

TECHNICAL SPECIFICATION



Energy management system application program interface (EMS-API) –
Part 556: CIM based graphic exchange format (CIM/G)

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INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENERGY MANAGEMENT SYSTEM APPLICATION
PROGRAM INTERFACE (EMS-API) –****Part 556: CIM based graphic exchange format (CIM/G)**

FOREWORD

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

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

IEC TS 61970-556, 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
57/1731/DTS	57/1770/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.

In this technical specification, the following print types are used:

- *attributes for user defined graphic elements: in italic type.*

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- withdrawn,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.

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INTRODUCTION

This technical specification is part of the IEC 61970 series that define 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 an electric utility operation. The CIM is described using the Unified Modelling Language (UML), a language used to specify, visualize, and document systems in an object oriented manner.

This part of IEC 61970, which is a technical specification, specifies how to exchange CIM based graphic objects using XML, which details how to display an object. This document defines a format to facilitate efficient graphic data transfer, which will meet the real-time requirements for on-line remote diagram browsing and exchanging.

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

Part 556: CIM based graphic exchange format (CIM/G)

1 Scope

This part of IEC 61970, which is a technical specification, specifies a CIM-based graphic exchange format (CIM/G). It includes graphic file structure and graphic element definitions.

This document supports a mechanism for off-line exchange of graphic displays and on-line remote browsing of diagrams among distinct SCADA/EMS systems that may be provided by multiple vendors and located in different places.

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 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

[IEC TS 61970-556:2016](#)

IEC 61970-453, *Energy management system application program interface (EMS-API) – Part 453: Diagram layout profile*

[93bccaf14655/iec-ts-61970-556-2016](#)

IEC TS 61970-555, *Energy management system application program interface (EMS-API) – Part 555: CIM based efficient model exchange format*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050 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

domain object

instance of a class that models a Real-World Object with a unique identity

Note 1 to entry: A domain object inherits from a CIM *Identified Object*; it is normally not a diagram object. The definition of Domain object refers to IEC 61970-453. In this document, it indicates the graphic model of power system equipment.

3.2

diagram

electronic equivalent of a seamless paper plan

Note 1 to entry: The diagram is an identified container for the diagram objects. Examples of diagrams include substation schematics, transportation or distribution network orthogonal schematics, or pseudo-geographical schematics. A diagram has a well-defined coordinate space. A diagram is a set of power system graphic elements, basic graphic elements, analog and static text. This definition refers to IEC 61970-453. The diagram in this document indicates a single picture file, such as substation one-line diagram file, power grid diagram file.

3.3

diagram object

representation of domain objects or static background in a diagram

Note 1 to entry: An example for domain objects includes breakers. An example for static background object includes lakes. This definition refers to IEC 61970-453. Diagram object is defined as Graphic Element in this document. Graphic Element includes Basic Shape Graphic Element and Power System Graphic Element.

3.4

diagram object style

definition of how to render diagram objects possibly based on the state of domain objects

Note 1 to entry: Typically, the diagram object style is resolved in a very specific way for each system. This definition refers to IEC 61970-453. It indicates rendering style of Basic Graphic Elements and Power System Graphic Elements in this document.

3.5

layer

set of graphics displayed as varying granularity within certain zooming levels

Note 1 to entry: Each layer within the same magnification of graphics can be configured separately as visible or invisible, so as to meet the different description requirements of grid models in different application environments.

3.6

basic shape graphic element

SVG compatible basic shape graphic element, such as line, rectangle, circle, ellipse, polygon, etc.

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3.7

power system graphic element

graphic element of power system equipment and topology

Note 1 to entry: This is a representation of domain objects and instantiation of diagram objects in IEC 61979-453.

4 Relationship of this technical specification with other standards

This part of IEC 61970 (CIM/G) is a part of the IEC 61970 series. It is based on the IEC 61970-300 and 61970-400 series. It has a close relationship with IEC 61970-453, as shown in Figure 1. This document inherits the roles shaped in IEC 61970-301; at the same time it complements and expands IEC 61970-453 on diagram presentation and rendering. The diagram layout profiles and linkage with power equipment model are defined in IEC 61970-453; while the detailed diagram presentation and exchange format are defined in this document, not only in off-line cases, but also for on-line applications.

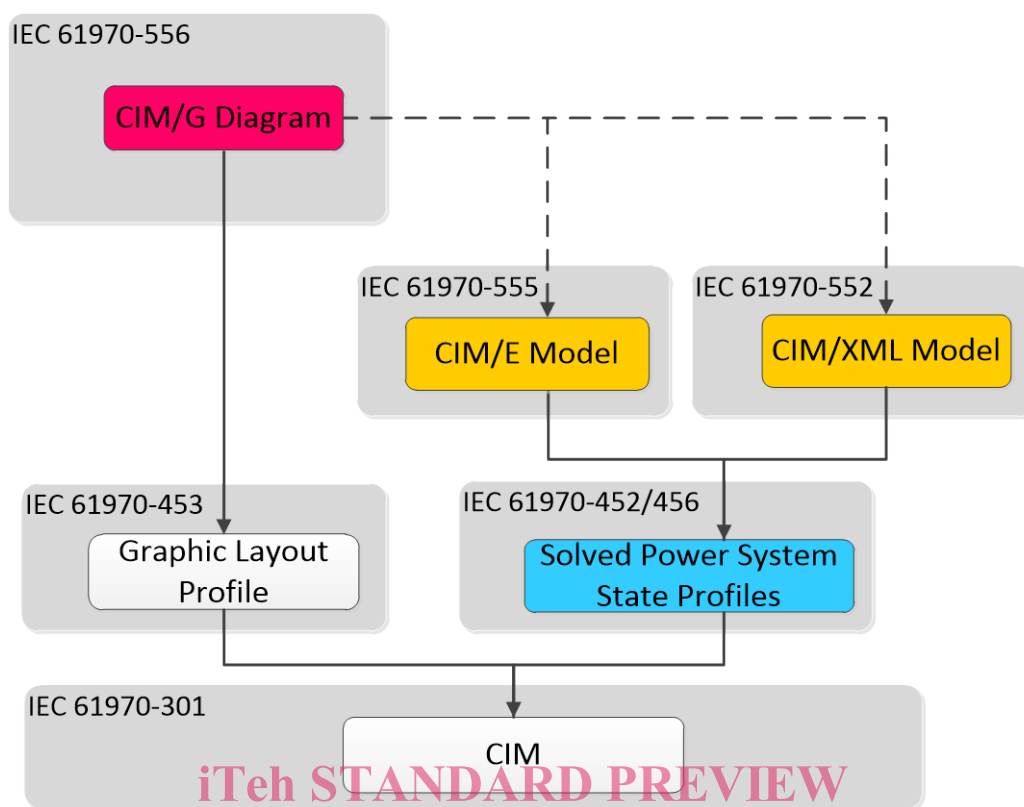


Figure 1 – Relationship with other standards

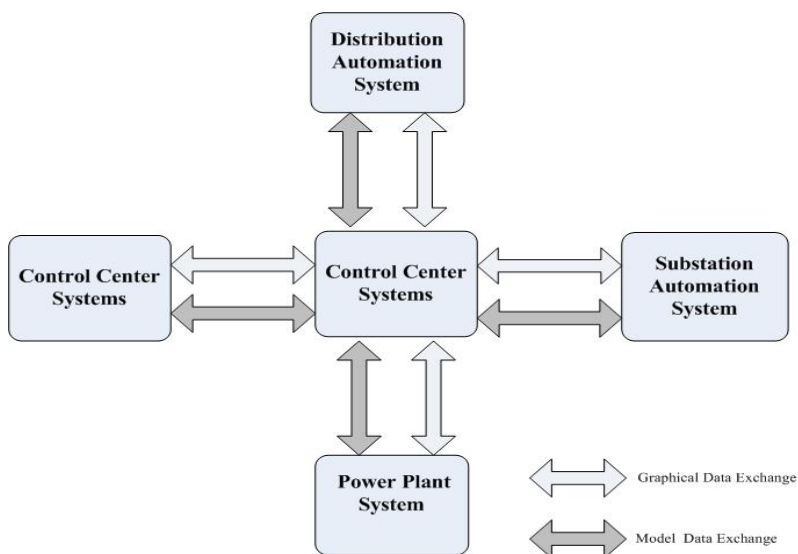
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5 Use cases <https://standards.iteh.ai/catalog/standards/sist/f588a95b-dde9-44d8-9719-93bccafd4655/iec-ts-61970-556-2016>

With this document, the following scenarios are envisaged:

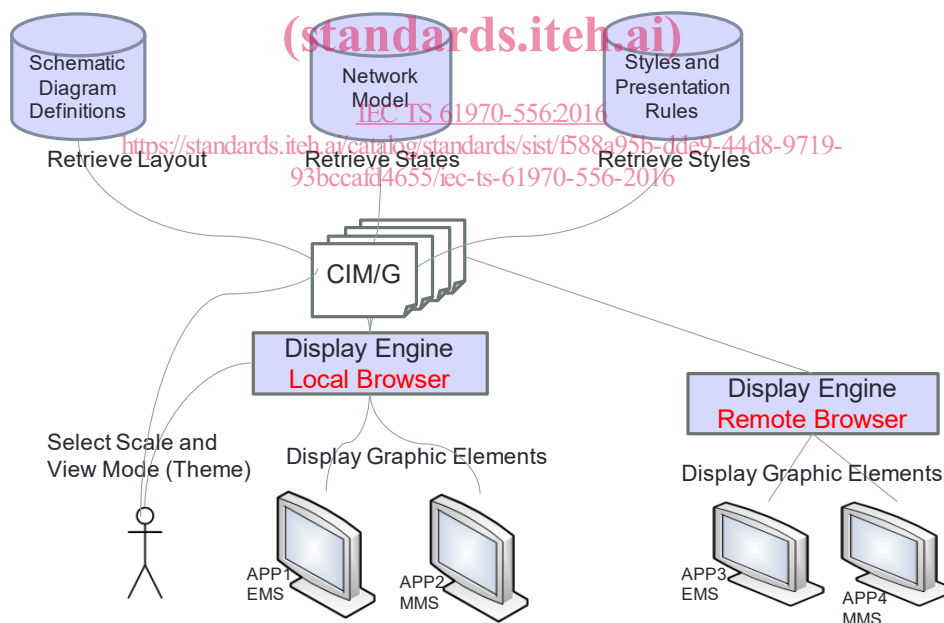
- 1) Diagram layout profile and the exchange rules of diagram objects are defined in IEC 61970-453, and the exchange entity is specified in this document, which specifies how to exchange CIM based diagram objects using XML and details how to display an object. This document can realize the off-line exchange of graphic displays among distinct SCADA/EMS systems that may be provided by multiple vendors and located in different places, i.e. between control center A and control center B, between a control center and a substation or power plant, etc. Mutual conversion between graphics and models can also be achieved efficiently by it. Figure 2 shows a typical scenario of off-line application.



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Figure 2 – Scenario of off-line application

- 2) On-line remote browsing of diagrams among distinct SCADA/EMS systems that may be provided by multiple vendors and located in different places, i.e. between control center A and control center B, between a control center and a substation or power plant, etc. Figure 3 shows a typical scenario of common MMI and online browsing.



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Figure 3 – Scenario of common MMI and online browsing

The online diagram browsing mechanism based on CIM/G is just like the web browsing based on HTML. The information browsing on Internet cannot be achieved without specific HTML description. The CIM/G specification works similarly to HTML specification, which describes the power equipment for on-line diagram browsing. Upon that substantial project costs could be saved, especially for those substations or power plants whose diagrams are seldom called by the control center but should be browsed quickly when required.

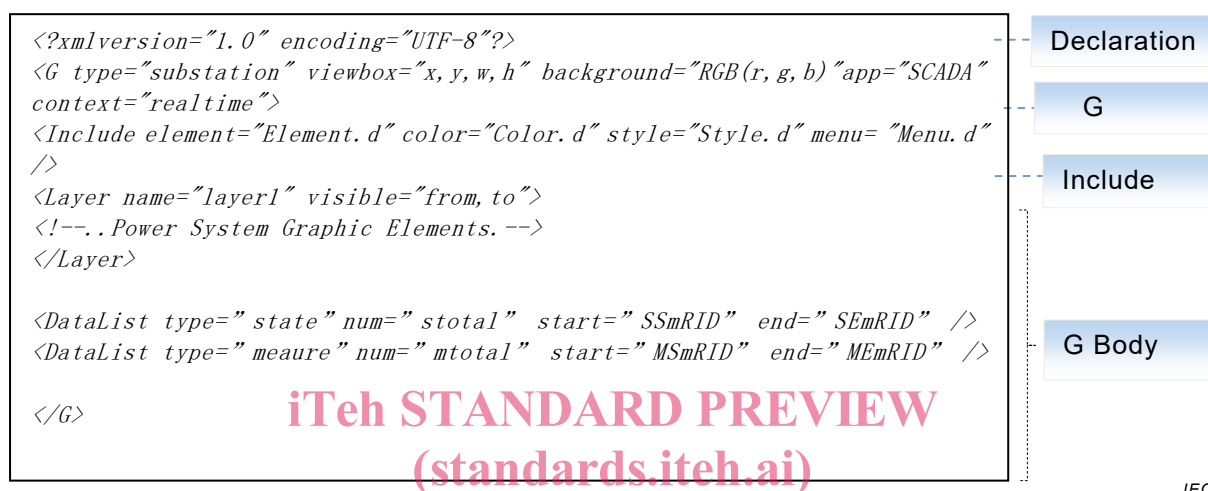
6 Structure of diagram file and definition file

6.1 General

CIM/G files are plain text files based on XML. There are two kinds of files in CIM/G; one is the visible diagram file, and the other is the definition file.

6.2 Diagram file structure

The diagram file includes Declaration tag, Include tag, and G block. 'G' block includes 'Layer' tag and graphic element tag. Figure 4 shows a general CIM/G file.



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Figure 4 – Structure of diagram file

Declaration: Declaration shows XML version and encoding information of CIM/G.

Include tag: Include tag is used to import the predefined common used graphic information, the definition file structure refer to 8.2. The *Include* tag has three attributes: *element*, *color* and *style*.

- The *element='Element.d'* list the predefined power system graphic elements, refer to Annex A.
- The *color='Color.d'* list the predefined colour's code, name, related RGB value and voltage level, all of them have the same meaning, it could be extended or redefined by the user (vendor), refer to Annex B.
- The *style='Style.d'* list the default values of diagram style, refer to Annex C.
- The *menu='Menu.d'* list the predefined menu, it could be extended or redefined by the user (vendor), refer to Annex E.

G tag: G is the root tag in a G file. All of the graphic objects in G tag should be displayed concretely. The entire graphic data block starts and ends with G tag. *In the G block, all graphic elements are sensitive points which could interact with the user, just like 'Anchor' points in Web page.* It has five attributes: *'type'*, *'viewbox'*, *'background'*, *'app'*, *'context'*.

- The *'type'* attribute indicates the diagram types such as *grid*, *substation*, *powerplant*, *GIS*(geographic diagram), etc.
- The *'viewbox'* attribute indicates the G diagram visible rectangle area (x,y,w,h), which defined by the top left point coordinate with the width and height of the diagram.
- The *'background'* attribute indicates the background colour by colour name or *RGB(r,g,b)* value, or a picture by *image file*. Other attributes could be defined by the user.