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**Energy management system application program interface (EMS-API) –
Part 301: Common information model (CIM) base**

**Interface de programmation d'application pour système de gestion d'énergie
(EMS-API) –
Partie 301: Base de modèle d'information commun (CIM)**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 301: Common information model (CIM) base

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 61970-301 edition 7.1 contains the seventh edition (2020-06) [documents 57/2210/FDIS and 57/2224/RVD] and its amendment 1 (2022-02) [documents 57/2439/FDIS and 57/2450/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 61970-301 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This seventh constitutes a technical revision.

This edition reflects the model content version 'IEC61970CIM17v38', dated '2020-01-21', and includes the following significant technical changes with respect to the previous edition:

- a) Added Feeder modelling;
- b) Added ICCP configuration modelling;
- c) Correction of issues found in interoperability testing or use of the standard;
- d) Improved documentation;
- e) Updated Annex A with custom extensions;
- f) Added Annex B Examples of PST transformer modelling;
- g) Added Annex C HVDC use cases.

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

A list of all parts of the IEC 61970 series, under the general title: *Energy management system application program interface (EMS-API)*, can be found on the IEC website.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under 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- withdrawn,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

This document is part of the IEC 61970 series which define an application program interface (API) for an energy management system (EMS). IEC 61970 was originally based upon the work of the EPRI Control Center API (CCAPI) research project (RP-3654-1). The principle objectives of the EPRI CCAPI project were to:

- reduce the cost and time needed to add new applications to an EMS;
- protect the investment of existing applications or systems that are working effectively with an EMS.

The principal objective of the IEC 61970 series is to produce documents which facilitate the integration of EMS applications developed independently by different vendors, between entire EMS systems developed independently, or between an EMS system and other systems concerned with different aspects of power system operations, such as generation or distribution management systems (DMS). This is accomplished by defining application program interfaces to enable these applications or systems access to public data and exchange information independent of how such information is represented internally.

The Common Information Model (CIM) specifies the semantics for this API. The Component Interface Specifications (CIS), which are contained in other parts of the IEC 61970 series, specify the content of the messages exchanged.

The CIM is an abstract model that represents all the major objects in an electric utility enterprise typically needed to model the operational aspects of a utility. This model includes public classes and attributes for these objects, as well as the relationships between them.

This document defines the CIM Base set of packages which provide a logical view of the functional aspects of an Energy Management System including Supervisory Control and Data Acquisition (SCADA). Other functional areas are standardized in separate IEC documents that augment and reference this document. For example, IEC 61968-11 addresses distribution models and references this document. While there are multiple IEC standards dealing with different parts of the CIM, there is a single, unified information model comprising the CIM behind all these individual standards documents.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning a computer-based implementation of an object-oriented power system model in a relational database. As such, it does not conflict with the development of any logical power system model including the Common Information Model (CIM), where implementation of the model is not defined.

The IEC takes no position concerning the evidence, validity and scope of this patent right.

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ISO (www.iso.org/patents) and IEC (http://www.iec.ch/tctools/patent_decl.htm) maintain on-line data bases of patents relevant to their standards. Users are encouraged to consult the data bases for the most up to date information concerning patents.

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ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 301: Common information model (CIM) base

1 Scope

The common information model (CIM) is an abstract model that represents all the major objects in an electric utility enterprise typically involved in utility operations. By providing a standard way of representing power system resources as object classes and attributes, along with their relationships, the CIM facilitates the integration and interoperability of network applications developed independently by different vendors, between entire systems running network applications developed independently, or between a system running network applications and other systems concerned with different aspects of power system operations, such as generation or distribution management. SCADA is modelled to the extent necessary to support power system simulation and inter-control centre communication. The CIM facilitates integration by defining a common language (i.e. semantics) based on the CIM to enable these applications or systems to access public data and exchange information independent of how such information is represented internally.

The object classes represented in the CIM are abstract in nature and can be used in a wide variety of applications. The use of the CIM goes far beyond its application in an EMS. This document should be understood as a tool to enable integration in any domain where a common power system model is needed to facilitate interoperability and plug compatibility between applications and systems independent of any particular implementation.

Due to the size of the complete CIM, the object classes contained in the CIM are grouped into several logical Packages, each of which represents a certain part of the overall power system being modelled. Collections of these Packages are progressed as separate International Standards. This document specifies a Base set of packages which provide a logical view of the functional aspects of Energy Management System (EMS) and power system modelling information within the electric utility enterprise that is shared between all applications. Other standards specify more specific parts of the model that are needed by only certain applications. Subclause 4.3 of this document provides the current grouping of packages into standards documents.

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 61850 (all parts), *Communication networks and systems for power utility automation*

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61968 (all parts), *Application integration at electric utilities – System interfaces for distribution management*

IEC TS 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

Object Management Group: *UML 2.0 Specification* – <http://www.omg.org>

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61970-2 and the following 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>

3.1 energy management system EMS

computer system comprising a software platform providing basic support services and a set of applications providing the functionality needed for the effective operation of electrical generation and transmission facilities so as to assure adequate security of energy supply at minimum cost

3.2 application program interface API

set of public functions provided by an executable application component for use by other executable application components

3.3 unified modelling language UML

formal and comprehensive descriptive language with diagramming techniques used to represent software systems, from requirements analysis, through design and implementation, to documentation

Note 1 to entry: UML has evolved from a collection of methods contributed by different practitioners into an International Standard (ISO/IEC 19505, published in 2012). The CIM relies on UML for defining the model, and automated tools generate the documentation, schemas, and other artefacts directly from the UML. A basic understanding of UML is necessary to understand the CIM.

3.4 profile

subset of CIM classes, associations and attributes needed to accomplish a specific type of interface

Note 1 to entry: This may be expressed in XSD, RDF, and/or OWL files. A profile can be tested between applications. A profile is necessary in order to “use” the CIM. Several profiles are defined in other parts of the IEC 61968 and IEC 62325 series.

4 CIM specification

4.1 Overview

The CIM model is described in the Unified Modelling Language (UML) which is maintained as a UML file managed by a UML editing tool. The UML file exists in two different formats:

- a tool proprietary format,
- a standardized xmi format.