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**Energy management system application
program interface (EMS-API) –**

**Part 501:
Common Information Model Resource
Description Framework (CIM RDF) schema**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENERGY MANAGEMENT SYSTEM APPLICATION
PROGRAM INTERFACE (EMS-API) –**
**Part 501: Common Information Model Resource
Description Framework (CIM RDF) schema**

FOREWORD

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International Standard IEC 61970-501 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

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

FDIS	Report on voting
57/801/FDIS	57/813/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.

IEC 61970 consists of the following parts, under the general title *Energy Management System Application Program Interface (EMS-API)*:

- Part 1: Guidelines and general requirements
- Part 2: Glossary
- Part 301: Common Information Model (CIM) base
- Part 302: Common information model (CIM) financial, energy scheduling and reservations ¹
- Part 401: Component interface specification (CIS) framework
- Part 402: Component interface specification (CIS) – Common services¹
- Part 403: Component Interface Specification (CIS) – Generic data access¹
- Part 404: Component Interface Specification (CIS) – High speed data access¹
- Part 405: Component Interface Specification (CIS) – Generic eventing and subscription¹
- Part 407: Component Interface Specification (CIS) – Time series data access¹
- Part 453: Exchange of Graphics Schematics Definitions (Common Graphics Exchange) ¹
- Part 501: Common Information Model Resource Description Framework (CIM RDF) schema

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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- withdrawn,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.

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A bilingual edition of this standard may be issued at a later date.
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¹ Under consideration.

INTRODUCTION

This standard is part of the IEC 61970 series that define an Application Program Interface (API) for an Energy Management System (EMS). This standard is based upon the work of the EPRI Control Center API (CCAPI) research project (RP-3654-1).

This part specifies the mapping between the conceptual model specified as Unified Modeling Language (UML) defined in IEC 61970-3XX series: Common Information Model and the machine readable Extensible Markup Language (XML) representation of that schema using the Resource Description Framework (RDF) Schema specification language.

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

Part 501: Common Information Model Resource Description Framework (CIM RDF) schema

1 Scope

This International Standard specifies a Component Interface Specification (CIS) for energy management systems application program interfaces. This part of IEC 61970 specifies the format and rules for producing a machine readable form of the Common Information Model (CIM) as specified in the IEC 61970-301 standard. It describes a CIM vocabulary to support the data access facility and associated CIM semantics.

This part of IEC 61970 supports a mechanism for applications from independent suppliers to access CIM metadata in a common format and with standard services for the purpose of subsequent CIM data access. Secondary objectives are to provide CIM versioning capabilities and a mechanism that is easily extensible to support site-specific needs. The proposed solution:

- is both machine readable and human readable, although primarily intended for programmatic access;
- can be accessed using any tool that supports the Document Object Model (DOM) application program interface;
- is self-describing; <https://standards.iteh.ai/catalog/standards/sist/a55ba5cf-328d-4299-ac34-22a510000000/iec-61970-501-2006>
- takes advantage of current web standards.

This document is the Level 2 Component Interface Specification document that describes in narrative terms (with text and examples based on the CIM), the detailed definition of the CIM metadata interface to be standardized.

2 Normative references

The following referenced documents are indispensable for the application 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 61970-1, *Energy management system application program interface (EMS-API) – Part 1: Guidelines and general requirements*

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

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

IEC 60050 series: *International Electrotechnical Vocabulary*

3 Terms and definitions

For the purposes of this part of IEC 61970, the terms and definitions given in IEC 61970-2, as well as the following, apply.

3.1

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 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, 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.

3.2

Document Object Model

DOM

platform- and language-neutral interface defined by the World Wide Web Consortium (W3C) that allows programs and scripts to dynamically access and exchange the content, structure and style of documents

3.3

Resource Description Framework

RDF

language recommended by the W3C for expressing metadata that machines can process simply. It is expressed as a special kind of XML document

3.4

RDF Schema

schema specification language expressed using RDF to describe resources and their properties, including how resources are related to other resources, which is used to specify an application-specific schema

3.5

Unified Modelling Language

UML

modelling language and methodology for specifying, visualizing, constructing, and documenting the artefacts of a system-intensive process

3.6

Extensible Markup Language

XML

subset of Standard Generalized Markup Language (SGML), ISO 8879, for putting structured data in a text file. It is an endorsed recommendation from the W3C

NOTE It is license-free, platform-independent and well-supported by many readily available software tools.

4 Structure of an XML document

4.1 General

An XML document is a set of containers. The containers can contain other containers as well as content. The two required pieces of a well-formed XML document are the prolog and the root element. The prolog contains statements that indicate the version of the XML standard to which the document conforms and the encoding that is used. The prolog for the CIM RDF Schema file is simply:

```
<?xml version="1.0" encoding="UTF-8"?>
```

The root element contains the XML document's actual contents, which are contained within starting and ending tags. The CIM RDF Schema contains the root element:

```
<rdf:RDF>
.
.
.</rdf:RDF>
```

The root element also contains references to namespaces, which define a context for elements that are used within the rest of the document. The element name is preceded by the namespace alias followed by a colon. For example, the RDF Schema namespace is declared:

```
xmlns:rdfs="http://www.w3.org/TR/1999/PR-rdf-schema-19990303#"
```

References to it within the document use the syntax:

```
<rdfs:subClassOf rdf:resource="rdfs:Resource"/>
```

Comments can appear anywhere within an XML document; they are delimited with `<!--` and `-->` characters.

4.2 Elements

An element is a container enclosed between start and stop tags. The start tag defines the name of the element and contains any attributes of the element. In the following example, Class is the name of the element and ID is its attribute.

```
<rdfs:Class rdf:ID="Bay">
```

The stop tag for this element is `</rdfs:Class>`.

4.3 Attributes

The ID attribute is used for the Class elements to be able to reference other element nodes within the CIM RDF Schema document. The element with `ID="Bay"` can be referenced by other elements using the `#` symbol in front of the attribute's value, as `"#Bay"`.

Note that the XML concept of *attribute* is not the same as the UML definition. XML attributes store information about the element that are not directly or immediately relevant to the reader, such as an ID which is used for linking internal elements. UML attributes are data in this context. They shall hold structure of their own, such as datatype, constraints, and description. Therefore, they are specified as elements in the CIM RDF Schema.

5 Metadata and RDF Schema

5.1 General

RDF Schema allows the definition of application-specific vocabularies. It is a very concise way to represent the CIM classes and their attributes and relationships. It is designed to be extensible, so that local extensions to the CIM can easily be referenced.

5.2 Resource

A resource is anything that can be referenced by a Uniform Resource Identifier (URI). For the purposes of the CIM RDF Schema, a resource corresponds to a class. By convention, resources are named with an initial uppercase letter.

5.3 Property

A property is a specific aspect, characteristic, attribute, or relation used to describe a resource. Each property has a specific meaning, defines its permitted values, the types of resources it can describe, and its relationship with other properties. Within the context of the CIM RDF Schema, a property can be either a class attribute or a rolename for an association of the class. By convention, properties are named with an initial lowercase letter.

5.4 Namespaces

Namespaces are a way to tie a specific use of a word in context to the dictionary (schema) where the intended definition is to be found. RDF requires the XML namespace facility to precisely associate each property with the schema that defines the property.

5.5 CIM RDF Schema extensions

5.5.1 General

The RDF Schema has been extended to support some of the UML concepts that are important or useful in the CIM.

5.5.2 Multiplicity

A constraint property is a special kind of property that can be used to limit the values for the named properties. A multiplicity constraint documents the CIM values for allowed cardinality for a rolename in an association. The multiplicity resource is defined as:

```
<rdfs:ConstraintProperty rdf:ID="multiplicity">
  <rdfs:label xml:lang="en">multiplicity</rdfs:label>
  <rdfs:domain rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-
ns#Property"/>
  <rdfs:range rdf:resource="#Multiplicity"/>
  <rdfs:comment>Indicates how many instances of a given property are
allowed for a given resource. Allowed values are:
M:0..1 (zero-or-one), M:1..1 (exactly-one), M:0..n (zero-or-more),
M:1..n (one-or-more).</rdfs:comment>
</rdfs:ConstraintProperty>

<rdfs:Class rdf:ID="Multiplicity">
  <rdfs:label xml:lang="en">Multiplicity</rdfs:label>
  <rdfs:comment>Definition of the enumerated type which will contain
the list of valid values. </rdfs:comment>
</rdfs:Class>
```

The CIM RDF Schema extensions create resources of this type which are used to express the values for allowed CIM cardinalities. The resources are named M:0..1, M:1..1, M:0..n, and M:1..n to correspond to the UML values in the model.

5.5.3 Inverse Rolename

The inverseRolename property provides the name of the rolename at the opposite class for the association. This property is useful for navigating through the CIM relationships. It is defined as:

```
<rdfs:ConstraintProperty rdf:ID="inverseRoleName">
  <rdfs:label xml:lang="en">inverseRoleName</rdfs:label>
  <rdfs:domain rdf:resource="http://www.w3.org/1999/02/22-rdf-syntax-
ns#Property"/>
  <rdfs:comment>Role name at opposite end of this association.
  </rdfs:comment>
</rdfs:ConstraintProperty>
```