

**57/529/NP****NEW WORK ITEM PROPOSAL**

Proposer Secretary	Date of proposal 2001- 04-05
TC/SC TC 57	Secretariat Germany
Date of circulation 2001-05-18	Closing date for voting 2001-08-17

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be circulated to the P-members of the technical committee or subcommittee for voting, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Committee of Action or one of the advisory committees, or the General Secretary. Guidelines for proposing and justifying a new work item are given in ISO/IEC Directives, Part 1, Annex C (see extract overleaf). **This form is not to be used for amendments or revisions to existing publications.**

The proposal (to be completed by the proposer)

Title of proposal IEC 61968-3 System Interfaces For Distribution Management – Part 3: Interface Standard for Network Operations		
<input checked="" type="checkbox"/> Standard	<input type="checkbox"/> Technical Report	
Scope (as defined in ISO/IEC Directives, Part 3, 6.2.1) This document is Part 3 of the IEC 61968 standard and specifies the information content of a set of message types that can be used to support many of the business functions related to Network Operations. Typical uses of the message types defined in Part 3 include data acquisition by external systems, fault isolation, fault restoration, trouble management, maintaining plant, and commissioning plant. Message types defined in other Parts of IEC61968 may also be relevant to these use cases. <i>The mapping of these messages to specific technologies such as XML will be described at a later date following receipt of National Committee comments.</i>		
Purpose and justification , including the market relevance and relationship to Safety (Guide 104), EMC (Guide 107), Environmental aspects (Guide 109) and Quality assurance (Guide 102) . (attach a separate page as annex, if necessary) The purpose of the 61968 series of standards is to define interfaces among major DMS functional components so that interoperability may be achieved between application software running on system distributed throughout the utility. Realization of this objective will provide utilities with increased flexibility in combining software and systems from multiple sources. This should result in each DMS being composed of integrated functions that are optimized to manage the utility's distribution system. Part 3 emphasizes support for electric network operations.		
Target date	for first CDV 2002-07	for IS 2003-08
Estimated number of meetings 5	Frequency of meetings 3 per year	Date and place of first meeting: Keystone, Colorado, 2001-02
Proposed working methods	<input checked="" type="checkbox"/> E-mail	<input checked="" type="checkbox"/> ftp
Relevant documents to be considered 1. Draft IEC 61968-1, System Interfaces For Distribution Management – Part 1 Interface Architecture and General Requirements 2. Draft IEC 61968-2, System Interfaces For Distribution Management – Part 2 Glossary 3. Draft IEC 61970-1, EMS-API Guidelines and General Requirements 4. Draft IEC 61970-301, Common Information Model (CIM) Base		
Relationship of project to activities of other international bodies Not Applicable		

Liaison organizations Open Application Group (OAG), IEEE	Need for coordination within ISO or IEC IEC TC57: SPAG, WG10, WG13
Preparatory work Check one of the two following boxes <input checked="" type="checkbox"/> A draft is attached for vote and comment <input type="checkbox"/> An outline is attached We nominate a project leader as follows in accordance with ISO/IEC Directives, Part 1, 2.3.4 (name, address, fax and e-mail): Mr. Greg M. Robinson President Xtensible Solutions, Inc. 20405 Brightwater Place Sterling, VA 20165 USA Tel.: +1 703 421 9419 Fax: +1 703 421 9419 e-mail: g.m.robinson@worldnet.att.net	
Concerns known patented items (see ISO/IEC Directives, Part 2) <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If yes, provide full information as an annex	Name and/or signature of the proposer Dr. Andreas Huber, Secretary TC 57
Comments and recommendations from the TC/SC officers	
Comments with respect to the proposal in general, and recommendations thereon 1) Work allocation <input type="checkbox"/> Project team <input type="checkbox"/> New working group <input checked="" type="checkbox"/> Existing working group no: 14 2) Draft suitable for direct submission as <input checked="" type="checkbox"/> CD <input type="checkbox"/> CDV 3) General quality of the draft (conformance with ISO/IEC Directives, Part 3) <input type="checkbox"/> Little redrafting needed <input type="checkbox"/> Substantial redrafting needed <input type="checkbox"/> no draft (outline only) 4) Relationship with other activities In IEC In other organizations	
Other remarks	
Remarks from the TC/SC officers The National Committees are requested to submit comments on the draft attached.	
Remarks from the Sector Board Members of Sector Board 1, 'Electricity transmission and distribution', and Sector Board 3, 'Industrial automation systems', were asked to comment on the market relevance of this proposal. Two comments were received, both favourable to the development of the standard. One also pointed out that the increased complexity could lead to short-term cost increases.	

Elements to be clarified when proposing a new work item
Title

Indicate the subject matter of the proposed new standard.

Indicate whether it is intended to prepare a standard, a technical report or an amendment to an existing standard.

Scope

Give a clear indication of the coverage of the proposed new work item and, if necessary for clarity, exclusions.

Indicate whether the subject proposed relates to one or more of the fields of safety, EMC, the environment or quality assurance.

Purpose and justification

Give details based on a critical study of the following elements wherever practicable.

- The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.
- The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.
- Feasibility of the activity: Are there factors that could hinder the successful establishment or general application of the standard?

- d) Timeliness of the standard to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standard outdated? Is the proposed standard required as a basis for the future development of the technology in question?
- e) Urgency of the activity, considering the needs of the market (industry, consumers, trade, governments etc.) as well as other fields or organizations. Indicate target date and, when a series of standards is proposed, suggest priorities.
- f) The benefits to be gained by the implementation of the proposed standard; alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume or value of trade should be included and quantified.
- g) If the standardization activity is, or is likely to be, the subject of regulations or to require the harmonization of existing regulations, this should be indicated.

If a series of new work items is proposed, the purpose and justification of which is common, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.

Relevant documents

List any known relevant documents (such as standards and regulations), regardless of their source. When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendments), indicate this with appropriate justification and attach a copy to the proposal.

Cooperation and liaison

List relevant organizations or bodies with which cooperation and liaison should exist.

Preparatory work

Indicate the name of the project leader nominated by the proposer.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

System Interfaces For Distribution Management –

Part 3: Interface Standard for Network Operations

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61968 has been prepared by Working Group 14, of IEC technical committee 57: Power System Control And Associated Communications.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/-----	57/-----

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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IEC 61968

System Interfaces For Distribution Management –

Part 3: Interface Standard for Network Operations

Introduction

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 optimized for close, real-time, synchronous connections and interactive request/reply or conversation communication models. IEC 61968, by contrast, is intended to support the inter-application integration of a utility enterprise that needs to connect disparate applications that are already built or new (legacy or purchased applications), each supported by dissimilar runtime environments. Therefore, these 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 Part 1: Interface Architecture and General Requirements

This Part contains the following clauses:

Clause	Title	Purpose
1.	Scope	The scope and purpose of the document are described.
2.	Normative References	Documents that contain provisions which, through reference in this text, constitute provisions of this International Standard.
3.	Reference and Information Models	Description of the relevant parts of the interface reference model, static information model and message type naming convention.
4.	Network Operations Message Types	Requirements common to all message types described in clauses 5 and 6.
5.	Measurement Message Types	Message types related to the exchange of analogue and discrete measurement values between systems.
6.	Operational Document Message Types	Message types related to the exchange of information for operational documents
Annex	Informative Use cases	Informative section illustrating how the message types could be used.

Table 1: Document Overview For IEC 61968 - Part 3

1 Scope

1.1 Scope of full standard

The IEC 61968 standard, taken as a whole, defines interfaces for the major elements of an interface architecture for Distribution Management Systems (DMS). Part 1:Interface Architecture and General Requirements, identifies and establishes requirements for standard interfaces based on an Interface Reference Model (IRM). Parts 3-10 of this standard define interfaces relevant to each of the major business functions described by the Interface Reference Model.

This set of standards is limited to the definition of interfaces and is implementation independent. It provides for interoperability among different computer systems, platforms, and languages. Methods and technologies used to implement functionality conforming to these interfaces are considered outside of the scope of these standards; only the interface itself is specified in these standards.

1.2 Scope of this Part

This document is Part 3 of the IEC 61968 standard and specifies the information content of a set of message types that can be used to support many of the business functions related to Network Operations. Typical uses of the message types defined in Part 3 include data acquisition by external systems, fault isolation, fault restoration, trouble management, maintaining plant, and commissioning plant. Message types defined in other Parts of IEC61968 may also be relevant to these use cases.

The mapping of these messages to specific technologies such as XML will be described at a later date following receipt of National Committee comments.

2 Normative references

The following normative documents contain provisions, which through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest editions of the normative documents referred to apply. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 61970-301 *Energy Management System Application Program Interfaces – Part 301 Common Information Model Core.*

3 Reference and Information Models

3.1 Introduction

The message types defined in this document are based on a logical partitioning of the DMS business functions and components called the IEC 61968 Interface Reference Model.

The contents of the message types are based on a static information model to ensure consistency of field names and data types. Each message type is defined as a set of fields copied from Common Information Model (CIM) classes as defined in Part 11 of this standard. The message types defined in this standard are intended to satisfy a majority of typical applications. In some particular project implementations, it may be desirable to modify the set of fields using a methodology such as that described in Part 1.

3.2 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 Parts 3 to 10. It does not necessarily mean that compliant software is delivered as separate modules.

Part 1 of this standard describes infrastructure services common to all abstract components whilst Parts 3-10 define the details of the information exchanged for specific types of abstract component.

IEC 61968 defines that:

1. An inter-application infrastructure is compliant if it supplies services defined in Part 1 to support at least two applications with interfaces compliant to sections of Parts 3 to 10.
2. An application interface is compliant if it supports the interface standards defined in Parts 3 to 10 for the relevant abstract components defined in the Interface Reference Model.
3. An application is only required to support interface standards of the applicable components listed in Column 3. It is not required to support interfaces required by other Abstract Components (Column 3) of the same Business Sub-Function (Column 2) or within the same Business Function (Column 1). While this standard primarily defines information exchanged among components in different business functions, it will occasionally also define information exchanged among components within a single Business Function when a strong market need for this capability has been realised.

3.3 Network Operations Functions and Components

It should be noted that the message types defined in this document: IEC 61968 Part 3: Interface Standard for Network Operations may be sent or received by any type of component within a DMS system.

The following table shows those functions and typical abstract components that are expected to be producers of information for these message types. Typical consumers of the information include, but are not restricted to, the other components as listed in IEC 61968 Part 1 for example, Geographic Information Systems, Energy Management Systems, Customer Information Systems.

Business Functions	Business Sub-Functions	Abstract Components
Network operation (NO)	Network operation monitoring (NMON)	Substation state supervision
		Network state supervision e.g. by topology processing and network colouring
		Switching action supervision
		Management of data acquired from SCADA and metering systems
		Management of data acquired through operation (field crews, customers, scheduled and unscheduled outages)
		Alarm management including supervision, acknowledgement, and deletion.
		Operator and event logs
	Network control (CTL)	User access control
		Automatic controls: <ul style="list-style-type: none"> Protection (fault clearance) Sectionalising Local voltage/reactive power control
		Assisted control: <ul style="list-style-type: none"> Remote switch control Load shedding Voltage regulation e.g. broadcast of voltage reduction command Local control through field crews
		Safety document management
		Safety checking and interlocks
		Major incident co-ordination
	Fault Management (FLT)	Trouble call handling and coherency analysis (LV network)
		Protective relays analysis
		Fault location by analysis of fault detectors and/or trouble call localisation
		Supply restoration assessment
		Customer incident information
	Operation feedback analysis (OFA)	Mal-operation analysis
		Network fault analysis
		Quality index analysis
		Device operation history
		Post-disturbance review
	Operation statistics and reporting (OST)	Maintenance information
		Information for planning
		Information for management control
	Network calculations – real-time (CLC)	Load estimation
		Energy trading analysis
		Load flow/voltage profile
		Fault current analysis
		Adaptive relay settings
	Dispatcher training (TRN)	SCADA simulation

3.4 Message Types

3.4.1 Message Type Names

The message types defined in this standard are described using the following terms.

Message Type Name

Each message type has a name consisting of a Verb and a Noun. In principle, any of the standard verbs listed in Clause 3.4.2 can be combined with any of the Document nouns in Clause 3.4.3 to form a Message Type. In practice some combinations are not applicable and have therefore been omitted from Clauses 5 and 6.

Message Type Verb

The Verb describes the purpose of the message.

Message Type Noun

The Noun describes the type of data in the message body. Each noun corresponds to a class name in the static information model. For most message types, the Nouns are a type of Document.

Message Body

The body of each message type is based on the attributes (fields) of the classes described by the Nouns.

Document reference code

This is an alphanumeric string that uniquely identifies each instance of a type of document within the utility Distribution Management System. This allows software components and human users to distinguish between messages that define new instances and messages that define changes to previous message contents

Note that this standard does not define the format of the Document reference code and places no restrictions on the mechanism of creating such reference codes. For example, in some systems there may be a centralised component to allocate these codes, whilst in other systems, each component could generate its own series of document reference codes for the messages that component produces.

PowerSystemResource

This is an entity that describes a logical part of the utility business. Typically PowerSystemResources are types of conducting equipment. See IEC61970 Part 301.

PowerSystemResource.name

This is a human defined and readable alphanumeric string that identifies an entity with a specific scope e.g. within a particular substation.

PowerSystemResource.ID

IEC 61970 Part 301 does not define a way of identifying equipment with a single attribute. It is however usual for utilities to use unique alphanumeric codes to identify their substations and the equipment in each substation. In some implementations, these codes may have to be prefixed with additional characters to guarantee uniqueness across organisation boundaries.

In this standard, the term "PowerSystemResource.ID" means one of these alphanumeric codes. This is an alphanumeric string that identifies entities like PowerSystemResource and ConnectivityNode such that non-hierarchical relationships may be described within a message. IDs may be allocated by a software component or by a person.

MeasurementValue.Key

This is an implementation specific number (typically 32 bits) that identifies entities like MeasurementValue in an efficient form better suited to computing.

3.4.2 Message Type Verbs

The verbs used in IEC 61968 messages are described below.

61968 Verb	Meaning	Message Body
New	This the first time that data for this document reference code has been published. This type of message is a special type of response to a Subscribe message.	All sections
Change	Data has changed for this document reference code since it was last published by a New or Show message. This type of message is a special type of response to a Subscribe message.	All sections
Show	A publication of data as a result of a Get, Request or Subscribe message.	All sections
Close	No more data will be published for this document reference code due to normal completion of activities e.g. CloseOutageRecord means all affected customers have supply restored.	Header information only e.g. Document reference code, modifiedBy.Person modifiedDateTime
Cancel	No more data will be published for this document reference code due to some sort of error, e.g. the document was created inadvertently. An additional Show message may be required to pass information to assist the receiving components to rollback to a correct state.	Header information only e.g. Document reference code, modifiedBy.Person modifiedDateTime
Delete	Any references to this document reference code can be removed. This is the opposite of New. It may be used instead of or in addition to Close or Cancel	Header information only e.g. Document reference code, modifiedBy.Person modifiedDateTime
Get	A request for data for a given document reference code or set of documents.	One or more Document reference codes or a query by example expression.
Request	Alternative to 'Get'. Request is a more correct term for asynchronous messaging, but Get is shorter and is already used by the Open Application Group (OAG) and by LISTSERV protocols for email group lists. See IEC 61968 Part 2 Glossary.	One or more Document reference codes or a query by example expression.
Ack	An acknowledgement that a document reference code or set has been received	One or more Document reference codes.

61968 Verb	Meaning	Message Body
Subscribe	A request for future messages for a set of documents based on some filter criteria	One or more Document reference codes or a query by example expression.
Unsubscribe	A request to stop receiving messages for a set of documents based on some filter criteria.	One or more Document reference codes or a query by example expression.

3.4.3 Message Type Nouns

The following set of nouns can be used within message types. Each noun corresponds to a class name in the static information model.

Nouns that are of type 'Document' are groupings of other objects and are used to form message type names.

Nouns that are of type 'Part' refer to objects that only exist as part of a larger document.

Noun	Type	Description
MeasurementList	Document	<p>A list of data describing measurements. Each measurement is defined by a set of names for company, substation, equipment, terminal and measurement units, a multilevel description string containing a concatenation of the set of names, a numeric key, and the current value and quality.</p> <p>The set of names, the multilevel description string and numeric key are all alternative ways of defining a specific instance of a Measurement to suit different systems.</p>
MeasKeyValueList	Document	A simplified form of MeasurementList that omits all the static names. Each measurement has a numeric key and the current value and quality.
OutageRecord	Document	<p>A document describing details of an outage in part of the distribution network. An OutageRecord is typically produced as part of a planned activity (e.g. work order for maintenance) or following a breaker trip detected by SCADA or within a Trouble Call System by grouping customer calls.</p> <p>An OutageRecord has an associated OutageStep for each supply point, e.g. distribution transformer or metered switch, that is affected by the outage.</p>
OutageStep	Part	Holds an outage history (startTime, endTime) for a supply point, e.g. distribution transformer or metered switch.

Noun	Type	Description
OperationalRestriction	Document	<p>A document describing how one or more items of plant should be operated at less than the manufacturers' ratings. It is assumed that these messages are in the Network Operations domain and hence are associated with Power System Resources only.</p> <p>Cross-referencing of Assets to PowerSystemResources is covered by the GetAssetList, ShowAssetList message types in Part 4.</p>
SafetyDocument	Document	<p>A document restricting or authorising work on electrical equipment e.g. a permit to work, sanction for test, limitation of access, certificate of isolation.</p>
SwitchingSchedule	Document	<p>A document describing a set of steps to perform an item of work e.g. to isolate some plant with regard to safety, equipment ratings, and standards of customer service.</p>
SwitchingStep	Part	<p>A step within a SwitchingSchedule that describes a control action to be applied to an item of plant, or a SafetyDocument to be issued or cancelled or simple text.</p>

3.5 Static Information Model

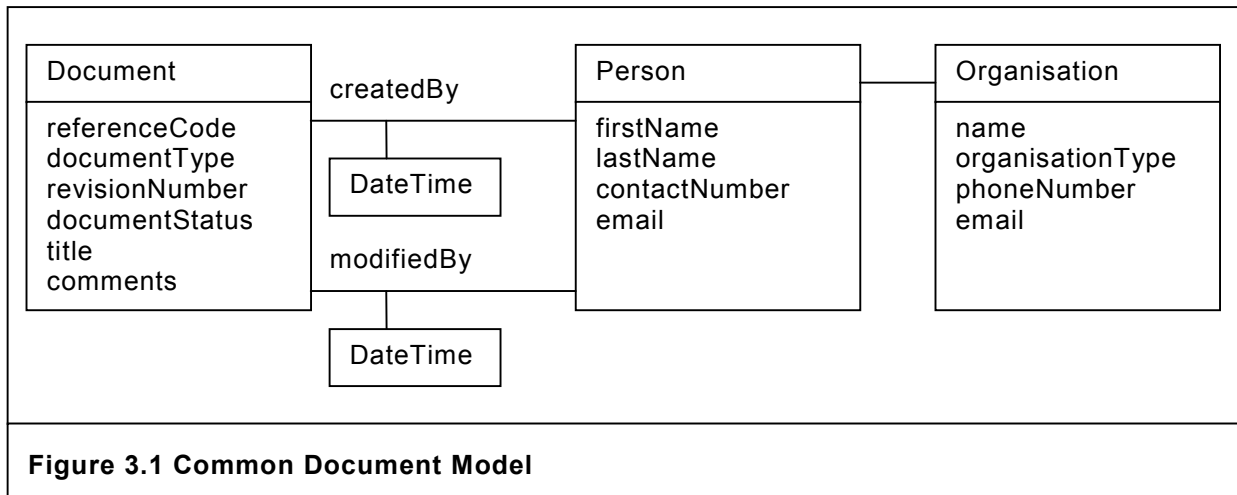
The information model relevant to Network Operations consists of classes as described by the Nouns listed in Clause 3.3 together with the related classes that provide attributes for each message.

This standard also refers to classes from the Core and Meas packages in IEC 61970 Part 301 “Energy Management System Application Program Interfaces – Part 301 Common Information Model Core.”

Later versions of this document will include tables listing the descriptions of all the relevant classes, relationships and attributes including data types such as integer, double, string, datetime.

3.5.1 Base Document Model

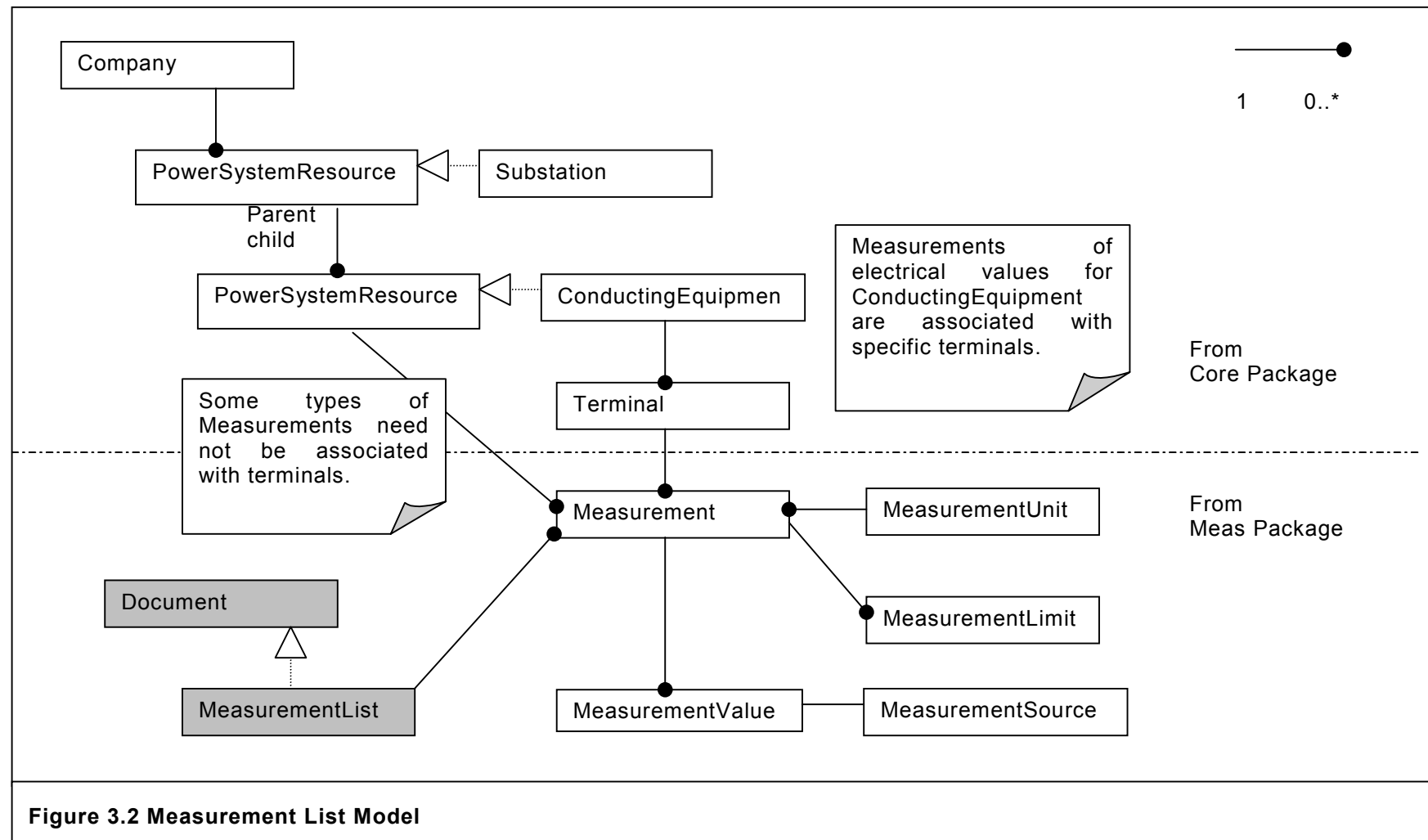
All message types are based on the same model of a document and its associated authors. An organisation may be a company or a division within a company



3.5.2 Measurement List Model

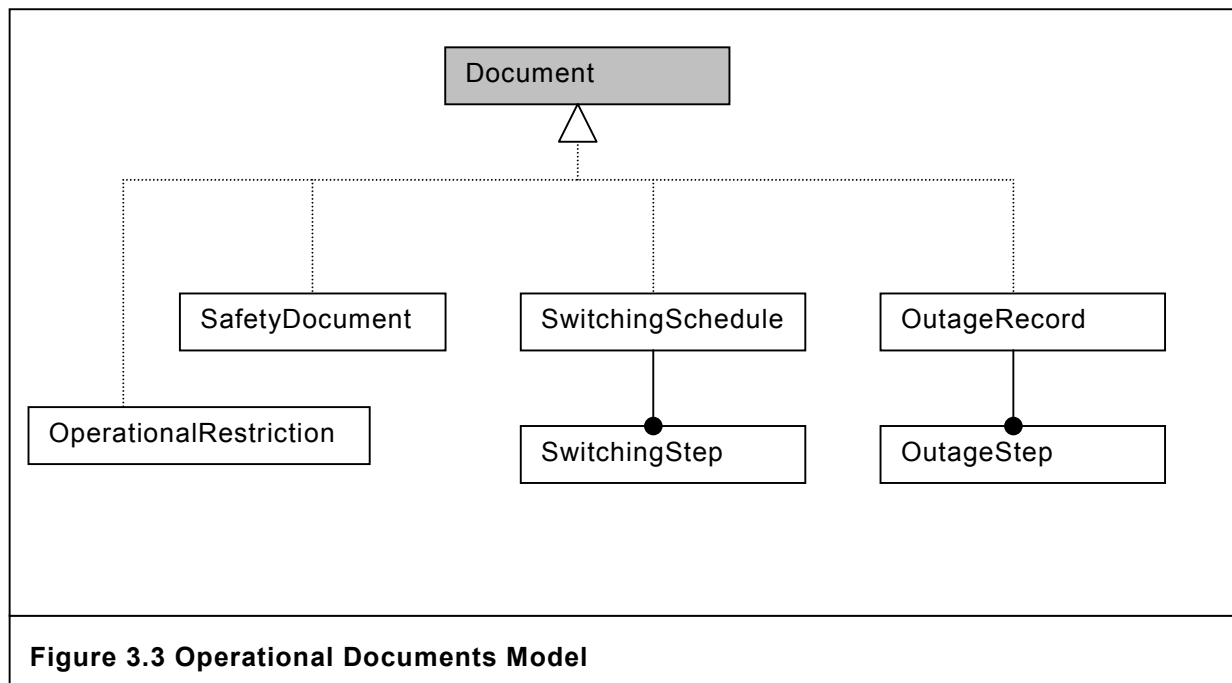
Measurements are based on a subset of the classes defined in the Core and Meas packages of IEC 61970 Part 301.

This diagram to be replaced by copy of relevant figure for Measurement Model from IEC 61970 Part 301.



Operational Documents Model

Operational Documents inherit from the base Document class and have associations with PowerSystemResources.



4 Network Operations Message Types

4.1 Message Usage

The simplest way of using the message types defined in this document, is for an information consumer component to send a Get message type, to which an information producer component will respond with a Show message type.

In addition, this standard also defines a set of message types that can be used for subscribing for multiple sets of data. The standard does not define when such data updates will be sent. It is expected that the message definitions are equally applicable for changes following utility data events, timer events or computer system events.

4.2 Message formats

In general message types have been defined with fields that may hold different representations of the same data. It is expected that producer applications will set some fields with default null values.

In the message format descriptions, terms like Document.* mean all attributes of class Document from the static information model. Multiple copies of sets of attributes are indicated by the term [0..*].

4.3 Query-by-example

Some messages with verbs such as Get, Subscribe, Unsubscribe, can contain data used to select the data of interest. In some cases, the message body would simply be a set of explicit document reference numbers. In other cases the message body fields would contain expressions which allow a query to be constructed. If there are no message body fields, then this shall be interpreted to mean all documents of the relevant type.

Expressions will match ANSI standard SQL including

=, <, >, <=, >=, <>

LIKE

IN [<value1, ..., <valueN>]

4.4 Common message type fields

The following fields shall be part of all message types defined in this standard.

Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime

4.5 Equipment identifiers

IEC 61970 Part 301 does not define a way of identifying equipment with a single attribute. It is however usual for utilities to use unique alphanumeric codes to identify their plant. In some implementations, these codes may have to be prefixed with additional characters to guarantee uniqueness across organisation boundaries.

In this standard, the term “PowerSystemResource.ID” means one of these alphanumeric codes.

4.6 Compliance

Comments are particularly welcome on this section

This committee draft of the standard defines the logical names of message types and fields within message types. It is expected that the final version will include a mapping to XML.

Compliance to XML mapping will be defined in terms similar to:

Compliance can be assessed separately for each message type. However it is expected that vendors will offer compliance for all messages defined in IEC 61968 Part 3, for a group of messages defined in a clause e.g. “Clause 5 Measurement Message Types”; or for a group of messages defined in a sub-clause e.g. “5.2 MeasurementList Message Types”.

A software component is deemed to be compliant to any specific message type if

1. The component can produce an XML message as defined in this standard and including all the fields with names and data types as defined in this standard. Data may be set to default values if it is not available within a component.
2. The component can read an XML message as defined in this standard and correctly interpret those fields that have a meaning within the component and ignore those fields that have no meaning.

5 Measurement Message Types

5.1 General

Verb types Cancel, Close and Delete are not applicable to MeasurementList and MeasKeyValueList type data.

5.2 MeasurementList Message Types

A MeasurementList describes a set of measurements. Each measurement is defined by a set of names for company, substation, equipment, terminal and measurement units, a multilevel description string containing a concatenation of the set of names, a numeric key, and the current value and quality.

The set of names, the multilevel description string and numeric key are all alternative ways of defining a specific instance of a Measurement to suit different systems. The set of names is the most generic form and can be defined and read by humans as well as software. The multilevel description string and the numeric key are more computationally efficient alternatives. The GetMeasurementList and ShowMeasurementList message types can be used to obtain translation between the names, description and keys.

The **multiLevelDescription** is a string that contains the concatenated names of company, substation, equipment, terminal and measurement units. The names are separated by '/' or '\'. This is an alternative to the set of names that is more computationally efficient for some systems.

The **MeasurementSource.name** could be the name of an RTU supplying telemetered data, the name of a collaborating control centre, 'Default', 'Manual', 'Estimated', 'Test'

The **MeasurementValue.value** is either a floating point number representing an analogue or counter value in the relevant engineering units, or it is an enumerated code corresponding to a digital status value. Draft IEC61970 Part 301 does not state how status measurement values are represented. This is under revision following comments on the Committee Draft of Part 301 and work commencing on IEC61970 Part 403 - Scada Interfaces. It is expected that this work will include the definition of the representation of transition status events (e.g. Close --> Open) or a fleeting status events (e.g. Off --> On --> Off)

5.2.1 NewMeasurementList

Usage: sent as the first response to a SubscribeMeasurementList message.

Preconditions: a SubscribeMeasurementList message has just been received.

Message Format: Identical to ShowMeasurementList

5.2.2 ChangeMeasurementList

Usage: sent as second or later response to a SubscribeMeasurementList message, following some change in the data values.

Preconditions: a SubscribeMeasurementList message has been received some time ago.

Message Format: Identical to ShowMeasurementList

5.2.3 ShowMeasurementList

Usage: sent as a response to a GetMeasurementList message, or as an alternative to NewMeasurementList or ChangeMeasurementList messages following appropriate events affecting measurements defined in a SubscribeMeasurementList message.

Preconditions: Either a GetMeasurementList or a SubscribeMeasurementList must have been received by the producer component

Postconditions: None

Message Format: As shown below.

```

Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createdDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime
[0..*]
    Company.name
    Substation.name
    PowerSystemResource.name
    Terminal.name
    Measurement.name
    MeasurementUnit.name
    Measurement.multiLevelDescription
    [0..*]
        MeasurementLimit.name
        MeasurementLimit.description
        MeasurementLimit.highLimit
        MeasurementLimit.lowLimit
        MeasurementLimit.priority

    Measurement.key
    MeasurementValue.value
    MeasurementValue.quality
    MeasurementValue.timestamp
    MeasurementValue.alarmState
    MeasurementSource.name                (see description above)

```

5.2.4 GetMeasurementList

Usage: sent by a consumer application to request a set of measurement data.

Preconditions: None.

Postconditions: A ShowMeasurementList will be returned containing data for measurement identities, keys, and current value.

Message format: Same as ShowMeasurementList except that the message body contains either the required measurement identities; or the required measurement keys or a set of query-by-example patterns.

5.2.5 SubscribeMeasurementList

Usage: sent by a consumer application to create or add measurement identities to a subscription for updates of measurement values.

Preconditions: None.

Postconditions: Values of the measurements are passed in subsequent NewMeasurementList, ChangeMeasurementList or ShowMeasurementList messages. The subscription is cancelled by an UnsubscribeMeasurementList message.

Message format: Same as ShowMeasurementList except that the message body contains either the required measurement identities; or the required measurement keys or a set of query-by-example patterns.

5.2.6 AckMeasurementList

Typical Usage: sent by producer application following a SubscribeMeasurementList message.

Preconditions: None.

Postconditions: A ShowMeasurementList will be sent later containing data for measurement identities, keys, and current value.

Message format: Same as ShowMeasurementList except that the message body is expected to only have a set of measurement keys.

5.2.7 UnsubscribeMeasurementList

Usage: sent by a consumer application to delete all or some measurements from a subscription for updates of measurement values.

Preconditions: This message would follow a SubscribeMeasurementList message sent some time earlier.

Postconditions: If the UnsubscribeMeasurementList matches the pattern defined in the previous SubscribeMeasurementList, then no more subsequent NewMeasurementList, ChangeMeasurementList or ShowMeasurementList messages will be sent to the consumer application. If the subscribe and unsubscribe lists don't match, then shorter NewMeasurementList, ChangeMeasurementList or ShowMeasurementList messages are sent.

Message format: Same as ShowMeasurementList except that the message body contains either the required measurement identities; or the required measurement keys or a set of query-by-example patterns.

5.3 MeasKeyValue Message Types

These messages are alternatives to the MeasurementList message types, but with fewer fields to suit systems that require higher performance. In these message types, numeric keys rather than names are used to identify Measurements.

5.3.1 NewMeasKeyValueList

Appropriate to the first response after a SubscribeMeasKeyValueList message type. The message format is identical format to ShowMeasKeyValueList.

5.3.2 ChangeMeasKeyValueList

Appropriate to the second and subsequent responses after a SubscribeMeasKeyValueList message type. The message format is identical format to ShowMeasKeyValueList.

5.3.3 ShowMeasKeyValueList

Message Format:

```
Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus

Document.modifiedDateTime
[0..*]
    Measurement.key
    MeasurementValue.value
    MeasurementValue.quality
    MeasurementValue.timestamp
    MeasurementValue.alarmState
    MeasurementSource.name
```

5.3.4 GetMeasKeyValueList

An alternative to GetMeasurementList if the keys have already been defined via a previous ShowMeasurementList message.

5.3.5 SubscribeMeasKeyValueList

An alternative to SubscribeMeasurementList if the keys have already been defined via a previous ShowMeasurementList message.

5.3.6 AckMeasKeyValueList

An alternative to AckMeasurementList that contains numeric keys but not names.

5.3.7 UnsubscribeMeasKeyValueList

An alternative to UnsubscribeMeasurementList if the keys have already been defined via a previous ShowMeasurementList message.

6 Operations Document Message Types

For more information on the usage of each message type see section 3.4 Message Type Verbs.

6.1 OperationalRestriction Message Types

An Operational Restriction document describes how one or more items of plant should be operated at less than the manufacturers' ratings. It is assumed that these messages are in the Network Operations domain and hence are associated with Power System Resources only.

Cross-referencing of Assets to PowerSystemResources is covered by the GetAssetList, ShowAssetList message types in IEC 61968 Part 4.

6.1.1 NewOperationalRestriction

Message format: Identical to ShowOperationalRestriction except that the producer application is indicating that this is the first occasion that data for this document reference code has been published.

6.1.2 ChangeOperationalRestriction

Message format: Identical to ShowOperationalRestriction except that the producer application is indicating that some of the data sections have different values since the previous message for the same document reference code.

6.1.3 ShowOperationalRestriction

Message format:

```
Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createdDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime

OperationalRestriction.startDateTime
OperationalRestriction.endDateTime
OperationalRestriction.restriction
OperationalRestriction.reason
OperationalRestriction.affects.[0..*]PowerSystemResource.ID
```

6.1.4 CancelOperationalRestriction

Message format:

```
Document.*
```

6.1.5 CloseOperationalRestriction

Message format:

`Document.*`

6.1.6 DeleteOperationalRestriction

Message format:

`Document.*`

6.1.7 GetOperationalRestriction

Message format: Identical to ShowOperationalRestriction except the message body contains the query-by-example pattern.

6.1.8 SubscribeOperationalRestriction

Message format: Identical to ShowOperationalRestriction except the message body contains the query-by-example pattern.

6.1.9 AckOperationalRestriction

Message format:

`Document.*`

6.1.10 UnsubscribeOperationalRestriction

Message format: Identical to ShowOperationalRestriction except the message body contains the query-by-example pattern.

6.2 OutageRecord Message Types

An OutageRecord document describes details of an outage in part of the distribution network.

An OutageRecord is typically produced as part of a planned activity (e.g. work order for maintenance) or following a breaker trip detected by SCADA or within a Trouble Call System by grouping customer calls. An OutageRecord has an associated OutageStep for each supply point, e.g. distribution transformer or metered switch, that is affected by the outage.

Some of the fields e.g. OutageStep.fatality may be specific to particular utilities and systems. It should be noted that the `Document.comments` field is available for general purpose text that can characterise the outage.

6.2.1 NewOutageRecord

Message format: Identical to ShowOutageRecord except that the producer application is indicating that this is the first occasion that data for this document reference code has been published.

6.2.2 ChangeOutageRecord

Message format: Identical to ShowOutageRecord except that the producer application is indicating that some of the data sections have different values since the previous message for this document reference code.

6.2.3 ShowOutageRecord

Message format:

```

Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments                    (free text comments)

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createdDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime

OutageRecord.startDateTime
OutageRecord.endDateTime              (may be estimated)
OutageRecord.suspect.ConductingEquipment.ID
OutageRecord.reason                  (utility specific concise text description)
OutageRecord.[0..1].SwitchingSchedule.referenceCode
[0..*]
    OutageStep.equipment.PowerSystemResource.ID
                                (transformer or metered switch)
    OutageStep.offDateTime
    OutageStep.onDateTime              (may be estimated restoration time)
    OutageStep.jobPriority
    OutageStep.numberTotalCustomers   (connected to the PowerSystemresource)
    OutageStep.numberSpecialCustomers (e.g. high reliability required)
    OutageStep.numberCriticalCustomers (e.g. with dialysis machine)
    OutageStep.numberCallers           (number of customers phoning in)

```

<code>OutageStep.fatality</code>	(reported by caller or engineer Y/N/Null)
<code>OutageStep.injury</code>	(reported by caller or engineer Y/N/Null)
<code>OutageStep.shocks</code>	(reported by caller or engineer Y/N/Null)
<code>OutageStep.damage</code>	(reported by caller or engineer Y/N/Null)

6.2.4 CancelOutageRecord

Message format:

`Document.*`

6.2.5 CloseOutageRecord

Message format:

`Document.*`

6.2.6 DeleteOutageRecord

Message format:

`Document.*`

6.2.7 GetOutageRecord

Message format: Identical to `ShowOutageRecord` except the message body contains the query-by-example pattern.

6.2.8 SubscribeOutageRecord

Message format: Identical to `ShowOutageRecord` except the message body contains the query-by-example pattern.

6.2.9 AckOutageRecord

Message format:

`Document.*`

6.2.10 UnsubscribeOutageRecord

Message format: Identical to `ShowOutageRecord` except the message body contains the query-by-example pattern.

6.3 SafetyDocument Message Types

A SafetyDocument restricts or authorises work on electrical equipment e.g. a permit to work, sanction for test, limitation of access, certificate of isolation.

6.3.1 NewSafetyDocument

Message format: Identical to ShowSafetyDocument except that the producer application is indicating that this is the first occasion that data for this document reference code has been published.

6.3.2 ChangeSafetyDocument

Message format: Identical to ShowSafetyDocument except that the producer application is indicating that some of the data sections have different values since the previous message for this document reference code.

6.3.3 ShowSafetyDocument

Message format:

```

Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments                                (free text comments)

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createdDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime

SafetyDocument.appliedBy.SwitchingSchedule.referenceCode
SafetyDocument.appliedTo.PowerSystemResource.ID
SafetyDocument.appliedAt.Location.*

SafetyDocument.isolatedBy[0..*]PowerSystemResource.ID
SafetyDocument.earthedBy[0..*]PowerSystemResource.ID
SafetyDocument.permits[0..*]PowerSystemResource.ID

SafetyDocument.issuedBy.Person.*                (control engineer)
SafetyDocument.issuedDateTime

SafetyDocument.receivedBy.Person.*              (field engineer)
SafetyDocument.receivedDateTime

SafetyDocument.clearedBy.Person.*              (field engineer)
SafetyDocument.clearedDateTime

SafetyDocument.cancelledBy.Person.*            (control engineer)
SafetyDocument.cancelledDateTime

```

6.3.4 CancelSafetyDocument

Message format:

Document.*

6.3.5 CloseSafetyDocument

Message format:

Document.*

6.3.6 DeleteSafetyDocument

Message format:

Document.*

6.3.7 GetSafetyDocument

Message format: Identical to ShowSafetyDocument except the message body contains the query-by-example pattern.

6.3.8 SubscribeSafetyDocument

Message format: Identical to ShowSafetyDocument except the message body contains the query-by-example pattern.

6.3.9 AckSafetyDocument

Message format:

Document.*

6.3.10 UnsubscribeSafetyDocument

Message format: Identical to ShowSafetyDocument except the message body contains the query-by-example pattern.

6.4 SwitchingSchedule Message Types

A SwitchingSchedule document describes a set of steps to perform an item of work e.g. to isolate some plant with regard to safety, equipment ratings, and standards of customer service.

The ScheduleStep status field has one of the following values:

Ready

Equipment is correct state for the control action

Proposed

The control action is proposed to allow the system to check against safety rules.

Instructed

The control action has been executed through telemetry or as an instruction to field crew.

Completed

The control action has been reported complete by telemetry or verbally from field crew

Skip

This step will not or has not been executed.

6.4.1 NewSwitchingSchedule

Message format: Identical to ShowSwitchingSchedule except that the producer application is indicating that this is the first occasion that data for this document reference code has been published.

6.4.2 ChangeSwitchingSchedule

Message format: Identical to ShowSwitchingSchedule except that the producer application is indicating that some of the data sections have different values since the previous message for this document reference code.

6.4.3 ShowSwitchingSchedule

Message format:

```
Document.documentType
Document.referenceCode
Document.revisionNumber
Document.documentStatus
Document.title
Document.comments (free text comments)

Document.createdBy.Person.*
Document.createdBy.Person.Organisation.*
Document.createdDateTime
Document.modifiedBy.Person.*
Document.modifiedBy.Person.Organisation.*
Document.modifiedDateTime

SwitchingSchedule.startDateTime
SwitchingSchedule.endDateTime
SwitchingSchedule.reason
SwitchingSchedule.[0..*].WorkOrder.referenceCode
SwitchingSchedule.[0..*].OutageRecord.referenceCode
SwitchingSchedule.executedBy.Person
```

```
SwitchingSchedule.requestedBy.Person.*
SwitchingSchedule.requestedBy.Person.Organisation.*
SwitchingSchedule.requestedDateTime
```

```
SwitchingSchedule.checkedBy.Person
SwitchingSchedule.checkedBy.Person.Organisation.*
SwitchingSchedule.checkedDateTime
```

```
SwitchingSchedule.approvedBy.Person
SwitchingSchedule.approvedBy.Person.Organisation.*
SwitchingSchedule.approvedDateTime
```

```
[0..*]
```

```
    ScheduleStep.sequenceNumber
    ScheduleStep.PowerSystemResource.ID
    ScheduleStep.requiredControlAction
    ScheduleStep.SafetyDocument.referenceCode
    ScheduleStep.requiredDocStatus
    ScheduleStep.text
    ScheduleStep.status
    ScheduleStep.instructedDateTime
    ScheduleStep.completedDateTime
```

6.4.4 CancelSwitchingSchedule

Message format:

```
Document.*
```

6.4.5 CloseSwitchingSchedule

Message format:

```
Document.*
```

6.4.6 DeleteSwitchingSchedule

Message format:

```
Document.*
```

6.4.7 GetSwitchingSchedule

Message format: Identical to ShowSwitchingSchedule except the message body contains the query-by-example pattern.

6.4.8 SubscribeSwitchingSchedule

Message format: Identical to ShowSwitchingSchedule except the message body contains the query-by-example pattern.

6.4.9 AckSwitchingSchedule

Message format:

```
Document.*
```


6.4.10 UnsubscribeSwitchingSchedule

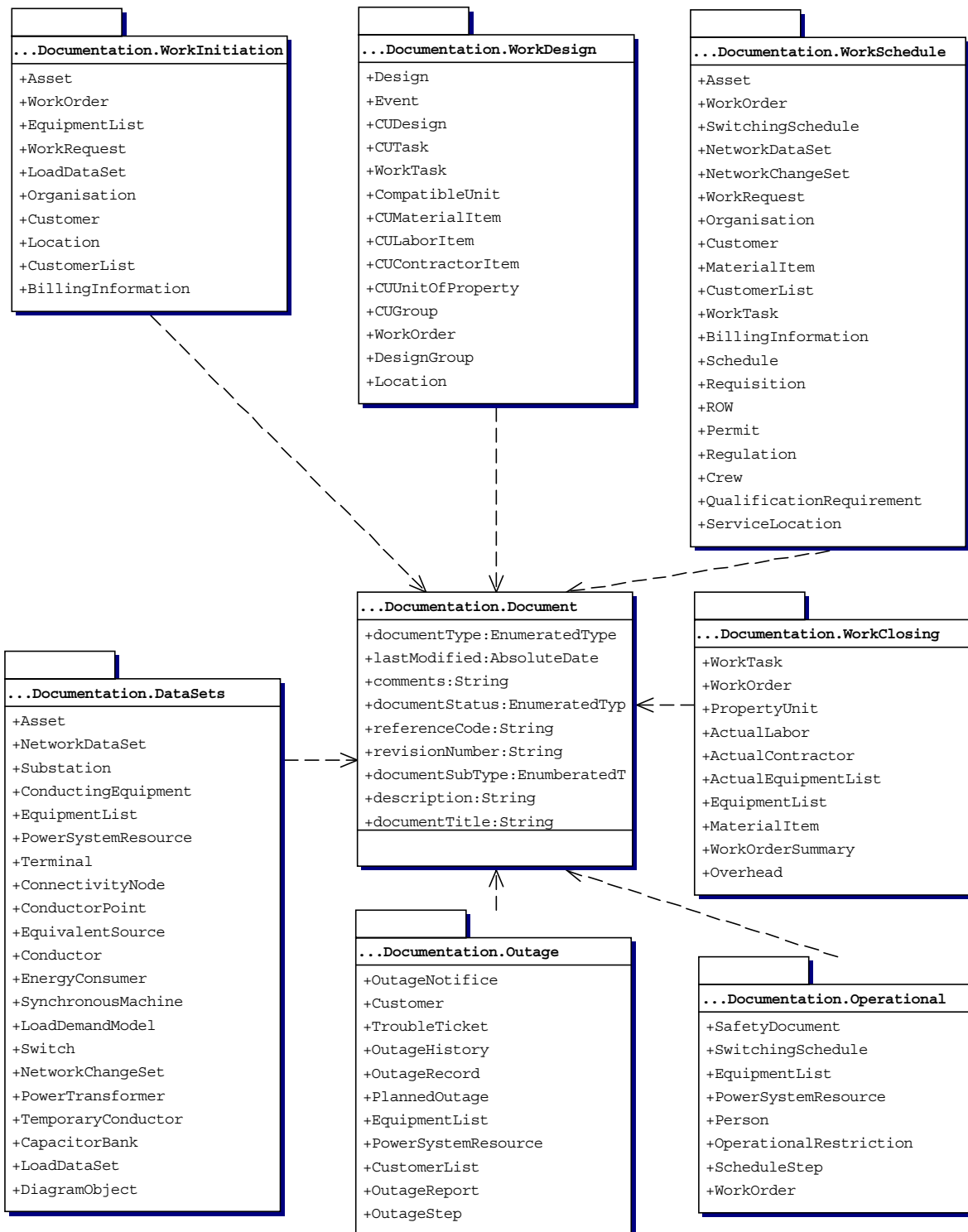
Message format: Identical to ShowSwitchingSchedule except the message body contains the query-by-example pattern.

Informative Annex

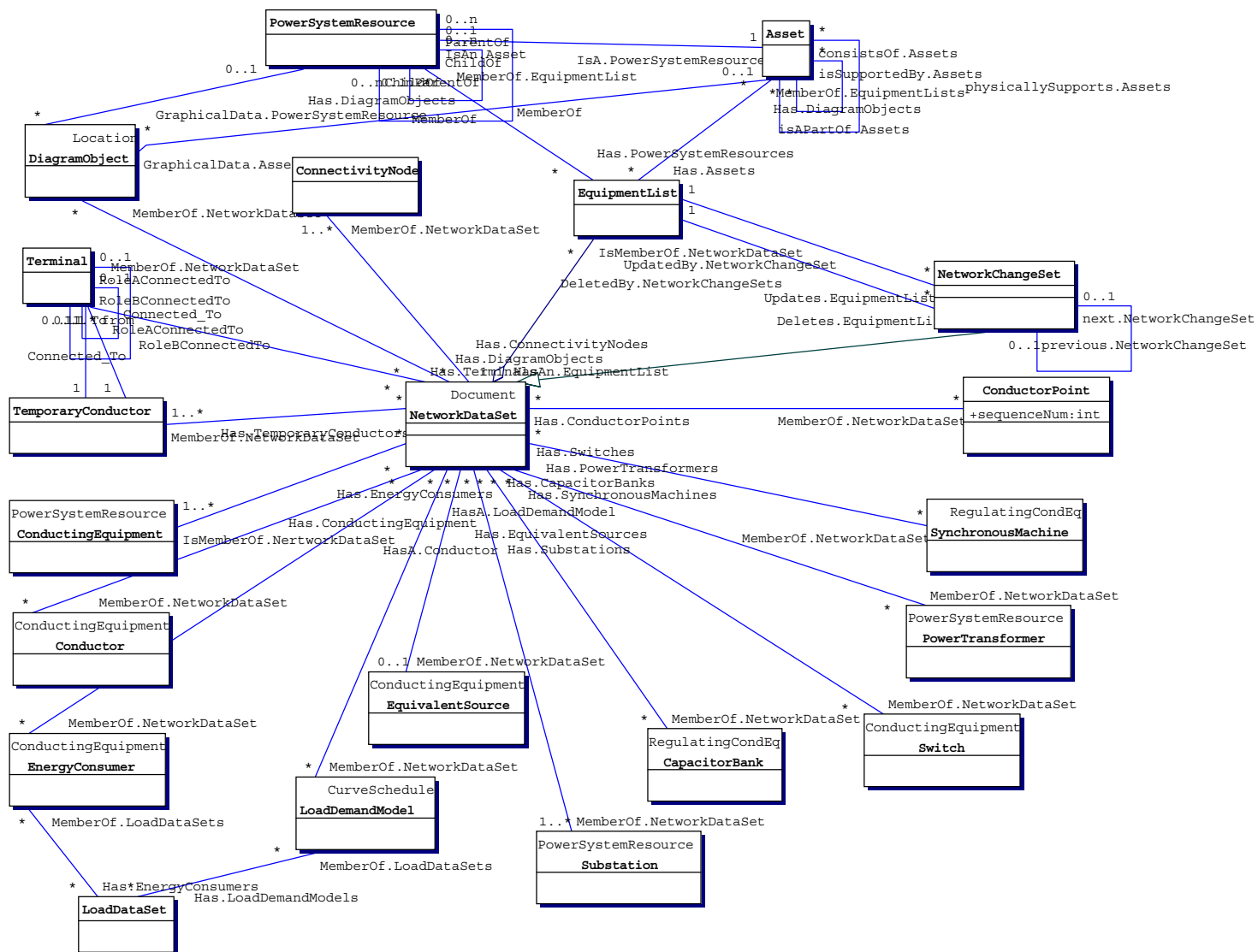
ANNEX A: Relevant Packages of the Common Information Model (IEC 61968-11)

For a detailed description of the Common Information Model (CIM) classes and their attributes and relationships used in this specification's message types, refer to IEC 61968-11 and IEC 61970-301. For convenient reference, the most frequently used classes of the CIM are depicted in the following packages.

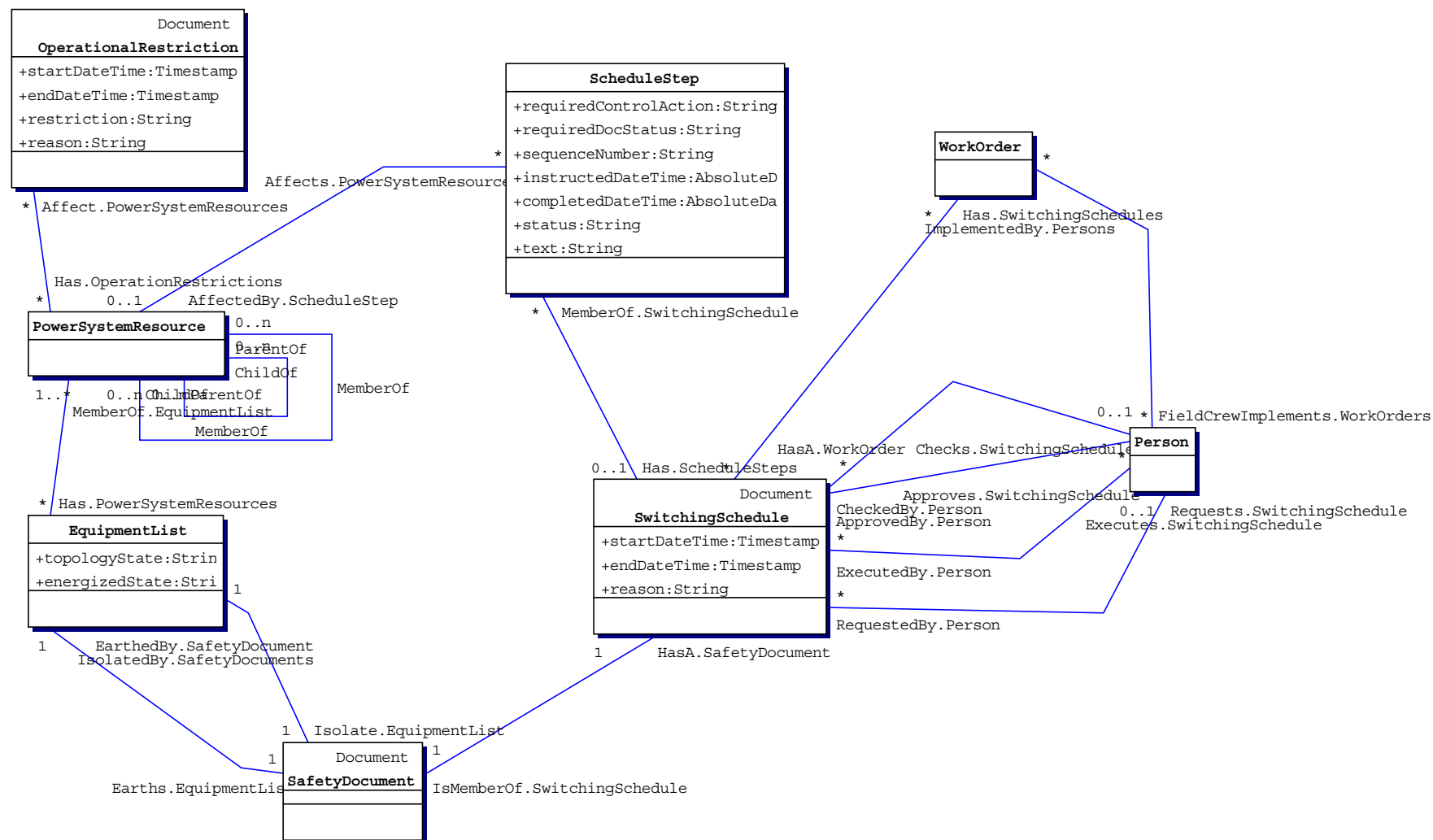
Documentation Overview



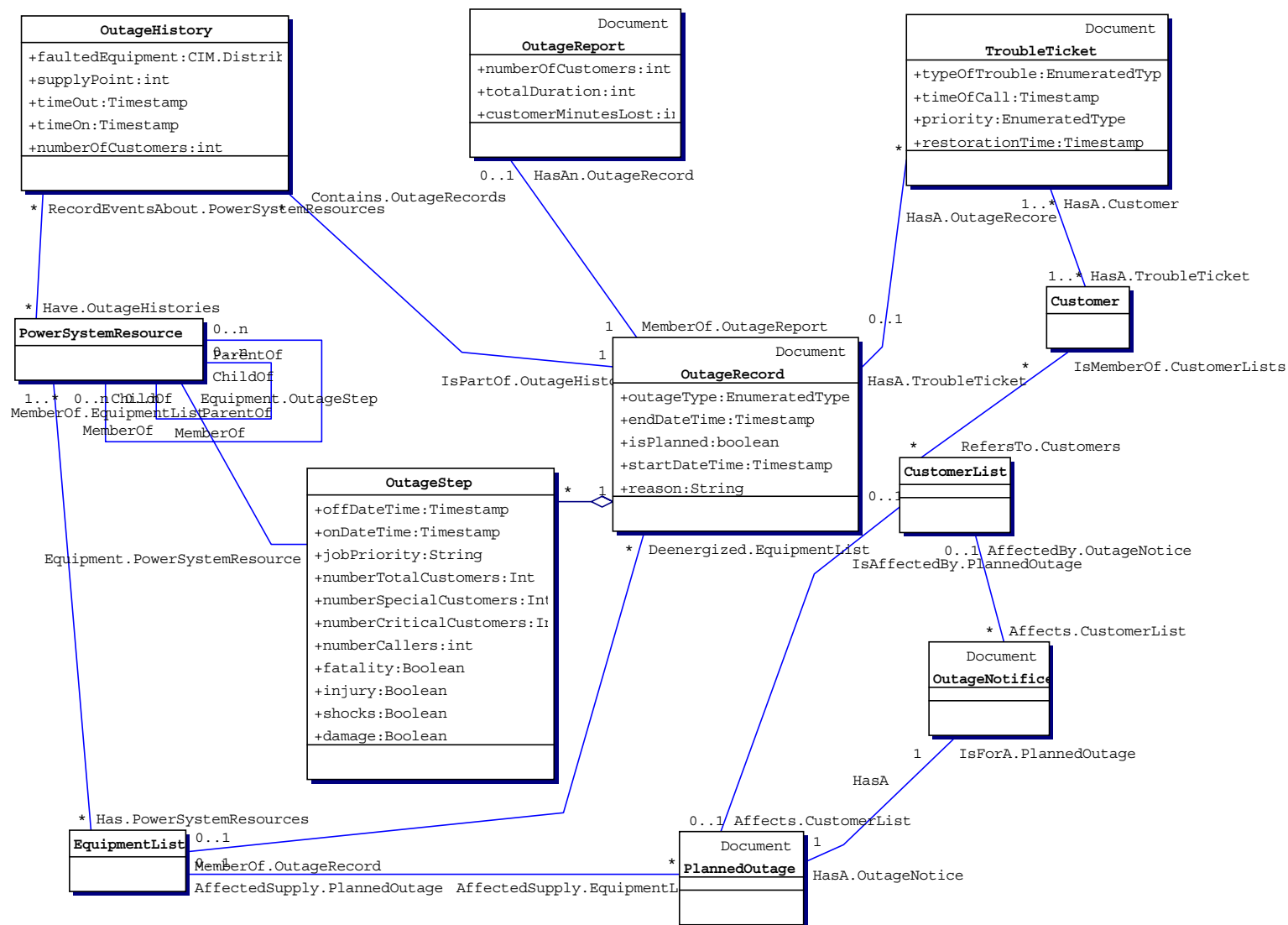
Documentation - Network Data Set

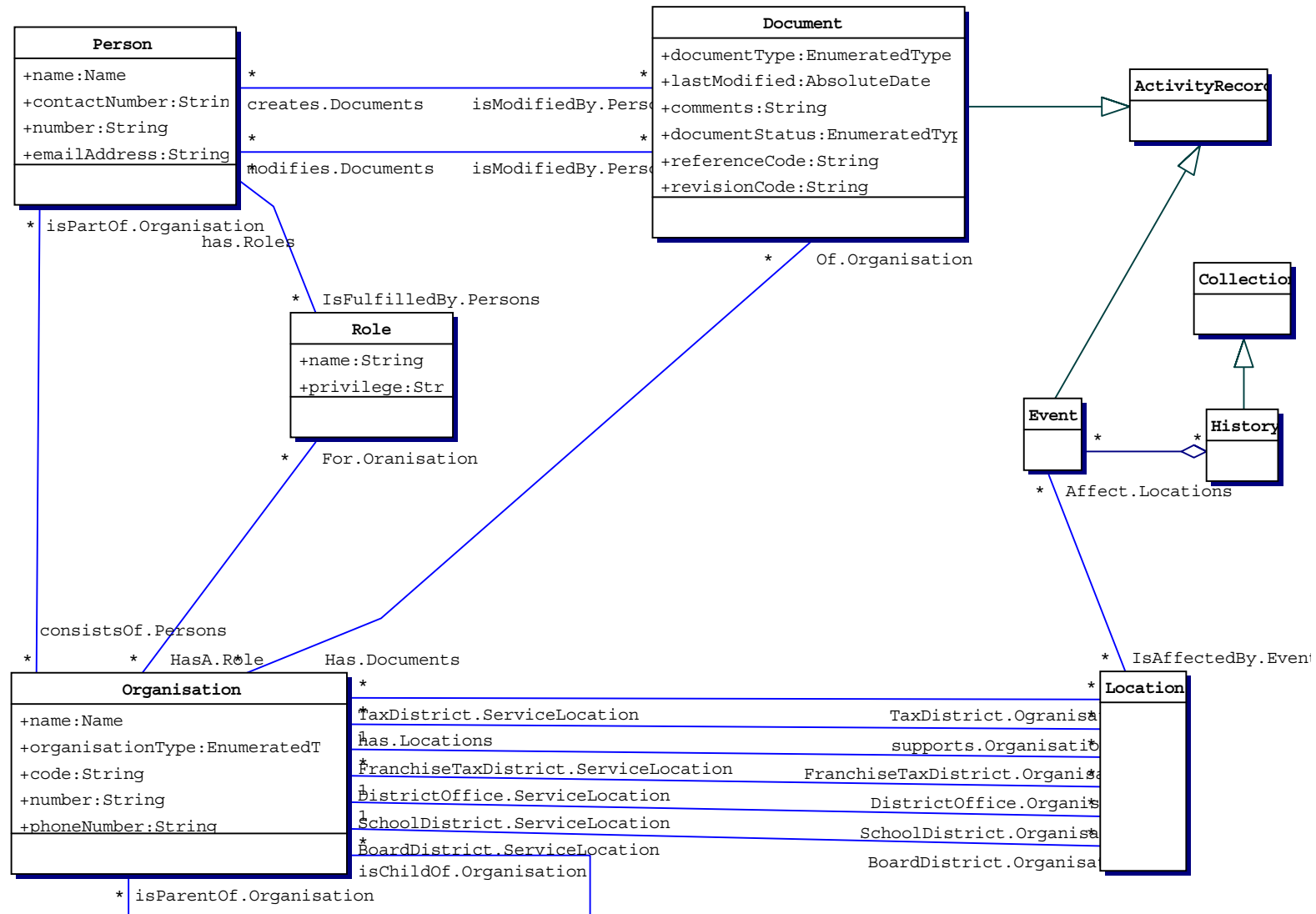


Documentation – Operational



Documentation - Outage Mangement





ANNEX B: Informative: Use cases

UC46: Data acquisition by external system

Summary:

This use case describes how an external Energy Management System (EXT-EMS) could get analogue and status measurement data from a Network Operations – Network Monitoring (NO-NMON) subsystem within a Distribution Management System (DMS). The measurement data could originate from a variety of sources including Remote Terminal Units (RTU), networked Intelligent Electrical Devices (IEDs), manual data entry or calculations within the Network Operations system. The NO-NMON subsystem will present all measurement information in a consistent manner regardless of the source.

Data maintenance and Telemetry network maintenance are considered separate use cases but relevant Actors and Systems are shown for reference.

This use case includes a very simple form of data discovery which returns a numeric key if a named measurement exists and an error return code if a named measurement does not exist. It is assumed that the external system has some rules to define the set of names that it will attempt to discover.

This use case assumes a single context for all information exchanges.

Actor(s):

Name	Role description
Data maintenance technician	A person who maintains the data describing the electrical and telemetry networks. <i>{participates in pre-conditions only}</i>
Telemetry System	(External System) Provides information in the form of analogue measurements, status, or accumulator data from substation, neighboring control center, or field device.
Control engineer	A person who monitors and controls system operations

Participating Business Functions:

Acronym	Business Function Abstract Component	Services or information provided
AM AM-EINV	Records and asset management Substation and network inventory	<i>{participates in pre-conditions only}</i> Substation display Telecontrol database For example, the off-line definition database and functions within a SCADA system.
MC MC-TLM	Maintenance & Construction Telemetry Network	<i>{participates in pre-conditions only}</i> Telemetry Communications Links The physical telemetry network is considered an Actor within this use case.

Acronym	Business Function Abstract Component	Services or information provided
NO	Network operations	Network switching state Data acquired from SCADA Data acquired from field crews For example, the real-time database and functions within a SCADA system.
NO-NMON	Network monitoring	
EXT	External System	Could simply be a remote user interface for monitoring
EXT-EMS	Energy Management System	For example, network security and pricing calculations, load forecast.

Assumptions / Design Considerations:

◆ Name/Structure cross-reference table

It is assumed that the external system only requires a relatively static subset of the electrical network monitored by the DMS Network Monitoring component. For example, substations at the boundary of transmission and distribution networks may be monitored by one system with data supplied to the other.

The EMS and DMS components may have different internal representations of the power system network. If the EMS does not use exactly the same name and structure internally as the DMS, then it needs a set of cross-reference tables and/or rules to map the relevant DMS name/structure to the desired EMS name/structure.

For example, equipment with different nominal voltages at the same physical location ('a substation') may be represented in the DMS as belonging to several substations, one for each voltage level; and may be represented in the EMS as belonging to different voltage levels within a single substation.

This use case assumes an information exchange based on a simple hierarchy of Company, Substation, Equipment, [optional Terminal], Measurement names. An alternative is a multi-level description string using '/' or '\' characters to separate PowerSystemResource names.

"...For example the method used on the NERC ISN is a concatenated string approach (which follows the hierarchical problem well)

I/R/C/F/EO/T/P/VT where:

I=Interconnection

R=Region

C=Company

F=Facility

EO=Electrical Object (could be divided into Volt/Class/ID)

T=Terminal

P=Phase

VT=Value Type (i.e. quantity)

E//CE/8 FISK/38TR 72/12/A/MW

Means

Eastern Interconnection, MAIN Region, ComEd, Fisk Generation Plant, 138 KV

Transformer 72, 12KV Winding Terminal, A Phase, MegaWatt
[source: Dennis Friend]

◆ Interesting measurements

It is assumed that the EMS has rules for which types of measurements are applicable for different equipment types. These rules may depend on the particular EMS application e.g. Generation or Network Analysis. Information on equipment type is not exchanged as part of this use case. In other words the intelligence on which measurements are *useful* resides in the external EMS and its data maintenance staff.

In this use case, the DMS is considered the master of the data and has the intelligence on which measurements are *available*. It is assumed that information on available, valid names for Company, Substation, ConductingEquipment and Measurements are made available to the data maintenance staff of the EMS system. Note that in order to decide which measurements to use, it may be necessary to supply additional information on the connectivity and normal topology of the DMS equipment. However, it is beyond the scope of this use case whether any of such information is supplied on paper or electronically.

◆ Numeric keys or handles

SCADA systems will usually have some internal numeric key or handle for measurements that are used for fast lookups of values. These keys may have a specific meaning such as an array index or a C++ pointer address. In the latter case, the key is only valid whilst the process is running. However for the purposes of this use case, it is sufficient that these numeric keys can be passed to external systems to allow faster information exchanges than using name strings.

◆ Subscription table

It is assumed that the Network Operations – Network Monitoring component and/or associated middle-ware supports tables recording which measurements have been subscribed to.

It is also assumed that these subscription tables are automatically tidied up after a permanent loss of connection.

◆ Analogue measurement limit processing & alarm states

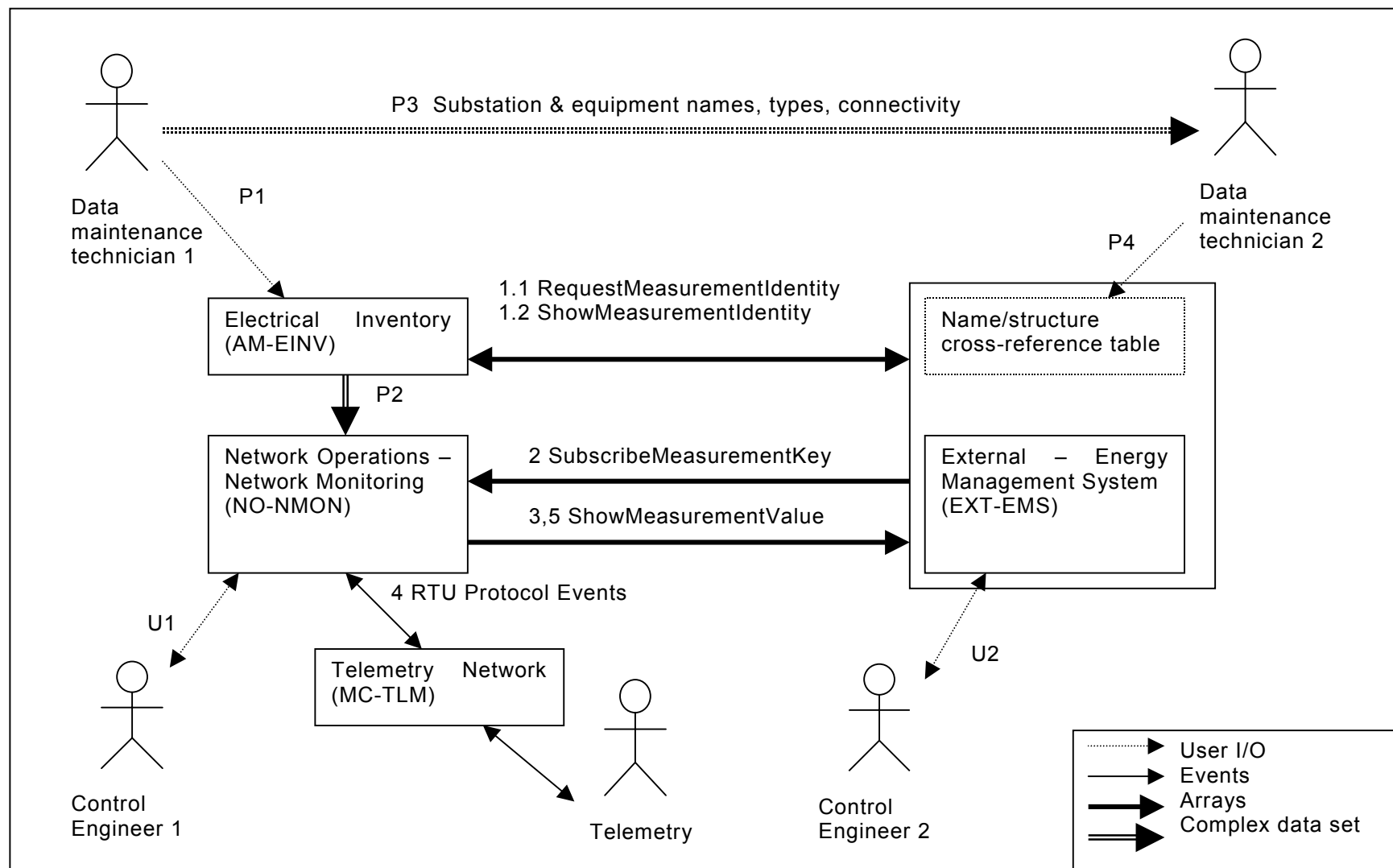
It is assumed that the Network Operations – Network Monitoring component compares analogue measurement values against limits and passes the alarm state to the external system. The meaning of each alarm state must be passed to the external system as part of the pre-conditions, not necessarily in an electronic form.

◆ Status measurement values & alarm states

It is assumed that the Network Operations – Network Monitoring component produces numeric values for status measurements with pre-defined meanings. It is likely that the numeric status values correspond to a set of alarm states for each type of equipment and/or measurement. The meaning of each status value and/or alarm state must be passed to the external system as part of the pre-conditions, not necessarily in an electronic form

Integration Scenario Diagram:

This diagram shows the participating components and major information exchanges. The numbers refer to the sequence steps.



Pre-conditions:

- P1. A data maintenance technician has defined the master inventory of the telemetry database.
- P2. The telemetry database has been configured in the real time Network Operations – Network Monitoring system
- P3 Information on names of Substations, Equipment and Measurements has been passed to the data maintenance staff of the EMS system
- P4 If necessary, a set of identifier cross-reference tables has been set up within the External EMS system to allow EMS system names to be translated into the names within the NO-NMON system.

Normal Sequence:

(This shows in time order, the sequence of information exchanges between the subsystems)

Use Case Step	Event	Description Of Process	Information To Be Exchanged	<u>ProducerTo Receiver</u> Abstract Component	<u>Message Type (Verb/Noun)</u>
1.1.	External system requests mapping of names to keys	External system sends list of names	Company.name Substation.name Equipment.name Measurement.name	EXT-EMS to AM-EINV (or NO-NMON)	RequestMeasurementIdentities
1.2.	Return numeric keys	looks up names zero or negative key means name(s) not found	As above plus MeasurementUnit.name Measurement.key	AM-EINV (or NO-NMON) to EXT-EMS	ShowMeasurementIdentities
2.	External system subscribes to required measurements	EXT sends list of keys. NMON sets up subscription table.	Measurement.key	EXT-EMS to NO-NMON	SubscribeMeasurementKeys

Use Case Step	Event	Description Of Process	Information To Be Exchanged	ProducerTo Receiver Abstract Component	Message Type (Verb/Noun)
3.	NMON system sends current values. This is an implicit acknowledgment to the subscription request	For each entry in each subscription table find most recent value.	Measurement.key MeasurementValue .value MeasurementValue. .quality	NO-NMON to EXT-EMS	ShowMeasurementValues
4.	Telemetry system sends measurement event using RTU protocol	NMON Interprets RTU message; stores data in real time database; Calculates alarm states if any; raises alarms as necessary; logs changes as necessary;	Measurement.key MeasurementValue .value .quality .timestamp	In terms of IEC61968, this is all internal to NO-NMON	Not applicable
5.	NMON sends changed data values	Check EXT subscription table references for changed measurements	Measurement.key MeasurementValue .value .quality .timestamp .alarmState .source	NO-NMON to EXT-EMS	ShowMeasurementValues

Post Conditions

- U1 The NO-NMON use interface is updated with new measurement values
 U2 The EXT-EMS component contains a copy of the measurement values which are displayed on relevant user interfaces.

Exceptions / Alternate Sequences

A. Orderly exit / change of interest

Use Case Step	Event	Description Of Process	Information To Be Exchanged	<u>ProducerTo</u> <u>Receiver Abstract</u> <u>Component</u>	<u>Message Type (Verb/Noun)</u>
A1.	External system unsubscribes to specified measurements	External system sends list of keys.	Measurement.key	EXT-EMS to NO-NMON	Unsubscribe-MeasurementKeys
A2.	Confirm change in subscription (optional)	Removes keys from subscription list. A copy of these keys could be returned.	Measurement.key Or none.	NO-NMON to EXT-EMS	AckUnsubscribe MeasurementKeys

B. Lost connection

Essential: When connection is lost between NO-NMON and EXT-EMS for a significant time (minimum 0, maximum 24 hours), the subscription tables are deleted.

Possible: When connection is lost between NO-NMON and EXT-EMS for less than some configured time delay, then after reconnection, the measurement values are sent automatically for measurements in the subscription table. This is probably middle-ware dependent.

C. Telemetry Network status

As well as measurements for power network equipment, this interface could be used for measurements i.e. status of telemetry network equipment such as RTUs or CommunicationsLinks. It is not necessary to have standard types of non-conducting equipment as they can all be represented as generic PowerSystemResources.

D. Change in network model

If equipment is added or removed to either component model, then the models can be kept consistent by repeating the whole use case. If lists of the identity of equipment that has been inserted, deleted or updated are available, then it is feasible to un-subscribe and re-subscribe to data for the affected equipment.

E. Multi-level description

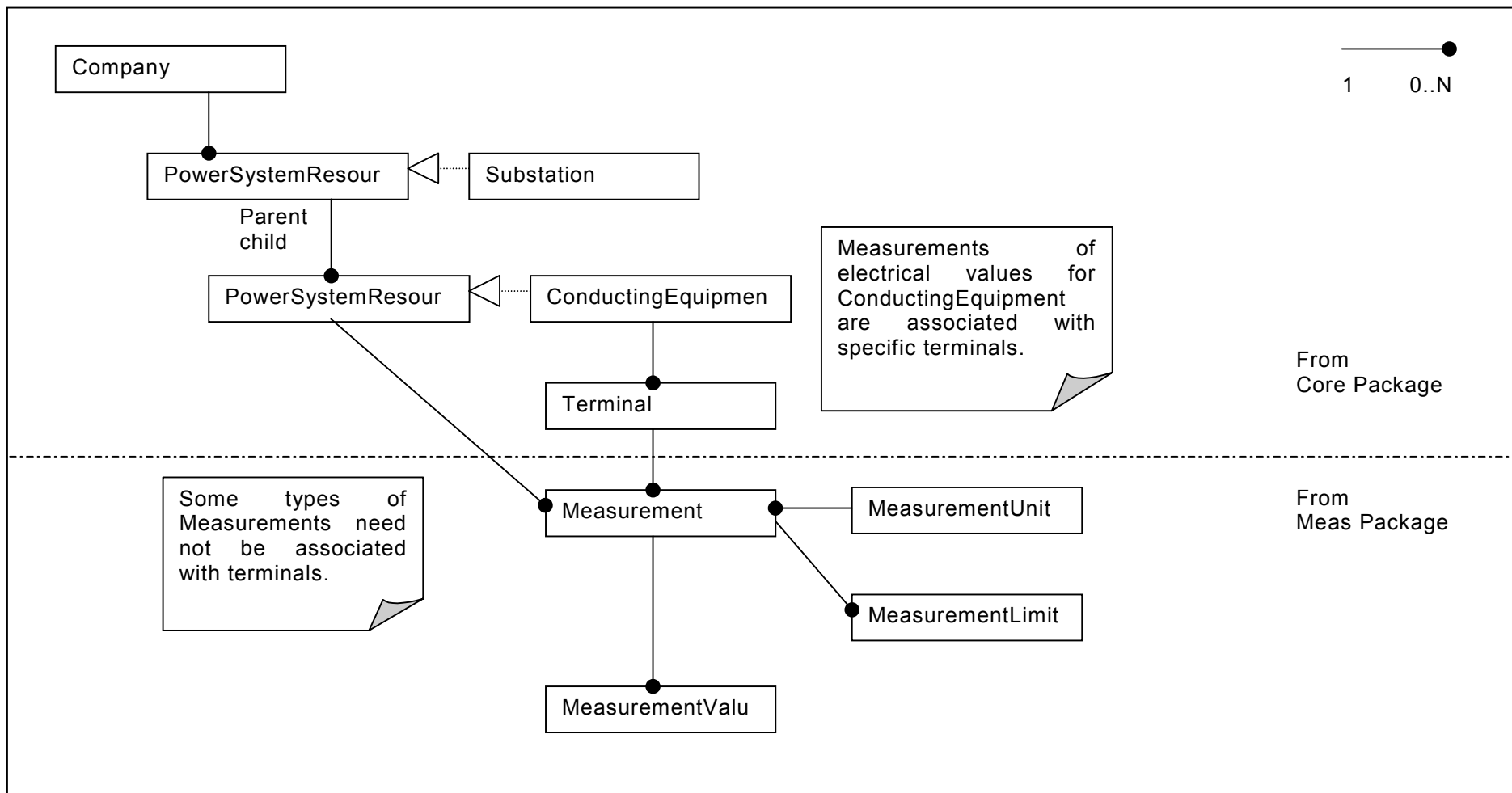
As an alternative to a fixed set of names as in step 1.1 and 1.2, the information exchange could be a single string which is a concatenation of the PowerSystemResource name hierarchy separated by a standard character e.g. '/' or '\'.

F. Measurement message superset

As an alternative to the two-stage information exchange of (one) MeasurementIdentity and (many) MeasurementValue, it is feasible to put all the information into a single message structure.

Static Data Reference Model – Relevant classes from Core and Meas packages

This is an extract from the IEC61970 Common Information Model, i.e. a reference model that can support a wide range of standard interfaces. Most of these classes are used only to set up the initial subscription. MeasurementValue attributes represent dynamically changing data.



Information Model for normal sequence.

Class	Class Attributes	Attribute Type	Domain	Relations
Company	Name	String	Globally unique	Company(1).operates. (1..N)Substations
Substation {isA.PowerSystemResource}	Name	String	Unique within Company	Substation(1).parent. .child(1..N)ConductingEquipment {Inherit from PowerSystemResource}
Equipment ConductingEquipment isA.PowerSystemResource}	Name	String	Unique with Substation	ConductingEquipment(1).has. (1..N)Terminals
Terminal	Name	String	Unique for type of equipment	Terminal(1).has. (1..N)Measurements
PowerSystemResource	Name	String		PowerSystemResource(1).has. (0..N)Measurements
Measurement	Name – Note 1 Key – Note 2	String Long integer		Measurement(1).has. (1)MeasurementUnit Measurement(1).has. (0..N)MeasurementLimit Measurement(1).has. (1..N)MeasurementValue
MeasurementUnit	Name – Note 3	Enumeration or String	kV, MW, MVAR, kA kW, KVAR, V, A etc.	
MeasurementLimit				Internal to NO-NMON system Or could be duplicated in EXT- EMS system
MeasurementValue	Value – Note 4	Double		Value of measured quantity
MeasurementValue	Quality	Bits		As IEC61850
MeasurementValue	TimeStamp – Note 2	Date/time		
MeasurementValue	AlarmState – Notes 2,5	Enumeration or String	NORMAL, HIGH, LOW etc.	
MeasurementValue	Source – Note 6	Bit mask, enumeration or String	METERED = RAW, DEFAULT, ESTIMATOR, CALCULATED, REMOTE	Internal to NO-NMON. If “Metered”, then the MeasurementValue is associated with Telemetry.

Note 1. IEC61970 is not clear on what Measurement.name means. Possibilities include:

The name of the quantity e.g. Potential, Current, Real Power, Reactive Power

The symbol of the quantity e.g. V, I, P, Q

The same as the unit name e.g. kV, A, MW, MVAR

As above with a suffix to indicate the measurement source e.g. MW01, MW02

As any of the above but translated into the local language.

Note 2. Additional to IEC 61970 Part 301 Common Information Model - Draft 5

Note 3. IEC 61970 will define a set of valid Units. A given implementation is likely to only support a subset e.g. kV not V, A not kA. Translation between these types of units could take place within either component. The optimal location will depend on the specific project implementation. It may be easier to add code to perform a specific translation than to add large numbers of derived measurements.

Note 4. The value for analogue measurements is of type double. The value for status or counter measurements may be an integer number but this could be coded as a double anyway. The meaning of the status numeric values must be supplied to the external system as a pre-condition.

Note 5. The permitted values of alarmState are the recorded as MeasurementLimit.name and must be available within the external system as a pre-condition. The alarmState could also represent the meaning of status numeric values as above. Valid alarm states will depend on the type of equipment and the type of status measurement.

Note 6. IEC61970 is not clear whether there is a standard set of possible values for the source attribute or whether it is an implementation specific string.

Issues include:

- a. Some external applications such as a State Estimator need to distinguish between types of measurement source, particularly between raw telemetered measurements and others. This could be done using Quality bits.
- b. The intelligence to decide on the 'best' measurement value may be application specific.
- c. It is feasible that a system will have multiple transducers or telemetry communication paths for the same quantity. This could be dealt with by
 - i. Many messages with different message header context information, one measurement name and key;
 - ii. One message header context, many measurement names and keys;
 - iii. One message header context, one measurement name and key, possibly many MeasurementValue.sources.

The method adopted affects the information exchanges that map measurement names to keys. It is clearly desirable to have the same Measurement name for a quantity regardless of the source of the data. This use case assumes a single context and hence multiple MeasurementValue.sources.

Measurement Quality and Source flags

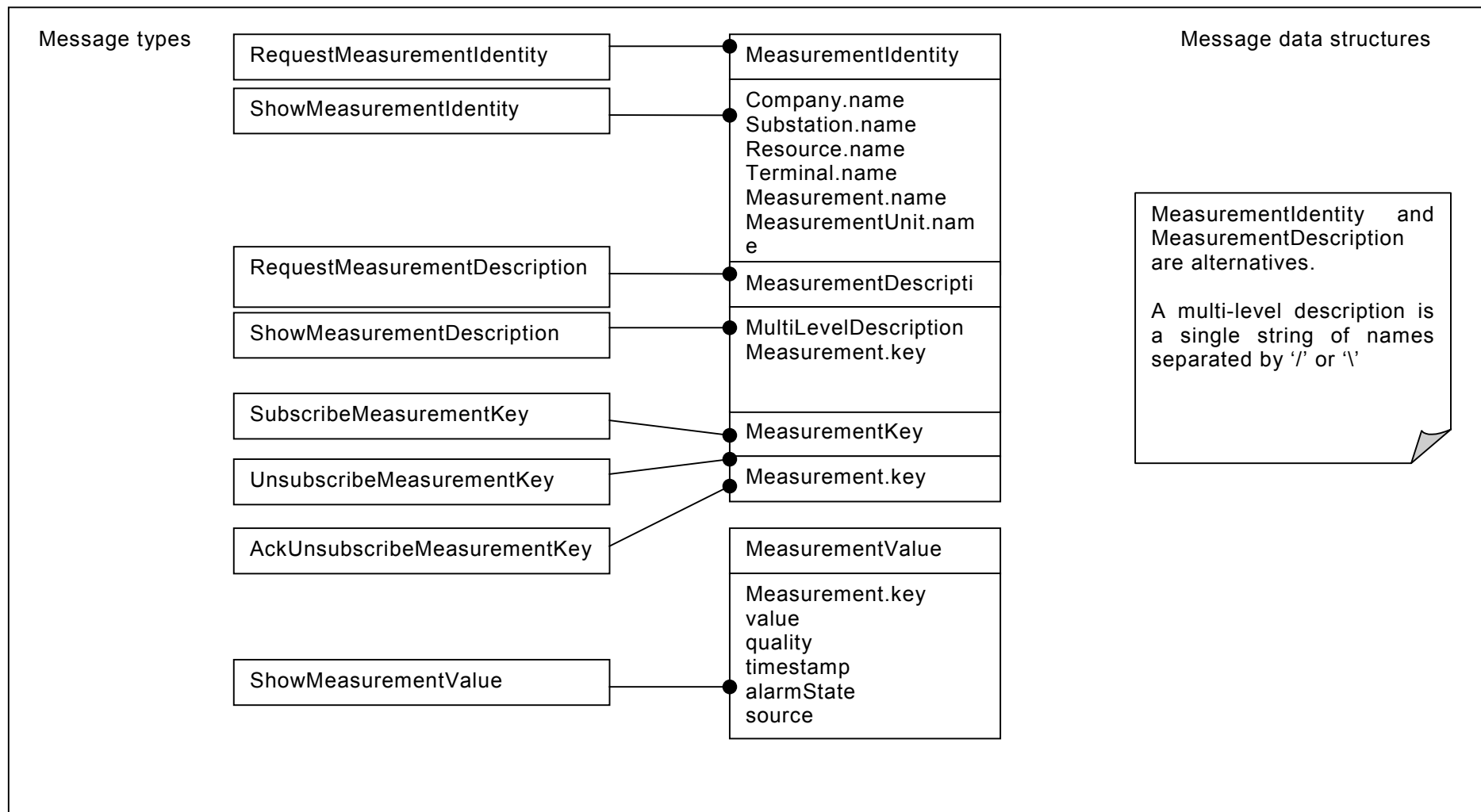
Attribute name	Description	OPC
	Copied from 61850-7-3	
badReference	The sensor calibration is bad.	QUALITY_SENSOR_CAL
commFailure	Value is not valid due to a communication failure.	QUALITY_COMM_FAILURE
blocked	Value is blocked (unavailable) for transmission.	QUALITY_OUT_OF_SERVICE
substituted	Value has been substituted, e.g. by input of an operator, or software.	QUALITY_LOCAL_OVERRIDE
nonTopical	Value is old and possibly invalid, as it has not been successfully updated during a specified time interval.	QUALITY_LAST_USABLE
invalid	Value may be incorrect and should not be used.	QUALITY_BAD
overflow	Value is beyond the capability of being represented properly. E.g. counter overflow	
overRange	Value is beyond a predefined range of value.	QUALITY_EGU_EXCEEDED
transientState	Value is due to a transient condition.	
defaultValue	Value is a default value	
test	Value is transmitted for test purposes.	
	Proposed to match OPC	
subNormal	Value is derived from multiple sources where the majority has less than required good quality.	QUALITY_SUB_NORMAL
configError	There is a server configuration error concerning this value.	QUALITY_CONFIG_ERROR
sourceError	The source of the value is not connected.	QUALITY_NOT_CONNECTED
	A device failure has been detected.	QUALITY_DEVICE_FAILURE
	A sensor failure has been detected.	QUALITY_SENSOR_FAILURE
	Additional quality from State Estimator	
estimatorReplaced	Value has been replaced by State Estimator.	
suspect	State Estimator has detected a bad measurement.	
	Possible flags to indicate measurement source	
remote	Value has been transferred from another control centre	
metered	Value has been read from a RTU or IED	
calculated	Value has been calculated within data acquisition subsystem	
operatorReplaced	Value has been substituted by the control centre operator	

Message Data Model

Each data structure uses attributes from the static reference model in the previous diagram.

In XML, each message type is a document that contains one to many data structures.

In IDL, each message type is a one-way method with an argument that is a sequence of data structures



XML Schemas

Note that this has only been verified with Internet Explorer default style.

```
<?xml version="1.0" encoding="UTF-8"?>
<IEC61968:Measurements
  xmlns:IEC61968="http://www.iec.org/61968"
  xmlns:IEC61970="http://www.iec.org/61970">

  <IEC61968:MeasurementIdentity>
    <IEC61970:companyName>companyname</IEC61970:companyName>
    <IEC61970:substationName>stationname</IEC61970:substationName>

<IEC61970:powerSystemResourceName>resourcenname</IEC61970:powerSystemResourceName>
  <IEC61970:terminalName>teminalname</IEC61970:terminalName>
  <IEC61970:measurementName>measurementname</IEC61970:measurementName>
  <IEC61970:measurementUnitName>unitname</IEC61970:measurementUnitName>
  <IEC61968:measurementKey>key</IEC61968:measurementKey>
</IEC61968:MeasurementIdentity>

  <IEC61968:MeasurementValue>
    <IEC61968:measurementKey>key</IEC61968:measurementKey>
    <IEC61970:measurementValue>value</IEC61970:measurementValue>

<IEC61970:measurementValueQuality>quality</IEC61970:measurementValueQuality>
>
  <IEC61968:alarmState>alarm</IEC61968:alarmState>
  <IEC61968:timestamp>time</IEC61968:timestamp>
  <IEC61970:source>source</IEC61970:source>
</IEC61968:MeasurementValue>

</IEC61968:Measurements>
```

References:

IEC 61970 Part 301 Common Information Model - Draft 5
 CCAP State Estimation Use case V0.3 [SE03_StateEstimation.doc]
 CCAP Example Interface Specification based on use case analysis V0.2 [Cis02des.doc]
 CCAP Correspondence on Measurement Sources, 2-12 June 2000
 IEC TC57 WG14 Use Case 37: Analogue Change Notification.

Issues:

ID	Description	Status
1.	Is the Substation – Equipment hierarchy adequate? NERC Multi-level description is probably better.	Closed
2.	Is there a standard set of alarmStates? CCAP discussion says no.	Closed
3.	Is MeasurementValue.source any use? CCAP discussion says yes.	Closed
4.	It is debatable whether this belongs to IEC61968 or IEC61970	Open

Revision History:

No	Date	Author	Description
1.	31-May-00	T. Berry	Original started based on State Estimator use case
2.	16-Jun-00	T. Berry	Comments on Measurement sources and names from Jay Britton, Lars-Ola Osterlund, Dennis Friend. Add more words on 'source'

UC47: Fault Isolation, Repair and Restoration of Supply**Summary:**

This usecase describes the process of locating fault, repairing work and restoring the supply. The fault could be due to Short Circuit or Open Circuit.

Call taker receives the calls. Calls are analysed and located on the One Line Diagram. All calls related to the same electrical connection are grouped under an Incident

Field Operatives are dispatched to confirm the problem. When the problem reported by the calls are confirmed, a fault outage is created. Switching operations are then carried out to locate the fault. Once the fault is located, the faulty section is isolated and earthed for repair work. The supply is then restored to as many customers as possible by opening a normally open point to provide back-feed. Crew is managed to repair the work.

Before the repair work can start, "Permit To Work" document is issued. Once the repair work is completed the "Permit To Work" is cancelled and the "Sanction For Test" document is issued. If tests are satisfactory then the "Sanction For Test" is cancelled. Further switching operations are carried out to restore supply to rest of the customers. Once the supply is restored to all the customers, the remaining field operatives are released from the job and the Fault Outage is completed.

Actor(s):

Name	Role description
Field Operative	Field operations Project planning On site Safety
Control Engineer	Approving Planned Switching Schedules Safety from the System Network operations within thermal and short circuit ratings Direction of switching to release plant for work or restore supplies following a fault
Trouble Calltaker	Taking trouble calls Passing information re state of network to customer
Dispatcher	Prioritising outages and assigning appropriate staff and materials

Participating Business Functions:

Acronym	Business Function, Sub-Function and Abstract Component
MC-MWK	Maintenance & Construction
CI-OM,	Outage Management
CI-CRW	Crew Management
AM-EINV	Records and Asset Management – Sub/Network Inventory
NO	Network Operation
NO-NMON	Network Opr. Monitoring
NO-CTL	Network Control

Assumptions / Design considerations:

Restore critical supplies quickly

Minimise outage times

Normal Sequence:

Use Case Step	Event	Description Of Process	Information To Be Exchanged	Producer To Receiver Abstract Component	Message Type (Verb/Noun)
1.	Customers Calls	Call taker takes all the relevant info from the customer and enters in the calls in Call Taking System	<u>Call Information</u> Operator Name Call date/time Start date of problem Customer Name Address Post Code Telephone Customer Type CustomerReferenceNumber Problem Information Caller's Name,	CI to AM-ENV	New Call

[illegible]

			<ul style="list-style-type: none"> • TimeStamp • Event Description • Event Time • Dispatcher Name <p>Apparatus List JobId ApparatusList</p>	CI-OM to NO	ShowApparatusList
3.	Group Calls	<p>All other calls related to the same electrical connection are grouped under the incident</p> <p>Update Apparatus List</p>	<p>Updated Apparatus List JobId ApparatusList</p> <p><u>Followup Event:</u> JobId Event Description</p> <ul style="list-style-type: none"> • TimeStamp • Event Description • Event Time • Dispatcher Name 	<p>CI -OM to NO</p> <p>CI -OM to AM-ENV</p>	<p>ShowApparatusList</p> <p>ShowFollowup</p>
4.	Generate Alarm	If a field operative is not dispatched within a specified time an alarm is generated	<p><u>Dispatcher Alarm:</u> Time Stamp JobId Alarm Description</p>	CI -OM to AM-ENV	<p>ShowDispatcherAlarms</p> <p>ShowFollowup</p>
5.	Despatch Field Operative	Update Despatch time in the incident details	<p><u>Updated Timing Info:</u> JobId Timing Information</p> <p><u>Field Operative</u> JobId FieldOperativeID Despatched/assignedStatus</p> <p><u>Updated Followup:</u></p>	<p>CI -OM to AM-ENV</p> <p>CI -CRW to AM-ENV CI -CRW to MC-MWK</p> <p>CI -OM to</p>	<p>ShowTimes</p> <p>ShowFieldOperatives</p> <p>ShowFollowup</p>

				AM-ENV	
6.	Field Operatives confirm arrival	<p>Update timing information for the Incident</p> <p>Update Followup</p> <p>Some customers may require callback. Update call back list</p>	<p><u>Updated Timing Info:</u> JobId Timing Information</p> <p><u>Updated Followup:</u></p> <p><u>Call Back Event:</u> JobId TimeStamp Name Address Phone Description Status</p>	<p>CI -OM to AM-ENV</p> <p>CI -OM to AM-ENV</p>	<p>ShowTimes</p> <p>ShowFollowup</p> <p>ShowCallbacks</p>
7.	Field Operatives confirm Problem	<p>Estimated Time of Repair is updated</p> <p>Some customers may require callback. Update Call-back list</p>	<p><u>Updated Incident Timing Info:</u> JobId Timing Information</p> <p><u>Call Back Event</u></p>	<p>CI -OM to AM-ENV</p> <p>CI -OM to AM-ENV</p>	<p>ShowTimes</p> <p>ShowCall backs</p>
8.	Dispatcher converts the incident to an outage	<p>Get customer attachment records</p> <p>The Incident is now considered as an Outage</p> <p>The OLD shows Outage symbol instead of the Incident Symbol</p>	<p>Customer Attachments:</p> <ul style="list-style-type: none"> • CustomerID • CustomerName • Customer Address • CustomerType • Special Needs • Other Data 	CI-OM from AM-EINV	GetCustomersAttachedToDe vice
9.	The Fault Outage is made Active		<p><u>Fault Outage data:</u> JobId OutageType (fault) Outage Status (Active) Voltage Level InccidentID Field Operative IDs Area Region Problem Location</p>	<p>CI -OM to AM-ENV</p> <p>CI -OM to NO</p>	NewOutage

			Apparatus Apparatus Location Primary Substation Sheet Reference Actual Fault Fault Type Progress status Times: <ul style="list-style-type: none"> • First Call • 1ST Despatch • 1ST ETA • 1ST Arrival • ETR • Completed/Cancelled <u>Customer Affected by the Outage:</u> JobID Customer List	CI -OM to AM-ENV	Show CustomersAffectedbyOutage
10.	Deal with other associated Calls	Calls connected electrically to the outage is now grouped under the outage	<u>Updated Calls List::</u> JobID Call List	CI -OM to AM-ENV	Show CallList
11.	Dispatcher deals with other incident which may have been created but is covered by the same outage	Group the incident under the outage Update Call List Update Follow up	<u>Updated Calls List::</u> JobID Call List <u>Update Followup:</u>	CI -OM to AM-ENV	Show CallList Show Followup
12.	Manage Crew	Assign Field Operatives Despatched Field Operatives Despatch an assigned Field Operative Release Field Operatives	<u>Field Operative</u> JobID FieldOperativeID Despatched/assignedStatus	CI -CRW to AM-ENV CI -CRW to MC-MWK	Show FieldOperative
13.	Create a Fault Switching Schedule	Create a fault-switching schedule. Update follow-up	<u>Switching Schedule:</u> 1. Switching Schedule ID 2. JobID 3. ScheduleType (Fault)	NO to CI-OM NO to AM-EINV	New SwitchingSchedule

			4. Proposed Switching Schedule Steps (Plant) 5. Proposed Switching Schedule Steps (Documents) 6. Field operative – for the step 7. Switching Schedule Writer ID 8. Control Engineer ID 9. Start Date/Time 10. Finish Date/ Time 11. Reason for requirement 12. Comments Updated Followup	CI -OM to AM-ENV	ShowFollowup
14.	If Open Circuit Fault is suspected from the grouping of the calls the field operatives use test equipment to find the Faulty Section. GOTO STEP 22				
15.	For a Short Circuit Fault a switching step is created to open sectionaliser at mid-point of feeder and attempt to reclose				
16.	Control Engineer communicates with the Field Operative and Instructs the switching step	The network shows the Instructed State	<u>Network State Change:</u> 1. TimeStamp 2. Plant Id 3. Attribute_Id 4. Attribute_Confirmed State: <u>5.</u> Proposed_Prefix : (I) Plant under switching Instruction <u>6.</u> Proposed_State	NO – NMON to CI – OM NO – NMON to AM-EINV	ShowNetworkStateChange ShowControlOperationLog

[illegible]

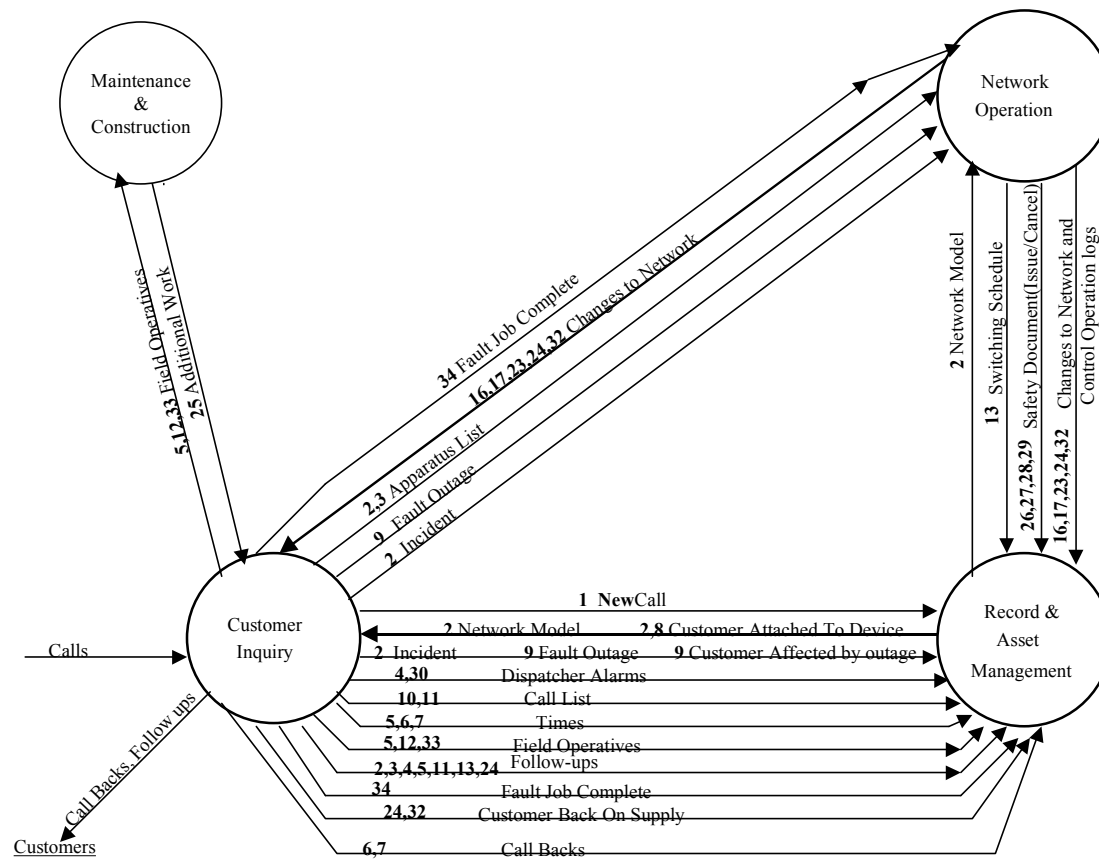
		breaker			
20.	<p>Device may trip again – Goto Step 21.</p> <p>If the protection setting is high it may turn the Short Circuit to an Open Circuit fault. If this happens then the field operatives use test equipment to find the Faulty Section. GOTO STEP 22</p>				
21.	Carry out Switching Operations	Close the last sectionaliser and select another sectionaliser. Repeat steps 16 to 20 until the faulty section is found			
22.	Identify possible back-feeds	Consult network diagram.			
23.	Perform switching to isolate faulty section	<p>Create Switching steps to Isolate the Faulty section.</p> <p>Instruct and confirm switching steps to isolate and earth the faulty section</p>	<p>(Changes to current state of network model)</p> <p>Network State Changes:</p> <ol style="list-style-type: none"> 1. Device ID 2. Count of Changes 3. TimeStamp 4. Iteration of changes containing: <ul style="list-style-type: none"> • Attribute_ID • Attribute_State <p>(UC –38 for Dynamic Attributes and the States)</p>	<p>NO –</p> <p>NMON to</p> <p>CI – OM</p> <p>NO –</p> <p>NMON to</p> <p>AM-EINV</p>	ShowNetworkStateChanges
24.	Close a normally open point for the back feed	<p>Create switching steps to provide back-feed</p> <p>Instruct and confirm switching steps to provide the back-feed</p> <p>Supply is partially</p>	<p>(Changes to current state of network model)</p> <p>Network State Changes:</p>	<p>NO –</p> <p>NMON to</p> <p>CI – OM</p> <p>NO –</p> <p>NMON to</p> <p>AM-EINV</p>	ShowNetworkStateChanges

		Restored Update follow-ups	<u>Number of customer back on:</u> JobID Customers RestorationPhaseNumber	CI -OM to AM-ENV	Show CustomersBackOn Show Followup
25.	Additional Work may be requested		JobId Additional Work Details	MC-MWK to CI-OM	Show AdditionalWork
26.	Create and Issue a Safety Document – Permit to Work	For repair work to be carried out safely.	1. Safety Doc ID 2. JobID 3. DocumentType (Permit to work) 4. Safety Document Status 5. Switching Schedule ID 6. List of POIs 7. List of PEs 8. Other Info!	NO-CTL to AM-EINV	New SafetyDocument
27.	Cancel Permit to Work	Repair work complete	1. Safety Doc ID 2. Safety Document Status	NO-CTL to AM-EINV	Show SafetyDocumentStatus
28.	Issue Sanction for test	To test the repair work	1. Safety Doc ID 2. DocumentType (Sanction for test, 3. Safety Document Status 4. Switching Schedule ID 5. List of POIs 6. List of Pes 7. Other Info!	NO-CTL to AM-EINV	New SafetyDocument
29.	Cancel Sanction for test	Test Completed	3. Safety Doc ID 4. Safety Document Status	NO-CTL to AM-EINV	Show SafetyDocumentStatus
30.	Alarm any violation of regulatory standards	Generate Alarms for the violation of regulatory standards	<u>Dispatcher Alarm:</u> Time Stamp JobId Alarm Description	CI -OM to AM-ENV	Show DispatcherAlarms
31.	If Test fails Repeat Step 26 to 31 until tests are successful				

32.	Carry out switching	Restore supply to rest of the customer Update follow-ups	<u>Network Changes</u> Customers Back on supply Updated Follow-ups	NO-NMON to CI-OM NO – NMON to AM-EINV CI -OM to AM-ENV	ShowNetworkStateChanges ShowCustomersBackOn ShowFollowup
33.	Manage Crew to release the field operatives	Release field operative from the job	<u>Field Operative</u> JobId FieldOperativeID Despatched/assignedStatus	CI -OM to MC-MWK CI-CRW to AM-EINV	ShowFieldOperative
34.	Complete the Outage		1. JobID 2. JobStatus	CI-OM To NO CI -OM to AM-ENV	ShowJobStatus

Integration Scenarios

The Diagram below shows the sequence of operations and the data flow between the Business Functions.



Message Type Table

Message Type Identifier	Message Type Verb/Noun	Message Type Content Class.Attribute	Revision Number
1.	NewCall	JobId Operator Name Call date/time Start date of problem Customer Name Address Post Code Telephone Customer Type CustomerReferenceNumber Problem Information Caller's Name, CallersTelephone Advice Access Details Comments Call from Police or Fire Ownership Advice of charge WhenToCallBack	1
2.	NewIncident	JobId Area Region Problem Location Callers Supply Point Apparatus Apparatus Location Primary Substation Sheet Reference Actual Fault Fault Type Progress Status Number of Calls Priority	1

		Timing Information <ul style="list-style-type: none"> • First Call • 1ST Despatch • 1ST ETA • 1ST Arrival • ETR • Completed/Cancelled 	
3.	ShowFollowup	JobId Event Description containing: <ul style="list-style-type: none"> • TimeStamp • Event Description • Event Time • Dispatcher Name 	1
4.	GetAffectedNetworkDataSet	Plant Data Connectivity Data	1
5.	ShowApparatusList	JobId ApparatusList	
6.	ShowDispatcherAlarms	Time Stamp JobId Alarm Description	1
7.	ShowTimes	JobId Timing Information	1
8.	ShowFieldOpeatives	JobId FieldOperativeID Despachted/assignedStatus	1
9.	ShowCallbacks	JobId TimeStamp Name Address Phone Description Status	1
10.	GetCustomersAttachedToDevice	<ul style="list-style-type: none"> • CustomerID • CustomerName • Customer Address • CustomerType • Special Needs • Other Data 	1
11.	ShowCustomersAffectedbyOutage	JobID Customer List	1

12.	New Outage	JobId OutageType (fault) Outage Status (Active) Voltage Level InccidentID Field Operative IDs Area Region Problem Location Apparatus Apparatus Location Primary Substation Sheet Reference Actual Fault Fault Type Progress status Times: <ul style="list-style-type: none"> • First Call • 1ST Despatch • 1ST ETA • 1ST Arrival • ETR • Completed/Cancelled 	1
13.	Show CallList	JobID Call List	1
14.	New SwitchingSchedule	Switching Schedule ID ScheduleType (Fault) Proposed Switching Schedule Steps (Plant) Proposed Switching Schedule Steps (Documents) Requester (field operative) Switching Schedule Writer ID Control Engineer ID Start Date/Time Finish Date/ Time Reason for requirement Comments	
15.	Show NetworkStateChange	TimeStamp Plant Id Attribute_Id	1

		Attribute_Confirmed State: Proposed_Prefix : (I) Plant under switching Instruction Proposed_State	
16.	Show ControlOperationLog	TimeStamp Control Operation Type: Manual Confirm Plant Id Attribute_Id Confirmed State UserID Switching Schedule Id	1
17.	Show AdditionalWork	JobId Additional Work Details	1
18.	New SafetyDocument	Safety Doc ID DocumentType Safety Document Status Switching Schedule ID List of POIs List of PEs Other Info!	1
19.	Show SafetyDocumentStatus	Safety Doc ID Safety Document Status	1
20.	Show CustomersBackOn	JobID Customers RestorationPhaseNumber	1
21.	Show JobStatus	JobID JobStatus	1

Revision History:

No	Date	Author	Description
1	3 rd OCT 2000	Peter Walker, Shahed Ansar	Fault Isolation, Repair and Restoration of Supply

UC02: Maintaining Plant**Summary:**

This usecase involves the 'Maintenance and Construction' to schedule a planned maintenance with the resource pre-booked for the maintenance. the 'Operation Panning and Optimisation' produces a switching schedule. A planned interruption is created prior to the start of the maintenance work. The approved switching schedule is acted upon to create a Dead Zone for the maintenance work. Once the maintenance is completed the switching schedule is used to restore service.

Actor(s):

Name	Role description
Field Operative	Field operations Project planning On site Safety
Control Engineer	Approving Planned Switching Schedules Safety from the System Network operations within thermal and short circuit ratings Direction of switching to release plant for work or restore supplies following a fault
Switching Schedule Writer	Create Switching Plans for future execution
Trouble Calltaker	Taking trouble calls Passing information re state of network to customer
Dispatcher	Prioritising outages and assigning appropriate staff and materials

Participating Business Functions:

Acronym	Business Function, Sub-Function and Abstract Component
MC-MWK	Maintenance & Construction
OP-SIM	Operation Planning and Optimization
CI-OM,	Outage Management
CI-CRW	Crew Management
AM-EINV	Records and Asset Management – Sub/Network Inventory
NO	Network Operation
NO-NMON	Network Opr. Monitoring
NO-CTL	Network Control

Assumptions / Design Considerations:

Assuming that interruptions of supply are involved.

Assuming that work crew scheduling for planned work is done within MC (No use informing customers of interruptions if work cannot be done due to lack of resources)

Normal Sequence:

Use Case Step	Event	Description Of Process	Information To Be Exchanged	Producer To Receiver Abstract Component	Message Type (Verb/Noun)
1.	Receive requirement for maintenance	Maintenance required may be time or condition based	1. Maintenance Ticket ID 2. ID of plant 3. Condition of plant 4. Type of Maintenance required 5. Operational Restrictions lifted by maintenance 6. Materials required? 7. Field Operative IDs	MC-MWK to OP-SIM	New MaintenanceTicket
2.	Get data needed to	Get network model as required	Network Model For Maintenance	OP-SIM from AM-EINV	Get AffectedNetworkDataSet

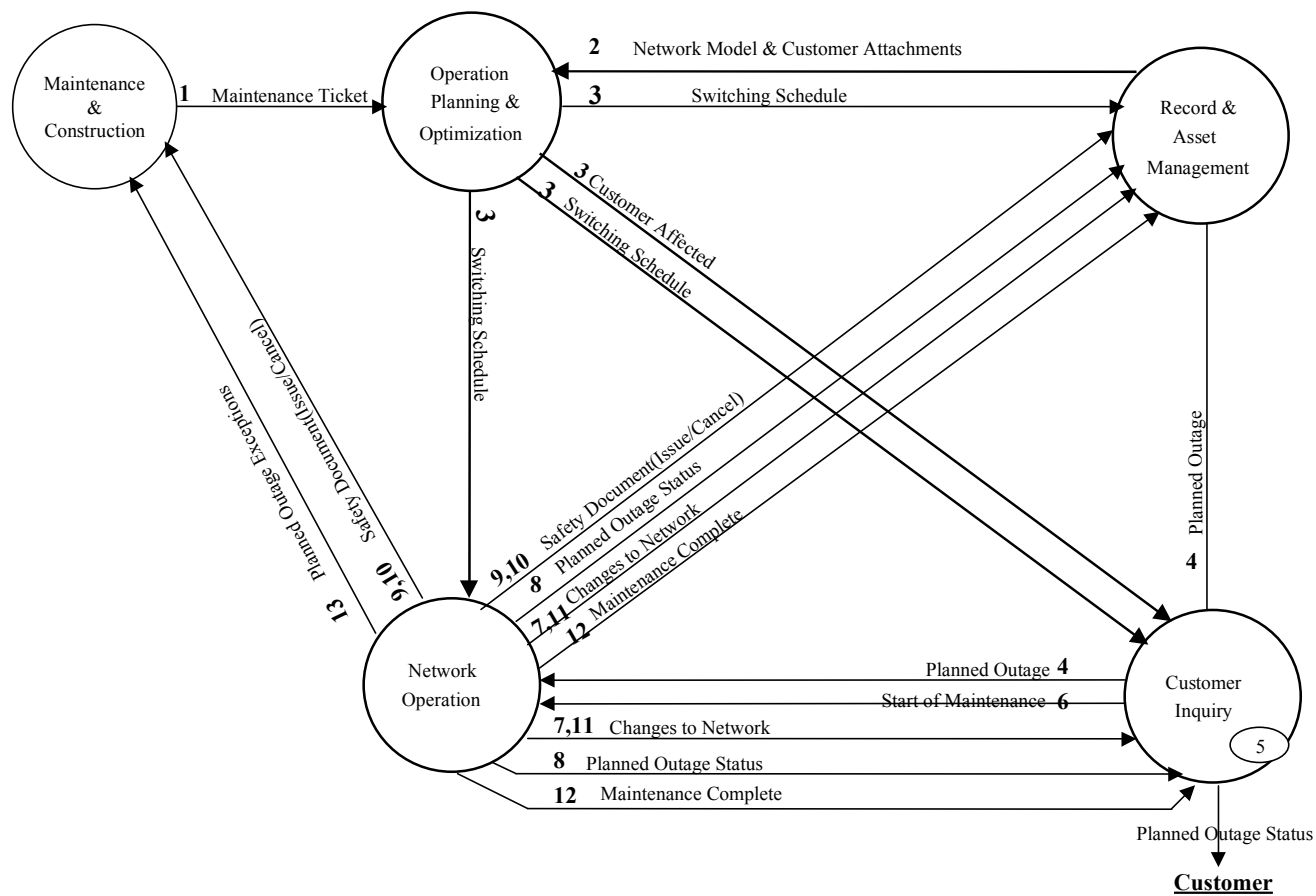
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			9. Reason for requirement 10. Comments		
5.	Planned interruption status changes to be notified	Customers will possibly call re planned outage following receipt of notification or at any time from now on			
6.	Start Maintenance Job	Incoming Communication from Field operative Network operation gets jobs for that operative and selects relevant jobs	1. Maintenance Ticket ID 2. ID Field Operative 3. ID of Switching Schedule 4. ID of Planned Outage	CI- CRW to NO	ShowStartOfPlannedMaintenance
7.	Carry out Switching	Network re configured It may be necessary to analyse calls re other outages (faults)	(Changes to current state of network model) Network State Changes: 5. Device ID 6. Count of Changes 7. TimeStamp 8. Iteration of changes containing: • Attribute_ID • Attribute_State (UC -38 for Dynamic Attributes and the States)	NO – NMON to CI – OM NO – NMON to AM-EINV	ShowNetworkStateChanges
8.	Carry out Switching	Dead zone created – outage made active	1. ID of Planned Outage 2. Status	NO-NMON to CI-OM NO – NMON to AM-EINV	ShowOutageStatus
9.	Issue Safety Doc	For maintenance work to be carried out	9. Safety Doc ID 10. DocumentType (e.g. Sanction for test, Permit to work) 11. Safety Document Status 12. Switching Schedule ID 13. List of POIs 14. List of Pes	NO-CTL to AM-EINV	NewSafetyDocument

			15. Other Info!		
10.	Cancel Safety Doc	work complete	5. Safety Doc ID 6. Safety Document Status	NO-CTL to AM-EINV NO-CTL to MC-MWK	ShowSafetyDocumentStatus
11.	Carry out switching	To restore	(Changes to current state of network model) Network State Changes: 9. Device ID 10. Count of Changes 11. TimeStamp 12. Iteration of changes containing: • Attribute_ID • Attribute_State (UC -38 for Dynamic Attributes and the States)	NO-NMON to CI-OM NO – NMON to AM-EINV	ShowNetworkStateChanges
12.	Maintenance Job Complete	Field Operative available for other work? Post that job complete	1. Maintenance Job ID 2. ID Field Operative 3. ID of Switching Schedule 4. ID of Planned Outage	NO to CI-CRW NO to AM-EINV NO to CI-OM	ShowCompletedMaintenance
13.	Exceptions to work done	Not all planned work completed – extra tasks carried out	1. Maintenance Job ID 2. ID of Planned Outage 3. Exceptions	NO-CTL? to MC-MWK	ShowMaintenanceJobExceptions

Integration Scenarios

The Diagram below shows the sequence of operations and the data flow between the Business Functions.



Information Model for normal sequence:

Class	Class Attribute	Attribute Type	Operations	Relations

MaintenanceTicket	MaintenanceTicketID PlantID ConditionOfPlant TypeOfMaintenanceRequired OperationalRestrictionsLifted MaterialsList FieldOperativeList		New	
NetworkDataSet	PlantDetails Connectivity		Get	
CustomersAttached	CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData		Get	
SwitchingSchedule	SwitchingScheduleID ProposedSwitchingScheduleStepsFor Plants ProposedSwitchingScheduleStepsFor Documents Requester (field operative) SwitchingScheduleWriterID ControlEngineerID StartDateTime FinishDateTime Reason Comments		New	
CustomersAffected	Switching ScheduleID CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData		Show	
PlannedOutage	PlannedOutageID PlannedOutageStatus AffectedCustomersList FieldOperativeList SwitchingScheduleID SwitchingScheduleCreator ID		New	

	ControlEngineerID StartDateTime FinishDateTime Reason Comments			
StartOfMaintenance	MaintenanceTicketID FieldOperativeList SwitchingScheduleID PlannedOutageID		Show	
NetworkStateChanges	TimeStamp PlantID CountOfChanges Iteration of changes containing: <ul style="list-style-type: none"> • AttributeID • AttributeState (UC –38 for Dynamic Attributes and the States)		Show	
PlannedOutageStatus	PlannedOutageID OutageStatus		Show	
SafetyDocument	SafetyDocumentID SafetyDocumentType SafetyDocumentStatus SwitchingScheduleID PointsOfIsolation ListOfPrimaryEarths OtherData		New	
SafetyDocStatus	SafetyDocumentID SafetyDocumentStatus		Show	
CompletedMaintenance	MaintenanceTicketID FieldOperativeList SwitchingScheduleID PlannedOutageID		Show	
MaintenanceJobExceptions	MaintenanceTicketID PlannedOutageID ExceptionsList		Show	

Message Type Table

Message Type Identifier	Message Type Verb/Noun	Message Type Content Class.Attribute (Modelling team to identify the class)	Revision Number
22.	New MaintenanceTicket	MaintenanceTicketID PlantID ConditionOfPlant TypeOfMaintenanceRequired OperationalRestrictionsLifted MaterialsList FieldOperativeList	1
23.	Get AffectedNetworkDataSet	PlantDetails Connectivity	1
24.	Get CustomersAttached	CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData	1
25.	New SwitchingSchedule	SwitchingScheduleID ProposedSwitchingScheduleStepsForPlants ProposedSwitchingScheduleStepsForDocuments Requester (field operative) SwitchingScheduleWriterID ControlEngineerID StartDateTime FinishDateTime Reason Comments	1
26.	Show CustomersAffected	Switching ScheduleID CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData	1
27.	New Planned outage	PlannedOutageID PlannedOutageStatus AffectedCustomersList	1

		FieldOperativeList SwitchingScheduleID SwitchingScheduleCreator ID ControlEngineerID StartDateTime FinishDateTime Reason Comments	
28.	Show StartOfPlannedMaintenance	MaintenanceTicketID FieldOperativeList SwitchingScheduleID PlannedOutageID	1
29.	Show NetworkStateChanges	TimeStamp PlantID CountOfChanges Iteration of changes containing: <ul style="list-style-type: none"> • AttributeID • AttributeState (UC –38 for Dynamic Attributes and the States)	1
30.	Show OutageStatus	PlannedOutageID OutageStatus	1
31.	New SafetyDocument	SafetyDocumentID SafetyDocumentType SafetyDocumentStatus SwitchingScheduleID PointsOfIsolation ListOfPrimaryEarths OtherData	1
32.	Show SafetyDocumentStatus	SafetyDocumentID SafetyDocumentStatus	1
33.	Show CompletedMaintenance	MaintenanceTicketID FieldOperativeList SwitchingScheduleID PlannedOutageID	1
34.	Show MaintenanceJobExceptions	MaintenanceTicketID PlannedOutageID ExceptionsList	1

Revision History:

No	Date	Author	Description
1	31 st Jan 200	Peter Walker, Shahed Ansar	Maintenance of a High Voltage Plant
2	18 th Sept'2000	Peter Walker, Shahed Ansar	Maintenance of a High Voltage Plant

UC14: Commissioning Plant (extending the network)**Summary:**

This usecase involves the 'Maintenance and Construction' to schedule an Approved Network Extension with the resource pre-booked for the job. The 'Operation Planning and Optimisation' produces a switching schedule. A planned interruption is created prior to the start of the work. The approved switching schedule is acted upon to create a Dead Zone for the work. Once the Network extension is completed, the network changes is applied to preferred state model. Switching operations are carried out to restore the supplies.

Actor(s):

Name	Role description
Field Operative	Field operations Project planning On site Safety
Control Engineer	Approving Planned Switching Schedules Safety from the System Network operations within thermal and short circuit ratings Direction of switching to release plant for work or restore supplies following a fault
Switching Schedule Writer	Create Switching Plans for future execution
Trouble Calltaker	Taking trouble calls Passing information re state of network to customer
Dispatcher	Prioritising outages and assigning appropriate staff and materials

Participating Business Functions:

Acronym	Business Function, Sub-Function and Abstract Component
NE	Network Extension Planning
MC-MWK	Maintenance & Construction
OP-SIM	Operation Planning and Optimization
CI-OM,	Outage Management
CI-CRW	Crew Management
AM-EINV	Records and Asset Management – Sub/Network Inventory
NO	Network Operation
NO-NMON	Network Opr. Monitoring
NO-CTL	Network Control

Assumptions / Design Considerations

Approved Extension Project is received from Network Extension Planning. The crew scheduling for Network Extension Work is done within MC. Assuming that interruptions of supply are involved:

Normal Sequence:

Use Case Step	Event	Description Of Process	Information To Be Exchanged	<u>ProducerTo Receiver Abstract Component</u>	<u>Message Type (Verb/Noun)</u>
1.	Receive requirement for network extension (See Use Case Network Extension Planning)	Network extension has previously been passed from NE to MC-MWK	Extension Project Job: 1. Extension Project ID 2. Proposed Network Changes <i>(Important not proposed network)</i> 3. Materials required 4. Field Operative IDs	MC-MWK to OP-SIM	New ExtensionProjectWork
2.	Get data needed to create schedule	Get network model Get customer attachment records	Affected Network for Extension: 3. Plant Data 4. Connectivity Data Customer Attachments: 7. CustomerID 8. CustomerName 9. Customer Address 10. CustomerType 11. Special Needs 12. Other Data	AM-EINV to OP-SIM	Get AffectedNetworkDataSet Get CustomersAttached

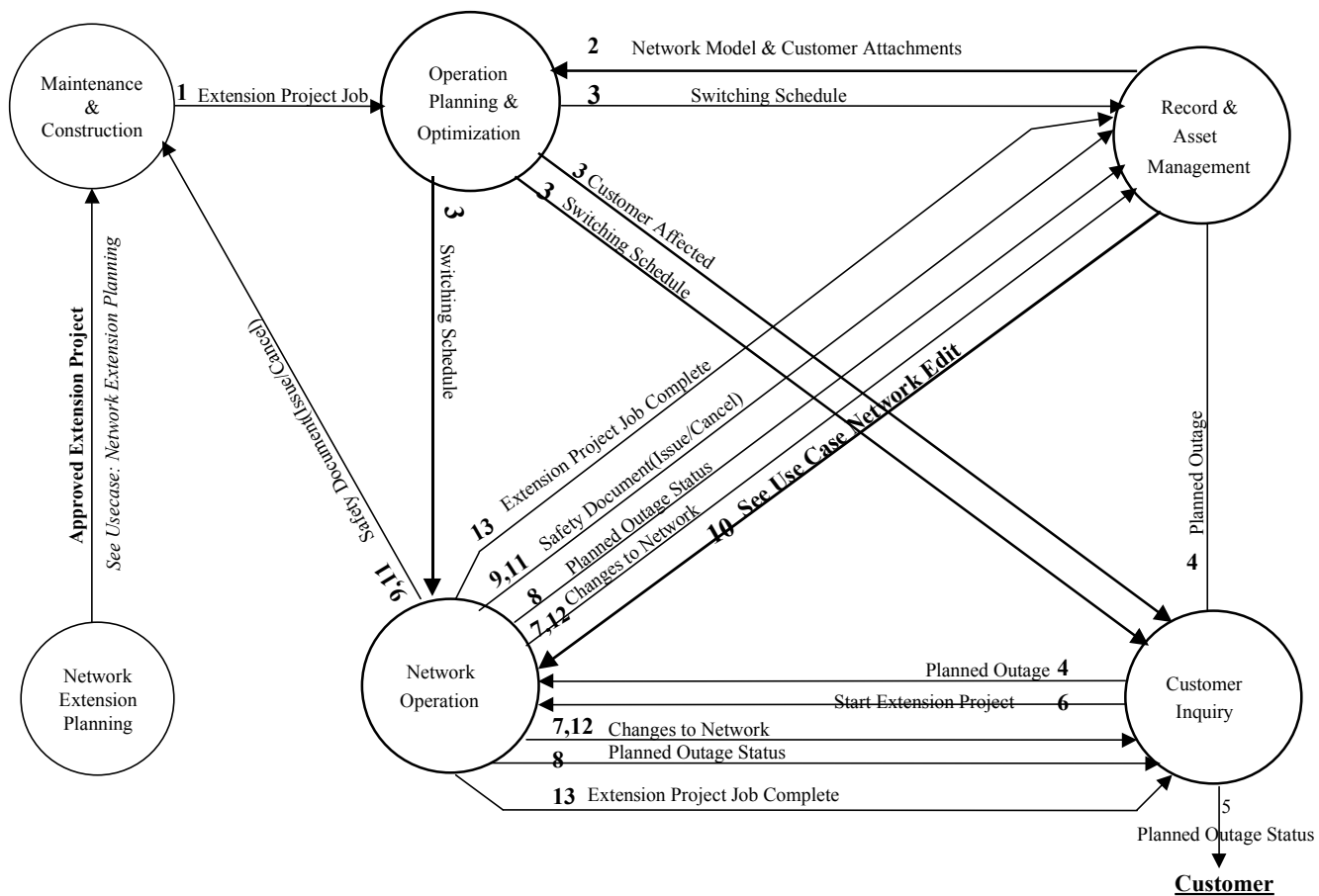
[illegible]

5.	Planned interruption status changes to notified	Customers will possibly call re planned outage following receipt of notification or at any time from now on			
6.	Start Network Extension Job	Incoming Communication from Field operative Network operation gets jobs for that operative and selects relevant jobs	Start Network Extension Job: 5. Extension Project Id 6. ID of Field Operatives 7. ID of Switching Schedule 8. ID of Planned Outage	CI- CRW to NO	ShowStartOfExtensioProject
7.	Carry out Switching	Network re configured It may be necessary to analyse calls re other outages (faults)	(Changes to current state of network model) Network State Changes: 13. Device ID 14. Count of Changes 15. TimeStamp 16. Iteration of changes containing: • Attribute_ID • Attribute_State (UC -38 for Dynamic Attributes and the States)	NO – NMON to CI – OM NO – NMON to AM-EINV	ShowNetworkStateChanges
8.	Carry out Switching	Dead zone created – outage made active	3. ID of Planned Outage 4. Status	NO-NMON to CI-OM NO – NMON to AM-EINV	ShowOutageStatus

9.	Issue Safety Doc	For network extension work to be carried out	16. Safety Doc ID 17. Document Type (e.g. Sanction for test, Permit to work) 18. Safety Document Status 19. Switching Schedule Id 20. List of Point of Isolation 21. List of Primary Earths 22. Other Info!	NO-CTL to AM-EINV	NewSafetyDocument
10.	Apply changes to preferred state model in DMS and confirm changes to GIS	Network extensions applied	See Usecase EDIT NETWORK – Import from GIS to DMS)		
11.	Cancel Safety Doc	Work complete	7. Safety Doc ID 8. Safety Document Status	NO-CTL to AM-EINV NO-CTL to MC-MWK	ShowSafetyDocumentStatus
12.	Carry out switching	To restore	(Changes to current state of network model) Network State Changes: 17. Device ID 18. Count of Changes 19. TimeStamp 20. Iteration of changes containing: • Attribute_ID • Attribute_State (UC –38 for Dynamic Attributes and the States)	NO-NMON to CI-OM NO – NMON to AM-EINV	ShowNetworkStateChanges
13.	Network extension Job Complete	Field Operative available for other work? Post that job complete	5. Extension Project Id 6. ID Field Operative 7. ID of Switching Schedule 8. ID of Planned Outage	NO to CI-CRW NO to CI-OM NO to NE	ShowCompletedExtensionProject
14.	Exceptions to work done	Not all planned work completed – extra tasks carried out	4. Extension Project Id 5. ID of Planned Outage 6. Exceptions	NO-CTL? to MC-MWK	ShowExtensionProjectExceptions

Integration Scenarios

The Diagram below shows the sequence of operations and the data flow between the Business Functions.



Information Model for normal sequence:

Interface Class	Class Attribute	Attribute Type	Operations	Relations
NetworkEextensionJob	ExtensionProjectID PlantID ConditionOfPlant TypeOfMaintenanceRequired OperationalRestrictionsLifted MaterialsList FieldOperativeList		New	
AffectedNetworkForExtension	ExtensionProjectID PlantDetails Connectivity		Get	
CustomersAttachedToASupplyPoints	CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData		Get	

SwitchingSchedule	SwitchingScheduleID ProposedSwitchingScheduleStepsForPlants ProposedSwitchingScheduleStepsForDocuments Requester (field operative) SwitchingScheduleWriterID ControlEngineerID StartDateTime FinishDateTime Reason Comments		New	
CustomersAffectedForAPlanned Network extension	SwitchingScheduleID CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData		Show	
PlannedOutage	PlannedOutageID PlannedOutageStatus AffectedCustomersList FieldOperativeList SwitchingScheduleID SwitchingScheduleCreator ID ControlEngineerID StartDateTime FinishDateTime Reason Comments		New	
StartOfExtensionProject	ExtensionProjectID FieldOperativeList SwitchingScheduleID PlannedOutageID		Show	
NetworkStateChanges	TimeStamp PlantID CountOfChanges Iteration of changes containing:		Show	

	<ul style="list-style-type: none"> AttributeID AttributeState (UC -38 for Dynamic Attributes and the States)			
PlannedOutageStatus	PlannedOutageID OutageStatus		Show	
SafetyDocument	SafetyDocumentID SafetyDocumentType SafetyDocumentStatus SwitchingScheduleID PointsOfIsolation ListOfPrimaryEarths OtherData		New	
SafetyDocStatus	SafetyDocumentID SafetyDocumentStatus		Show	
CompletedExtensionProject	ExtensionProjectID FieldOperativeList SwitchingScheduleID PlannedOutageID		Show	
ExtensionProjectExceptions	ExtensionProjectID PlannedOutageID ExceptionsList		Show	

Message Type Table

Message Type Identifier	Message Type Verb/Noun	Message Type Content Class.Attribute	Revision Number
	New ExtensionProjectWork	ExtensionProjectID PlantID ConditionOfPlant TypeOfMaintenanceRequired OperationalRestrictionsLifted MaterialsList FieldOperativeList	1
	Get AffectedNetworkDataSet	ExtensionProjectID PlantDetails Connectivity	1
	Get CustomersAttached	CustomerID	1

		CustomerName CustomerAddress CustomerType SpecialNeeds OtherData	
	New SwitchingSchedule	SwitchingScheduleID ProposedSwitchingScheduleStepsForPlants ProposedSwitchingScheduleStepsForDocuments Requester (field operative) SwitchingScheduleWriterID ControlEngineerID StartDateTime FinishDateTime Reason Comments	1
	Show CustomersAffected	SwitchingScheduleID CustomerID CustomerName CustomerAddress CustomerType SpecialNeeds OtherData	1
	New Planned outage	PlannedOutageID PlannedOutageStatus AffectedCustomersList FieldOperativeList SwitchingScheduleID SwitchingScheduleCreator ID ControlEngineerID StartDateTime FinishDateTime Reason Comments	1
	Show StartOfExtensioProject	ExtensionProjectID FieldOperativeList SwitchingScheduleID PlannedOutageID	1
	Show NetworkStateChanges	TimeStamp PlantID CountOfChanges	1

		Iteration of changes containing: <ul style="list-style-type: none"> AttributeID AttributeState (UC –38 for Dynamic Attributes and the States)	
	Show OutageStatus	PlannedOutageID OutageStatus	1
	New SafetyDocument	SafetyDocumentID SafetyDocumentType SafetyDocumentStatus SwitchingScheduleID PointsOfIsolation ListOfPrimaryEarths OtherData	1
	Show SafetyDocStatus	SafetyDocumentID SafetyDocumentStatus	1
	Show CompletedExtensionProject	ExtensionProjectID FieldOperativeList SwitchingScheduleID PlannedOutageID	1
	Show ExtensionProjectExceptions	ExtensionProjectID PlannedOutageID ExceptionsList	1

Revision History:

No	Date	Author	Description
1	31 st Jan' 2000	Paul Fleeman Peter Walker, Shahed Ansar	Network Extension Implementation
2	18 th Sept'2000	Paul Fleeman Peter Walker, Shahed Ansar	Network Extension Implementation