



BSI Standards Publication

Application integration at electric utilities — System interfaces for distribution management

Part 1: Interface architecture and general recommendations

National foreword

This British Standard is the UK implementation of EN IEC 61968-1:2020. It is identical to IEC 61968-1:2020. It supersedes BS EN 61968-1:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PEL/57, Power systems management and associated information exchange.

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

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

© The British Standards Institution 2020

Published by BSI Standards Limited 2020

ISBN 978 0 580 96665 1

ICS 33.200

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2020.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

Application integration at electric utilities - System interfaces for
distribution management - Part 1: Interface architecture and
general recommendations
(IEC 61968-1:2020)

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)

Integration von Anwendungen in Anlagen der
Elektrizitätsversorgung - Systemschnittstellen für
Netzführung - Teil 13: Allgemeine Profile zur Modellierung
von Verteilnetzen
(IEC 61968-1:2020)

This European Standard was approved by CENELEC on 2020-06-03. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 57/2174/FDIS, future edition 3 of IEC 61968-1, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61968-1:2020.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-03-03
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-06-03

This document supersedes EN 61968-1:2013 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61968-1:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61968-4	NOTE	Harmonized as EN IEC 61968-4
IEC 61968-6	NOTE	Harmonized as EN 61968-6
IEC 61968-8	NOTE	Harmonized as EN 61968-8
IEC 61970-301	NOTE	Harmonized as EN 61970-301
IEC 61970-501	NOTE	Harmonized as EN 61970-501
IEC 61970-552	NOTE	Harmonized as EN 61970-552
IEC 62325 (series)	NOTE	Harmonized as EN IEC 62325 (series)
IEC 62325-301	NOTE	Harmonized as EN IEC 62325-301
IEC 62325-450	NOTE	Harmonized as EN 62325-450
IEC 62325-503	NOTE	Harmonized as EN IEC 62325-503
IEC 62351 (series)	NOTE	Harmonized as EN 62351 (series)
IEC 62361-100	NOTE	Harmonized as EN 62361-100
IEC 62559-2	NOTE	Harmonized as EN 62559-2
ISO 19125 (series)	NOTE	Harmonized as EN ISO 19125 (series)
ISO 19115 (series)	NOTE	Harmonized as EN ISO 19115 (series)

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61968-3	-	Application integration at electric utilities – System interfaces for distribution management – Part 3: Interface for network operations	EN IEC 61968-3	-
IEC 61968-4	-	Application integration at electric utilities - System interfaces for distribution management - Part 4: Interfaces for records and asset management	EN IEC 61968-4	-
IEC 61968-5 ¹	-	Application integration at electric utilities - System interfaces for distribution management - Part 5: Distributed energy optimization	EN IEC 61968-5 ²	-
IEC 61968-6	-	Application integration at electric utilities - System interfaces for distribution management - Part 6: Interfaces for maintenance and construction	EN 61968-6	-
IEC 61968-8	-	Application integration at electric utilities - System interfaces for distribution management - Part 8: Interfaces for customer operations	EN 61968-8	-
IEC 61968-9	-	Application integration at electric utilities - System interfaces for distribution management - Part 9: Interfaces for meter reading and control	EN 61968-9	-
IEC 61968-11	-	Application integration at electric utilities - System interfaces for distribution management - Part 11: Common information model (CIM) extensions for distribution	EN 61968-11	-

¹ Under preparation. Stage at the time of publication: IEC/AFDIS 61968-5:2019.

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

EN IEC 61968-1:2020 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61968-13	-	Application integration at electric utilities - System interfaces for distribution management - Part 13: CIM RDF Model exchange format for distribution	EN 61968-13	-
IEC 61968-100	-	Application integration at electric utilities - System interfaces for distribution management - Part 100: Implementation profiles	EN 61968-100	-
IEC 62351-11	-	Power systems management and associated information exchange - Data and communications security - Part 11: Security for XML documents	EN 62351-11	-
IEC/TR 103:2018	62361--	Power systems management and associated information exchange - Interoperability in the long term - Part 103: Standard profiling	-	-

CONTENTS

FOREWORD	5
INTRODUCTION	7
1 Scope	10
2 Normative references	10
3 Terms and definitions	11
3.5 Abbreviated terms	12
4 Interface reference model	12
4.1 Domain	12
4.2 Business functions	13
4.3 Interface reference model	13
4.3.1 General	13
4.3.2 Asset Management (AM)	14
4.3.3 Customer Management (CM)	19
4.3.4 Emergency Simulation (ES)	22
4.3.5 End Device Operation (EDO)	25
4.3.6 Engineering Design Management (EDM)	27
4.3.7 Fault Management (FM)	34
4.3.8 Compliance Management (CO)	37
4.3.9 Market Operation (MO)	39
4.3.10 Market Settlement (MS)	42
4.3.11 Network Model Management (NMM)	45
4.3.12 Network Operation (NO)	48
4.3.13 Predictive Operation Planning (POP)	54
4.3.14 Retail Market Operation (RMO)	59
4.3.15 System Development Planning (SDP)	61
4.3.16 Work Management (WM)	64
4.3.17 External to IEC	68
4.4 General	75
4.5 Requirements analysis methodology	75
5 Interface profile	75
5.1 General	75
5.2 Business function	76
5.3 Application adapter	77
5.4 Interface specification	78
5.5 Middleware adapter	78
5.6 Middleware service	79
5.7 Communication service	80
5.8 Platform environment	80
6 Information exchange model	80
6.1 General requirements	80
6.2 Message structures	81
6.2.1 General	81
6.2.2 Compliance philosophy	81
6.2.3 Extension	82
7 Component reporting and error handling	82

7.1	Component reporting	82
7.2	Error message handling	83
8	Security and authentication	83
9	Maintenance aspects	84
Annex A	(informative) Use of IEC 61968 series of standards	85
A.1	General.....	85
A.2	Application of IEC 61968 series by a product vendor	85
A.3	Application of IEC 61968 series by a utility	85
A.4	Establish interface architecture	87
A.5	Define generic use cases	88
A.6	Message type verbs.....	88
A.7	Development of CIM model extensions for distribution	88
Annex B	(informative) Inter-application integration performance considerations	89
Annex C	(informative) Views of data in a conventional electric utility	90
C.1	General.....	90
C.2	Classification	90
C.3	Identification	91
Annex D	(informative) Relevant ArchiMate definitions for IRM.....	93
D.1	General.....	93
D.2	Business role	93
D.3	Business function.....	94
D.4	Business object.....	94
D.5	Data object	95
D.6	Composition relationship.....	95
D.7	Aggregation relationship	96
D.8	Realization relationship.....	96
D.9	Access relationship	96
D.10	Specialization relationship	97
Annex E	(informative) ED2 Interface profile mapping to ArchiMate.....	98
E.1	ED2 Interface profile	98
E.2	ArchiMate interface profile	98
E.3	Mapping between the 61968-1:2012 IRM and ArchiMate Used for ED3	100
Bibliography		102
Figure 1	– High-level IEC IRM business functions	7
Figure 2	– Defined business function for Interface Reference Model (IRM)	13
Figure 3	– Asset management business functions and business objects	16
Figure 4	– Customer management business functions and business objects	20
Figure 5	– Emergency simulation training business functions and business objects	23
Figure 6	– End device operation business functions and business objects	25
Figure 7	– Engineering design management business functions and business objects	29
Figure 8	– Break down of detail engineering and detail design	30
Figure 9	– Fault management business functions and business objects	35
Figure 10	– Compliance management business functions and business objects	37
Figure 11	– Market operation business functions and business objects	40
Figure 12	– Market settlement business functions and business objects	43

Figure 13 – Network model management business functions and business objects	46
Figure 14 – Network operation business functions and business objects	49
Figure 15 – Predictive operation planning business functions and business objects	55
Figure 16 – Retail market operation business functions and business objects	60
Figure 17 – System development planning business functions and business objects	62
Figure 18 – Work management business functions and business objects	65
Figure 19 – External to IEC business functions and business objects	69
Figure 20 – Overview of the interface profile and corresponding subclause numbers	76
Figure 21 – Manage Work Business Process Example	76
Figure 22 – WorkRequest Data Object Example	77
Figure 23 – Application Process Sequence Diagram Example	78
Figure A.1 – Process A: Application of IEC 61968 series by a utility	86
Figure A.2 – Process B: application of IEC 61968 series by a utility	87
Figure C.1 – Database views depend on the time and user	91
Figure D.1 – Business role notation	93
Figure D.2 – Business function notation	94
Figure D.3 – Business object notation	95
Figure D.4 – Data object notation	95
Figure D.5 – Composition notation	96
Figure D.6 – Aggregation notation	96
Figure D.7 – Realization notation	96
Figure D.8 – Access notation	97
Figure D.9 – Specialization notation	97
Figure D.10 – Specialization	97
Figure E.1 – Overview of the interface profile in IEC 61968-1:2012 and corresponding subclause numbers	98
Figure E.2 – Simplified Mapping between the ArchiMate Language and the TOGAF ADM	99
Figure E.3 – Decomposition of the different layer to passive structure, behaviour and active structure	100
Table 1 – Document overview for IEC 61968-1	9
Table B.1 – Typical load scenario	89

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**APPLICATION INTEGRATION AT ELECTRIC UTILITIES –
SYSTEM INTERFACES FOR DISTRIBUTION MANAGEMENT –****Part 1: Interface architecture and general recommendations**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

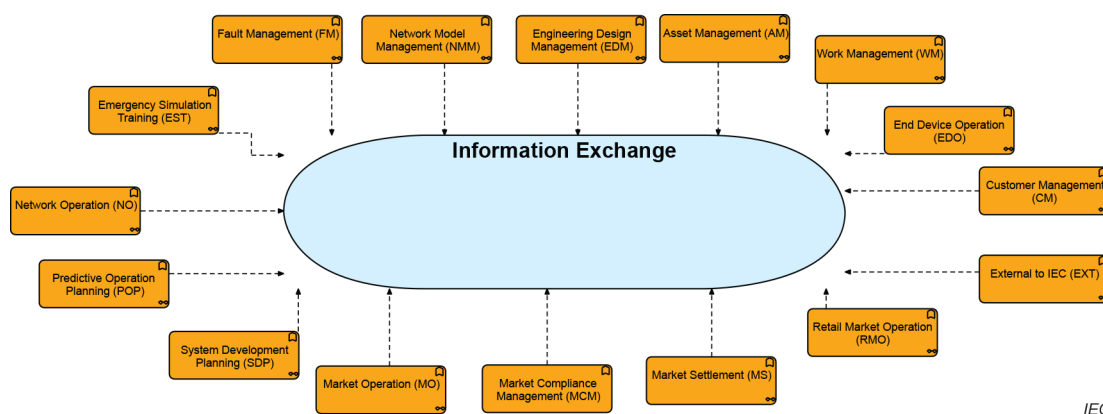
IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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.



IEC

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

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 optimization²*

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*

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 function³ 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.

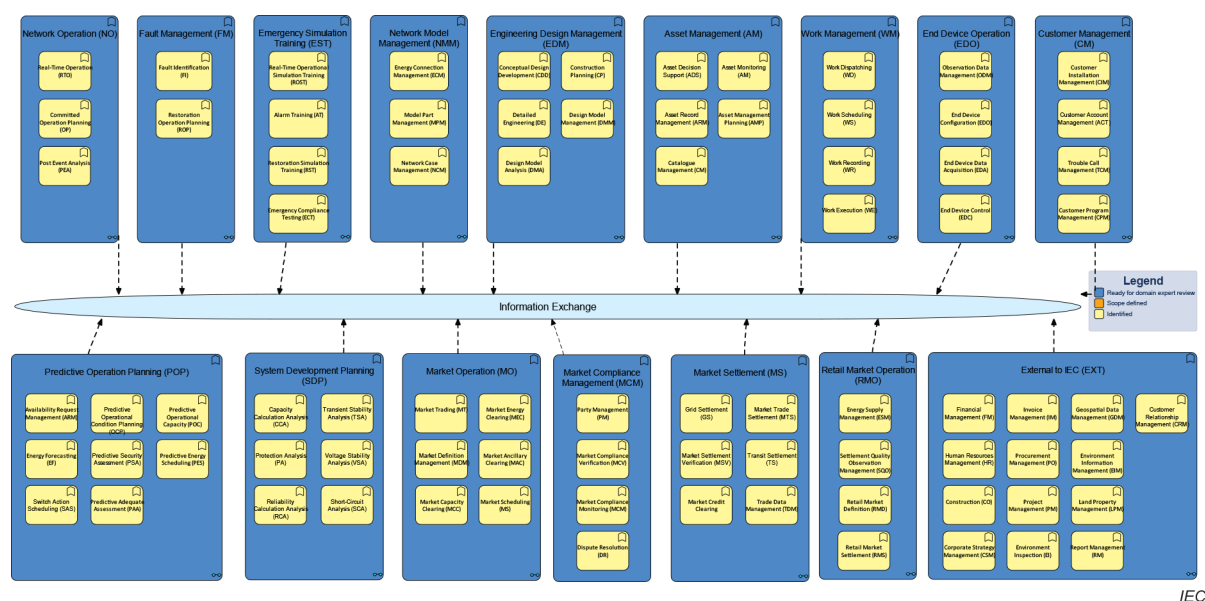


Figure 2 – Defined business function for Interface Reference Model (IRM)

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.

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

The major business functions and business objects are listed in Subclauses 4.3.2 to 4.3.17. These business functions and objects describe the business layer that provides the business input for developing the data objects that represent the CIM profile (logical representation of the schemas) in the application layer.

The goal is to create and maintain a common IRM for IEC TC 57 that cover domains like transmission, distribution, market, generation, consumer, and regional reliability operations.

The IRM provides a business context for the profiles defined in IEC TC 57. Vendor-produced system solution will have different coverage the IRM. It has not been the intention to describe the current functionality delivered by those systems, but rather develop a generic context view that will not need to be changed based on new types of offerings by vendors, nor changes in regulation or technology.

The IRM ArchiMate model is not intended to replace the existing UML modelling, but rather complement it for addressing architecture issues.

The modelling strategy for creating the IRM is to identify the relevant business objects that are being realised through one or more data objects (IEC 61968-3 to -9, -13), also called CIM profiles. The relevant business functions that consume or produce the business objects have been identified to create the relevant context for the business objects and to describe their purpose. The major business functions are used to identify the high-level context that CIM is addressing. These business functions are then broken down to sub-business functions. However, only the business functions that access certain business objects are modelled. Note that some valid business functions are not modelled as sub-business functions due to the reason that they do not access any business objects other than those accessed by the top business function. All business objects that are accessed by a top business function are also accessible by the sub-business function. All business objects are allocated to one major business function but can be accessed by multiple functions. The colour scheme of the business object in the all diagrams for Subclause 4.3 indicate if the business object belongs to the business function modelled in the same diagram or others.

The use of access relationship (arrow from business function) does not indicate information flow, e.g. if the business object is produced or consumed by the business function. The use of the arrow is just for showing the business object's responsibility. IRM does not define any business process or link to any data object. This information will be maintained in the different standards that use the IRM. The ArchiMate notation used in IRM is listed in Annex D.

4.3.2 Asset Management (AM)

4.3.2.1 General

The Asset Management (AM) package in the CIM IRM defines the business functions and business objects involved in balancing of costs, opportunities and risks against the desired performance of assets, to achieve the organisational objectives. The relationships between the business functions and business objects are described in Figure 3.

This package is interlinked with Work Management (WM), Engineering Design Management (EDM), Network Model Management (NMM) and Network Operation (NO) packages.

The Institute of Asset Management (IAM) defines the scope of Asset Management to include the following concepts:

- organisational strategy plan;
- organisation and people;
- asset knowledge;
- asset management decision making;
- asset management strategy and planning;

- lifecycle delivery including acquire/design, operate, maintain and dispose;
- risk and review.

CIM, in Asset Management, is focusing on creating an information model and document messages (CIM profiles) that support the management of (primarily) the physical assets lifecycle including design/acquisition, operations, maintenance and renewal/disposal to ensure safe, secure, cost-effective (value-for-money) operation of power systems.

IEC 61968-4 defines the document messages (i.e. CIM profiles) for asset management. The asset management system does not need to support the business layer defined in this package for being CIM compliant. The compliance is defined by the support of the document message (i.e. CIM profile). However, vendors and utilities are encouraged to link application function requirement or capability to the business function defined in this package.

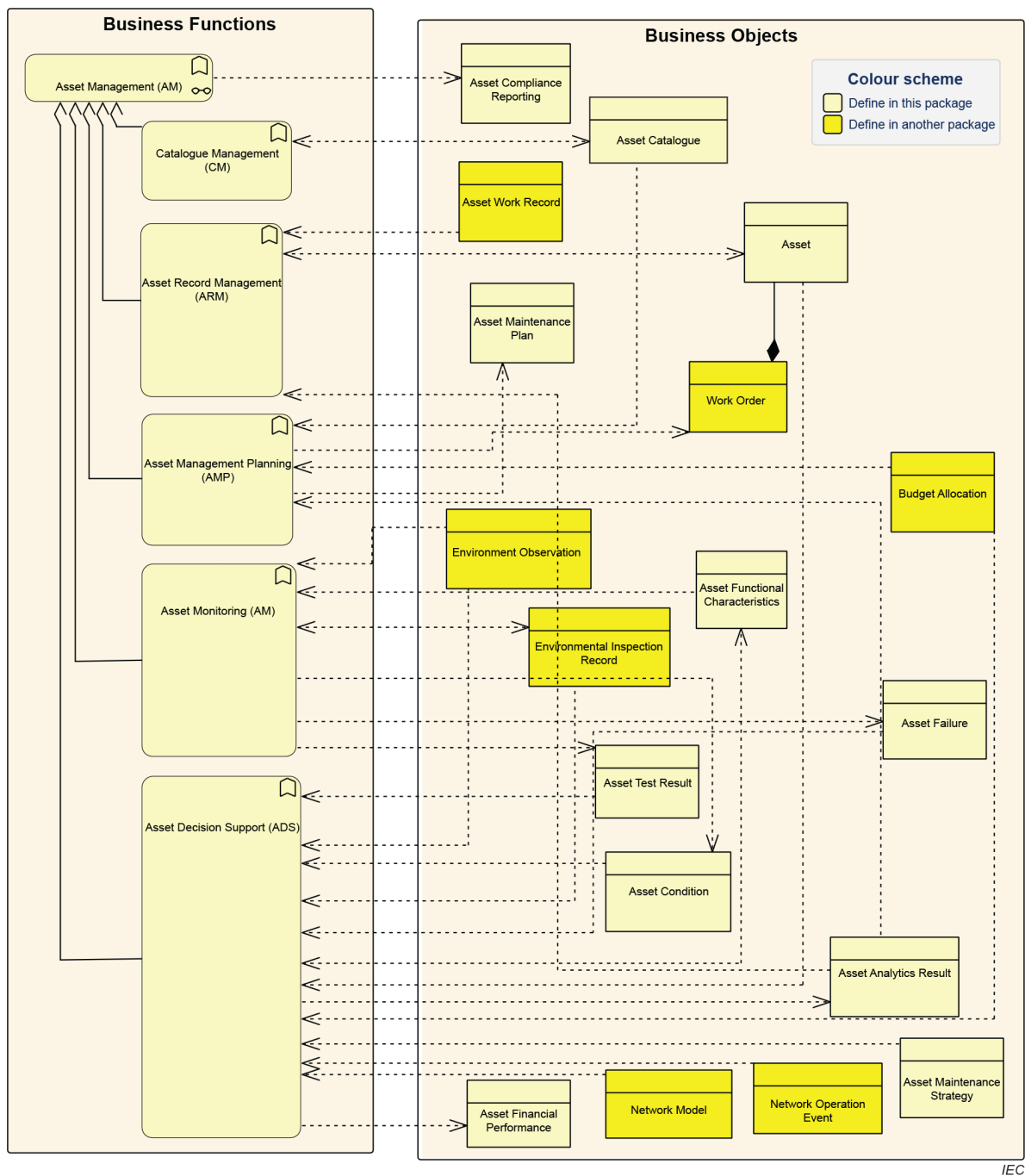


Figure 3 – Asset management business functions and business objects

4.3.2.2 Business functions

Name		Description
Asset Management (AM)		The Asset Management (AM) business function coordinates activities of an organisation to realise value from assets. Assets are in general considered to be items, things or entities that have potential or actual value to an organisation. This business function is focused on physical assets in the power system. Asset Management involves the balancing of cost, opportunities and risks against the desired performance of assets, to achieve the organisational objectives (see ISO 55000).
	Asset Decision Support (ADS)	The Asset Decision Support (ADS) business function involves strategy definition and prioritization, maintenance strategy planning, risk management, programme management and decision-making. The central aspect of asset decision support is analytics. It drives the condition, configuration, performance, operating costs, and flexibility of the asset base, with the aim of maximising value. The Asset Decision Support (ADS) business function involves also the following business functions: • Asset Criticality Analysis (ACA) The business function of developing an understanding of the role of each asset to deliver the required function, and the risk associated with operating a particular asset. • Failure Mode Effect Analysis (FMEA) The business function to determine the potential failures of systems, subsystems, equipment, component and their consequences with the goal of mitigating or reducing the risks associated with the identified failures to safely and reliably operate those assets. This will also assist to identify the best strategies to maintain these assets throughout their lifecycle.
	Asset Management Planning (AMP)	The Asset Management Planning (AMP) business function involves the specification of the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organization's asset management objectives. Reliability trends and the evaluation of corrective actions needs to be performed. The grouping of assets may be by asset type, asset class, asset system or asset portfolio. An asset management plan is derived from the strategic asset management plan.
	Asset Monitoring (AM)	The Asset Monitoring (AM) business function involves inspection, testing, measurement, and monitoring of the assets in order to understand, assess and manage their condition and performance.
	Asset Record Management (ARM)	The Asset Record Management (ARM) business function involves the registration and maintenance of the legal (e.g. ownership), commercial (e.g. supplier), financial (e.g. different type of cost), technical and managerial information for: • Substation and Network Assets The electrical substation and network assets that a utility owns, or for which it has responsibility, maintained in an accurate asset register developed around an asset hierarchy that supports advanced asset management functions. • Energy Resource Asset Record of the Energy Resource, including Distributed Energy Resource (DER), that can be aggregated to provide power necessary to meet demand. These resources refer to distributed generation, storage, load management, combined heat and power and other sources involved in electricity supply, both in stand-alone and interconnection applications.

Name		Description
		- Non-Electrical Grid Asset The non-electrical assets (e.g. poles, cross-arms, etc.) that a utility owns, or for which it has responsibility, maintained in an accurate asset register that supports advanced asset management functions. - Non-Grid Asset The non-grid assets (e.g. tools, vehicle, etc.) that a utility owns or responsibility for that is not related directly to the network grid.
	Catalogue Management (CM)	The Catalogue Management (CM) business function involves the maintenance of the collection of information regarding available types of products and materials that are used to design, build or install, maintain or to operate assets. Asset having common characteristics that distinguish those assets as a group or class are defined into asset type. Management of manufacturer product specification for given asset types and management of the engineering design asset type specification.

4.3.2.3 Business objects

Name		Description
Asset		The Asset business object includes legal (e.g. ownership), commercial (e.g. supplier), financial (e.g. different type of cost), technical and managerial information for substation and network, energy resource (including distributed energy resource (DER)), and non-electrical assets. Identification numbers (specification number, product number, serial number) are central items that allow for collection of additional information associated with the asset.
Asset Analytics Result		The Asset Analytics Result business object includes various analytic scores for the asset, asset type or group of asset (e.g. breakers from a given manufacture) that describe the criticality to the organisation, performance targets or standards, non-conformance criteria, operating cost, replacement value, downtime impact and health assessment.
Asset Catalogue		The Asset Catalogue (AC) business object includes the information of asset grouping with relevant specification to provide information on a given set of generic asset material to be used in strategic planning, design/acquisition, operations, maintenance and renewal/disposal.
Asset Compliance Reporting		The Asset Compliance Reporting business object describes compliance to organisation realisation of asset management in regard to value, efficiency and effectiveness, integrity, execution and leadership against regulatory, standard and business requirements. This could include reporting on compliance to maintenance strategy, maintenance execution, deliverables, and continual improvement. Reporting can be done on individual asset, asset type and asset group in regard to operational, reliability and security standards and regulations. It can also include their impact on the environment in regard to government regulation.
Asset Condition		The Asset Condition business object describes a given asset or asset type key performance indicators for given operational condition, performance targets or standard, operational safety and reliability assessment.
Asset Failure		The Asset Failure business object describes the failure history or statistics associated with a given asset, asset type or asset group (e.g. breakers from a given manufacturer). This includes burnout and accidents.

Name	Description
Asset Financial Performance	The Asset Financial Performance business object includes the evaluation of return-on-investment (ROI) for a given asset, asset type or asset group by comparing resource investment and cost for lifecycle management against performance and availability.
Asset Functional Characteristics	The Asset Functional Characteristics business object describes the combination and interdependencies of asset data (technical information), engineering data, design parameters, environment conditions (both static and dynamic), asset condition data and asset maintenance strategy to form the safe operational space and operational constraints. For example, inherent/permanent thermal rating of assets deployed in the network including changes in electrical asset performance limits based on temperature, wind speed and solar radiation, which set the frame for a variety of actual operational limits on network elements.
Asset Maintenance Plan	The Asset Maintenance Plan business object specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organization's asset management objectives and prevent expected impact of asset failure.
Asset Maintenance Strategy	The Asset Maintenance Strategy business object describes the business and compliance requirements in regard to value provided to stakeholders, such as safety, return on investment, return on assets, return on equity and service levels. The organisation's appetite for risk (safety, financial, environment and reputational) and its performance goal need to be explicitly stated or be possible to be derived. Asset maintenance is a key lever to deliver business outcomes and the strategy defines the alignment and combination of technical and financial management to provide equipment/assets that are "fit for purpose", "safe to use" and "financially sustainable" over the short and long term. This includes the asset lifecycle of design/acquisition, operations, maintenance and renewal/disposal.
Asset Test Result	The Asset Test Result business object describes the result of monitoring, inspections, a formal evaluation task, and built-in self-test (BIST) activities. This is the result of measurements, tests and gauges applied to certain characteristics in regard to an item/thing or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets. Standard Inspection Procedures ensure consistent checking and interpretation of the result. These include results from laboratory work.
Asset Work Record	The Asset Work Record business object describe the job completion including close work orders (time and material consumption), post-work documentation needed for updating/cleaning-up the asset record. As part of work execution, additional business objects such as Failure Record, Asset Test Result, Asset Condition Data and Asset Analytics Result can be produced.

4.3.3 Customer Management (CM)

4.3.3.1 General

The Customer Management (CM) package in the CIM IRM defines the business functions and business objects involved in the management of customer data and records, customer trouble calls, customer installation, customer agreements and settlement (creating the billing components that are aggregated as part of the billing process) and the development of new products. The relationships between the business functions and business objects are described in Figure 4.

This package is interlinked with End Device Operation (EDO), Predictive Operation Planning (POP), Retail Market Operation (RMO), Work Management (WM), Fault Management (FM), External to IEC (EXT) and Network Operation (NO).

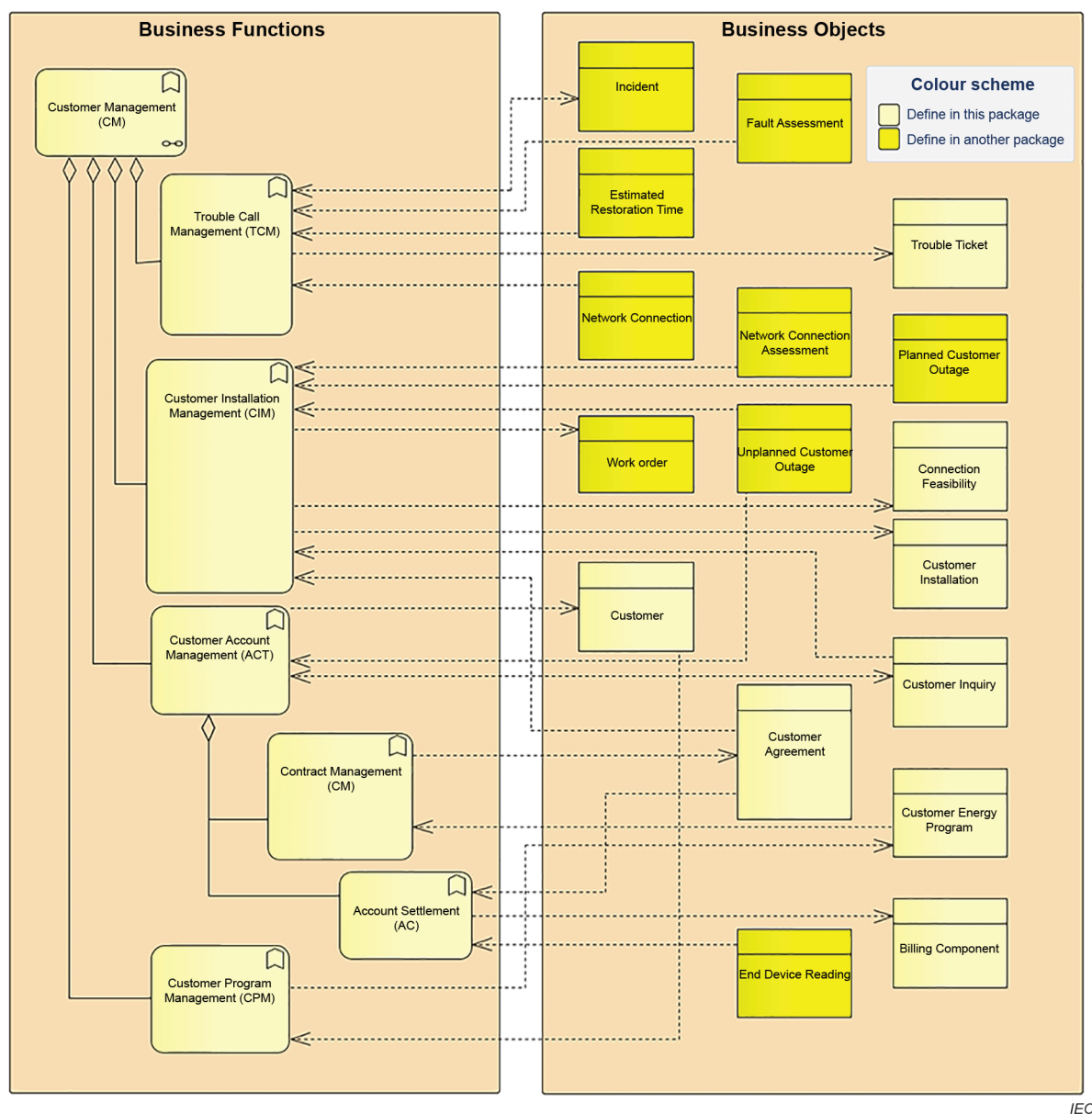


Figure 4 – Customer management business functions and business objects

4.3.3.2 Business functions

Name		Description
Customer Account Management (ACT)		The Customer Account Management (ACT) business function includes the creation, ongoing management (including responding to customer inquiries relative to their account), account billing, and account closing.
	Account Settlement (AC)	The Account Settlement (AC) (or Billing Management or Customer Settlement Management) business function involves the settlement calculation based on the customer agreement and the Settlement Quality observation (typically through a meter reading). This produces the items, statements or billing components that are used in the billing process for invoicing the customer.
	Contract Management (CM)	The Contract Management (CM) (or Contract Administration) business function involves the management of contracts/agreements with customer in regard to services to the customer installation, maintenance and creation of new customer installation.
Customer Installation Management (CIM)		The Customer Installation Management (CIM) business function is managing the information related to the customer installation and connection to the grid. This includes line extension, fuse and capacity description, inspection and survival, meter installation and interconnection of additional devices (e.g. solar panels through an inverter) to the grid. This also includes the work definition, work task breakdown and request for a schedule of the work.
Customer Programme Management (CPM)		The Customer Programme Management (CPM) business function involves the creation and maintenance of programs made available to customers such as various rate options or programs which will affect their usage/billing (e.g. demand response (DR)).
Trouble Call Management (TCM)		The Trouble Call Management (TCM) business function manages the receipt of information from and communications to customers or other observation related to service to one of more customers. This involves the matching up of previous reported trouble ticket, know incident (in the related area) or unplanned (some cases planned) outages.

4.3.3.3 Business objects

Name		Description
Billing Component		The Billing Component (or Settlement Statement, Customer Settlement Statement or Customer Billing Statement) business object describes the line items that constitute the charges and payment created as part of settling the contract signed with the customer. This provides some of the input to invoicing where pay and receivable and payment agreement is not included.
Connection Feasibility		The Connection Feasibility business object describes the result of a feasibility study for connection.
Customer		The Customer business object describes an individual person or business that has or has had an agreement with the utility in regard to provide goods or services.
Customer Agreement		The Customer Agreement (or Customer Contract) business object describes the commitment between the service provider and a customer. The agreement describes the aspects of the service in regard to quality, availability and responsibilities.
	Energy Agreement	The Energy Agreement (or Energy Contract) business object is a specialisation of Customer Agreement where the commitment is in relation to the delivery of energy to or from a given customer installation and customer. In some cases, this could also describe agreement in regard to active power that is delivered or consumed as well.
	Grid Connection Agreement	The Grid Agreement (or Grid Contract) business object is a specialisation of Customer Agreement where the commitment is in relation to the connection into the grid, distribution or transmission.
	Network Extension Agreement	The Network Extension Agreement (or Network Extension Contract) business object is a specialisation of Customer Agreement where the commitment is in relation to extending an existing customer installation or the creation of a new customer installation.
Customer Energy Programme		The Customer Energy Programme business object describes the product that a customer can be entered into agreement with. It normally describes a way for a utility to control the customer installation as a reserve for balancing the grid in regard to demand (or in some cases production surplus). The customer is compensated for providing the flexibility and when the flexibility is activated. This could be a demand response product or other power effect control program.
Customer Inquiry		The Customer Inquiry business object describes the inquiries from a given customer.
Customer Installation		The Customer Installation business object describes the content of the installation on the customer premises in regard to installation, premise, point of delivery and device (e.g. a meter for meter reading) and their location (directly or relative to the connection to the grid).
Trouble Ticket		The Trouble Ticket business object describes the event and/or symptoms that may or may not affect the grid that is reported by a customer or third-party observer. The trouble ticket might be linked to an Incident, Unplanned Customer Outage or in some cases a Planned Customer Outage.

4.3.4 Emergency Simulation (ES)

4.3.4.1 General

The Emergency Simulation (ES) package in the CIM IRM defines the business functions and business objects involved in training, planning and simulation of emergency situations. The relationships between the business functions and business objects are described in Figure 5.

The emergency simulation includes training and planning for both internal enterprise and external cross utility/entity corporation. Both are in the horizontal and vertical domain, e.g. TSOs-TSOs and TSOs-DSOs coordination.

This package is interlinked with Network Model Management (NMM) and Network Operation (NO) packages.

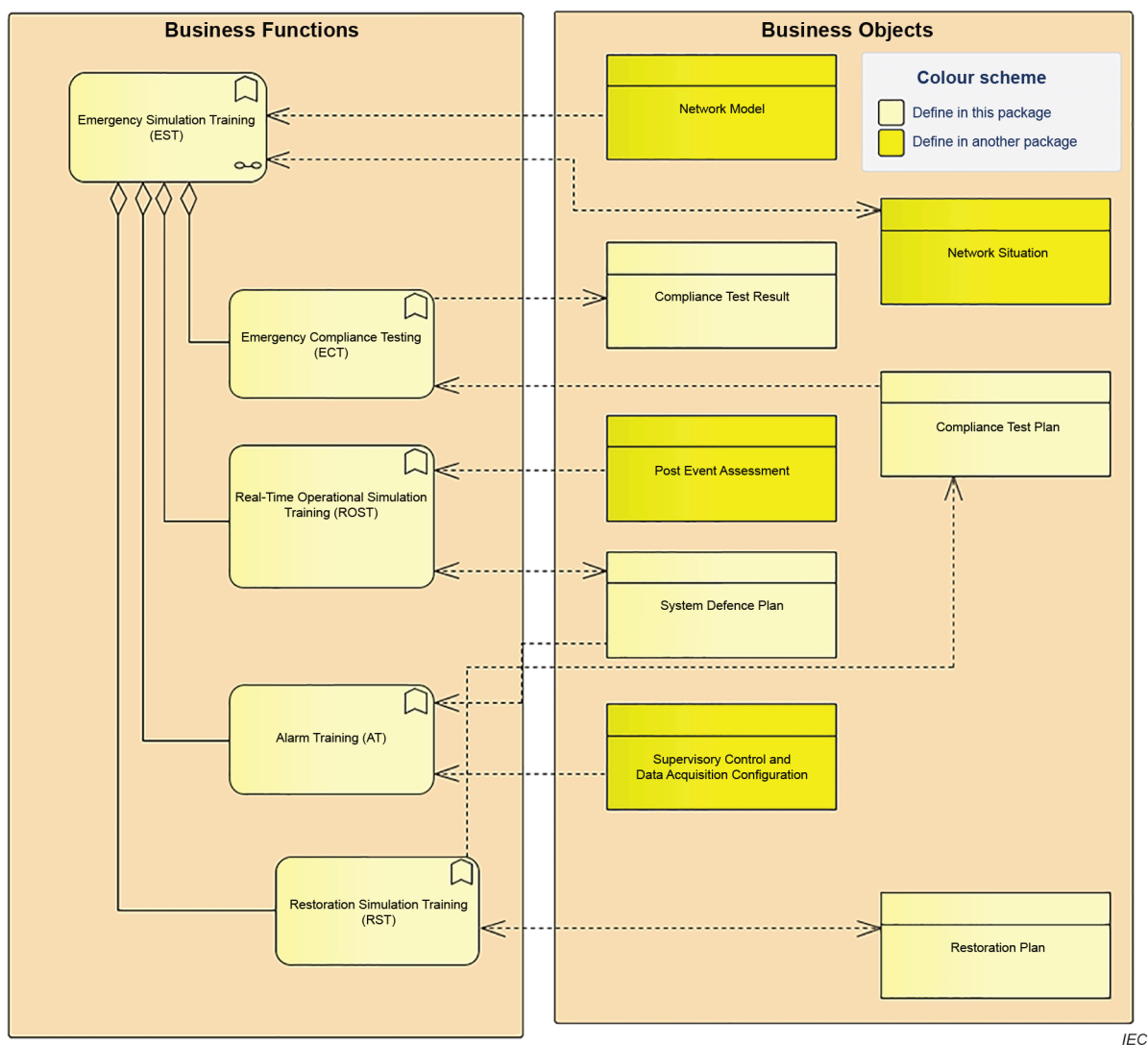


Figure 5 – Emergency simulation training business functions and business objects

4.3.4.2 Business functions

Name		Description
Emergency Simulation (ES)		The Emergency Simulation (ES) business function involved operational training and operational planning with the use of network and situation simulation to prepare for emergency situations.
	Alarm Training (AT)	The Alarm Training business function involves training in interpreting alarms and how to change the network operation so that the alarm situation is resolved.
	Emergency Compliance Testing (ECT)	The Emergency Compliance Testing business function involves the formal verification of equipment and capabilities relevant for the system defence plan and the restoration plan.
	Real-Time Operational Simulation Training (ROST)	The Real-Time Operational Simulation Training business function involves the training of operators in real-time operating environment such as control centres to operate a plant, facility or grid.
	Restoration Simulation Training (RST)	The Restoration Simulation Training business function involves the training of executing defence and restoration plans, e.g. restoration from blackout.

4.3.4.3 Business objects

Name		Description
Compliance Test Plan		The Compliance Test Plan business object includes legal (e.g. ownership), commercial, (e.g. supplier), financial (e.g. different type of cost), technical and managerial information for substation and network, energy resource (including distributed energy resource (DER)), and non-electrical asset that are included and used in a defence and restoration plan. Identification of the network function and the physical assets are central items that allow for the retrieval of additional information associated with the asset and its network function.
Compliance Test Result		The Compliance Test Result business object includes the identification of the asset and network function that has passed the compliance test.
Restoration Plan		The Restoration Plan business object includes the all technical and organisational measures necessary for the restoration of the system back to normal state.
System Defence Plan		The System Defence Plan business object includes the identification of critical grid elements and their relevant roles, e.g. operator of significant production, the conditions under which the system defence plan is activated. It needs to include the list of measurements that is implemented and can be active on the installations that are deemed critical. This includes a protection schema as: • automatic under-frequency control scheme; • automatic scheme against voltage collapse. And defence procedures for: • frequency deviation; • voltage deviation; • power flow management; • demand disconnection.

4.3.5 End Device Operation (EDO)

4.3.5.1 General

The End Device Operation (EDO) package in the CIM IRM defines the business functions and business objects for configuration, control and acquisition of information from end devices. The relationships between the business functions and business objects are described in Figure 6.

End device is defined as the item that provides the source of the information and the destination of any control. The business function action is normally triggered by other business function, e.g. a meter reading that is triggered by billing or a device control triggered by a demand response programme. This is not preventing the underlying technology to be real-time based. The control signal for changing the temperature setting on an air condition is an example of a control that is triggered by the Network Operation business function. End device operation are independent of technology, ownership or type of device.

This package is interlinked with Customer Management (CM), Work Management (WM) and Network Operation (NO) packages.

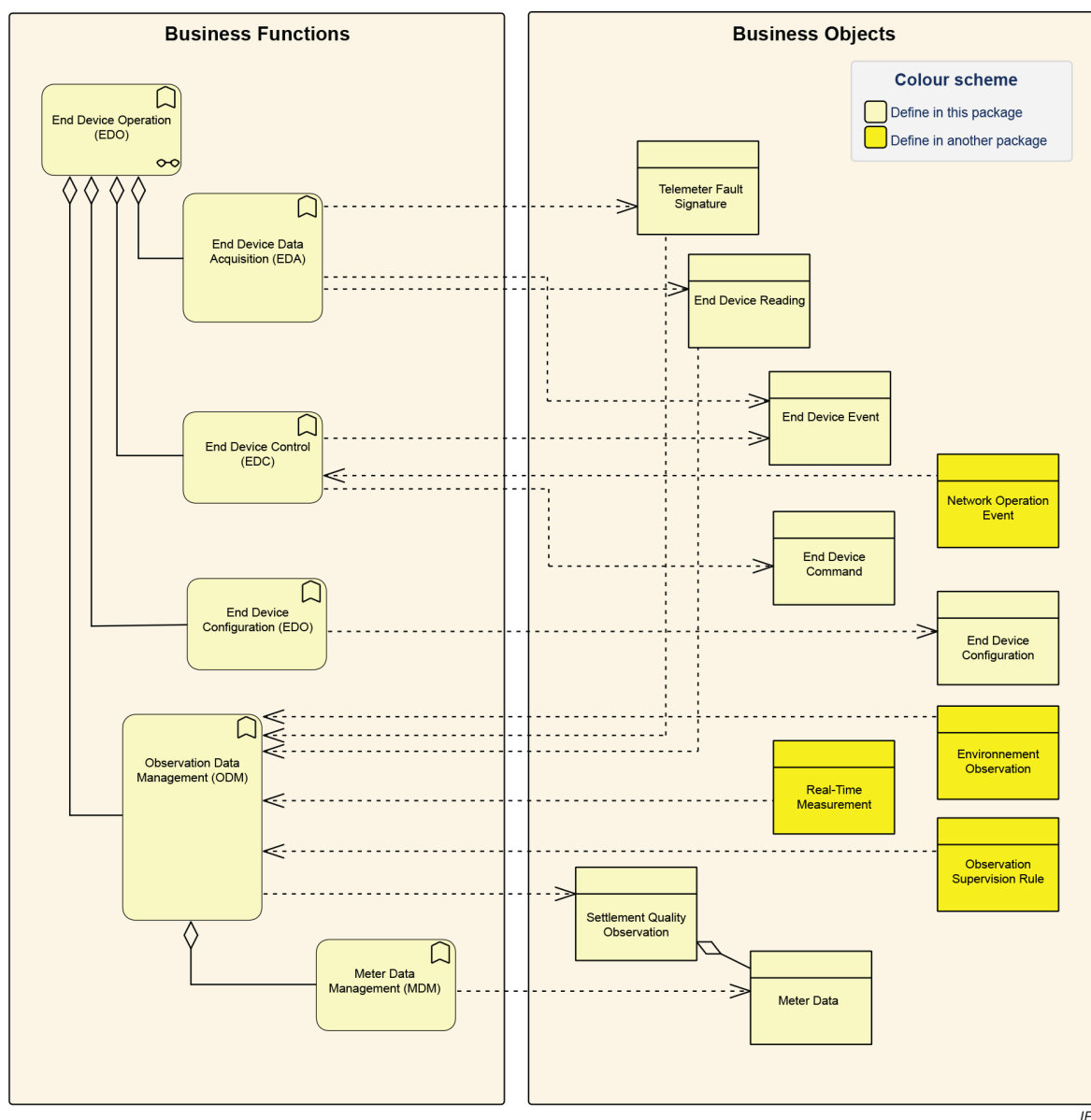


Figure 6 – End device operation business functions and business objects

4.3.5.2 Business functions

Name	Description
End Device Configuration (EDO)	The End Device Configuration (ECO) business function focuses on configuration of an end device including communication settings, establishing unique identification, control settings, acquisition setting in regard to measurement, accuracy, sampling rate and quality monitoring.
End Device Control (EDC)	The End Device Control (EDC) business function includes the ability to control the end device in regard to meet new configuration settings, operations (e.g. enabling demand response) or other controls of the system services by network operation.
End Device Data Acquisition (EDA)	The End Device Acquisition (EDA) business function includes all activities that gather non-real-time data from an end device, e.g. a meter, Phasor Measurement Unit (PMU), or fault recorder. This includes data such as: – analogue data such as meter reading; – discrete data such as on and off; – status; – control results.
Meter Data Management (MDM)	The Meter Data Management (MDM) business function collects, validates, stores and distributes readings and event-related data from meters and other end devices to other enterprise functions and systems. The meter data management function supports diverse end-use applications including but not limited to billing, load management, load forecasting, demand response, outage management, asset management and distribution network planning and maintenance. The function may perform validating, editing, and estimating (VEE) according to rules established by the appropriate supervising regulatory agency.
Observation Data Management (ODM)	The Observation Data Management (ODM) business function validates readings and other observation measurement against agreed quality rules. Observation that does not meet the requirement can be user edited or estimated bases on rules. The appropriate supervision rules for validating, editing and estimating (VEE) are normally defined by the relevant supervising regulatory agency.

4.3.5.3 Business objects

Name	Description
End Device Command	The End Device Command business object represent the command communicated to the end device, e.g. change temperature setting on the air condition.
End Device Configuration	The End Device Configuration business object describe the configuration of the end device. This can include communication settings, establishing unique identification, control settings, acquisition setting in regard to measurement, accuracy, sampling rate and quality monitoring.
End Device Event	The End Device Event business object is information provided by the end device based on the end device configuration and represents the occurrence of an event that has been under monitoring. Meter tampering and grounding error are examples of end device events.
End Device Reading	The End Device Reading business object represents the data that have been acquired by the end device. A meter reading that provides the cumulative kWh value recorded by a meter device from a previous reading, or a meter reading on an hourly resolution for a period are examples of end device readings. A fault reading from a remote fault recorder is also an example of an end device reading.
Meter Data	Meter data that are integrated over a period of time before being presented for billing or other purposes.
Settlement Quality Observation	The Settlement Quality Observation business object describes the data that meets the quality required by the settlement function defined in the Market Rules. For example, a meter reading can include the cumulative kWh value that needs to have the previous meter reading subtracted to calculate the consumption from previous billing components. The consumption value could be considered as settlement ready data that meets the requirement defined in the market rules.
Telemeter Fault Signature	The Telemetered Fault Signature business object includes one or more remotely monitored measurements from sensors that are used to identify the location of a Predicted Fault Event. The Telemetered Fault Signature could be waveform data from a fault recording device, fault passage and direction from fault passage indicator devices, fault distance from a relay, fault current from a relay, the open/close status of a switch or an analogue voltage/flow measurement.

4.3.6 Engineering Design Management (EDM)

4.3.6.1 General

The Engineering Design Management (EDM) package in the CIM IRM defines the business functions and business objects involved in creating and maintaining detailed design (e.g. blueprints) of all the structures that constitute the relevant grid elements. These include substation engineering, transmission line engineering, distribution engineering, generation engineering, and so on. Engineering design includes both electrical and non-electrical aspects at the level of detail necessary to support construction and maintenance activity, and typically identifies catalogue specifications that are associated with parts of the design. Detailed schematics are common, and the content describes how asset positions are to be connected (either mechanically or electrically). Engineering design functions are usually limited to owned parts of the grid. Engineering design connects the functional requirements to asset requirements and evolves from the generic requirement on the type of asset to the documentation of the specific asset. The relationships between the business functions and business objects are described in Figure 7. The breakdown of the detailed engineering and detailed design can be found in Figure 8.

This package is interlinked with Work Management (WM), Asset Management (AM) and Network Model Management (NMM) packages.

For the following domain area; legal, commercial, financial, managerial and organisational informational model will be harmonised with other exiting standards and information models, such as the Building Information Model (BIM).

As an example, this means that CIM does not intend to support Procurement & Supply Chain Management but provide input in regard to requirements for asset design, operations, maintenance and monitoring as well as evaluating the delivered or build solution.

The Building Information Modelling (BIM) lifecycle view includes:

- programming (e.g. project and functional requirements);
- conceptual design;
- detailed design;
- analysis;
- documentation;
- fabrication;
- construction 4D/5D (4D adding time to 3D, 5D adding of cost);
- construction logistics;
- operation and maintenance;
- demolition/renovation.

IEC 61968-6 defines the current document messages/CIM profiles for Engineering Design.

Engineering Design system does not need to support the business layer defined in this package to be CIM compliant. The compliance is defined by the support of the document message/CIM profile. However, the vendor and utility companies are encouraged to link application function requirements or capabilities to the business function defined in this package. Since power systems are considered part of the critical infrastructure and its operation and maintenance involves a high level of personal safety risk, the CIM standard has extra focus on information security and personal safety.