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Entwurf

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**Integration von Anwendungen in Anlagen der Elektrizitätsversorgung –
Systemschnittstellen für Netzführung –
Teil 3: Schnittstelle für Netzbetriebsarten
(IEC 57/2242/CDV:2020);
Englische Fassung prEN IEC 61968-3:2020**

Application integration at electric utilities –
System interfaces for distribution management –
Part 3: Interface for network operations
(IEC 57/2242/CDV:2020);
English version prEN IEC 61968-3:2020

Intégration d'applications pour les services électriques –
Interfaces système pour la gestion de la distribution –
Partie 3: Interface pour l'exploitation du réseau
(IEC 57/2242/CDV:2020);
Version anglaise prEN IEC 61968-3:2020

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2021-03-19 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses Entwurfs besonders zu vereinbaren.

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Gesamtumfang 401 Seiten

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Nationales Vorwort

Die Englische Fassung des europäischen Dokuments prEN IEC 61968-3:2020-08 "Integration von Anwendungen in Anlagen der Elektrizitätsversorgung – Systemschnittstellen für Netzführung – Teil 3: Schnittstelle für Netzbetriebsarten" (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 57/2242/CDV:2020-08 "Application integration at electric utilities – System interfaces for distribution management – Part 3: Interface for network operations" unverändert in den Entwurf prEN IEC 61968-3:2020-08 übernommen worden.

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Änderungen

Gegenüber DIN EN IEC 61968-3:2019-08 wurden folgende Änderungen vorgenommen:

- a) Umfassende Überarbeitung der Profile im Zusammenhang mit Switch Order und Ausfällen;
- b) detailliertere Dokumentation der Profile als Ergebnis der Analyse von End-to-End-Anwendungsfällen;
- c) Trennung von Mess- und Kontrollprofilen in zwei Profile: PSRMeasurement und PSRControls;
- d) das Profils Temporäre Netzveränderung durch das Profil SwitchingEvents ersetzt;

- e) das Profil MeasurementAction, ControlAction, GenericAction und VerificationAction zum Profil SwitchingPlans hinzugefügt. Beispiele hinzugefügt;
- f) das Profil SwitchingActions hinzugefügt, um die Koordination der SwitchingPlan-Ausführung zwischen Kontrollraum und Außendienstmitarbeitern zu unterstützen;
- g) die Profile ClampAction zum SwitchingPlan-, SwitchingAction- und SwitchingEvent-Profil hinzugefügt, um das Platzieren und Entfernen von Klammern (Clamps) unabhängig von Jumpers zu ermöglichen;
- h) Trennen des OutagesAndFaults-Profiles in; UnplannedOutages, PlannedOutages, EquipmentFaults, LineFaults;
- i) fügte dem Profil UnplannedOutages eine Liste von aktivierten und nicht aktivierten UsagePoints hinzu;
- j) das Profil PlannedOutages hinzugefügt;
- k) das Profil PlannedOutageNotifications (Geplante Ausfallmeldungen) hinzugefügt;
- l) das Profil SwitchingPlanRequest hinzugefügt, um das Profil OutageSchedules zu ersetzen;
- m) das TroubleOrders-Profil erweitert, um UnplannedOutages und TroubleTickets aufzunehmen und um es Crews zu ermöglichen, für einzelne Aufgaben innerhalb des TroubleOrders eingeplant zu werden;
- n) erweiterte Anwendungsfälle und Sequenzdiagramme;
- o) Sequenzdiagramme, die aktualisiert wurden, um 61968-100 Nachrichtenmuster zu verwenden;
- p) Anwendungsfälle in der IEC 62559-2-Vorlage für Anwendungsfälle;
- q) Beispiel-XML für Profile hinzugefügt;
- r) xsd im Anhang durch Tabellen ersetzt, um die Profile in einer von der Serialisierung unabhängigen Form zu dokumentieren;
- s) FLISR-Anwendungsfall geklärt, um Interaktionen zwischen DSO und ÜNB je Überprüfungscommentar aus Ausgabe 2 einzubeziehen;
- t) entfernte OperationalTags, da es nun Teil der TagAction in der SwitchingEvent-Nutzlast ist.

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INTRODUCTION

The purpose of this part of IEC 61968 is to define a standard for the integration of network operations systems with each other and other systems and business functions within the scope of IEC 61968. The specific details of communication protocols those systems employ are outside the scope of this part of IEC 61968. Instead, this part of IEC 61968 will recognize and model the general capabilities that can be potentially provided by network operations systems. In this way, this part of IEC 61968 will not be impacted by the specification, development and/or deployment of next generation network operations systems, either through the use of standards or proprietary means.

The IEC 61968 series of standards is intended to facilitate inter-application integration as opposed to intra-application integration. Intra-application integration is aimed at programs in the same application system, usually communicating with each other using middleware that is embedded in their underlying runtime environment, and tends to be optimised for close, real-time, synchronous connections and interactive request/reply or conversation communication models. Therefore, these inter-application interface standards are relevant to loosely coupled applications with more heterogeneity in languages, operating systems, protocols and management tools. This series of standards is intended to support applications that need to exchange data every few seconds, minutes, or hours rather than waiting for a nightly batch run. This series of standards, which are intended to be implemented with middleware services that exchange messages among applications, will complement, not replace utility data warehouses, database gateways, and operational stores.

As used in IEC 61968, a distribution management system (DMS) consists of various distributed application components for the utility to manage electrical distribution networks. These capabilities include monitoring and control of equipment for power delivery, management processes to ensure system reliability, voltage management, demand-side management, outage management, work management, automated mapping and facilities management. Standard interfaces are defined for each class of applications identified in the interface reference model (IRM), which is described in IEC 61968-1.

APPLICATION INTEGRATION AT ELECTRIC UTILITIES – SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT – Part 3: Interface for network operations

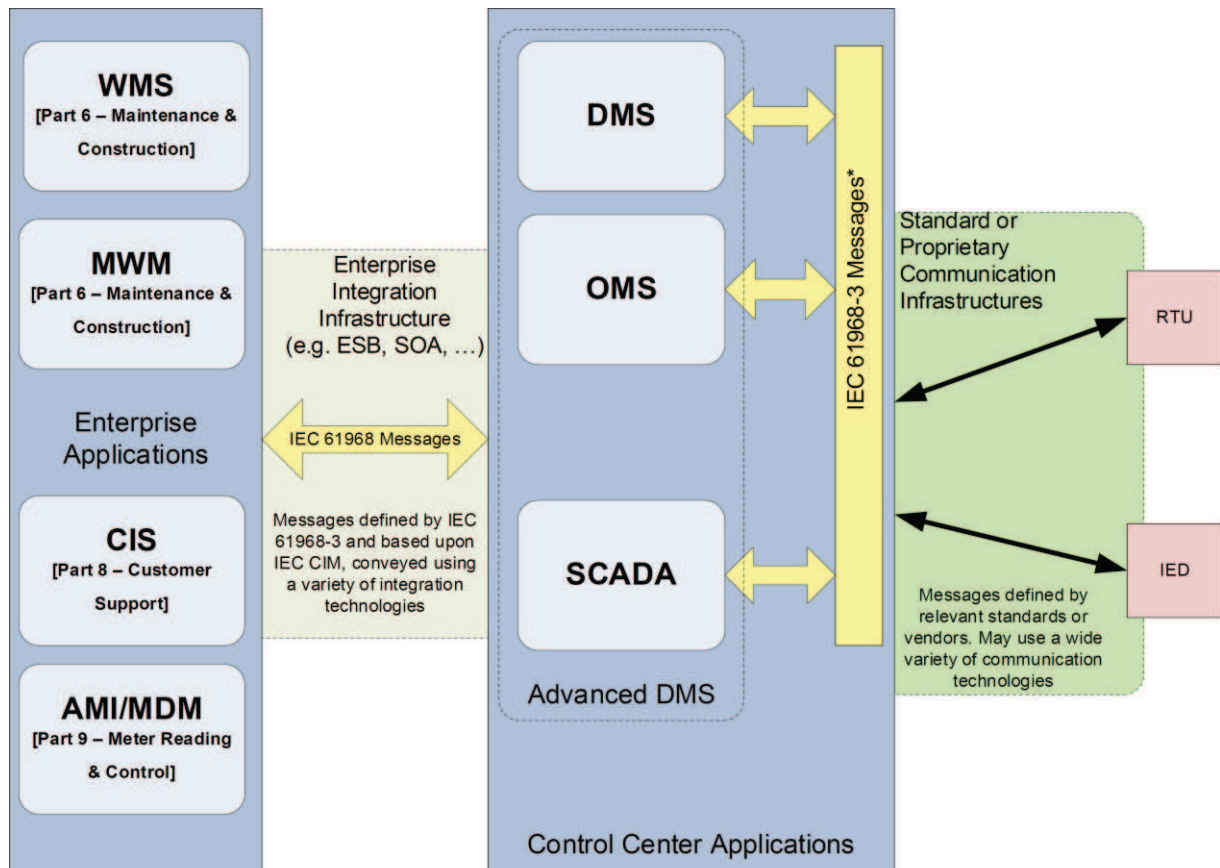
1 Scope

Per the IEC 61968 Interface Reference Model, the Network Operations function defined in this part of IEC 61968 provides utilities the means to supervise main substation topology (breaker and switch state), feeder topology and control equipment status through SCADA, AMI and other data sources. It also provides the means for handling network connectivity and loading conditions. Finally, it makes it possible for utilities to locate customer telephone complaints and coordinate activities of field crews with respect to planned and unplanned outages.

IEC 61968-3 specifies the information content of a set of message payloads that can be used to support many of the business functions related to network operations. Typical uses of the message payloads defined in IEC 61968-3 include data acquisition by external systems, fault isolation, fault restoration, trouble management and coordination of the real-time state of the network.

The scope diagram shown in Figure 1 illustrates the possibility of implementing IEC 61968-3 functionality as either a single integrated advanced distribution management system or as a set of separate functions – OMS, DMS and SCADA. Utilities may choose to buy these systems from different vendors and integrate them using the IEC 61968-3 messages. Alternatively, a single vendor could provide two or all of these components as a single integrated system. In the case of more than one system being provided by the same vendor, the vendor may choose to use either extensions of the IEC 61968-messages or a proprietary integration mechanism to provide enhanced functionality over and above what is required/supported by the IEC 61968-3 specification. While this is a possible implementation, clause 4.3 defines the scope in terms of business functions that are implemented in common vendor offerings.

Annexes in this standard document integration scenarios or use cases, which are informative examples showing typical ways of using the message payloads defined in this document as well as message payloads to be defined in other parts of the IEC 61968 series.



- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.2 Abbreviated terms

For the purposes of this document, the abbreviations given in IEC 61968-2 as well as the following apply.

NOTE Refer to International Electrotechnical Vocabulary, IEC 60050, for general glossary definitions.

FLISR Fault Location, Isolation and Service Restoration

WMS Work Management System

4 Reference and Information Models

4.1 General approach to network operations

Traditionally there have been two types of systems to manage distribution operations: Distribution Management Systems (DMS) and Outage Management Systems (OMS). Often a DMS has been delivered as an extension to a SCADA system, but some DMS can be delivered as a standalone set of distribution applications with no SCADA.

Outage Management Systems are used extensively in many parts of the world (typically with large service territories and a large amount of primary overhead conductor) to manage their distribution systems. Such distribution systems are typically configured radially and cover large distances. For this reason it has been historically expensive to monitor the status of the distribution system, particularly outside of the substation. In more dense populations the cost of telemetry and automation is lower, and can be justified on a cost per customer basis.

Thus often the only way that a distribution utility knows that there is a problem with the system is when a customer calls to report an outage. The utility then collects a set of outage calls, and from the pattern of calls received, determines the likely location and cause of the outage. A crew is then sent to the location of the outage to investigate further and affect repairs.

Distribution management systems have their roots in transmission SCADA systems. As automation has moved downwards and into distribution substations, there has been an increasing need to provide functionality for distribution applications. Distribution management systems originated as either extensions to the existing transmission SCADA, by adding additional points to cover the feeder breakers, or by adding a standalone distribution SCADA system. Both types of system usually have RTUs, communication front-ends, alarm systems and displays.

What characterizes these systems as distribution management systems are the addition of functions such as the ability to add temporary devices, such as line cuts and jumper lines. Such temporary devices are uncommon in transmission systems, but are very common in distribution systems. Since many distribution systems are operated in a radial configuration, it is often necessary to operate feeder tie switches to reconfigure feeders, either to restore outages or to adjust to different loading situations. This dictates a need for the ability to dynamically color lines according to which direction they are being energized from and also for the ability to color lines according to whether they are energized or not. In addition, in certain parts of the world, such systems can be unbalanced, meaning that each electrical phase is operated independently. Another characteristic of a distribution system is that change is the norm. New residential construction and routine maintenance means that the distribution network model changes frequently. It is not uncommon for 10 000 or even 100 000 changes to occur to a distribution system in a single week.

The thing that both the DMS and OMS have in common is the need for an as operated near real-time network model. Thus this part of IEC 61968 includes the ability to exchange distribution network models between two such systems and to keep them synchronized. Increasingly, vendors are beginning to realize that this integration is non-trivial to implement and maintain, are therefore offering integrated DMS/OMS, and even integrated DMS/OMS/SCADA systems in order to provide reduced total cost of ownership and consistent views of the real-time distribution network. The term ADMS (Advanced Distribution Management System) has been coined to describe such systems.

4.2 Reference Model

Figure 2 serves as a reference model and provides examples of the logical components and data flows related to this International Standard. Subclause 3 provides references to terms that are defined by the CIM.

The diagram in Figure 2 describes the flows between the components in the reference model. The label for each flow is the name of a 61968 message profile.

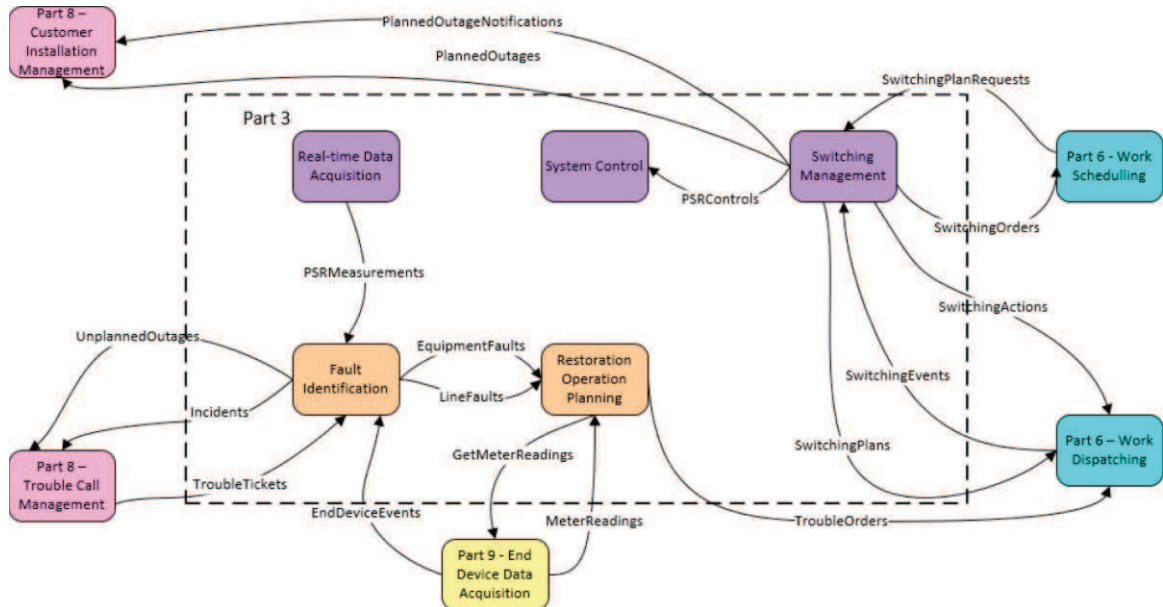


Figure 2 – IEC 61968-3 Reference Model

The reference architecture reflects four main logical components (potentially realized as systems or subsystems) related to network operations:

IEC 61968-9, *Meter Reading & Control*, for associating outage events and meter pings with operations

IEC 61968-8, *Customer Operations* for trouble call management associated with outages

IEC 61968-6, *Maintenance & Construction* for work orders required for trouble and switching

IEC 61968-5, *Operational Planning* for switching plan generation for both planned and unplanned work

4.3 Interface Reference Model

It is not the intention of this standard to define the applications and systems that vendors should produce. It is expected that a concrete (physical) application will provide the functionality of one or more abstract (logical) components as listed in this standard. These abstract components are grouped by the business functions of the Interface Reference Model.

In this standard, the term abstract component is used to refer to that portion of a software system that supports one or more of the interfaces defined in this part of IEC 61968 and IEC 61968-6, IEC 61968-8 and IEC 61968-9. It does not necessarily mean that compliant software is delivered either as separate modules or as a single system.

IEC 61968-1 describes the Interface Reference Model, while IEC 61968-3 through IEC 61968-9 define the details of the information exchanged for specific types of abstract component.

4.4 Network operations business functions and sub-business functions

It should be noted that the message payloads defined in this document, IEC 61968-3, *Interfaces for Network Operations*, may be sent or received by any type of component within a distribution management system (DMS) or outage management system (OMS).

Table 1 shows these business functions and typical sub-business functions that are expected to be producers of information for these message payloads. This is not intended to be an exhaustive list of business functions and sub-business functions, rather they are examples. Typical consumers of the information include, but are not restricted to, the other business functions as listed in IEC 61968-1.

Table 1 – Business FUNCTIONS and Sub-Business Functions

Business Functions	Sub-Business Functions
<p>Real-time Operation (RTO)</p> <p>The Real-Time Operation (RTO) business function includes the execution of the planned action in regard to changing the network operational state. In addition, it monitors the current state of the network to ensure that the power grid is operating in a secure and balanced state. Predefined and activated remedial action will be executed when the pre-condition is met.</p> <p>That a system is secure and balanced state means that there is balance between supply and demand and that the system can handle pre-defined unanticipated loss of system equipment without violating operational requirements in regard to voltage, frequency, and operational stability limits.</p>	<p>Real-Time Data Acquisition (RTDA)</p> <p>The Real-Time Data Acquisition business function includes the collection and validation of measurements and observations that are used to determine the present state of the system that is under the entities' control. This could include acquisition of measurements and observations that are outside the entity's responsibility, but where the equipment that is defined as relevant to determine the state of the responsible system. The measurements and observations could include:</p> <ul style="list-style-type: none"> traditional SCADA points and analogues; manually collected and entered data; phasor data; data generated by other systems, such as: generating plants; IEC 61850 systems; lower or higher-level operations' activities. <p>The common denominator for this data is that it is sampled data treated as raw input, as opposed to a setting or instruction or request received from some other system. In other words, the source of the data is completely ignorant of the acquisition and use of the data. It is not a coordinated integration of peer intelligence.</p>
	<p>Switching Management (SM)</p> <p>The Switching Management business function includes all activity involved in supervising execution of switching orders and outage restoration.</p> <p>Execution of switching steps can involve remote operations of devices via SCADA and/or modifying settings on system controls.</p> <p>Execution incorporates critical safety procedures.</p> <p>Wherever there is concern about the impact of switching on the grid, analytical evaluation of the security of the state that switching will establish is usual. The types of analysis are similar to real-time state evaluation except that power flow or optimal power flow replaces state estimation.</p>

Business Functions	Sub-Business Functions
	<p>System Control (SC)</p> <p>The System Control business function includes any activity (other than Switching Management) which issues instructions to field controls in order to change the state of the grid. These controls may be closed loop or man-in-the-loop. Controls can be divided into active and reactive domains and generally use either raw measurements or the evaluated state as the input to control logic, which then develops a proposed change. Such control logic can be quite complex, even involving analyses based on algorithms such as optimal power flow. Control functions also may include follow-up logic to confirm that an issued control was in fact executed in the field and/or to assess whether the impact of the control was as predicted.</p> <p>Controls are important to model in analytical simulations, and a key distinguishing characteristic is whether the control can be represented by standard block diagram components or whether one has to incorporate the control software in order to simulate.</p> <p>Active controls include:</p> <p>AGC, LFC;</p> <p>active reserve management;</p> <p>controllable load management;</p> <p>remedial action scheme settings;</p> <p>security constrained dispatch.</p> <p>Reactive controls include:</p> <p>reactive reserve management;</p> <p>Volt-VAr optimization;</p> <p>DER settings;</p> <p>FLISR.</p>
<p>Fault Management (FM)</p> <p>The Fault Management (FM) business function receives notifications regarding faults in the electrical network and analyses those notifications in order to estimate the location of the fault. Fault Management tracks the fault through the stages of actual location, minimizing the area impacted by the fault, restoring service to all impacted parts of the network and coordinating permanent repairs. Fault Management ensures that fault durations and restoration times are correctly captured for regulatory reporting purposes.</p>	<p>Fault Identification (FI)</p> <p>The Fault Identification (FI) business function uses a variety of inputs in order to identify where the real fault has occurred. It will also identify the cause of the fault, where known.</p>
	<p>Restoration Operation Planning (ROP)</p> <p>The Restoration Operation Planning (ROP) business function create a plan for handling unplanned or forced outage to recover to an acceptable operation state. It also includes a plan to restore the network to its pre-fault condition after repairs have been made</p>

The use case sequence diagrams presented in this document assume a simplified interpretation of the business functions listed in Table 1. This allows for easier mapping of business functions to systems familiar to the parties implementing the standard.

4.5 Static Information Model

4.5.1 General

The information model relevant to network operations consists of classes that provide a template for the attributes for each message payload.

The classes are defined in detail in IEC 61968-11, Common Information Model (CIM) Extensions for Distribution or in IEC 61970-301, Energy Management System Application Program Interfaces – Common Information Model Core.

4.5.2 Classes for network operations

Table 2 lists classes used within message types. Usually all the attributes of these classes are defined within a message type. The descriptions provided describe usage within 61968-3.

Classes that are used to specify the network model are defined in IEC 61970.

Classes described as type "Asset" are defined in the 61968/Assets package of the CIM.

Classes described as type "Work" are defined in the 61968/Work package of the CIM.

Classes described as type "Customer" are defined in the 61968/Customers package of the CIM.

Classes described as type "Metering" are defined in the 61968/Metering package of the CIM.

Classes described as type "Profile" are contextual profiles defined for 61968-3 that describe message definitions defined using CIM objects.

Table 2 – Classes for network operations

Class	Type	Description
AreaKind	Class	Enumeration for the type of area defined; e.g., county, state, parish, zipcode, etc.
ClearanceAction	Class	Action on clearance document as a switching step.
ClearanceActionKind	Class	Type of clearance action.
ClearanceDocument	Class	Safety document used to authorise work on conducting equipment in the field. Tagged equipment is not allowed to be operated.
ControlAction	Class	Control executed as a switching step.
CutAction	Class	Action on cut as a switching step.
EnergySourceAction	Class	Action on energy source as a switching step.
ERTConfidenceKind	Class	The estimated time of restoration can have a confidence factor applied such as high or low confidence that the ERT will be accomplished. This confidence factor may be updated as needed during the outage period - just as the actual ERT can be updated.
EstimatedRestorationTime	Class	The Estimated Restoration Time for a single outage
FieldSafetySupervisor	Class	Crew member on work site responsible for all local safety measures for the work crew doing maintenance, construction and repair in a substation or on a power line/cable.
GenericAction	Class	An arbitrary switching step.
GroundAction	Class	Action on ground as a switching step.
Incident	Class	Description of a problem in the field that may be reported in a trouble ticket or come from another source. It may have to do with an outage.
JumperAction	Class	Action on jumper as a switching step.
MeasurementAction	Class	Measurement taken as a switching step.

Class	Type	Description
OperationalTag	Class	Operational tag placed on a power system resource or asset in the context of switching plan execution or other work in the field.
OperationsSafetySupervisor	Class	Operator with responsibility that the work in high voltage installation is executed in a safe manner and according to safety regulation.
Outage	Class	<p>Document describing details of an active or planned outage in a part of the electrical network.</p> <p>A non-planned outage may be created upon:</p> <ul style="list-style-type: none"> - a breaker trip, - a fault indicator status change, - a meter event indicating customer outage, - a reception of one or more customer trouble calls, or - an operator command, reflecting information obtained from the field crew. <p>Outage restoration may be performed using a switching plan which complements the outage information with detailed switching activities, including the relationship to the crew and work.</p> <p>A planned outage may be created upon:</p> <ul style="list-style-type: none"> - a request for service, maintenance or construction work in the field, or - an operator-defined outage for what-if/contingency network analysis.
OutageArea	Class	This defines the area covered by the Outage.
OutageCauseKind	Class	This enumeration describes the primary cause of the outage - planned, unplanned, etc.
OutageOrder	Class	Transmits an outage plan to a crew in order for the planned outage to be executed.
OutagePlan	Class	Document containing the definition of planned outages of equipment and/or usage points. It will reference switching plans that are used to execute the planned outage.
OutageStatusKind	Class	This defines if the outage have been predicted or confirmed
PlannedOutage	Class	An outage that is created by the utility that will impact a customer. These may be created to implement a switching plan or energize a new line or device. The customer may or may not be notified in advance.
PlannedOutageNotification	Class	Notifies customers about a planned outage that they will be impacted by.
PSREvent	Class	Event recording the change in operational status of a power system resource; may be for an event that has already occurred or for a planned activity.
PSREventKind	Class	Kind of power system resource event.
SafetyDocument	Class	Document restricting or authorising works on electrical equipment (for example a permit to work, sanction for test, limitation of access, or certificate of isolation), defined based upon organisational practices.

Class	Type	Description
ServicePointOutageSummary	Class	Summary counts of service points affected by an outage. These counts are sometimes referred to as total and critical customer count.
SwitchAction	Class	Action on switch as a switching step.
SwitchActionKind	Class	Kind of action on switch.
SwitchingAction	Class	Atomic switching action.
SwitchingEvent	Class	Event indicating the completion (success or fail) of any switching action (jumper action, cut action, tag action, etc). The switching action may or may not be a consequential event in response to a request to complete the action.
SwitchingOrder	Class	Transmits a switching plan to a crew in order for the plan to be executed.
SwitchingPlan	Class	A sequence of grouped or atomic steps intended to: - de-energise equipment or part of the network for safe work, and/or - bring back in service previously de-energised equipment or part of the network.
SwitchingPlanRequest	Class	A document used to request that a switching plan be created for a particular purpose.
SwitchingStep	Class	Atomic switching step; can be part of a switching step group, or part of a switching plan.
SwitchingStepGroup	Class	A logical step, grouping atomic switching steps that are important to distinguish when they may change topology (e.g. placing a jumper between two cuts).
TagAction	Class	Action on operation tag as a switching step.
TagActionKind	Class	Kind of action on tag.
TempEquipActionKind	Class	Kind of action on temporary equipment (such as cut, jumper, ground, energy source).
TroubleOrder	Class	Trouble order sends an incident to a crew to initiate a response to an unplanned outage.

Class	Type	Description
UnplannedOutage	Class	<p>Document describing the consequence of an unplanned outage in a part of the electrical network. For the purposes of this model, an unplanned outage refers to a state where energy is not delivered; such as, customers out of service, a street light is not served, etc.</p> <p>A unplanned outage may be created upon:</p> <ul style="list-style-type: none"> - impacts the SAIDI calculation - a breaker trip, - a fault indicator status change, - a meter event indicating customer outage, - a reception of one or more customer trouble calls, or - an operator command, reflecting information obtained from the field crew. <p>Outage restoration may be performed using a switching plan which complements the outage information with detailed switching activities, including the relationship to the crew and work.</p>
VerificationAction	Class	Verification of a switch position or other condition as a switching step

4.5.3 Classes related to network operations

Table 3 lists classes that are commonly associated with network operations classes. Their attributes, or a subset of their attributes, are used in the messages defined in this standard. The detailed attributes of those classes are defined in IEC 61968-11.

Table 3 – Classes related to network operations

Related Class	Reference	Description
AccountNotification	Customer	Notifications for move-in, move-out, delinquencies, etc.
Agreement	Common	Formal agreement between two parties defining the terms and conditions for a set of services. The specifics of the services are, in turn, defined via one or more service agreements.
Approver	Common	Person who accepted/signed or rejected the document.
Asset	Asset	Tangible resource of the utility, including power system equipment, various end devices, cabinets, buildings, etc. For electrical network equipment, the role of the asset is defined through PowerSystemResource and its subAssets, defined mainly in the Wires model (refer to IEC61970-301 and model package IEC61970::Wires). Asset description places emphasis on the

Related Class	Reference	Description
		physical characteristics of the equipment fulfilling that role.
AssetContainer	Asset	Asset that is aggregation of other assets such as conductors, transformers, switchgear, land, fences, buildings, equipment, vehicles, etc.
AssetFunction	Asset	Function performed by an asset.
AssetInfo	Asset	Set of attributes of an asset, representing typical datasheet information of a physical device that can be instantiated and shared in different data exchange contexts: - as attributes of an asset instance (installed or in stock) - as attributes of an asset model (product by a manufacturer) - as attributes of a type asset (generic type of an asset as used in designs/extension planning).
AssetKind	Asset	Kinds of assets or asset components.
Author	Common	Person who created document or activity record.
BaseWork	Class	Common representation for work and work tasks.
ConfigurationEvent	Common	Used to report details on creation, change or deletion of an entity or its configuration.
CoordinateSystem	Common	Coordinate reference system.
Crew	Common	Group of people with specific skills, tools, and vehicles.
CrewMember	Common	Member of a crew.
CrewStatusKind	Common	Defines the current status of the Crew - assigned, arrived, etc.
CrewType	Common	Custom description of the type of crew. This may be used to determine the type of work the crew can be assigned to. Examples include repair, tree trimming, switching, etc.

Related Class	Reference	Description
Customer	Customer	Organisation receiving services from service supplier.
CustomerAccount	Customer	Assignment of a group of products and services purchased by the customer through a customer agreement, used as a mechanism for customer billing and payment. It contains common information from the various types of customer agreements to create billings (invoices) for a customer and receive payment.
CustomerAgreement	Customer	Agreement between the customer and the service supplier to pay for service at a specific service location. It records certain billing information about the type of service provided at the service location and is used during charge creation to determine the type of service.
CustomerKind	Customer	Kind of customer.
CustomerNotification	Customer	Conditions for notifying the customer about the changes in the status of their service (e.g., outage restore, estimated restoration time, tariff or service level change, etc.)
Document	Common	Parent class for different groupings of information collected and managed as a part of a business process. It will frequently contain references to other objects, such as assets, people and power system resources.
DocumentPersonRole	Common	Person role with respect to documents.
Editor	Common	Person who modified the document.
ElectronicAddress	Common	Electronic address information.
FieldDispatchHistory	Common	The history of field dispatch statuses for this work.
FieldDispatchStep	Common	Details of the step in the field dispatch history.
Hazard	Common	An object or a condition that is a danger for causing loss or perils to an asset and/or people.
Issuer	Common	Person who issued the document and is responsible for its content.
Location	Common	The place, scene, or point of something where someone or something has been, is, and/or will be at a given moment in time. It can be defined with one or more position points (coordinates) in a given coordinate system.

Related Class	Reference	Description
NotificationTriggerKind	Customer	Kind of trigger to notify customer.
OperationPersonRole	Common	Person role in the context of utility operations.
Operator	Common	Control room operator.
Organisation	Common	Organisation that might have roles as utility, contractor, supplier, manufacturer, customer, etc.
Ownership	Common	Ownership of e.g. asset.
Person	Common	General purpose information for name and other information to contact people.
PositionPoint	Common	Set of spatial coordinates that determine a point, defined in the coordinate system specified in 'Location.CoordinateSystem'. Use a single position point instance to describe a point-oriented location. Use a sequence of position points to describe a line-oriented object (physical location of non-point oriented objects like cables or lines), or area of an object (like a substation or a geographical zone - in this case, have first and last position point with the same values).
Priority	Common	Priority definition.
ServiceCategory	Customer	Category of service provided to the customer.
ServiceKind	Customer	Kind of service.
ServiceLocation	Customer	A real estate location, commonly referred to as premises.
Status	Common	Current status information relevant to an entity.
StreetAddress	Common	General purpose street and postal address information.
StreetDetail	Common	Street details, in the context of address.
TelephoneNumber	Common	Telephone number.
TownDetail	Common	Town details, in the context of address.
TroubleCallKind	Customer	Describes the type of Trouble, based on customer input.
TroubleReportingKind	Customer	Kind of trouble reporting.
TroubleTicket	Customer	Customer call to report a problem with their service.
Work	Work	Document used to request, initiate, track and record work.

Related Class	Reference	Description
WorkActivityRecord	Work	Records information about the status of work or work task at a point in time.
WorkAsset	Work	Asset used to perform work.
WorkKind	Work	Kinds of work.
WorkLocation	Work	Information about a particular location for various forms of work.
WorkStatusKind	Work	Kind of status, specific to work.
WorkTask	Work	A task within a set of work.
WorkTaskKind	Work	Kinds of work tasks.

5 Network operations message payloads

5.1 General

The purpose of this clause is to describe the message payloads related to IEC 61968-3. It is important to note that some of these message payloads may also be used by other parts of IEC 61968. The general approach to the realization of message structures and XML schemas for IEC 61968 message payloads is described in IEC 61968-100.

Although they may be represented in sequence diagrams for context and completeness, this document does not describe message formats that are defined by other parts of IEC 61968. The message payload structures defined by this part of IEC 61968 are described in Subclause 5.

Message structures are diagrammed within Subclause 5. Note that these diagrams are examples and not intended to be exhaustive. The notation convention shows required elements with a solid outline, and optional elements with dashed outlines.

It is also important to note that the use cases and sequence diagrams provided in Annex A are informative in nature, and are intended to provide examples of usage for the normative message payload definitions. There is no intent by this standard to standardize specific business processes.

The following are some general conventions in the message definitions provided in this document:

- Objects are identified by one of the following:
 - **mRID** inherited from **IdentifiedObject**
 - one or more **Name.name** instances. Transacting systems may use one or both of the attributes to uniquely identify the objects being exchanged.
 - a combination of **mRID** and one or more **Name.name** instances
- Several CIM classes have an attribute called **type** to provide a string description of an instance of the class. Some CIM classes (such as **Asset**) also have an enumerated attribute called "**kind**". This provides for better interoperability. Messages in this document that incorporate such classes include both the "**type**" and "**kind**" attributes. Where an appropriate value is not available for "**kind**", the transacting systems may use the value "**other**" for "**kind**" in order to indicate that the string description in the "**type**" attribute should be used.
- The majority of attributes in the message payloads are optional. It is up to the transacting system to implement the logic for any required fields.

5.2 Summary of 61968-3 message profiles

Table 4 shows a summary of all of the messages defined in 61968-3 and their purpose.

Table 4 – Summary of 61968-3 message profiles

Profile Name	Purpose
PSRMeasurements	Contains accumulator, analog, discrete and string values from SCADA. Time stamps and quality codes are also included. If applicable, includes a reference to the PowerSystemResource that the measurement is associated with.
PSRControls	Request to SCADA to change a value in the field. The change can be an accumulator reset, analog control, command, raise/lower command or a setpoint. If applicable, includes a reference to the PowerSystemResource that is associated with the control request.
SwitchingPlanRequests	A SwitchingPlanRequest is used to convey a request from work management (or other business function) to network operations that switching needs to be performed (e.g. part of the network needs to be isolated) in order for maintenance or construction work to be performed. The payload includes the type of work to be performed and when it should start. The typical outcome of a SwitchingPlanRequest is the creation of a SwitchingPlan .
SwitchingPlans	SwitchingPlans message payloads are designed to communicate a set of SwitchingActions that form a sequence of operations to manage a complete operational task. SwitchingPlans may also be created in order to perform emergency switching.
SwitchingOrders	SwitchingOrders message payloads are designed to communicate requests for scheduling the execution of a SwitchingPlan for emergency or planned switching.
SwitchingActions	SwitchingActions are used to coordinate the manual execution of steps within SwitchingPlans between the control room and field crews. Automated step execution is coordinated with PSRControls messages.
SwitchingEvents	SwitchingEvents are used to communicate temporary network changes as a result of the execution of a step in a SwitchingPlan that was initiated via a SwitchingAction . SwitchingEvents are also used to communicate temporary network changes between enterprise systems. Results of PSRControls are coordinated with PSRMeasurements messages.
PlannedOutageNotifications	PlannedOutageNotifications are used to notify customers that they will be impacted by a PlannedOutage , prior to the execution of a SwitchingPlan . The payload includes scheduled start and end date/time and a list of customers who will be impacted.
PlannedOutages	PlannedOutages message payloads are designed to communicate the creation and status changes of PlannedOutages once one or more customers become de-energized as a result of planned switching actions. The payload includes: a list of customers affected and the actual start/end time.
UnplannedOutages	UnplannedOutages message payloads are designed to communicate the creation and status changes of UnplannedOutages once one or more customers become de-energized. This could be as a result of faults, such as short circuit faults and downed lines, switching errors or other causes.
TroubleOrders	TroubleOrders message payloads are designed to communicate work requests to field crews to perform work in response to an Incident , or an UnplannedOutage , and to track the status of the work.
Incidents	Incidents message payloads are designed to communicate a problem in the field. Typically, but not always, an Incident is associated with an UnplannedOutage .
EquipmentFaults	EquipmentFaults message payloads, are designed to communicate the detailed fault information as part of UnplannedOutages messages. An EquipmentFault is a fault applied at the terminal, external to the equipment. This class is not used to specify faults internal to the equipment.
LineFaults	LineFaults messages are designed to communicate the detailed fault information as part of UnplannedOutages messages. LineFaults define all types of faults that occur on AC or DC line segments.

5.3 Config Profiles

5.3.1 General

Config profiles are used to share a subset of the model so as to avoid sharing the entire model and to avoid sending configuration data at run-time. It is envisioned that config messages are exchanged between systems only when required.

For example, a Customer Information System may send **CustomerConfig**, **UsagePointConfig**, and **OperationsDataLinkageConfig** messages to an Outage Management System. By receiving these messages and instantiating the customer information, the usage point information, the association between customers and usage points, and information in its database, the OMS can produce customer contact lists for an outage.

All messages rely on unique identifiers (**mRIDs**) for all objects that are part of the common network model, in this case the common distribution network model which is defined as part of CIM. In order to publish those unique identifiers, the respective system needs either to import that network model or load the necessary identifiers as part of the system's configuration step.

Two mechanisms are supported for message transfer between systems, one is a 'push' model and the other is a 'pull' model. The mechanism selected depends upon the capabilities of the systems involved in the message exchange and the timeliness of the data exchanged. An example of a push message exchange is shown in Figure 3. In this example, a new customer is created in the CIS and the information is sent to OMS.

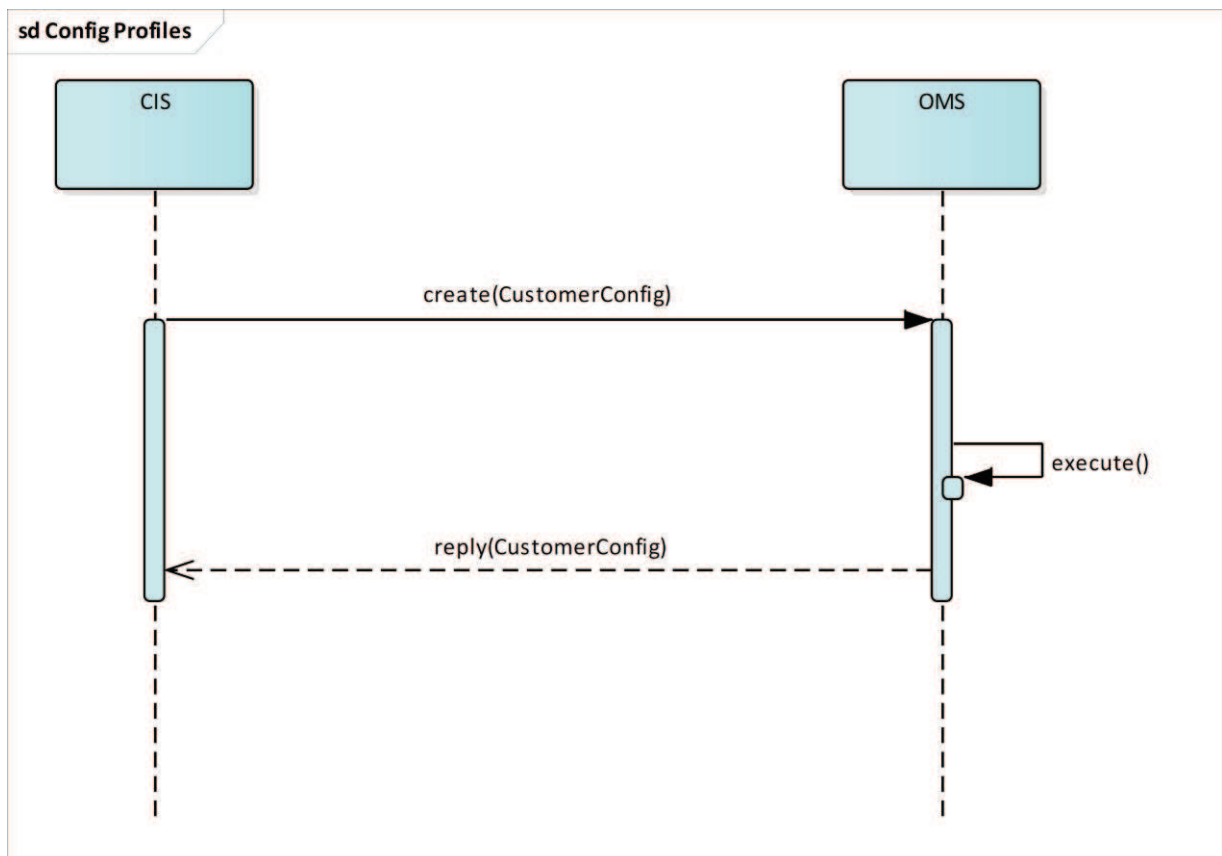


Figure 3 – Example of a Push Message Exchange

An example of a pull message exchange is shown in Figure 4.

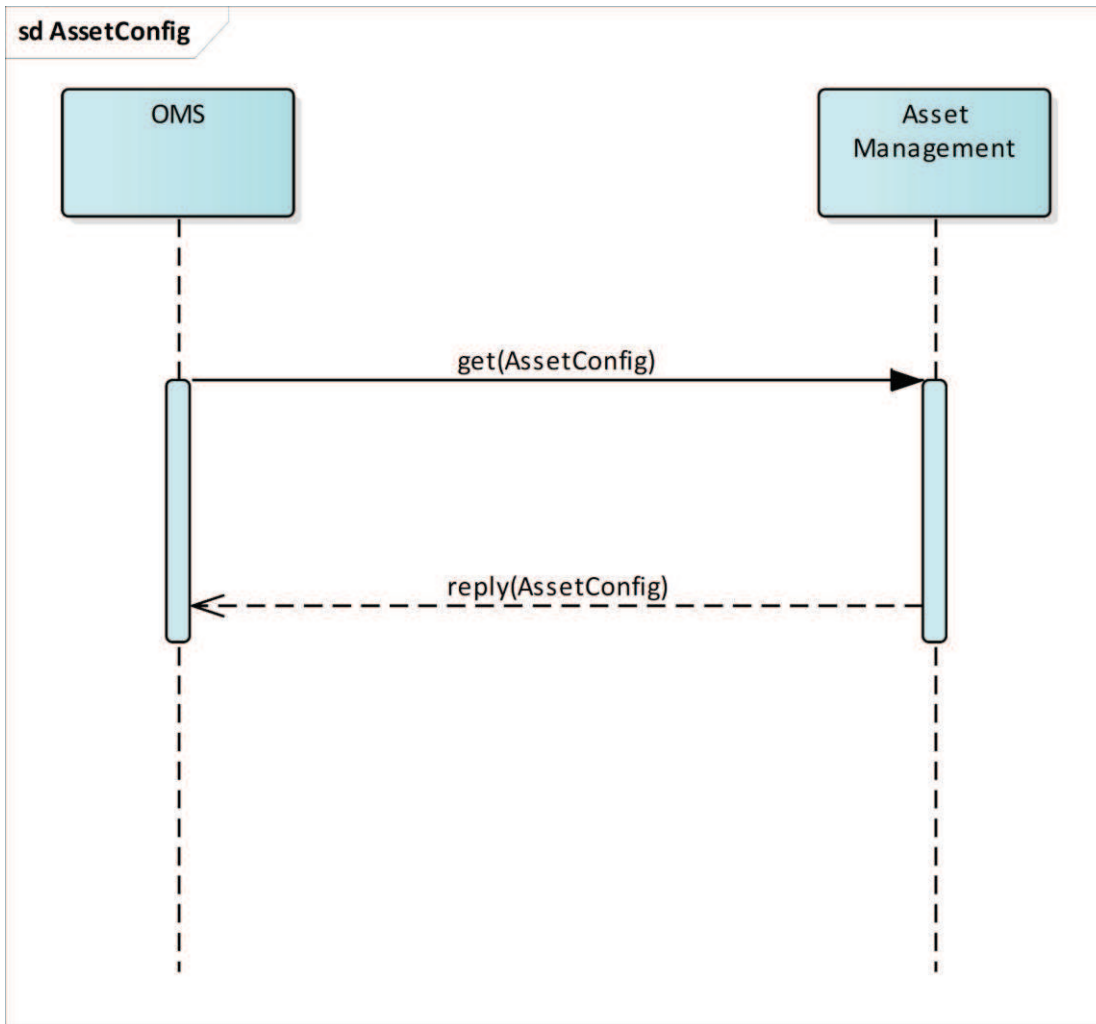


Figure 4 – Example of a Pull Message Exchange

5.3.2 Message payloads

There are multiple Config messages, including:

- **AssetConfig** – see 5.3.3
- **CustomerAgreementConfig** – see D.1
- **CustomerConfig** – see D.2
- **FaultCauseTypeConfig** – see 5.3.5
- **LocationConfig** – see 5.3.6
- **MeterConfig** – see D.3
- **PowerSystemResourceConfig** – see 5.3.8
- **UsagePointConfig** – see D.4
- **UsagePointLocationConfig** – see D.5

The above config messages are associated using the **OperationsDataLinkageConfig** message, to allow relationships between the various config messages to be defined.

5.3.4 AssetConfig payload

The **AssetConfig** payload shown in Figure 5 and Figure 6 defines zero, one or many **Assets**. Important attributes for the purposes of 61968-3 are the **mRID** and **Names** since this allows the mapping between the **mRID**, **Names** and the objects themselves in the messages so that the the entire object instance does not need to be sent in the message.

The attributes of the **AssetConfig** profile are described in Table 5.

Table 5 – AssetConfig Profile

AssetConfig				
Attribute	Data Type	Cardinality	Comments	Description
AssetConfig	Asset	[1..*]		
Profile Attributes				
mRID	String	[0..1]	GUID	mRID of the Asset
description	String	[0..1]		Free-form text field that describes the Asset
Names	Name	[0..*]	See Annex B.56	Human-readable names for the Asset.
baselineCondition	String	[0..1]		Condition of asset at last baseline. Examples include new, rebuilt, overhaul required, other. Refer to inspection data for information on the most current condition of the asset.
baselineLossOfLife	PerCent	[0..1]		Percentage of initial life expectancy that has been lost as of the last life expectancy baseline. Represents (initial life expectancy - current life expectancy) / initial life expectancy.
critical	Boolean	[0..1]		True if asset is considered critical for some reason (for example, a pole with critical attachments).
inUseState	inUseStateKind	[0..1]	See Annex C.9	Indication of whether asset is currently deployed (in use), ready to be put into use or not available for use.
kind	AssetKind	[0..1]	See Annex C.1	Kind of asset. Used in description of asset components in asset instance templates.

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AssetConfig				
Attribute	Data Type	Cardinality	Comments	Description
lifecycleState	AssetLifecycleStateKind	[0..1]	See Annex C.2	Current lifecycle state of asset.
lotNumber	String	[0..1]		Lot number for this asset. Even for the same model and version number, many assets are manufactured in lots.
position	String	[0..1]		Position of asset or asset component. May often be in relation to other assets or components.
purchasePrice	Money	[0..1]		Purchase price of asset.
retiredReason	RetiredReasonKind	[0..1]	See Annex C.16	Reason asset retired.
serialNumber	String	[0..1]		Serial number of this asset.
type	String	[0..1]		Utility-specific classification of Asset and its subtypes, according to their corporate standards, practices, and existing IT systems (e.g., for management of assets, maintenance, work, outage, customers, etc.).
utcNumber	String	[0..1]		Uniquely tracked commodity (UTC) number.
ActivityRecords	ActivityRecord	[0..*]	See Annex B.5	
AssetContainer	Choice of: Cabinet DuctBank Pole Structure Tower UndergroundStructure	[0..1]	For Cabinet, see Annex B.14 For DuctBank, see Annex B.30 For Pole, see Annex B.66 For Structure, see Annex B.84 For Tower, see Annex B.91 For UndergroundStructure, see Annex B.96	

AssetConfig				
Attribute	Data Type	Cardinality	Comments	Description
AssetFunction	AssetFunction	[0..*]	Reference to AssetFunction in this payload	Contains the mRID or Names.name of the referenced AssetFunction
ConfigurationEvents	ConfigurationEvent	[0..*]	See Annex B.19	All configuration events created for this asset.
electronicAddress	ElectronicAddress	[0..1]	See Annex B.32	Electronic address of this asset, such as a MAC address.
lifecycleDate	LifeCycleDate	[0..1]	See Annex B.50	Lifecycle dates for this asset.
Location	Location	[0..1]	See Annex B.52	Location of this asset
Ownerships	Ownership	[0..1]	See Annex B.64	All ownerships of this asset.
ProductAssetModel	ProductAssetModel	[0..1]	See Annex B.70	The model of this asset.
status	Status	[0..1]	See Annex B.79	Status of this asset.

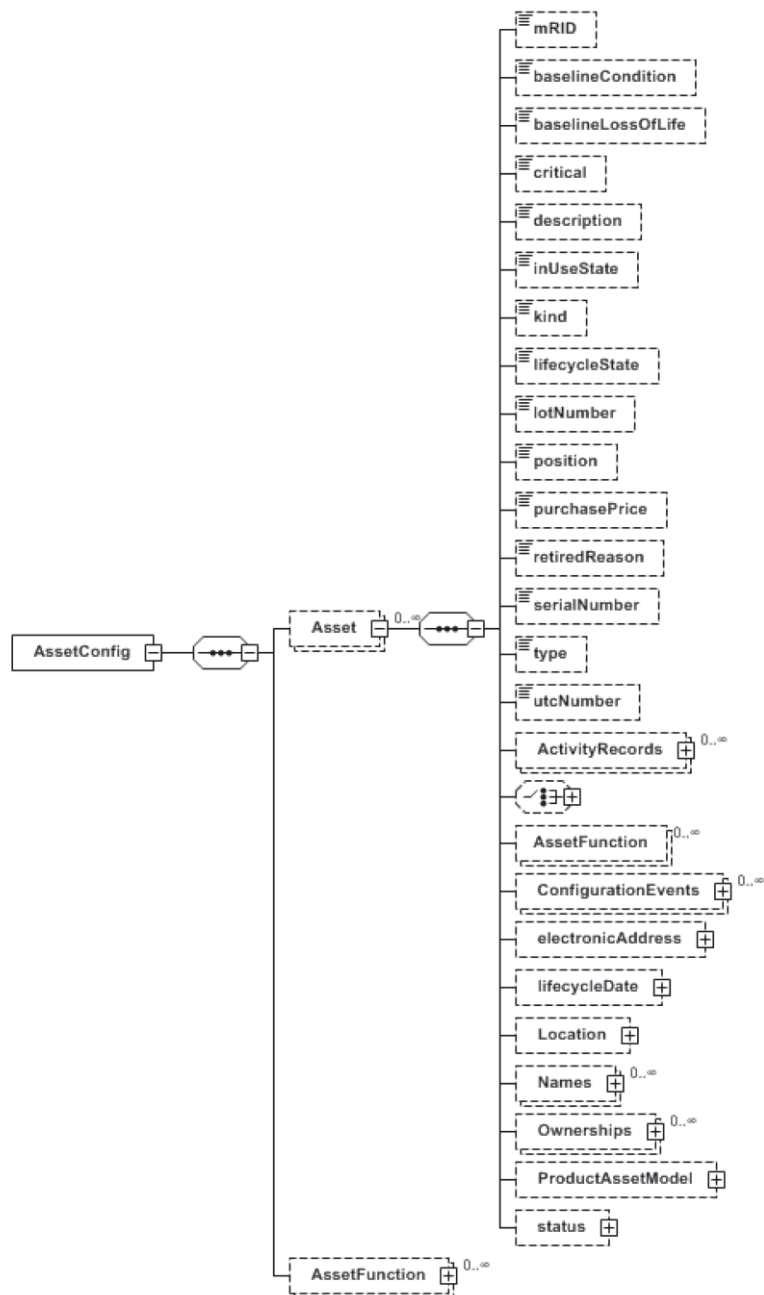


Figure 5 – AssetConfig payload (1)

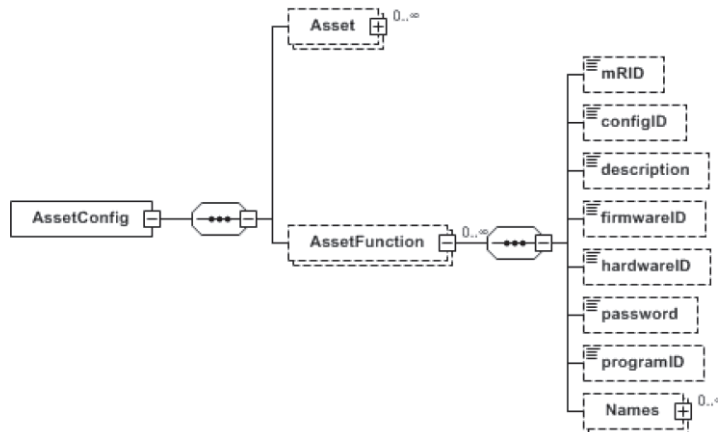


Figure 6 – AssetConfig payload (2)

5.3.5 FaultCauseTypeConfig payload

The **FaultCauseTypeConfig** payload shown in Figure 7 defines zero, one or many **FaultCauseTypes**. Important attributes for the purposes of 61968-3 are the **mRID** and **Names** since this allows the mapping **between** the **mRID**, **Names** and the objects themselves in the messages so that the the entire object instance does not need to be sent in the message.

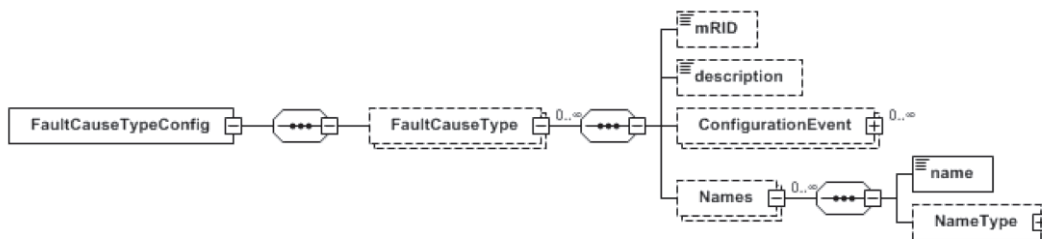


Figure 7 – FaultCauseTypeConfig payload

5.3.6 LocationConfig payload

The **LocationConfig** payload shown in Figure 8 defines zero, one or many **Locations**. Important attributes for the purposes of 61968-3 are the **mRID** and **Names** since this allows the mapping **between** the **mRID**, **Names** and the objects themselves in the messages so that the the entire object instance does not need to be sent in the message.

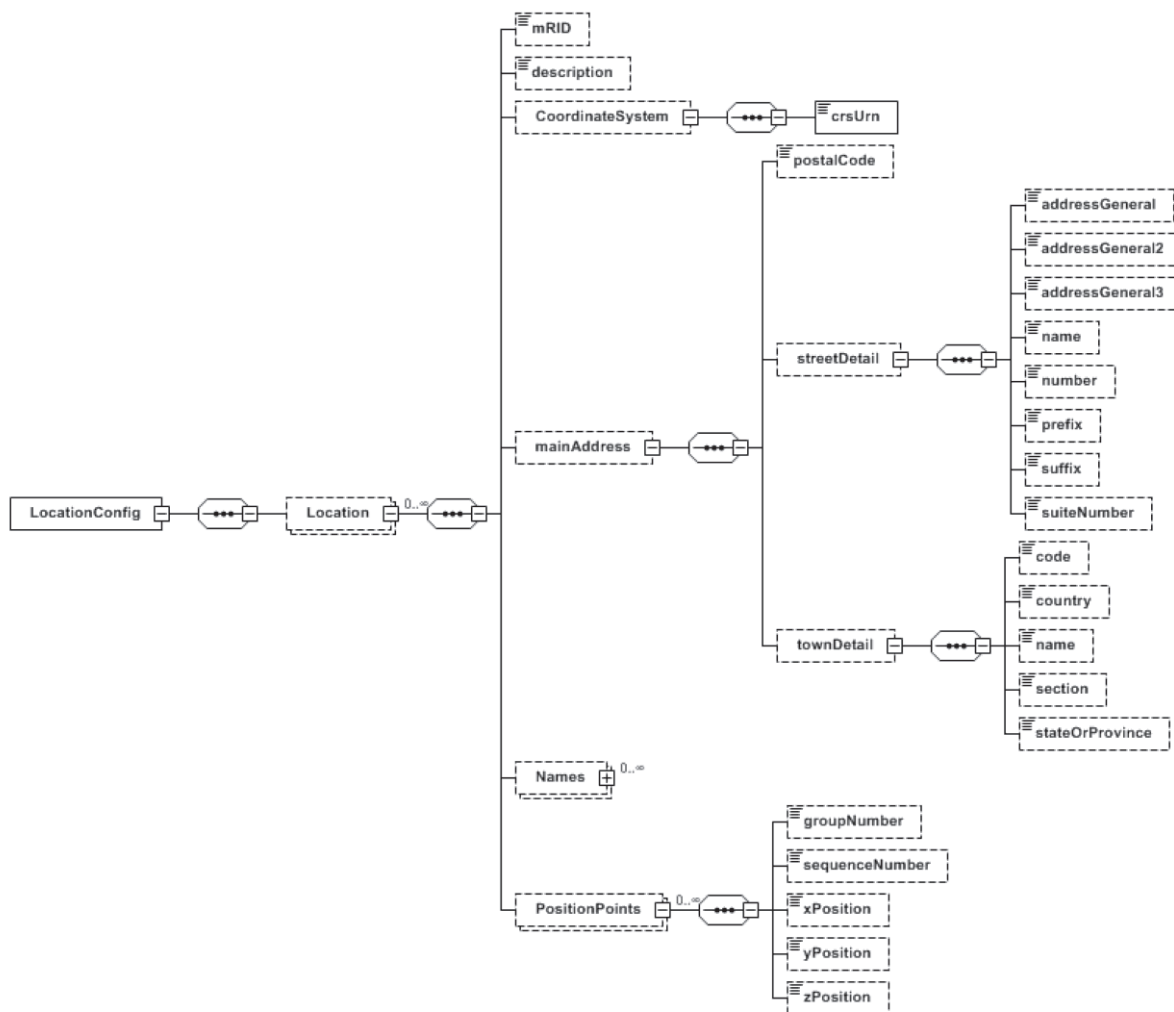


Figure 8 – LocationConfig payload

5.3.8 PowerSystemResourceConfig payload

The **PowerSystemResourceConfig** payload shown in Figure 9 defines zero, one or many **PowerSystemResources**. Important attributes for the purposes of 61968-3 are the **mRID** and **Names** since this allows the mapping **between** the **mRID**, **Names** and the objects themselves in the messages so that the the entire object instance does not need to be sent in the message.

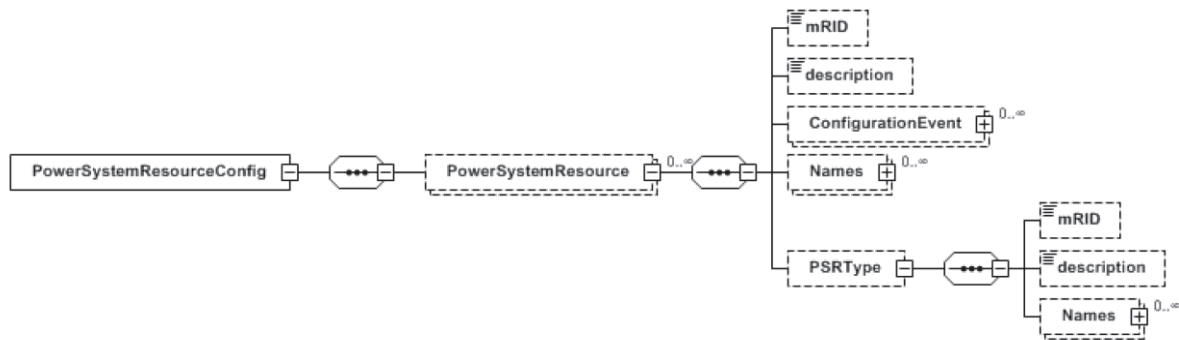


Figure 9 – PowerSystemResourceConfig payload

5.3.9 OperationsDataLinkageConfig payload

The **OperationsDataLinkageConfig** payload shown in Figure 10 and Figure 11 defines zero, one or many **OperationsDataLinkages**. This message links the various objects used in config messages together. In particular it optionally links one or more of the following together:

- Asset
- ConfigurationEvent
- Customer
- CustomerAccount
- CustomerAgreement
- EndDevice
- Location
- Meter
- PowerSystemResourceConfig
- UsagePoint
- UsagePointLocation

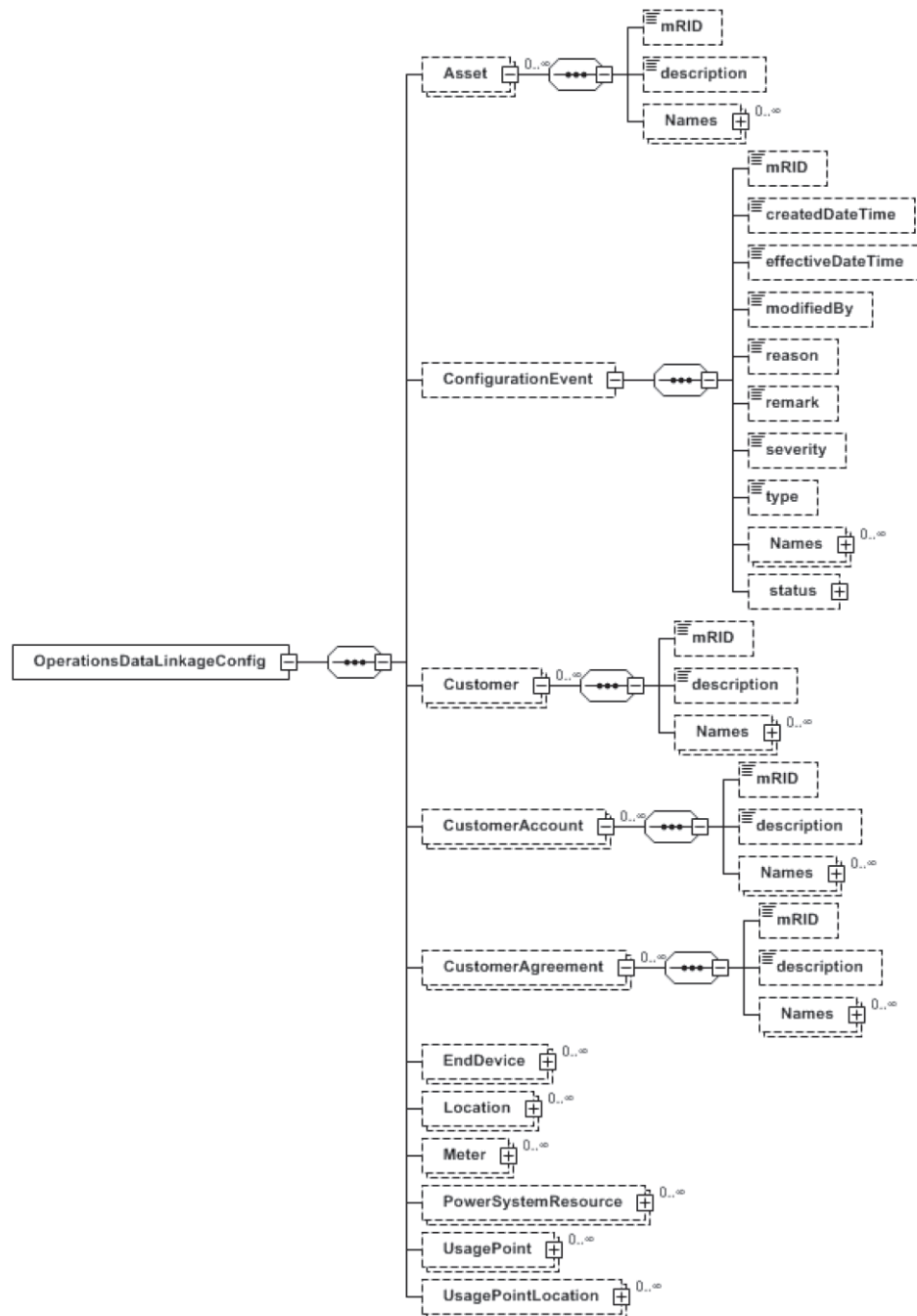


Figure 10 – OperationsDataLinkageConfig payload (1)

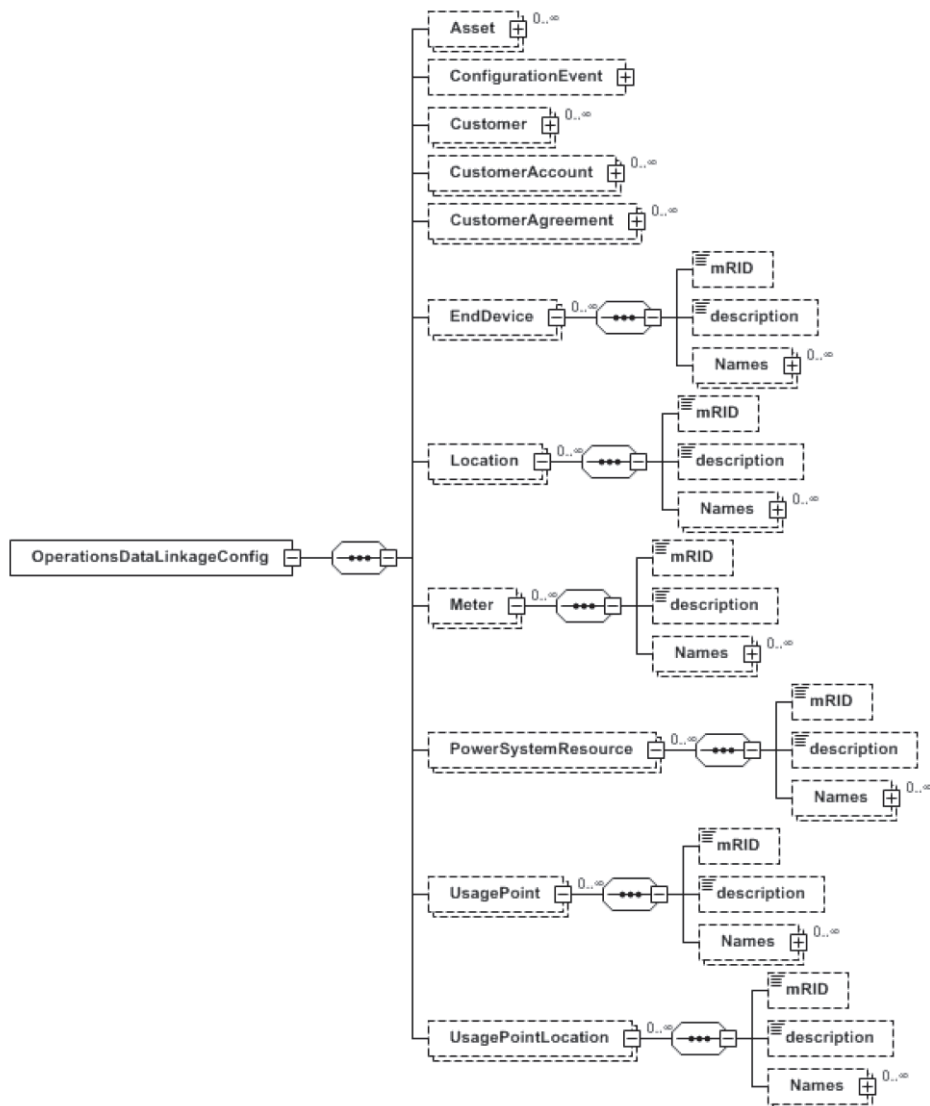


Figure 11 – OperationsDataLinkageConfig payload (2)

Possible use cases for this message include:

- Linking a customer to a meter
- Linking a customer to a power system resource, such as a load (energyConsumer).
- Linking a customer to their customer agreement, to determine participation in a demand response program

5.3.10 Example – linking a Customer to a PowerSystemResource

A common requirement for outage management and distribution management systems is to associate customers with the network. This can be done by associating a **Customer** with an **EnergyConsumer**. In this case, an **OperationsDataLinkageConfig** message could be sent from the system of record (e.g. CIS or GIS) and would contain the **Customer mRID** or **name** and the **PowerSystemResource mRID** or **name**.

In this example, it is not mandatory that a **CustomerConfig** message or a **PowerSystemResourceConfig** message to have been received, as long as the **mRID** or **name** of the **Customer** and **PowerSystemResource** are known to the receiving system. However, sample **CustomerConfig** and **PowerSystemResourceConfig** XML is included.

CustomerConfig sample XML. This defines information for one customer:

```
<?xml version="1.0" encoding="UTF-8"?>
<m:CustomerConfig xmlns:m="http://iec.ch/TC57/2019/CustomerConfig#" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2019/CustomerConfig# CustomerConfig.xsd">
  <m:Customer>
    <m:mRID>fd393766-f408-4ef8-8d83-d9f17fddf931</m:mRID>
    <m:kind>commercialIndustrial</m:kind>
    <m:locale>m:en</m:locale>
    <m:Names>
      <m:name>Michael B Higgins</m:name>
      <m:NameType>
        <m:name>Customer Name</m:name>
      </m:NameType>
    </m:Names>
    <m:Names>
      <m:name>02100045112314</m:name>
      <m:NameType>
        <m:name>Account Number</m:name>
      </m:NameType>
    </m:Names>
    <m:Organisation>
      <m:electronicAddress>
        <m:email1>michaelbhiggins31427@gmail.com</m:email1>
      </m:electronicAddress>
      <m:Names>
        <m:name>02100045112314</m:name>
        <m:NameType>
          <m:name>Account Number</m:name>
        </m:NameType>
      </m:Names>
      <m:phone1>
        <m:areaCode>919</m:areaCode>
        <m:cityCode>555</m:cityCode>
        <m:localNumber>1212</m:localNumber>
      </m:phone1>
      <m:postalAddress>
        <m:postalCode>27606</m:postalCode>
        <m:streetDetail>
          <m:addressGeneral>Main Campus Drive</m:addressGeneral>
          <m:number>901</m:number>
        </m:streetDetail>
        <m:townDetail>
          <m:name>Raleigh</m:name>
          <m:stateOrProvince>NC</m:stateOrProvince>
        </m:townDetail>
      </m:postalAddress>
      <m:streetAddress>
```