

Application integration at electric utilities — System interfaces for distribution management —

Part 1: Interface architecture and general requirements

The European Standard EN 61968-1:2004 has the status of a
British Standard

ICS 33.200

National foreword

This British Standard is the official English language version of EN 61968-1:2004. It is identical with IEC 61968-1:2003.

The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power system control and associated communications, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 13 February 2004

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 64, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

© BSI 13 February 2004

ISBN 0 580 43400 1

**Application integration at electric utilities –
System interfaces for distribution management
Part 1: Interface architecture and general requirements
(IEC 61968-1:2003)**

Intégration d'applications pour les services
électriques –
Systèmes d'interface pour la gestion
de la distribution
Partie 1 : Architecture des interfaces
et spécifications générales
(CEI 61968-1:2003)

Integration von Anwendungen in Anlagen
der Elektrizitätsversorgung –
Systemschnittstellen für Netzführung
Teil 1: Schnittstellenarchitektur
und allgemeine Anforderungen
(IEC 61968-1:2003)

This European Standard was approved by CENELEC on 2003-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 57/650/FDIS, future edition 1 of IEC 61968-1, prepared by IEC TC 57, Power system control and associated communications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61968-1 on 2003-12-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2004-09-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2006-12-01

Endorsement notice

The text of the International Standard IEC 61968-1:2003 was approved by CENELEC as a European Standard without any modification.

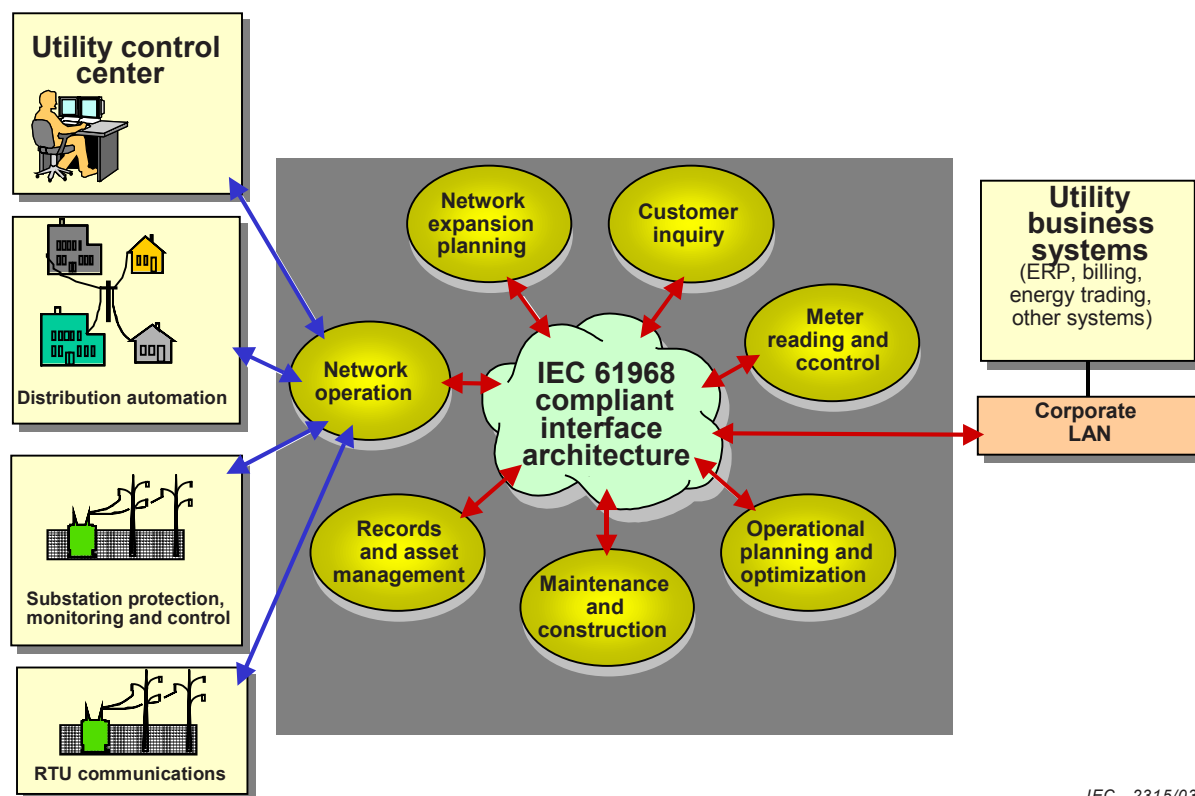
CONTENTS

INTRODUCTION.....	5
1 Scope.....	6
2 General	6
2.1 Overview of the IEC 61968 series	6
2.2 An example using the IEC 61968 series	7
2.3 Overview of IEC 61968-1.....	8
3 Interface reference model.....	9
3.1 Domain.....	9
3.2 Business functions	9
3.3 Interface reference model.....	10
4 Interface architecture.....	16
4.1 General	16
4.2 Requirements analysis methodology	17
5 Interface profile	17
5.1 Components.....	17
5.2 Component adapters	18
5.3 Interface specification	19
5.4 Middleware adapter.....	20
5.5 Middleware services.....	21
5.6 Communication services.....	22
5.7 Platform environment	22
6 Information exchange model.....	22
6.1 General requirements.....	22
6.2 IEM management related services.....	23
7 Component reporting and error handling.....	24
7.1 General	24
7.2 Error message handling	24
8 Security and authentication	25
8.1 General	25
8.2 Security threats	25
8.3 Security functions.....	26
8.4 Management of integrity and security	27
8.5 Security agent	27
9 Maintenance aspects.....	28
Annex A (informative) Distribution management domain	29
Annex B (informative) IEC 61968 series development process.....	32
Annex C (informative) Inter-application integration performance considerations.....	57
Annex D (informative) Views of data in a conventional electric utility	59
Annex E (informative) Business functions	62

Figure 1 – Distribution management system with IEC 61968 compliant interface architecture	5
Figure 2 – Example utility implementation of the IEC 61968 series	8
Figure 3 – Typical applications mapped to interface reference model.....	10
Figure 4 – Overview of the interface profile and corresponding subclause numbers	17
Figure A.1 – Hierarchy of complexity in a system environment.....	29
Figure A.2 – General utility structure.....	30
Figure B.1 – Process 1A: IEC Technical Committee 57 Working Group 14 process for developing future parts of the IEC 61968 series	33
Figure B.2 – Process 1B: (Continuation) IEC Technical Committee 57 Working Group 14 process for developing future parts of the IEC 61968 series.....	34
Figure B.3 – Process 2A: Typical business subfunctions of DMS and external systems	35
Figure B.4 – Process 2B: (continuation) an overview of an utility's application of the IEC 61968 standard	36
Figure B.5 – Typical components of major DMS business functions – Part 1	38
Figure B.6 – Typical components of major DMS business functions – Part 2	39
Figure B.7 – Integration scenario example (from: data acquisition for external EMS)	46
Figure B.8 – Message data model example (from use case 46: data acquisition for external EMS).....	54
Figure B.9 – CIM top level package	55
Figure D.1 – Database views depend on the time and user	60
Figure E.1 – Map of typical utility systems to the business functions of the IRM.....	62
Table 1 – Document overview for IEC 61968-1	8
Table 2 – Interface reference model.....	11
Table A.1 – Examples of data exchange in a company environment.....	30
Table A.2 – Data categories.....	31
Table B.1 – Use case template	41
Table B.2 – Example steps in a Use Case (From: Data Acquisition for External EMS).....	44
Table B.3 – Information model (from: data acquisition for external EMS).....	47
Table B.4 – Commonly used verbs.....	49
Table B.5 – OAG verbs	52
Table C.1 – Typical load scenario	57
Table C.2 – Example of typical transaction volume for DMS.....	58
Table E.1 – Typical information exchanged among business functions of the IRM.....	63

INTRODUCTION

The IEC 61968 series is intended to facilitate inter-application integration, as opposed to intra-application integration, of the various distributed software application systems supporting the management of utility electrical distribution networks. 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, IEC 61968 is relevant to loosely coupled applications with more heterogeneity in languages, operating systems, protocols and management tools. IEC 61968 is intended to support applications that need to exchange data on an event driven basis. IEC 61968 is intended to be implemented with middleware services that broker messages among applications, and will complement, but not replace utility data warehouses, database gateways, and operational stores.



IEC 2315/03

Figure 1 – Distribution management system with IEC 61968 compliant interface architecture

Figure 1 clarifies the scope of IEC 61968-1 graphically in terms of business functions and shows a Distribution Management System with IEC 61968 compliant interface architecture.

APPLICATION INTEGRATION AT ELECTRIC UTILITIES – SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT –

Part 1: Interface architecture and general requirements

1 Scope

This part of IEC 61968 is the first in a series that, taken as a whole, defines interfaces for the major elements of an interface architecture for Distribution Management Systems (DMS). This part of IEC 61968 identifies and establishes requirements for standard interfaces based on an Interface Reference Model (IRM). Subsequent parts of this standard are based on each interface identified in the IRM. This set of standards is limited to the definition of interfaces and is implementation independent. They provide 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 the IEC 61968 series.

As used in the IEC 61968 series, a 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. The IRM is specified in Clause 4.

2 General

2.1 Overview of the IEC 61968 series

As used in IEC 61968, a DMS (Distribution Management System) 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. Standards interfaces are to be defined for each class of applications identified in the Interface Reference Model (IRM), which is described in Clause 4.

IEC 61968 recommends that system interfaces of a compliant utility inter-application infrastructure be defined using Unified Modelling Language (UML).

The eXtensible Markup Language (XML) is a data format for structured document interchange particularly on the Internet. One of its primary uses is information exchange between different and potentially incompatible computer systems. XML is thus well-suited to the domain of system interfaces for distribution management.

Where applicable, future parts of the IEC 61968 series will define the information required for 'message payloads'. Message Payloads will be formatted using XML with the intent that these payloads can be loaded on to messages of various messaging transports, for example OAG, SOAP (Simple Object Access Protocol), etc. The XML encoding rules will be covered in a future part of the IEC 61968 series.

Communication between application components of the IRM requires compatibility on two levels:

- Message formats and protocols.
- Message contents must be mutually understood, including application-level issues of message layout and semantics.

Clause 5 defines abstract middleware services required to support communication between the applications defined in the IRM. These services are intended to be deployed, with little additional software required, by mapping them to commonly available services from various messaging technologies including middleware such as message brokers, Message Oriented Middleware (MOM), Message-Queuing Middleware (MQM), and Object Request Brokers (ORBs). This clause is organized as follows:

- Subclause 5.1 identifies general requirements of the applications identified in the IRM.
- Subclause 5.2 describes how standard information exchange services may either be invoked directly from an application (native mode) or that software may be used to map (adapt) an application to the information exchange services.
- Subclause 5.3 identifies standard services required for applications to exchange information with other applications.
- Subclause 5.4 describes how information exchange services may either be supported directly by middleware or that software may be required to map (adapt) the utility's middleware services to the standard information exchange services.
- Subclauses 5.5 to 5.7 describe environmental requirements for information exchange.

2.2 An example using the IEC 61968 series

An example of a typical utility's implementation of the IEC 61968 series is provided in Figure 2. In this example, the utility has used interface adapters as a means of integrating many of its legacy systems with other application systems that are IEC 61968 compliant. Note those legacy systems and IEC 61968 series compliant systems both continue to use proprietary integration techniques among their internal applications; only information that needs to be exchanged among applications at the utility enterprise level is expected to use IEC 61968 series middleware services.

For the purposes of this example, the utility's Outage Management System (OMS) is assumed to already have the capability of issuing controls to and gathering device states from the Distribution Automation System (DAS). As it is working acceptably for the utility, this interface does not need to be changed. However, because other applications need to be notified when distribution devices change state, the DAS publishes state changes through middleware services. Another benefit of publishing events is that they can be recorded by an event history application in a data store; this data can then be used in the generation of various types of reports. As much of the information exchanged among these systems is useful for management decision support, a data warehouse application has also been connected to the IEC 61968 middleware services so that it may receive published information.

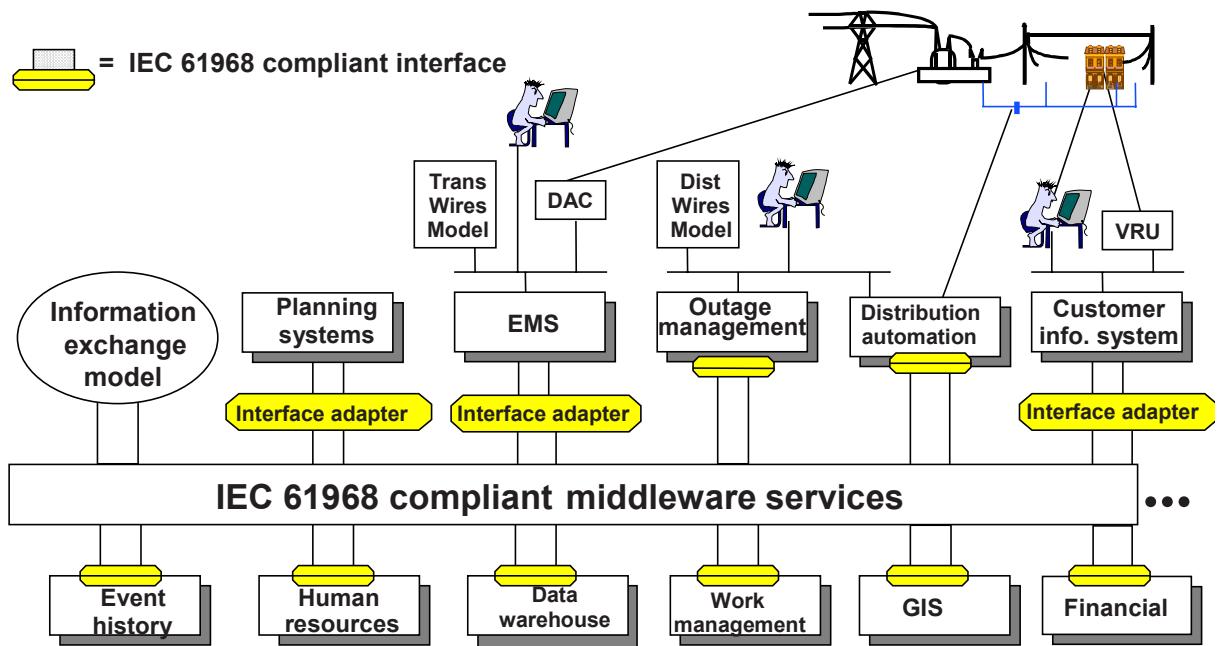


Figure 2 – Example utility implementation of the IEC 61968 series

2.3 Overview of IEC 61968-1

The organization of IEC 61968-1 is described in Table 1.

Table 1 – Document overview for IEC 61968-1

Clause	Title	Purpose
1	Scope	Scope of IEC 61968, Part 1.
2	General	Overview and examples.
3	Interface reference model	The domain relevant to the IEC 61968 series is described. For each relevant business function, a list of abstract components is provided, which is described by the functions performed by the component. future parts of the IEC 61968 series will define interfaces for these abstract components.
4	Interface architecture	The interface reference model for utility inter-application integration is provided along with the rationale for its structure.
5	Interface profile	Utility inter-application integration environmental requirements are described. Abstract message passing services are defined that must be available for applications to communicate information to other applications, including publish and subscribe services.
6	Information exchange model	Metadata is used to describe event types that are published by applications. Applications subscribing to receive all messages for a certain event type recognize the fields of a particular event message once they have looked up the metadata for the event type in the information exchange model. While many event types are described in the IEC 61968 series, metadata is the means by which vendors and utilities can add new event types without violating this standard.
7	Component reporting and error handling	Requirements for audit trails and error message handling authentication necessary to support utility inter-application integration are described.
8	Security and authentication	Requirements for security and authentication necessary to support utility inter-application integration are described.
9	Maintenance aspects	General maintenance requirements are specified.
Annex A	Distribution management domain	An overview of business functions required for electric utility distribution management is described.

Annex B	IEC 61968 series Development process	The methodology used to determine interface architecture requirements for utility inter-application integration is described.
Annex C	Inter-application integration performance considerations	Some typical performance requirements necessary to support utility inter-application integration are described. These requirements are of a general nature as specific implementation requirements will vary by utility.
Annex D	Views of data in a conventional electric utility	This annex describes some of the underlying principles of defining the reference data dictionary of a future part of the IEC 61968 series.
Annex E	Business functions	This annex describes the typical data producer and consumer subsystems for each DMS business function.

3 Interface reference model

3.1 Domain

Within this part of IEC 61968, the distribution management domain covers all aspects of management of utility electrical distribution networks. A distribution utility will have some or all of the responsibility for 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.

The distribution management domain may be organised as two inter-related types of business, electricity supply and electricity distribution. Electricity supply is concerned with the purchase of electrical energy from bulk producers for sale to individual consumers. Electricity distribution covers the management of the physical distribution network that connects the producers and consumers. In some countries, the responsibility of organisations may be legally restricted and certain sections of the IEC 61968 series will be inapplicable.

A utility domain includes the software systems, equipment, staff and consumers of a single utility organisation, which could be a company or a department. It is expected that within each utility domain, the systems, equipment, staff and consumers can be uniquely identified. When information is exchanged between two utility domains, then identifiers may need to be extended with the identity of the utility organisation in order to guarantee global uniqueness.

3.2 Business functions

Various departments within a utility co-operate to perform the operation and management of a power distribution network; this activity is termed distribution management. Other departments within the organisation may support the distribution management function without having direct responsibility for the distribution network. This segmentation by business function² is provided in the Interface Reference Model (IRM), which is described in detail in 3.3.

The use of a business-related model should ensure independence from vendor-produced system solutions. It is an important test of the viability of this standard that the IRM be recognisable to utility staff as a description of their own distribution network operation and management.

Major utility business functions, which provide the top level categories of the IRM, are shown in Figure 3 below.

² The work of the CIRED working group on distribution automation, published in 1996, is fully acknowledged in the segmentation.

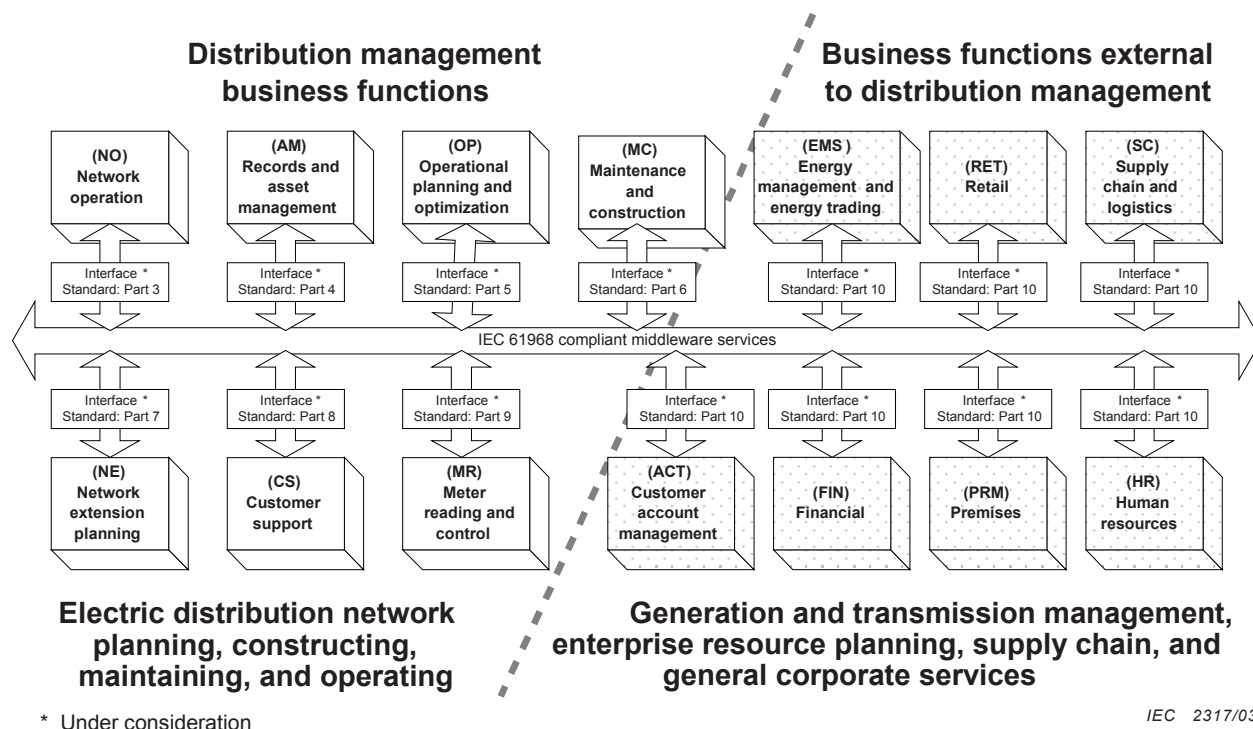


Figure 3 – Typical applications mapped to interface reference model

3.3 Interface reference model

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

In this standard, the term abstract component is used to refer to that portion of a software system that supports one or more of the interfaces defined in future parts of the IEC 61968 series. It does not necessarily mean that compliant software is delivered as separate modules.

In this subclause, the definitions of business functions defined in Subclause 3.2 are further extended into:

- Sub-business functions (second column of Table 2).
- Abstract components (third column of Table 2).

NOTE Some abstract components may be used by several different business functions. For example, a component like power flow can be used for network operation, short term operational planning and optimisation, and long term network extension planning. Much of the information exchanged for power flow purposes in each of these areas will therefore use many of the same information exchange message types (see Clause 5).

Applications from different vendors package the functionality of these abstract components in different ways. To use the IEC 61968 services, each application must support one or more of the interfaces for the abstract components.

This part of IEC 61968 describes infrastructure services common to all abstract components whilst future parts of the IEC 61968 series will define the details of the information exchanged for specific types of abstract component.

IEC 61968 series defines that:

- a) An inter-application infrastructure is compliant if it supplies services defined in this part of IEC 61968 to support at least two applications with interfaces compliant to sections of future parts of the IEC 61968 series.
- b) An application interface is compliant if it supports the interface standards defined in future parts of the IEC 61968 series for the relevant abstract components defined in the interface reference model.
- c) An application is only required to support interface standards of the applicable components listed in column 3 of Table 2. It is not required to support interfaces required by other abstract components (column 3 of Table 2) of the same business sub-function (column 2 of Table 2) or within the same business function (column 1 of Table 2). While this standard primarily defines information exchanged among components in different business functions, it will occasionally also defines information exchanged among components within a single business function when a strong market need for this capability has been realised.

Table 2 – Interface reference model

Business functions	Business sub-functions	Abstract components
Network operation (NO) (Refer to future IEC 61968-3)	Network operation monitoring (NMON)	Substation state supervision
		Network state supervision
		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 supervision
		Operator and event logs
		Weather monitoring (lightning detection)
	Network control (CTL)	User access control
		Automatic controls: Protection (fault clearance) Sectionalising Local voltage/reactive power control
		Assisted control: Remote switch control Load shedding Voltage reduction broadcast Local control through field crews
		Safety document management
		Safety checking and interlocks
		Major incident co-ordination

Business functions	Business sub-functions	Abstract components
	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
Records and asset management (AM) (Refer to future IEC 61968-4)	Substation and network inventory (EINV)	Equipment characteristics
		Connectivity model
		Substation display
		Telecontrol database
	Geographical inventory (GINV)	Network displays
		Cartographic maps
	Asset investment planning (AIP)	Maintenance strategy
		Life-cycle planning
		Reliability centred analysis
		Engineering and design standards
		Performance measurements
		Risk management
		Environmental management
		Decision support
		Budget allocation
		Maintain work triggers
		Asset maintenance groups (lists)
		Asset failure history
		Asset financial performance
		Thermal ratings of network equipment and lines

Business functions	Business sub-functions	Abstract components
Operational planning and optimisation (OP) (Refer to future IEC 61968-5)	Network operation simulation (SIM)	Load forecast
		Power flows computation
		Contingency analysis
		Short circuit analysis
		Optimal power flow
		Supply restoration assessment
		Switching simulation
		Incident simulation
		Weather forecast analysis
		Fire risk analysis
		Thermal ratings of network equipment and lines
	Switch action scheduling/operation work scheduling (SSC)	Release/clearance remote switch command scheduling
		Field crew loading analysis and work order scheduling
		Customer outage analysis and information
	Power import scheduling and optimisation (IMP)	
Maintenance and construction (MC) (Refer to future IEC 61968-6)	Maintenance and inspection (MAI)	Maintenance program management
		Maintain work triggers
		Asset maintenance groups (lists)
		Manage inspection readings
		Asset maintenance history
		Asset failure history
		Work order status tracking
		Work order closing
		Financial control
	Construction and design (CON)	Work initiation
		Work design
		Work cost estimation
		Work flow management
		Work order status tracking
		Work order closing
		Financial control
	Work scheduling (SCHD)	Work task planning
		Crew management
		Vehicle management
		Equipment management
		Material coordination
		Permit management

Business functions	Business sub-functions	Abstract components
	Field recording and design (FRD)	Field design
		Field inspection results
		Crew time entry
		Actual materials
	Work dispatch (DSP)	Field status tracking
		Real-time communication
		Weather monitoring
Network extension planning (NE) (Refer to future IEC 61968-7)	Network calculations (NCLC)	Load forecast
		Power flows
		Contingency analysis
		Short-circuit analysis
		Optimal power flow
		Energy loss calculations
		Feeder voltage profiles
	Construction supervision (CSP)	Construction costing
		Work management
	Project definition (PRJ)	Capital approval
	Compliance management (CMPL)	Safety compliance
		Technical compliance
		Regulatory compliance
Customer Support (CS) (Refer to future IEC 61968-8)	Customer service (CSRV)	Service requests
		Construction billing inquiry
		Work status
		Self service inquiry (Web, VRU (Voice Response Unit)...)...
		Customer connection
		Turn on, turn off
		Service level agreements
	Trouble call management (TCM)	Outage calls
		Power quality
		Planned outage notifications
		Media communication
		Performance indices
		Restoration projection/confirmation
		Outage history
Meter reading and control (MR) (Refer to future IEC 61968-9)	Meter reading (RMR)	Load characteristics
		Consumption meters
		Quality factors
	Load control (LDC)	Meter parameter telesetting
		Dynamic tariff application
		Power modulation

Business functions	Business sub-functions	Abstract components
External to DMS (EXT) (Refer to future IEC 61968-10)	Energy management and energy trading (EMS)	Transmission
		Generation
		Energy trading
	Retail (RET)	Marketing and selling
		Settlements
		Customer registration
		Product line diversification
		Portfolio management
	Supply chain and logistics (SC)	Procurement
		Contract management
		Warehouse logistics
		Materials management
	Customer account management (ACT)	Credit status
		Outage history
		Credit and collections
		Billing and payment
		Customer profiling
	Financial (FIN)	Activity based management
		Accounts payable
		Accounts receivable
		Forecasting
		Budgeting
		General ledger
		Regulatory accounting
		Tax accounting
		Treasury
		Decision support
		Performance metrics
		Strategic planning
		Business development
		Budgeting
		Regulatory relations
	Premises (PRM)	Address
		Source substation
		Meter information
		Right of ways, easements, grants
		Real estate management

Business functions	Business sub-functions	Abstract components
	Human resources (HR)	Health/safety reporting
		Payroll
		Safety administration
		Training
		Qualification tracking
		Hours on shift information
		Benefits administration
		Employee performance, review, and compensation
		Recruiting

4 Interface architecture

4.1 General

This part of IEC 61968 describes utility inter-application infrastructure requirements necessary to integrate components distributed throughout the enterprise. The services and functionality described is independent of the underlying component-based infrastructure. In the following requirements, an “event” is a unit of information exchange which is issued asynchronously by its source (“push”). A “component” is a module of application software which is a component of the integration bus as either a publisher or subscriber (receiver) of an information exchange.

The business process begins by identifying the information to be exchanged and the components involved. This typically involves one publisher that has the information and initiates the exchange, and zero or more subscribers that will receive the information.

The IEC 61968 series requires that a compliant utility inter-application infrastructure:

- a) Shall allow components to exchange information of arbitrary complexity.
- b) Shall be able to be implemented using various forms of distributed component technology (for example, CORBA (Common Object Request Broker Architecture), DCOM (Distributed Component Object Model), message brokers, message oriented middleware, relational databases, object-oriented databases, or others). (See Clause 5).
- c) Shall provide an information exchange model facility (see Clause 6) that users employ to describe the information to be exchanged. This facility presents the user with the models of events and the components to which they relate, and allows the new exchange to be added to the old, so that a comprehensive corporate exchange model, tailored to a utility’s specific needs, can be built rather than a collection of independent models.
- d) Shall allow a publisher and/or subscriber component to be deployed by system administrators independently of other components as long as interfaces remain the same.
- e) Shall ensure that, once a given type of event is published, additional subscribing components can be configured to receive the event without having to make any changes or additions in the publisher component.

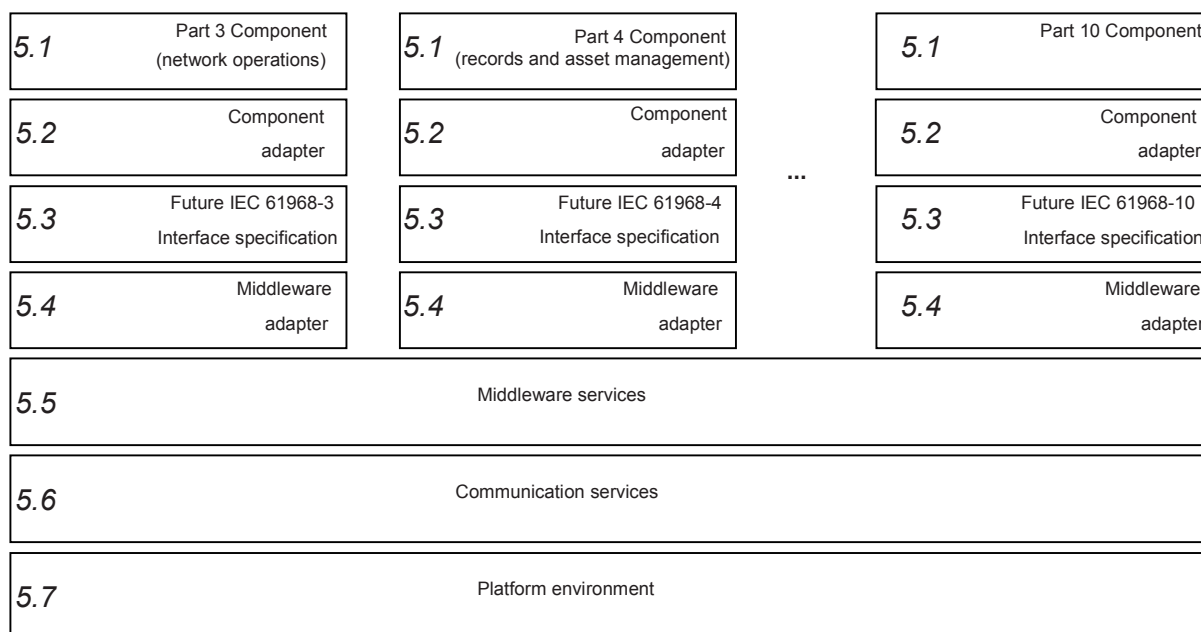
4.2 Requirements analysis methodology

To help solve the problem of effectively sharing information across electric utility departments and systems, a common modelling notation or language is needed. A modelling language extends natural language by adding formal constructs to aid in communication by reducing ambiguity. By using a common modelling language across the utility, utilities can better define what information needs to be shared across departments.

This modelling language should be rich enough to detail the requirements, have a graphically oriented (visual diagrams) to make it easy to use, be widely accepted, and supported by reasonably priced tools. Refer to Annex B for further information regarding this methodology that has been used for the development of the IEC 61968 series. The use cases used for the development of the interface reference model will be compiled in a future IEC technical report.

5 Interface profile

Clause 5 is organised according to the interface profile, given in Figure 4.



IEC 2318/03

Figure 4 – Overview of the interface profile and corresponding subclause numbers

The requirements for all the individual parts in this interface profile are explained in the following subclauses.

5.1 Components

Information exchange among components can either be a piece of data or the result of an execution of functionality³ and for this purpose is called a services exchange. For example, a component can be a classic, procedural application (also referred to as a legacy application) or a fully object-oriented application build around the latest technology. Also, components can be distributed across the network (LAN, Intranet, private corporate WAN or even the public Internet), enabling flexible deployment of DMS applications in the utility-wide ICT-architecture. The scope of a component is unlimited: it can perform any function that is required for distribution management. Typical categories of functions are showed in the interface reference model in Clause 3.

³ Meaning that this function can be invoked remotely.

A component can either be *profile-compliant*, meaning that it knows, understands and satisfies Services requirements or *non-profile-compliant*. A non-profile-compliant component must be made compliant before it can fulfil its role on the services (see 5.2).⁴

For components, the IEC 61968 series requires that applications shall:

- a) Implement at least one of the interfaces as specified in the relevant series of documents from future IEC 61968-3 onwards.
- b) Implement producer and consumer services exchanges in at least one interaction type: publish/subscribe, publish/reply or conversation (or request/reply if without session context).
- c) Register and unregister as a producer, a consumer or both for at least one interaction type.
- d) Provide for appropriate error handling and catching and recovery for service exchanges which cannot be produced or consumed. Each interface specification in the series from future IEC 61968-3 onwards contains a single services exchange for each interaction type. This specific IEC services exchange, for this purpose only, should be produced and consumed by each component on the services
- e) Be able to register in at least one specific “context” (for example real-time, test, study, version 1, version 2) at the same time such that services exchanges produced within a context will, by default, be delivered only to components within the same context.
- f) Be able to override the default context for a service exchange.
- g) When producing a service exchange, identify the generic type of the service exchange in order to verify consistency between the component and the information exchange model.
- h) When producing an service exchange, create and package new instances of the service exchange (using the information exchange model to identify items of data that should be filled in).
- i) When consuming a service exchange, identify the generic type of service exchange in order to verify consistency between the Component and the information exchange model.
- j) When consuming a services exchange, parse and unpack delivered instances of the services exchange (using the information exchange model to identify items of data that should be interrogated).
- k) Be able to work within transaction contexts in which one or more consumed services exchanges are either committed in full or rolled back (reverted) in full.

NOTE As an example, in CORBA, a component is equivalent to an object implementation. In DCOM, a component is equivalent to a client object or a server object.

5.2 Component adapters

A component adapter in the context of the IEC 61968 series is profile-compliant software that enables a non-compliant software application to use the services. As such, the component adapter only goes as far as necessary to make the component conformant to one or more specific interface specifications in the series from future IEC 61968-3 onwards.

⁴ For example, each vendor of current DMS applications may have its own application architecture, its own API and its own mechanism of interfacing the application with other products of the same vendor. Such existing applications may very well have an important role as a client of the Services. But the industry cannot expect that a vendor rebuild all its existing applications to new versions that are profile-compliant. Even new applications may not always be profile-compliant, but instead use the established vendor-specific architecture and application interface. Therefore, non-profile-compliant components probably will be in the majority during the early stages of the IEC 61968 series. When the IEC 61986 series becomes more widely accepted, profile-compliant components will become more widely available.

NOTE 1 This implies that:

- For components that already are profile-compliant, the component adapter is not necessary.
- When a non-compliant component is used in the services-environment, at least one component adapter is present for that component to make it profile-compliant. It can also be the case that more than one component adapter is used to make a single component compliant with the services (for example one component adapter for each IEC 61968 series interface specification).
- For those components that are non-compliant, each component adapter is custom-made for that specific component because it depends heavily on the architecture and implementation of the component. A component also runs in a specific hardware/operating system (HW/OS) environment. Therefore the triple set component, (set of) component adapter(s) and HW/OS are fully dependent on each other.

How the component adapter makes a non-profile-compliant component compliant to the services, depends on the component and the role it performs. A complication is that a component that was not coded to be profile-compliant cannot be made profile-compliant directly, and that each component is different.

NOTE 2 Examples of how the component adapter accesses non-profile-compliant components to make them profile-compliant are:

- accessing the component via its own specific application program interface;
- accessing the component via its data stores (flat files, databases, whatever);
- accessing the component via screen scraping (emulating a terminal and accessing fixed positions on the emulated screen);
- accessing the component via batch control or another external application run control method.

For component adapters, the IEC 61968 series requires that they shall meet the requirements specified in Clause 5.1 for a profile-compliant component.

NOTE 3 A component adapter does not exist for a profile-compliant component.

5.3 Interface specification

The IEC 61968 series interface specification requirements consists of three parts: component-specific specifications, requirements that refer to services specific for the distribution management domain and requirements that refer to services which are common in a distributed computing environment based on components. Individual IEC 61968 series interface specifications for functional areas (see the interface reference model in Clause 3) are available in following parts of the IEC 61968 series (future IEC 61968-3 and further).

For all three parts in an IEC 61968 series interface specification, it shall:

- a) be declarative, containing pre- and postconditions, attributes, methods and parameters as needed for all the service exchanges that are part of the specific interface specification;
- b) be programming-language neutral;
- c) emphasize the separation of interface and implementation;
- d) be middleware-independent.

Requirements for component-specific interface specifications have exclusive usage of IEC 61968 series interface services for those requirements that can be supported by those services.

NOTE This means that for requirements not covered, additional services may be specified (and probably need to be programmed or mapped in the middleware adapter or middleware services).

Required services for the distribution management domain shall be as follows:

- e) Identifier creation and aliasing service. This is a set of services for creating and maintaining unique identifiers for business objects for which information is transferred between components. There may be multiple types of identifiers based on specific rules for each type of business object. It is expected that within each utility domain (i.e. company or department), the systems, equipment, staff and consumers can be uniquely identified. When information is exchanged between two utility domains, then identifiers may need extending with the identity of the utility organisation in order to guarantee global uniqueness.