master system may in turn publish the changed object as an event using the verb ‘changed’ to notify that the object has been changed since last published. The master system may also use the verb ‘reply’ to respond to the ‘change’ request, indicating whether the request has been processed successfully.
changed	The ‘changed’ verb is used to publish an event that is a notification of the change of an object as a result of either an external request or an internal action within the master system of that object. This could be a generic change in the content of the object or a specific status change such as “approved,” “issued,” and so on. This message type is usually subscribed to by interested systems and could be used for mass updates. There is no need to reply to this message type.
delete	The ‘delete’ verb is used to publish a request to the master system to delete one or more objects. The master system may in turn publish the deleted object as an event using the verb ‘deleted’ to notify that the object has been deleted since last published. The master system may also use the verb ‘reply’ to respond to the ‘delete’ request, indicating whether the request has been processed successfully. The ‘delete’ verb is used when the business object should no longer be kept in the integrated systems because of either error(s) or archiving needs. However, the master system will most likely retain a historical record of the object after deletion.
deleted	The ‘deleted’ verb is used to publish an event that is a notification of the deletion of an object as a result of either an external request or an internal action within the master system of that object. This message type is usually subscribed to by interested systems and could be used for mass updates. There is no need to reply to this message type.
execute	The ‘execute’ verb is used when the message is conveying a complex transaction that involves a variety of create, delete, and/or change operations through the use of the Payload.OperationSet element.
executed	The ‘executed’ verb is used to publish an event that indicates the execution of a complex transaction that uses the Payload.OperationSet element.
get	The ‘get’ verb is used to issue a query request to the master system to return a set of zero or more objects that meet specified criteria. The master system may in turn return zero or more objects using the ‘reply’ verb in a response message.
reply	There are two primary usages of the ‘reply’ verb; in both cases, it is used only in response to request messages—whether the pattern used is synchronous or asynchronous. The first usage is to indicate the success, partial success, or failure of a transactional request to the master system to create, change, delete, cancel, or close a document. The second usage is in response to a ‘get’ request, where objects of interest may be returned in the response.

There are four message stereotypes defined in IEC 61968-100:

Message Stereotype	Description
RequestMessage	Sent from a client system to a server system to request a service from the server system.
ResponseMessage	Sent from a server system to a client system to respond to a request for a service.
EventMessage	Broadcast from a system to inform other systems in an unsolicited fashion of the occurrence of an event or the publication of data.
FaultMessage	Sent from a server system to a client system to inform the client that its prior request for a service resulted in a high-level fault condition. The FaultMessage is intended to be used as a response of last resort, typically informing a client system that a request was received but was corrupted in such a fashion that not even message-level structures were parseable. For this reason, the Header and Payload are deliberately removed from this message stereotype.

The definitions of the stereotypes are illustrated in Figures B-2 through B-5. Required elements are shown with solid borders; optional elements (where the presence or absence depends on the business intent of the message) are shown with dashed borders.

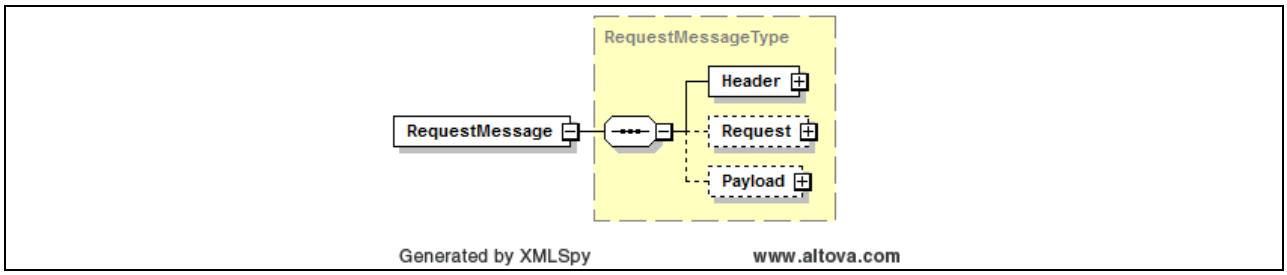


Figure B-2
RequestMessage stereotype

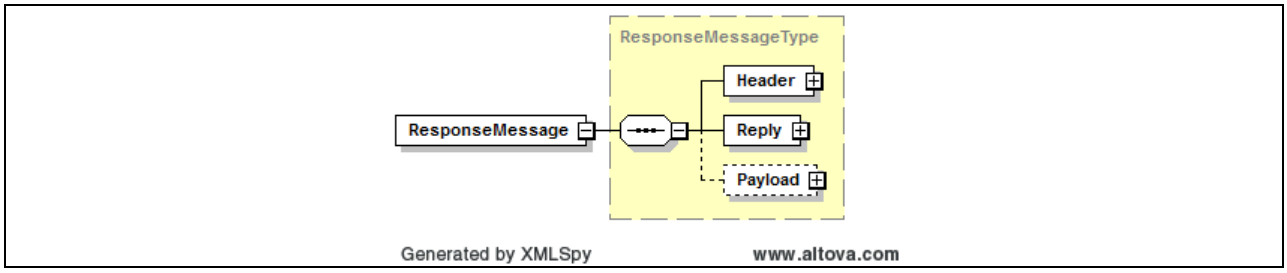


Figure B-3
ResponseMessage stereotype

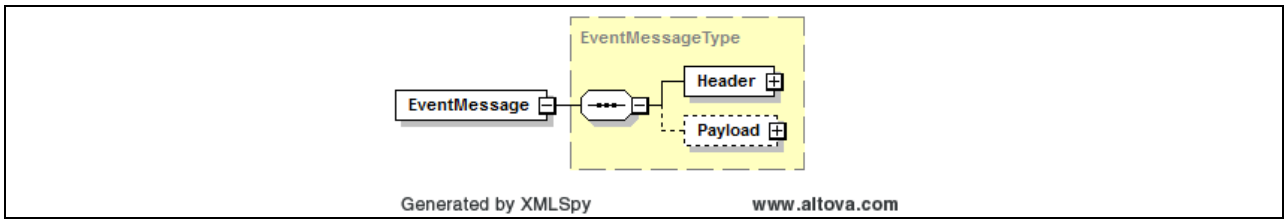


Figure B-4
EventMessage stereotype



Figure B-5
FaultMessage stereotype

As noted, messages are composed of four main components, as follows:

Message Component	Description
Header (HeaderType)	The Header is common to all message stereotypes except the Fault Stereotype Message. It is used to convey message-level control information. The verb and noun are the only elements prescribed as mandatory by the XML schema definition; however, other elements are also procedurally prescribed as mandatory by this interface specification.
Request (RequestType)	The Request structure can be used in a Request Stereotype Message to provide filtering criteria or other request-oriented parameters. The XML:any element in the RequestType is intended to provide a loosely coupled way to include structured request parameters that are specific to the noun found in the Header. The QueryDERGroups, QueryDERGroupStatuses, and QueryDERGroupForecasts XSDs are specific examples of the structures that can be contained in this XML:any element.
Reply (ReplyType)	The Reply structure is used in Response Stereotype Messages and Fault Stereotype Messages to provide reply-oriented feedback to the requestor. Typical use of the Reply structure in a Response Stereotype Message is to inform the requestor of any error conditions (or lack thereof) encountered in the processing of the request. Typical use of the Reply structure in a FaultStereotype Message is to communicate to the requestor any higher level error conditions encountered that prevented the processing of the request.

Message Component	Description
Payload (PayloadType)	The Payload structure is common to Request Stereotype Messages, Response Stereotype Messages, and Event Stereotype Messages. It is used to encapsulate the details of the requests, responses, or events being communicated. The Payload element is loosely typed as an XML any: type, so that any number of formats and structures can be contained. There are provisions in the PayloadType for compressing the Payload structure if message size limitations are a concern. In addition, the definition provides the ability to specify the format of the Payload if non-XML formats are desired.

The definitions of each of the complex types are illustrated in Figures B-6 through B-9. Figure B-10 illustrates the structure of the OperationSet construct within a Payload. OperationSets are discussed in Section 2 and in Appendix C.

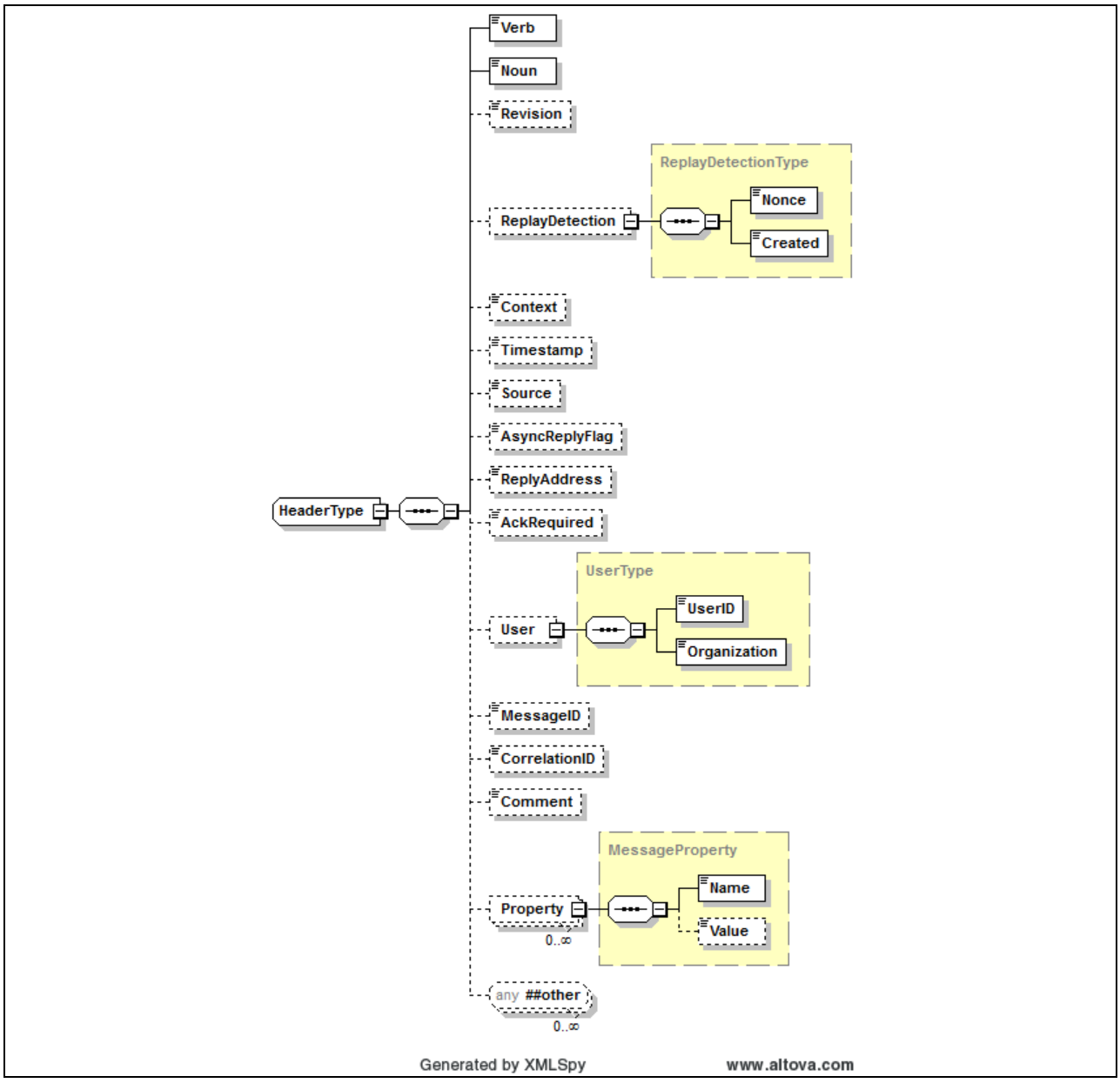


Figure B-6
Structure of HeaderType

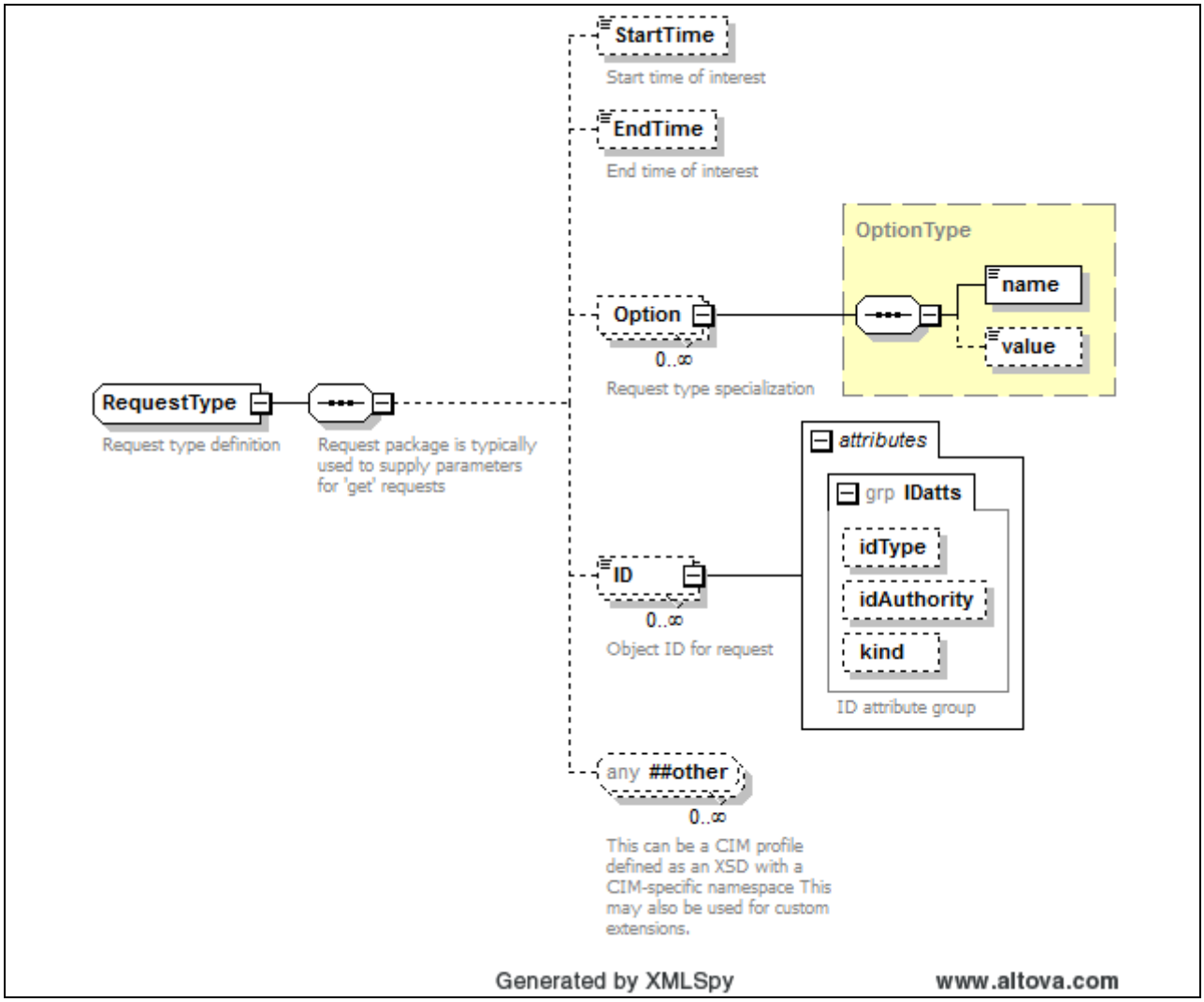


Figure B-7
Structure of RequestType

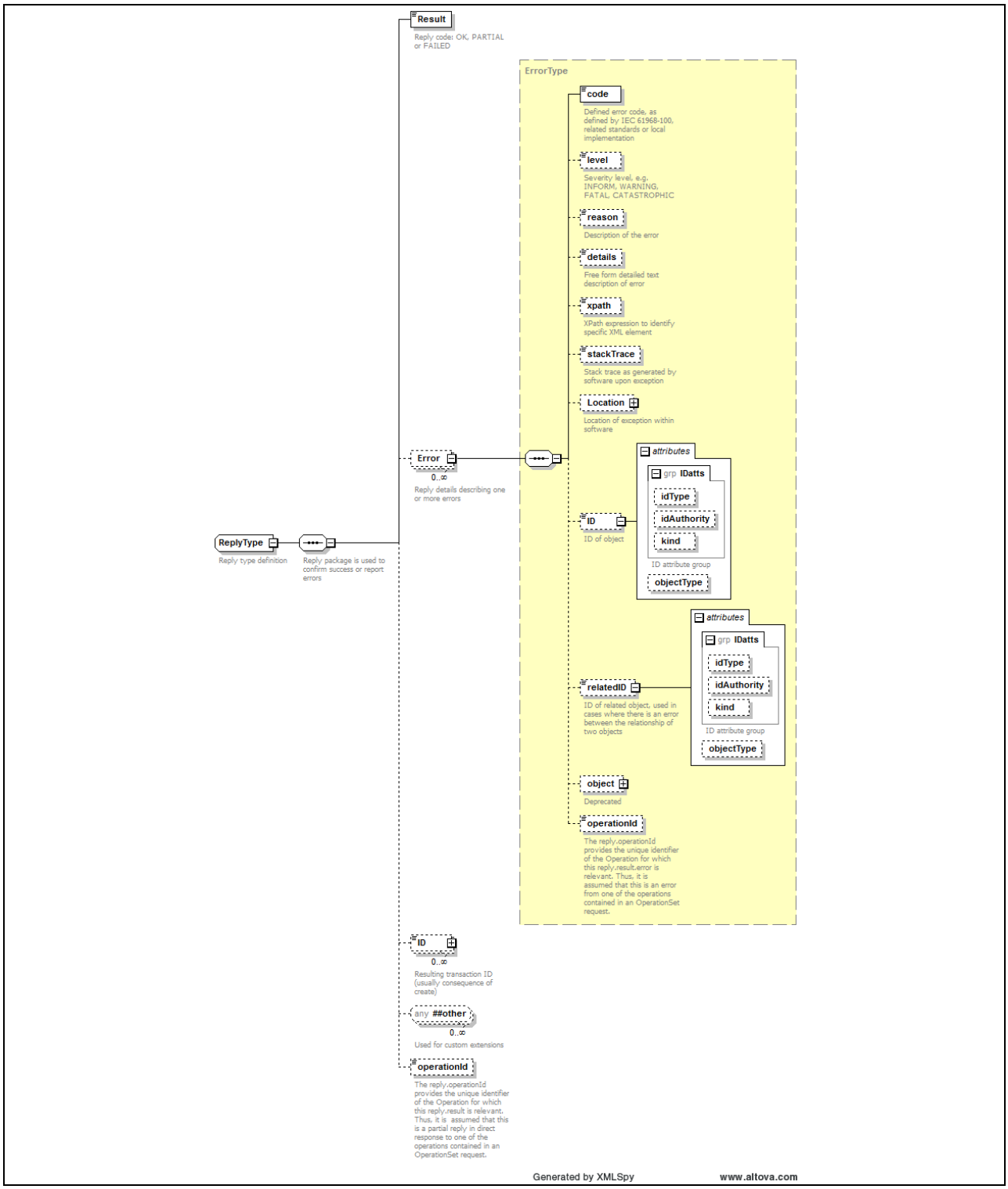


Figure B-8
Structure of ReplyType

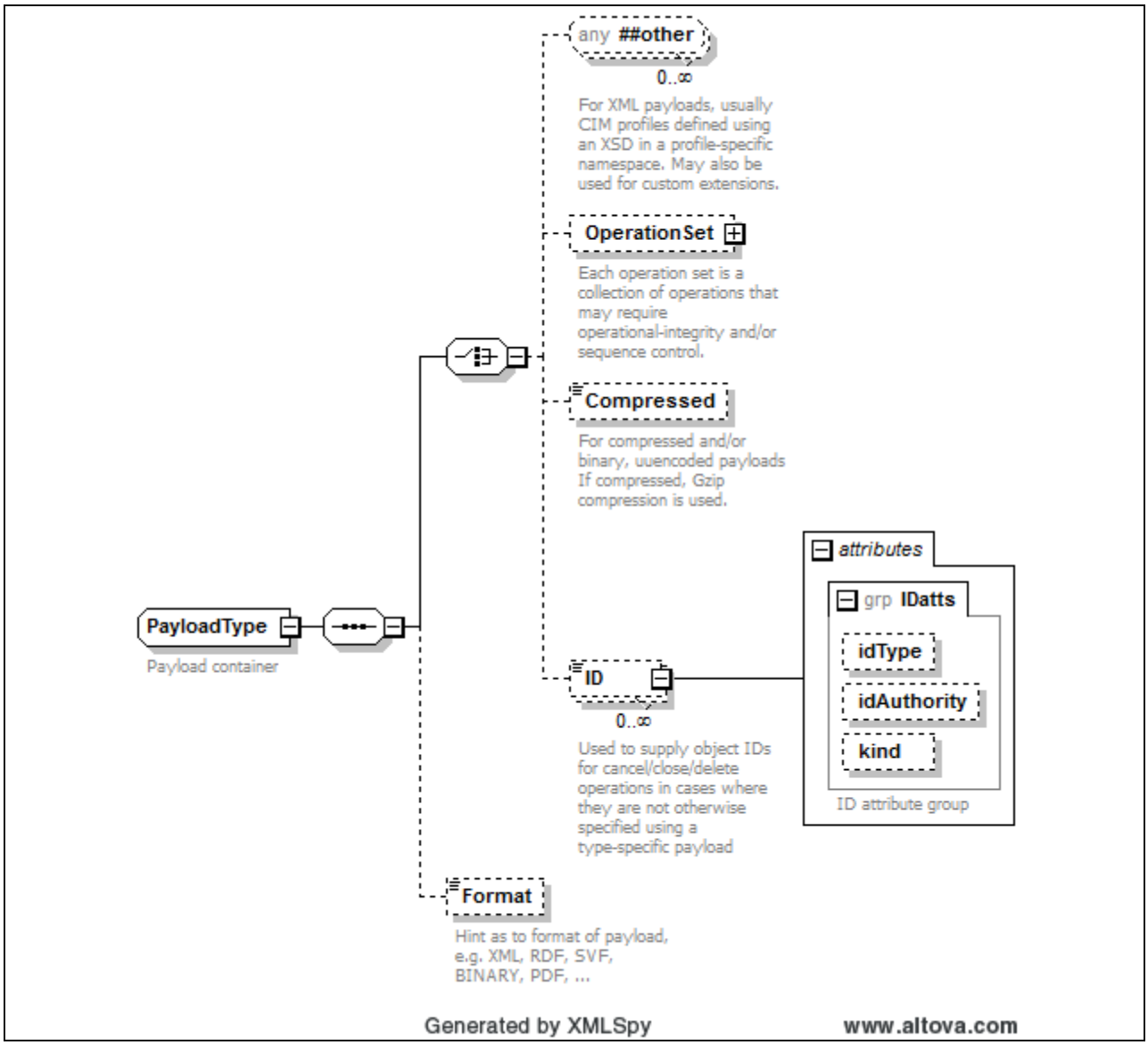


Figure B-9
Structure of PayloadType

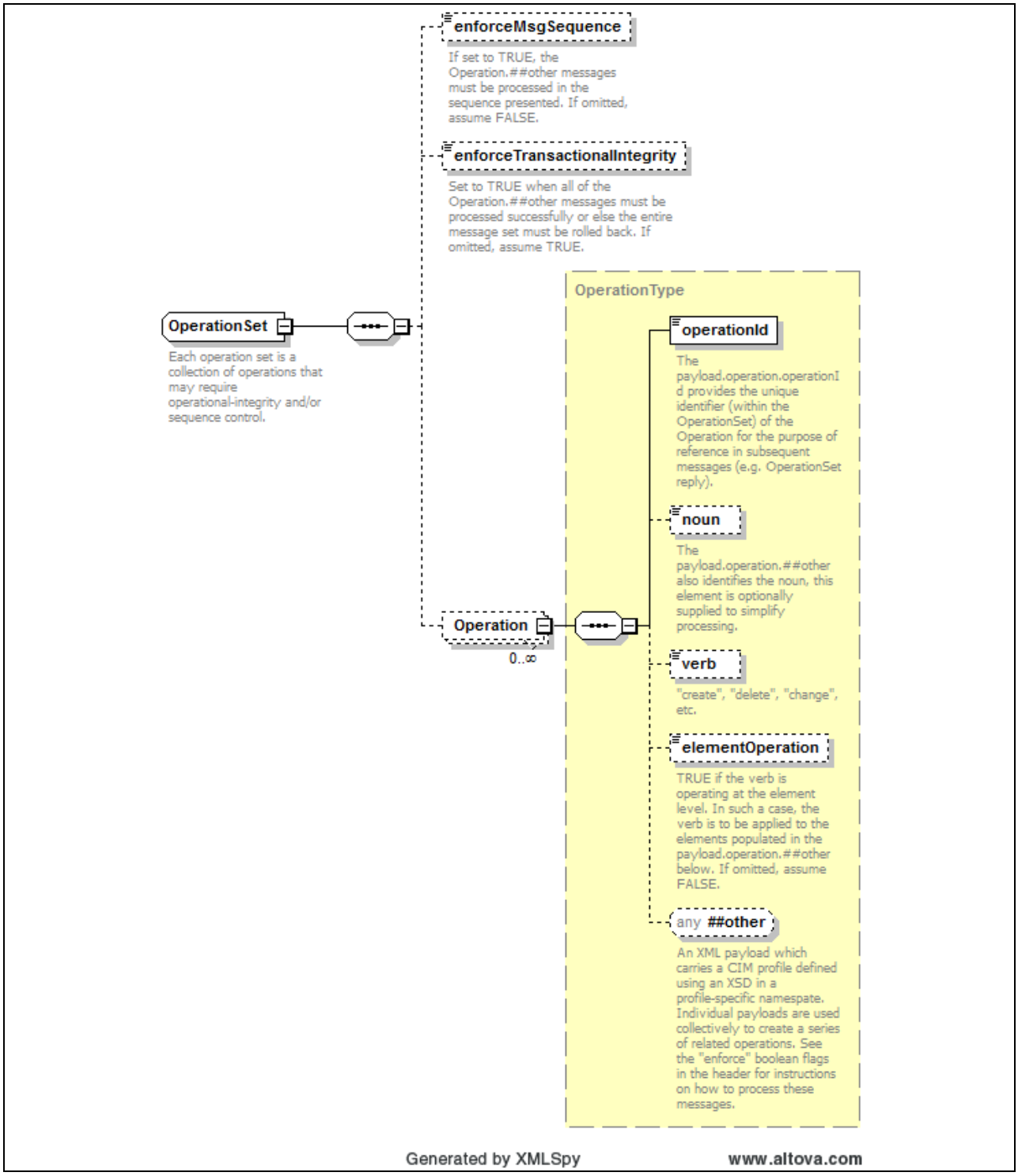


Figure B-10
Structure of OperationSet

The content of Message.xsd, taken directly from IEC 61968-100, can be found in the Supplemental Resources File at {01- IEC 61968-100 Message XSD}.

For information on the use of OperationSets to support the deletion of elements from a CIM object (for example, DERGroup), refer to Appendix C.

C
USE OF OPERATION SETS TO SUPPORT DELETION OF ATTRIBUTES AND ASSOCIATION CLASSES FROM CIM OBJECTS

The following is derived from information in IEC 61968-100:2013 and IEC 61968-9:2013. In those documents, there are two defined purposes for OperationSets. One involves the ability to perform a sequence of operations in a specified order and optionally preserve transactional integrity across the set of operations. The second usage is to support deletion of attributes and association classes (generically elements in the XSD/XML) from instances of CIM objects (such as a DERGroup). The first usage is not germane to this report and is not described here. The second is used in several test cases within this report (for example, DERG-3).

With the publication of the First Edition of IEC 61968-100:2013, the Message.xsd Message envelope has been extended in both the Reply and Payload sections of the message to support the use of OperationSets. See Figures B-8 through B-10 for a depiction of the OperationSet and supporting constructs in Message.xsd.

A message using the OperationSet construct always has a CIM Header verb of either “execute” or “executed” and a noun of “OperationSet.” An OperationSet in turn contains one or more Operations; each Operation has an OperationID that supplements the overall message CorrelationID to provide a fine-grained ability to correlate the contents of one or more reply messages with the individual Operations in an OperationSet. Individual Operations within an OperationSet have OperationSet-level verbs and nouns. When used to support the deletion of attributes or association classes (as done in selected use cases in this report), the verb within an Operation will be either “delete” or “deleted.” The use of other verbs in the Operation(s) of an OperationSet is supported but is not germane to this report.

Each Operation in an OperationSet also includes an elementOperation Boolean. This Boolean is to be set to true when the Operation verb is “delete” or “deleted,” and the intent is to delete or reflect the deletion of individual attributes or individual instances of associated CIM classes from the object specified by the Operation noun. This is as opposed to deleting the entire CIM object specified by the Operation noun. If omitted, elementOperation is assumed to be false; therefore, it is imperative to set it to true for the test cases when the intent is to delete attributes and/or association classes. It is emphasized that in this case, use of the Operation verb “delete” in combination with an elementOperation Boolean set to true effectively **modifies** (and does not delete) the CIM object specified by the Operation noun.

Note 1: When modifying the configuration of a CIM object using the verbs “change,” “changed,” “delete,” or “deleted,” only the ID of the object being changed and the information that is being changed or deleted are to be included. (This is true regardless of whether an OperationSet is being used.) For this reason, almost all elements within the unconstrained IEC 61968-5:CDV XSDs (that is, those used change or delete use cases) are optional in the profiles.

Note 2: When deleting an attribute from a CIM object using an Operation in which the elementOperation Boolean is true and the Operation verb is “delete” or “deleted,” it is necessary to supply a value for the attribute that will pass XML schema validation. In these instances, the actual value supplied is ignored; therefore, it may be any value that is of the proper data type to pass validation.

D
EPRI-GENERATED MESSAGE PROFILES AND TEMPLATES FOR USE IN CREATING STRONGLY TYPED WEB SERVICES

The EPRI-generated Message XSDs and XSD Templates used to support the testing associated with this report can be found in the Supplemental Resources File at the following locations:

Strongly Typed Message XSDs and Supporting Files Referenced by Message XSDs

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd}

{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd}

XSD Templates

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\xsd\XSD Templates}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\xsd\XSD Templates}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\xsd\XSD Templates}

{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\xsd\XSD Templates}

E

EPRI-GENERATED WSDLS AND WSDL TEMPLATES FOR USE IN CREATING STRONGLY TYPED WEB SERVICES

The EPRI-generated Message WSDLs and WSDL Templates used to support the testing associated with this report can be found in the Supplemental Resources File at the following locations:

WSDLs

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'}

{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'}

To generate the WSDLs, the corresponding Message XSDs and Part 5 XSDs must be located in the corresponding “xsd” subdirectory directly under each of these locations.

WSDL Templates

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'change or delete'\WSDL Templates}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'create'\WSDL Templates}

{03- IEC 61968-5 Strongly Typed Messages and WSDLs\'get'\WSDL Templates}

{05- IEC 61968-9 Strongly Typed Messages and WSDLs\'create'\WSDL Templates}

F

IEC 61968-100:2013 REPLY CODES TO BE USED FOR TESTING

The Reply.Error.codes that follow are either taken from or patterned after the content in Annex (Appendix) B of the IEC 61968-9:2013 International Standard. The specific Reply.Error.codes used in a given implementation will vary and are a function of the specific Enterprise Systems and the supported business functionality. In the following table, code 99.1 is fictitious and made up solely for this report: no DER-specific Reply.Error.code values have yet been documented by the IEC.

Reply.Error.code	Description
0.0	Success/no errors
6.1	Request cancelled per business rule
99.1	DERGroup does not exist

Response messages also have a single Reply.Result value. This is to be populated with “OK” (in the case of an Error.code having a first-position value of zero) or “FAILED” (in the case of an Error.code having a first-position value that is non-zero).

G

IEC 61968-9:2013 END DEVICE CONTROL CODES FOR DER CONNECT/DISCONNECT

The EndDeviceControlType codes for connecting or disconnecting DER devices to/from the grid are specified in Annex (Appendix) F of the IEC 61968-9:2013 International Standard and are as follows:

EndDeviceControlType	Description	Derivation by Position
2.31.0.18	Connect	2 = DERDevice 31 = RCDSwitch 0 = N/A 18 = Connect
2.31.0.23	Disconnect	2 = DERDevice 31 = RCDSwitch 0 = N/A 23 = Disconnect

H

IEC 61968-9:2013 END DEVICE EVENT CODES FOR DER CONNECT/DISCONNECT

The EndDeviceEventType codes for signaling that a DER Device has connected or disconnected or failed to connect or disconnect to/from the grid are specified in Annex (Appendix) E of the IEC 61968-9:2013 International Standard and are as follows:

EndDeviceEventType	Description	Derivation by Position
2.31.0.42	Connected	2 = DERDevice 31 = RCDSwitch 0 = N/A 42 = Connected
2.31.0.68	Disconnected	2 = DERDevice 31 = RCDSwitch 0 = N/A 23 = Disconnected
2.31.0.67	ConnectFailed	2 = DERDevice 31 = RCDSwitch 0 = N/A 67 = Connected
2.31.0.84	DisconnectFailed	2 = DERDevice 31 = RCDSwitch 0 = N/A 84 = Disconnected

I
SUMMARY OF TEST CASES (PICS LIST)

Tables I-1 through I-7 provide summary listings of all the test cases described in this report. They are grouped according to the general functionality of the various tests.

These tables also serve as Protocol Implementation Conformance Statements (PICS lists). Vendors should indicate in which tests they intend to participate and whether their system will be tested in the capacity of the Client, the Server, or both roles (one role at a time).

Table I-1
Summary of test cases for DER Group instantiations

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERG-1a	9-1	**Client requests creation of a DER Group and Server replies (Success - Single DER Group)** This test scenario emulates the creation of a single device group, DG1, with three EndDevice members.		
DERG-1b	9-5	**Client requests creation of a DER Group and the Server replies (Failure - Single DER Group)** This test scenario is similar to DERG-1a; however, this test fails because of duplicate IDs (mRIDs and Names) as DERG-1a.		
DERG-1c	9-8	**Client requests creation of two DER Group Dispatches and Server replies (Success - Two DER Groups in a single message)** In this test scenario, the client requests two DER Groups to be instantiated: DG2 and DG4.		
DERG-1d	9-12	**Client requests creation of two DER Groups and Server replies (Two DER Groups in a single message - One succeeds and one fails)** This test scenario is similar to DERG1-c, except that this time the server sends a message stating that creation of the second DER Group (DG5) has failed because of a business rule.		
DERG-1e	9-16	**Client requests creation of a DER Group and Server replies (Success - Single DER Group; Responder supplies mRID)** This test scenario emulates the creation of a single DER Group by specifying a valid Names identifier for the DERGroup.		
DERG-6	9-46	**Server informs Client of the creation of two DER Groups (Two DER Groups in a single message)** This test case scenario emulates a server system that autonomously reports to the client about the creation of two DER Groups: DG7 and DG8.		

Table I-2
Summary of test cases for DER Group modification/deletion

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERG-2a	9-20	**Client requests modification of an existing DER Group and Server replies (Success - Change supported DER Functions to include voltage regulation)** This test scenario has the client request the server to modify an existing DER Group (DG1) by changing the list of supported DER Functions to include voltage regulation.		
DERG-2b	9-23	**Client requests modification of an existing DER Group and Server replies (Success - Add an additional DER)** This test scenario has the client request the server to modify an existing DER Group (DG2, referenced by its mRID) by adding an additional DER Member to the DER Group.		
DERG-3	9-26	**Client requests modification of an existing DER Group and Server replies (Success - Delete a DER)** This test scenario has the client request the server to modify DG3 by deleting one of its existing DER Groups.		
DERG-4	9-30	**Client requests deletion of an existing DER Group and Server replies (Success)** This test scenario has the client request the server to delete an existing DER Group (DG1) entirely.		
DERG-7	9-49	**Server informs Client of modification of an existing DER Group (Change list of supported DER Functions to include ramp rate control)** This test scenario has the server inform the client that Ramp Rate Control has been added to the list of DER Functions supported by DER Group DG7.		
DERG-8	9-52	**Server informs Client of modification of an existing DER Group (Deletion of a member)** This test scenario has the server inform the client of the deletion of an EndDevice from DER Group DG8, created in Test Case DERG-6.		
DERG-9	9-54	**Server informs Client of the deletion of an existing DER Group** This test scenario has the server asynchronously inform the client of the deletion of an existing DER Group DG7, which was created by Test Case DERG-6.		

Table I-3
Summary of test cases for DER Group retrieval

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERG-5a	9-32	**Client requests retrieval of an existing DER Group and Server replies (Success)** This test scenario has the client request the server to provide the details of a single DER Group identified by its Names.names identifier (DG2).		
DERG-5b	9-36	**Client requests retrieval of two DER Groups and Server replies (Success - Two DER Groups in a single message)** This test scenario has the client request the server to provide the details of two DER Groups (DG2 and DG4).		
DERG-5c	9-41	**Client requests retrieval of all DER Groups and Server replies (Success - All DER Groups in a single message)** This test scenario has the client request the server to provide the details of all DER Groups by submitting an empty Payload.		

Table I-4
Summary of test cases for DER Group status retrieval

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERGS-1a	10-1	**Client requests status of a DER Group and Server replies (Success - Single DER Group)** This test scenario has the client request the server to provide the status of a single DER Group as identified by its Names.name identifier DG2.		
DERGS-1b	10-4	**Client requests status of a DER Group and Server replies (Failure - Single DER Group)** This test scenario has the client request the server to provide the status of a single DER Group as identified by its Names.name identifier DG1 (fails because DG1 no longer exists).		
DERGS-1c	10-8	**Client requests status of two DER Groups and Server replies (Success - Two DER Groups in a single message)** This test scenario has the client request the server to provide the status of two DER Groups as identified by their Names.name identifiers of DG3 and DG4, respectively.		
DERGS-1d	10-11	**Client requests status of two DER Groups and Server replies (Two DER Groups in a single message – One succeeds and one fails)** This test scenario has the client request the server to provide the status of two DER Groups as identified by their Names.name identifiers DG6 and DG7, respectively (partially fails because of deletion of DG7 in Test Case DERG-9).		
DERGS-2	10-15	**Server informs Client of a change in DER Group Status (Change in current active, apparent, and reactive power)** This test scenario has the server inform the client that the status of DER Group DG8 has changed, and the server provides the new values for the current active, reactive, and apparent power.		

Table I-5
Summary of test cases for DER Group forecast retrieval

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERGF-1a	11-1	**Client requests forecast for a DER Group and Server replies (Success - Single DER Group)** This test scenario has the client request the server to provide a forecast for a single DER Group. This DER Group has an mRID of 228650bf-7f77-44fa-9576-db4bbce8a07f and a Names.name identifier of DG2. It was created in Test Case DERG-1c and modified in Test Case DERG-2b.		
DERGF-1b	11-6	**Client requests forecast for a DER Group and Server replies (Failure - Single DER Group)** This test scenario has the client request the server to provide a forecast for a single DER Group as identified by its Names.name identifier DG1. This DER Group was deleted in Test Case DERG-4, resulting in failure.		
DERGF-1c	11-9	**Client requests forecasts for two DER Groups and Server replies (Success - Two DER Groups in a single message)** This test scenario has the client request the server to provide forecasts for two DER Groups as identified by their Names.name identifiers DG3 and DG4, respectively. DG3 was created in DERG-1c, and DG4 was created in DERG1-d.		
DERGF-1d	11-16	**Client requests forecasts for two DER Groups and Server replies (Two DER Groups in a single message - One succeeds and one fails)** This test scenario has the client request the server to provide forecasts for two DER Groups as identified by their Names.name identifiers DG6 and DG7, respectively. DG6 was created in Test Case DERG-1e, and DG7 was created in DERG-6 but subsequently deleted in DERG-9.		
DERGF-2	11-20	**Server informs Client of creation of a DER Group Forecast** This test scenario has the server inform the client that a forecast for DER Group DG8 has been created, and the Server provides the new forecast.		

Table I-6
Summary of test cases for DER Group dispatch instantiations

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERGD-1a	12-1	**Client requests creation of a DER Group Dispatch and Server replies (Success - Single DER Group)** This test scenario has the client request the server to create a single DER Group Dispatch for the DER Group having a Names.name identifier of DG2. DG2 was created in Test Case DERG-1c and modified in Test Case DERG-2b.		
DERGD-1b	12-4	**Client requests creation of a DER Group Dispatch and Server replies (Failure - Single DER Group)** This test scenario has the client request the server to create a single DER Group Dispatch for DER Group DG1. DER Group DG1 was created in Test Case DERG-1a but was deleted in Test Case DERG-4.		
DERGD-1c	12-8	**Client requests creation of two DER Group Dispatches and Server replies (Success - Two DER Groups in a single message)** This test scenario has the client request the server to create two DER Group Dispatches: one for DER Group DG3 and one for DER Group DG4. DG3 was created in Test Case DERG-1c, and DG4 was created in Test Case DERG-1d.		
DERGD-1d	12-12	**Client requests creation of two DER Group Dispatches and Server replies (Two DER Groups in a single message - One succeeds and one fails)** This test scenario has the client request the server to create two DER Group Dispatches: one for DG6 and one for DG7. DG6 was created in Test Case DERG-1e. DG7 was created in Test Case DERG07 but was subsequently deleted in Test Case DERG-9.		
DERGD-1e	12-16	**Client requests creation of a DER Group Dispatch and Server replies (Success - Single DER Group; Responder supplies mRID)** This test scenario has the client request the server to create a single DER Group Dispatch for DER Group DG8. DG8 was created in Test Case DERG-6 and modified in Test Case DERG-8.		

Table I-7
Summary of test cases for DER Group connect/disconnect instantiations

Test Case	Page	Description	Vendor System as Client	Vendor System as Server
DERGCD-1a	13-1	**Client requests disconnect of a DER Group and Server replies (Full success - Single DER Group)** This test scenario has the client use an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG2 to the grid. DG2 was created in Test Case DERG-1c and modified in Test Case DERG-2b.		
DERGCD-1b	13-7	**Client requests connection of a DER Group and Server replies (Failure - Single DER Group; Request rejected)** This test scenario has the client use an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG1 to the grid. DER Group DG1 was created in Test Case DERG-1a and modified in Test Case DERG-2a; however, it was subsequently deleted in Test Case DERG-4.		
DERGCD-1c	13-11	**Client requests connection of a DER Group and Server replies (Partial failure - Single DER Group; One DER Device fails to connect)** This test scenario has the client use an EndDeviceControls message to request the Server to connect the DER Group with a Names.name identifier of DG4 to the grid. DER Group DG2 was created in Test Case DERG-1d. DG4 has two DER Devices.		
DERGCD-1d	13-16	**Client requests disconnection of two DER Groups and Server replies (Full Success - Two DER Groups in a single message)** This test scenario has the client use an EndDeviceControls message to request the Server to disconnect the DER Groups with Names.name identifiers DG2 and DG6 from the grid. DG2 was created in Test Case DERG-1c, and DG6 was created in Test Case DERG-1e.		

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Electric Power Research Institute
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com