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TECHNICAL SPECIFICATION

colour inside

Energy management system application program interface (EMS-API) – Part 555: CIM based efficient model exchange format (CIM/E)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 555: CIM based efficient model exchange format (CIM/E)

FOREWORD

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61970-555, which is a technical specification, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
57/1730/DTS	57/1769/RVC

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

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

A list of all parts in the IEC 61970 series, published 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 this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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 part of IEC 61970, which is a technical specification, describes ‘CIM-E’, an alternative to IEC 61970-552 (CIM/XML) for serializing CIM data exchanges, which is in use in China. It is a general method of serialization that could be used with any defined exchange, but it was developed specifically as an alternative to IEC 61970-552 for exchanging power system network models and solutions, which are defined in IEC 61970-452 and IEC 61970-456. Following is an explanation as to why the IEC has formally documented this method in addition to IEC 61970-552.

When the IEC first developed its standard for exchanging power system models, the primary model exchange specification, IEC 61970-452, described exchange of a complete model. The companion standard, IEC 61970-552, specified how to serialize model data for exchange, and also described how to serialize ‘incremental updates’ of a model in which only changed parts are exchanged. This latter feature was included because complete models could be very large and require significant processing time, but in most real business situations, model transfers are updates of previous exchanges in which only small parts of the models have changed. Unfortunately, while the IEC understood the potential value of incremental processing, no ‘use cases’ were produced to document the situations in which full or incremental processing would be recommended.

At the time that the IEC was producing these documents, China was following the development of CIM standards and planning to use them. The situations in which they wanted to use CIM model exchange demanded high performance. The solution they chose was CIM-E, a more compact version of serialization than CIM/XML, which their applications could process quickly.

As time passed, the IEC expanded its set of exchanges to include solved cases and continued to envision incremental updates as the approach for optimizing performance. China began to participate actively in WG 13 meetings, and also continued to enhance the CIM-E serialization method, which is a national standard now in China.

In 2011, China proposed that IEC adopt CIM-E as a standard. The IEC concluded that a CIM-E specification was appropriate. China represents a significant part of the world’s electricity infrastructure. It is using CIM. The IEC therefore felt that an IEC specification for CIM-E would be useful, provided that it simply presented a specification for meeting a requirement for CIM-E exchange and did not endorse CIM-E as the recommended method for achieving high performance.

The IEC 61970 series defines an Application Program Interface (API) for an Energy Management System (EMS).

IEC 61970-301 specifies a Common Information Model (CIM): a logical view of the physical aspects of electric utility operations. The CIM is described using the Unified Modeling Language (UML), a language used to specify, visualize, and document systems in an object-oriented manner. UML is an analysis and design language; it is not a programming language. For software programs to use the CIM it needs to be transformed into a schema form that supports a programmable interface.

This part of IEC 61970 describes the translation of the CIM in UML form into a machine readable format as expressed in CIM based Efficient Model Exchange Format(CIM/E) representation of that schema using the CIM/E Schema.

This part of IEC 61970 specifies how the CIM/E schema is used to support power system models or particular application data models exchange requirements, especially for real-time or online applications. Similar to CIM/XML, CIM/E is an efficient serialization format to describe CIM objects. The power system model described by CIM/E or by CIM/XML can be converted bi-directionally with consistent result.

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

Part 555: CIM based efficient model exchange format (CIM/E)

1 Scope

This part of IEC 61970, which is a technical specification, specifies a Component Interface Specification (CIS) for Energy Management Systems Application Program Interfaces. This part specifies the format and rules for exchanging modelling information based upon the CIM. It uses the CIM/E Schema as the meta-model framework for constructing CIM/E documents of power system modelling information. The style of these documents is called CIM/E format. CIM/E is suitable for use in online model exchange of power system applications.

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 61970-452, *Energy management system application program interface (EMS-API) – Part 452: CIM model exchange specification*

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

3.1
Application Program Interface
API
the set of public functions provided by an executable application component for use by other executable application components

3.2
Common Information Model
CIM
abstract model that represents all the major objects in an electric utility enterprise typically contained in an EMS information model

Note 1 to entry: By providing a standard way of representing power system resources as object classes and attributes, along with their relationships, the CIM facilitates the integration of EMS applications developed independently by different vendors. It provides a common information presentation between 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.

3.3
CIM/E Schema
schema specification expressed by using CIM/E format to describe classes and their attributes and associations

3.4
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 ensure adequate security of energy supply at minimum cost

3.5
profile
schema that defines the structure and semantics of a model that may be exchanged

Note 1 to entry: A Profile is a restricted subset of the more general CIM.

3.6
Unified Modelling Language
UML
object-oriented modelling language and methodology for specifying, visualizing, constructing, and documenting the artefacts of a system-intensive process

3.7
Uniform Resource Identifier
URI
object-oriented modelling language and methodology for specifying, visualizing, constructing, and documenting the artefacts of a system-intensive process

4 Use case

4.1 General

With the rapid development of the power industry and renewable energy in the world, a large scale of random intermittent wind power and photovoltaic power are integrated to grids and system operators are faced with great challenges. There is a pressing need for the cooperation of multiple control centres to know the real-time situation of the adjacent system and all the power grids. Therefore, the real-time model and graphics of power systems should be shared among all related control centres. Both the 'ENTSO-E Real-time Awareness and Alarm System' project in Europe and the 'Smart Grid Dispatching Platform' project in China attempt to achieve this goal under urgent requirements.

4.2 Real-time sharing on CIM model

Consider an interconnection power grid with two Control Centres, A and B, as shown in Figure 1. Each control centre has an EMS from different vendors. Although A has no direct responsibility for parts of the grid supervised by B, B still has an influence on A's grid. A is, therefore, obliged to maintain a model of these additional parts in at least enough detail to gauge their effect on its own part of the grid.

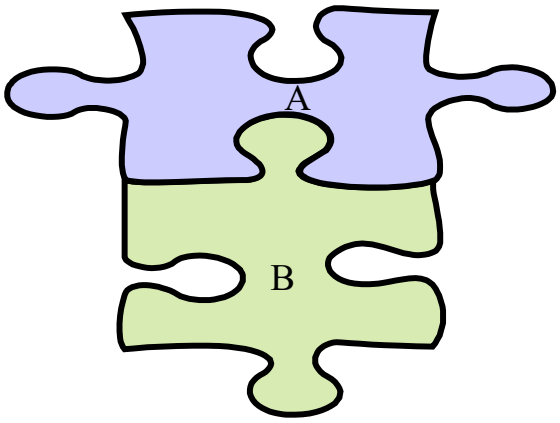

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Figure 1 – Interconnection power grid

Each control center maintains an official, detailed model of its own territory, and regularly makes all updates available to its neighbors by CIM/E. Each control center receives its neighbors' models and merges them together into a full detailed interconnection model, as shown in Figure 2.

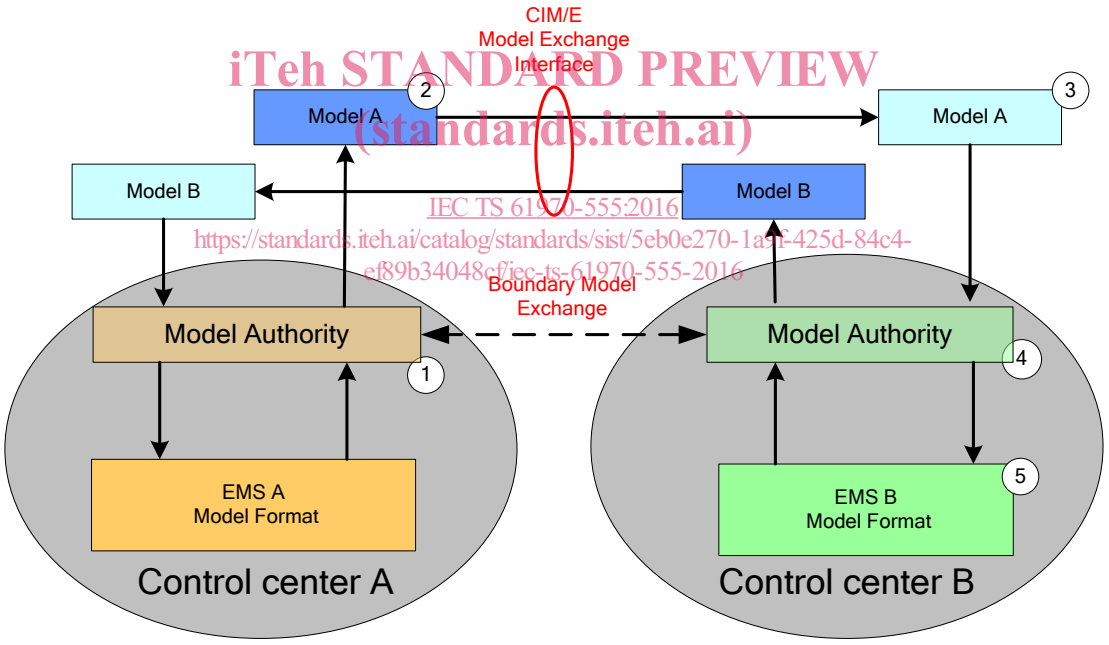

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Figure 2 – CIM model exchange and merge

This diagram shows the interaction between these two control centers, A and B. All actions are the same at each control center. Therefore, we can simply follow the steps as A makes a change:

a) A makes a change in its system model using its local EMS modeller.

b) A's model authority releases either its full model or the increment to CIM/E file and sends it to B.

c) B receives and verifies the model.

d) B extracts A's territory from the model according to the boundary and merges them together into a detailed interconnection model (B reduces A if necessary).

e) B imports the resulting model of A into its Model Authority and its EMS model.