IEC 61968-1

Edition 3.0 2020-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Application integration at electric utilities – System interfaces for distribution management –
Part 1: Interface architecture and general recommendations

Intégration d'applications pour les services électriques – Interfaces système pour la gestion de la distribution –
Partie 1: Architecture des interfaces et recommandations générales

IEC 61968-1:2020-04(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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

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FOREWORD

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International Standard IEC 61968-1 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) update of IRM section, which has been out of date since the 2nd edition;
b) update to IRM model using ArchiMate modelling language;
c) addition of missing business functions and business objects;
d) alignment with newly released documents from the technical committee;
e) alignment with IEC 61968-100;

f) update of annexes.

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

FDIS	Report on voting
57/2174/FDIS	57/2186/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61968 series, published under the general title *Application integration at electric utilities – System interfaces for distribution management*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61968 is a series of standards:

IEC 61968 part	Title
1	Interface architecture and general recommendations
2	Glossary
3	Interface for network operation
4	Interface for records and asset management
5	Interface standard for operational planning and optimisation
6	Interface for maintenance and construction
7	Interface standard for network extension planning[1]
8	Interface standard for customer support
9	Interface for meter reading and control
11	Common information model (CIM) extensions for distribution
13	CIM RDF model exchange format for distribution
100	Implementation profiles

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. Additionally, the intra-application integration tends to be optimized for close, real-time, synchronous connections and interactive request/reply or conversation communication models. The IEC 61968 series 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, the IEC 61968 series is relevant to loosely coupled applications with more heterogeneity in languages, operating systems, protocols, and management tools. The IEC 61968 series is intended to support applications that need to exchange data on an event driven basis. The IEC 61968 series is also intended to be implemented with middleware services that broker messages among applications and complementing, but not replacing, utility data warehouses, database gateways, and operational stores.

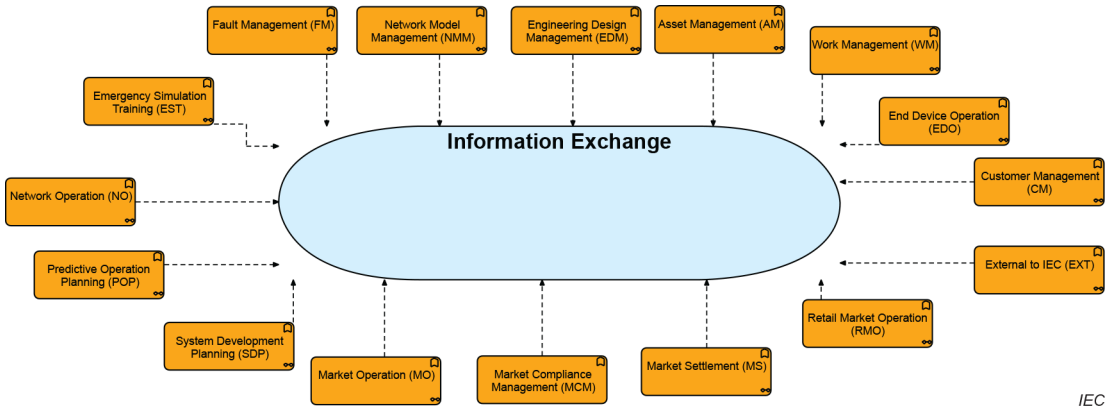

Figure 1 – High-level IEC IRM business functions

[1] Under consideration.

Figure 1 clarifies the scope of IEC IRM in terms of business functions.

As used in the IEC 61968 series, distribution management 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, and network model management. The distribution management system could also be integrated with premise area networks (PAN) through an advanced metering infrastructure (AMI) network. Standard interfaces are to be defined for each class of applications identified in Clause 3, Interface Reference Model (IRM), except for those in the group EXT (External to IEC).

In the distribution management domain it is important to keep in mind the basic meaning of the following terms:

- management: effective regulation and direction;
- automation: working without human participation in accordance with pre-defined rule sets;
- system: a set of organized operations working to support a particular activity (set of applications). Generally, a system in the context of this work is a computer-based technology.

In the world of integrated systems, systems can also be a subset of a larger system, a system of systems or a set of federated systems. A system composed of coordinating subsystems may support activities more efficiently than the subsystems operating independently.

As the size of an organisation increases so does the complexity of the tasks and information exchange associated with the tasks. Furthermore, the deeper the data structure is within a system the less transparent it is to the end user. This suggests the need for data stewardship to avoid:

- errors arising from multiple points of data entry;
- lack of consistency with software interfaces;
- expensive changes with new or upgraded software;
- loss of governance of authorised data.

The standardisation of data facilitates the reduction of errors, reduced time for data entry, and improved process control.

The IEC 61968 series recommends that the semantics (domain model) of 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 currently recommended to define grammar/syntax for profiles of a compliant utility inter-application infrastructure. A CIM profile, in accordance with IEC TR 62361-103, is derived from the CIM canonical model, which is maintained in the form of a logical information model using UML. Once defined, the profile can be used to generate an associated schema definition, most commonly (but not exclusively) as an XML Schema (XSD) or Resource Description Framework Schema (RDFS). The instance data for given information exchange must then conform to the schema defined for the profile in order to be valid. This can take into account additional restrictions that are defined for the profile over what is defined by the CIM, as almost everything is otherwise optional in the CIM by virtue of its role as a logical information model. Where applicable, IEC 61968-3 to -9 and -13 will define the information recommended for ‘message payloads’. Message payloads will be formatted in accordance with industry requirements and technology development such as XML Schema for IEC 61968-3 to -9 and RDF Schema for IEC 61968-13 with the intent that these payloads can be exchanged using common integration technologies such as SOAP,

JMS, RESTful HTTP, or Web Services (WS). It is the intent of the IEC 61968 series to be leveraged by Service-Oriented Architectures (SOA) and to encourage the usage of Enterprise Service Buses (ESB). In the future, it is possible that payload formats other than XML could be officially adopted by the IEC 61968 series for specific parts or information exchanges.

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 61968-1.
2.	Normative references	Documents that contain provisions which, through reference in this text, constitute provisions of this International Standard.
3.	Terms and definitions	The terms and definitions relevant to IEC 61968 series is described.
4.	Interface reference model	The domain relevant to 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. Parts IEC 61968-3 to -9 define interfaces for these abstract components.
5.	Interface profile	Utility inter-application integration environmental requirements are described. Abstract message passing services are defined and are available for applications to communicate information to other applications, including publish and subscribe services.
6.	Information exchange model	Requirements and recommendations are provided for information exchange between applications/functions listed in the IRM.
7.	Component reporting and error handling	Recommendations for audit trails and error message handling authentication necessary to support utility inter-application integration are described.
8.	Security and authentication	Recommendations for security and authentication necessary to support utility inter-application integration are described.
9.	Maintenance aspects	General maintenance recommendations are specified.
Informative Annex A	Use of IEC 61968 series	The methodology used to determine interface architecture recommendations for utility inter-application integration is described.
Informative Annex B	Inter-application integration performance considerations	Some typical performance recommendations necessary to support utility inter-application integration are described. These recommendations are of a general nature as specific implementation requirements will vary by utility.
Informative Annex C	Views of data in a conventional electric utility	This annex describes some of the underlying principles of defining the reference data dictionary of IEC 61968-11.
Informative Annex D	Relevant ArchiMate Definitions for IRM	This annex describes the ArchiMate notations used in the IEC 61968-1 IRM modelling.
Informative Annex E	61968:ED2 Interface profile mapping to ArchiMate	This annex provides the mapping between the 61968-1:2012 ED2 Interface profile and ArchiMate 3.0 from Open Group Standard that is used for this Edition (ED3).

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

Part 1: Interface architecture and general recommendations

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 power system management and associated information exchange.

This document identifies and establishes recommendations for standard interfaces based on an Interface Reference Model (IRM). Subsequent clauses of this document are based on each interface identified in the IRM. This set of standards is limited to the definition of interfaces. They provide for interoperability among different computer systems, platforms, and languages. IEC 61968-100 gives recommendations for methods and technologies to be used to implement functionality conforming to these interfaces.

As used in IEC 61968, distribution management 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, network model management, facilities management, and metering. The IRM is specified in Clause 3. The IRM defines the high-level view of the TC 57 reference architecture and the detailed in the relevant 61968 series, 61970 series or 62325 series. The goal of the IRM is to provide a common relevant context view for TC 57 that covers domains like transmission, distribution, market, generation, consumer, regional reliability operators, and regulators.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61968-3, *Application integration at electric utilities – System interfaces for distribution management – Part 3: Interface for network operations*

IEC 61968-4, *Application integration at electric utilities – System interfaces for distribution management – Part 4: Interfaces for records and asset management*

IEC 61968-5, *Application integration at electric utilities – System interfaces for distribution management – Part 5: Distributed energy optimization*[2]

IEC 61968-6, *Application integration at electric utilities – System interfaces for distribution management – Part 6: Interfaces for maintenance and construction*

IEC 61968-8, *Application integration at electric utilities – System interfaces for distribution management – Part 8: Interfaces for customer operations*

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2 Under preparation. Stage at the time of publication: IEC/AFDIS 61968-5:2019.

IEC 61968-9, *Application integration at electric utilities – System interfaces for distribution management – Part 9: Interfaces for meter reading and control*

IEC 61968-11, *Application integration at electric utilities – System interfaces for distribution management – Part 11: Common information model (CIM) extensions for distribution*

IEC 61968-13, *Application integration at electric utilities – System interfaces for distribution management – Part 13: CIM RDF Model exchange format for distribution*

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

IEC 62351-11, *Power systems management and associated information exchange – Data and communications security – Part 11: Security for XML documents*

IEC TR 62361-103, *Power systems management and associated information exchange – Interoperability in the long term – Part 103: Standard profiling*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

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

Where there is a difference between the definitions in this standard and those contained in other referenced IEC standards, then those defined in IEC 61968-2 shall take precedence over the others listed, and those defined in IEC 61968-1 shall take precedence over those defined in IEC 61968-2.

3.1
DMS
Distribution Management System
system consisting of various distributed application components for the utility to manage electrical distribution networks

Note 1 to entry: 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.

3.2
IRM
Interface Reference Model
standard interfaces for TC 57 cover domains like transmission, distribution, market, generation, consumer, regional reliability operators, and regulators defined using The Open Group ArchiMate standard

Note 1 to entry: The high-level view defined in 61968-1 Interface Architecture and General Requirements, defines the Business Layer context model using Business Function and Business Objects.

3.3
profiles
subset of the CIM used to define a specific message in a given context

3.4
use case
specification of a set of actions performed by a system which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system.

Note 1 to entry: There are two types of Use Cases:

- Business Use Cases describe how Business Roles interact to execute a business process. These processes are derived from services, i.e. business transactions which have previously been identified.
- System Use Cases describe how System and/or Business Roles of a given system interact to perform a Smart Grid Function required to enable / facilitate the business processes described in Business Use Cases. Their purpose is to detail the execution of those processes from an Information System perspective.

Note 2 to entry: Since a Smart Grid Function can be used to enable / facilitate more than one business process, a System Use Case can be linked to more than one Business Use Case.

[SOURCE: SG-CG/M490/E:2012-12]

3.5 Abbreviated terms

CIM	Common Information Model
DER	Distributed Energy Resource(s)
DERMS	Distributed Energy Resources Management System
DMS	Distribution Management System
EMS-API	Energy Management System Application Program Interface
RDF	Resource Description Framework
UML	Unified modelling language
XML	eXtended Markup Language
XSD	XML Schema Definition

4 Interface reference model

4.1 Domain

Within this document, 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, network model management, facilities management, and metering.

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 document 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 extending with the identity of the utility organisation in order to guarantee global uniqueness.

4.2 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 function[3] is provided in the Interface Reference Model (IRM), which is described in detail in 4.3.

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 document that the IRM be recognisable to utility staff as a description of their own distribution network operation and management.

Major utility business functions and sub-functions of the IRM are shown in Figure 2. Note that not all the functionalities listed are relevant to a given utility but all are relevant for different utilities. Since IRM covers the IEC TC 57 context, not all interfaces are relevant for a distribution utility. However, it is noteworthy that more and more inter-application interfaces are becoming intra-application interfaces. With the increase amount of intermittent resources (Distributed Energy Resource (DER)) in distribution network, the distribution utility becomes more dependent on traditional transmission business functions. Distribution is also more dependent on traditional market business functions.

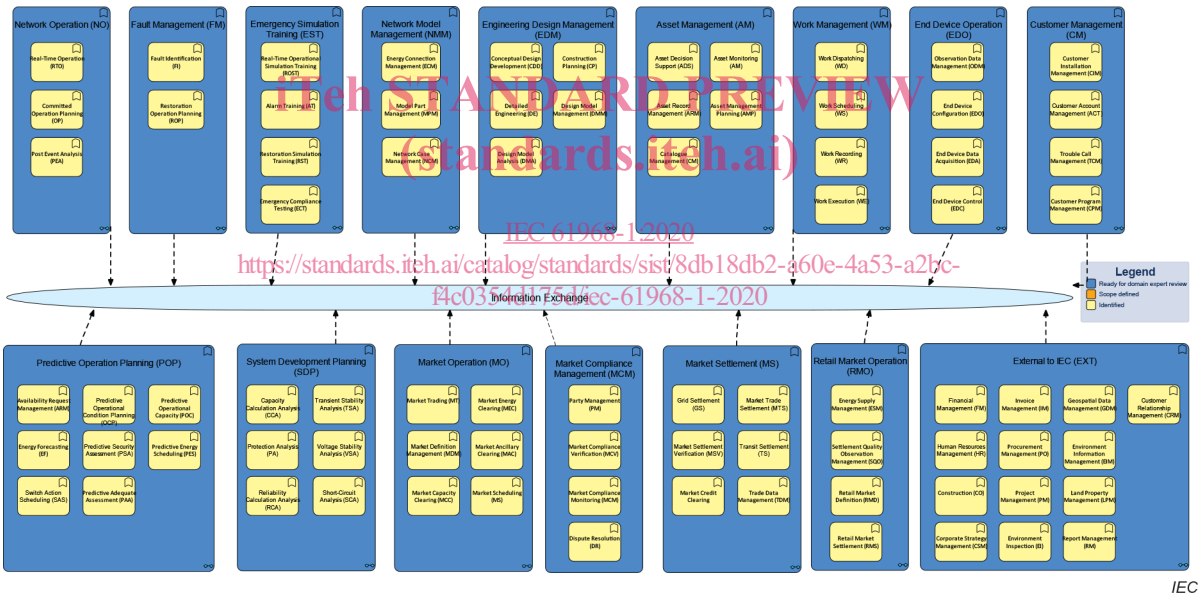

Figure 2 – Defined business function for Interface Reference Model (IRM)

4.3 Interface reference model

4.3.1 General

The Common Information Model (CIM) Interface Reference Model (IRM) utilizes The Open Group ArchiMate Modelling language to describe the business functions, business objects and business roles involved in the different major business systems that build up the power utility business capabilities.

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3 The work of the CIRED Working Group on Distribution Automation, published in 1996, is fully acknowledged in the segmentation.