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Software Interface for Maintenance Information Collection and Analysis (SIMICA): Common Information Elements

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National foreword

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1636.99 (2013)	91/1361/FDIS	91/1372/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.

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IEEE Standard for Software Interface for Maintenance Information Collection and Analysis (SIMICA): Common Information Elements

Sponsor

IEEE Standards Coordinating Committees on Test and Diagnosis for Electronic Systems (SCC20)

Approved 23 August 2013

IEEE-SA Standards Board

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Abstract: This standard is intended to promote and facilitate interoperability between components of SIMICA. The standard defines EXPRESS information models and XML schemas that together define the common information elements supporting these interfaces.

Keywords: automated test system (ATS), eXtensible markup language (XML), IEEE 1636.99™, session information, Software Interface for Maintenance Information Collection and Analysis (SIMICA), test results, XML schema

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IEEE Introduction

This introduction is not part of IEEE Std 1636.99™-2013, IEEE Standard for Software Interface for Maintenance Information Collection and Analysis (SIMICA): Common Information Elements.

Maintainers of complex systems require the ability to capture and share historical test and maintenance-related information in a way that supports such activities as performance analysis, post-production product improvement, maintenance process improvement, and diagnostic maturation. Principal stakeholders of this project include but are not limited to maintenance organizations within various Departments/Ministries of Defense, the commercial airlines, the automotive industry, and the telecommunications industry. This standard is being developed as a component of the IEEE 1636™ Software Interface for Maintenance Information Collection and Analysis (SIMICA) project. SIMICA's purpose is to specify a software interface for access, exchange, and analysis of product diagnostic and maintenance information. Maintenance action information provides a subset of the data needed to satisfy SIMICIA requirements.

The use of formal information models will facilitate exchanging historical maintenance information between information systems and analysis tools. The models will facilitate creating open system software architectures for maturing system diagnostics.

The XML schema described in this standard where appropriate utilizes and references components of the IEEE Std 1671™ schema set.

It is anticipated that these schemas will be used throughout industries that utilize diagnostic and maintenance data as an exchange format that can be understood by humans or machines. In order to ensure wide acceptance throughout the user community, the schemas have been designed to encompass a broad range of use cases. To accommodate use cases beyond the released design, the schemas provide means for user extensibility.

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1. Overview

1.1 General

This standard, which is a component of the Software Interface for Maintenance Information Collection and Analysis (SIMICA) standard, was developed by the Diagnostic and Maintenance Control Subcommittee of the IEEE Standards Coordinating Committee 20 (SCC20) on Test and Diagnosis for Electronic Systems to provide standard, unambiguous definitions of common SIMICA element semantics, and interrelationships.

This standard specifically describes a set of formal specifications consisting of the logical representation of the information that is common between IEEE Std 1636.1™ and IEEE Std 1636.2™, which may be used during related diagnostic and maintenance processes. The information model contained in this document provides a normative formal specification of the information concepts and precise semantics that support the unambiguous exchange of information between producers and consumers in a platform-independent manner.

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The schemas described in this document are intended to be shared by all SIMICA "dot" standards. The Express schema in this standard is based on ISO 10303-11:1994 [B9][1]. The XML schema associated with this standard is based on the W3C eXtensible Markup Language (XML) 1.0 Recommendation [B1][2].

1.2 Application of this documents annexes

This document includes three annexes. Of these three, two are normative (Annex A and Annex B).

Annex A contains the description of each of the XML schema elements and types.

Annex B contains the description of the EXPRESS and EXPRESS-G model elements.

Annex C is informative, and thus is provided strictly as information, for both users and maintainers of this document.

1.3 Scope

The SIMICA family of standards provides an implementation-independent software interfaces to information systems containing data pertinent to the diagnosis and maintenance of complex systems consisting of hardware, software, or any combination thereof. This standard defines EXPRESS information models and XML schemas that together define the common information elements supporting these interfaces.

1.4 Referenced IEEE Standards

SIMICA Common makes reference to IEEE Std 1671™-2010 Annex B.1. This normatively referenced IEEE standard, when utilized, is therefore considered part of the SIMICA definition.

1.5 Application

This standard provides a specification for information shared by SIMICA "dot" standards (e.g., IEEE Std 1636.1, IEEE Std 1636.2). Anticipated users of this standard include the following:

a) System developers

b) System maintainers

c) Reliability, maintainability, and diagnostic analytical applications

1.6 Conventions used in this document

1.6.1 General

In accordance with *IEEE Standards Style Manual* [B3], any schema examples will be shown in `Courier` font. In cases where instance document examples are necessary to depict clearly use of a schema type or element, such examples will also be shown in `Courier` font. When the characters "..." appear in an example, it indicates that the example component is incomplete.

[1] The numbers in brackets correspond to those of the bibliography in Annex C.
[2] W3C is a registered trademark of the World Wide Web Consortium.

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All simple types, complex types, attribute groups, and elements will be listed; explanatory information will be provided, along with examples if additional clarification is needed. The explanatory information shall include information on the intended use of the elements and/or attributes where the name of the entity does not clearly indicate its intended use. For elements derived from another source type (e.g., an abstract type), only attributes which extend the source type shall be listed; details regarding the base type shall be listed along with the base type.

When referring to an attribute of an XML element, the convention of *[element]@[attribute]* shall be used. In cases where an attribute name is referred to with no associated element, the attribute name shall be enclosed in single quotes.

In tables that describe XML elements, the column "Use" indicates the occurrence constraints for each element.

a) "Required" indicates that the element shall appear exactly once.

b) "Optional" indicates that the element may appear once or not at all.

c) "1..∞" indicates that the element shall appear at least once and may appear multiple times.

d) "0..∞" indicates that the element may appear multiple times, once, or not at all.

All specifications for the EXPRESS language are given in the `Courier` type font which includes references to entity and attribute names in the supporting text.

This standard uses the vocabulary and definitions of relevant IEEE standards. In case of conflict of definitions, except for those portions quoted from standards, the following precedence shall be observed: 1) Clause 3, and 2) The *IEEE Standards Dictionary Online* [B2][3].

1.6.2 Word usage

In accordance with *the IEEE Standards Style Manual* [B3], the word *shall* is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*). The use of the word *must* is used only to describe unavoidable situations. The use of the word *will* is only used in statements of fact.

The word *should* is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability (*can* equals *is able to*).

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2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE Std 1636™-2009, IEEE Standard for Software Interface for Maintenance Information Collection and Analysis (SIMICA).[4, 5]

IEEE Std 1671™-2010, IEEE Standard for Automatic Test Markup Language (ATML) for Exchanging Automatic Test Equipment and Test Information via XML.

3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* [B2] should be consulted for terms not defined in this clause. In the event a term is explicitly redefined, or defined in more detail, in an SIMICA component standard, the component standards definition shall be normative for that SIMICA component standard.

component (in eXtensible Markup Language (XML) schema): The generic term for the building blocks that compose the abstract data model of the schema.

eXtensible Markup Language (XML) attribute: Name-value pair associated with an XML element.

eXtensible Markup Language (XML) document: A (text) data object that conforms to the XML requirements for being well-formed (as defined by W3C).

eXtensible Markup Language (XML) namespace: A method for distinguishing XML elements and attributes that may have the same name but different meanings. A URL is used as a prefix to a "local name." This combination ensures the uniqueness of the element or attribute name. The URL is used only as a way to create a unique prefix and does not have to resolve to a real page on the Internet.

NOTE—See Namespaces in XML 1.0 [B10] and Schenk and Wilson [B11][6].

eXtensible Markup Language (XML) schema: The structure or framework used to define a data record. This includes each field's name, type, shape, dimension, and mapping.

framework: A framework is a real or conceptual structure expressed as a set of abstract classes. The framework provides a context for the components to be used.

instance document: A textual information set grouped for some purpose that is governed by a single XML schema.

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maintenance: Activity intended to keep equipment (hardware) or programs (software) in satisfactory working condition, including replacements, adjustments, repairs, software/firmware updates, and program improvements. Maintenance can be preventative or corrective (adapted from MIL-STD-1309D [B12]).

particle (in eXtensible Markup Language (XML) schema): A kind of component.

sequence (in XML schema): A compositor for model group schema components which specifies that subordinate elements in an instance document must correspond, in order, to the specified particles.

3.2 Acronyms and abbreviations

AI-ESTATE	Artificial Intelligence Exchange and Service Tie to All Test Environments
ATML	Automatic Test Markup Language
ATS	automatic test system
ISO	International Organization for Standardization
OID	object identifier
SIMICA	Software Interface for Maintenance Information Collection and Analysis
URL	uniform resource locator
URN	uniform resource name
UUT	unit under test
W3C	World Wide Web Consortium
XML	eXtensible Markup Language

4. SIMICA common elements

4.1 SIMICA common element partitioning

Common elements provide for the definition of XML types and attributes that are utilized within more than one SIMICA family XML schema.

Common element XML schemas are reference XML schemas containing only type definitions that may be used in other XML schemas. They have no root element, and there will be no instance documents directly validated against them.

Having each SIMICA family XML schema include the SIMICA common elements allows for a consistent definition of shared XML types and prevents each XML schema from defining XML types used by other SIMICA family XML schemas (which would have had to also define that XML type, possibly differently).

SIMICA Common elements as a result are simply a toolbox for the SIMICA family XML schemas to include.

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SIMICA defines one common element XML schema:

SIMICACommon.xsd: provides SIMICA-unique types and attributes.

This SIMICA common element XML schema is defined in Annex A.

The EXPRESS and EXPRESS-G models of SIMICA Common elements are defined in Annex B.

Every SIMICA family component XML schema shall include the SIMICA common element XML schema.

Every SIMICA family component shall reference the SIMICA common element EXPRESS models.

4.2 Use of the IEEE Std 1671 Common.xsd schema

The SIMICACommon.xsd schema includes the IEEE Std 1671 Common.xsd schema.

Having the SIMICA common elements XML schema include the ATML common elements XML schema allows for a consistent definition of shared XML types and prevents each XML schema from defining XML types used by other SIMICA and ATML family XML schemas.

5. EXPRESS model, EXPRESS-G diagram, and XML schema names and locations

The IEEE provides a download site for material published in association with IEEE Standards, presented in machine friendly format. This material is digital rights management restricted use material. The SIMICA family of standards utilizes this download site to allow easy accessibility to all of the SIMICA family EXPRESS models and XML schemas (and in some cases, example XML instance documents). As depicted by Figure 1, the IEEE download site (http://standards.ieee.org/downloads/) contains several folders, each folder labeled by an associated IEEE standards number (e.g., IEEE 1636 standards are in the 1636 folder). Each folder under the “base” IEEE standards number contains the material (XML schemas, etc) for that family member. Family members are identified by their “dot” standard number (if it is a “dot” standard) and the year in which that standard was published by the IEEE.

NOTE 1—Standards that are revised will contain a folder for the year in which the standard is reissued. Both folders (for each year the standard was published) will be present on the IEEE download Web site.

NOTE 2—Providing a particular standard has associated material that is to be made available via the download Web site, folders for that standard are not available until the standard is published by the IEEE.

Figure 1 depicts a portion of the IEEE download site, as it pertains to the SIMICA family of standards.

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http://standards.ieee.org/downloads

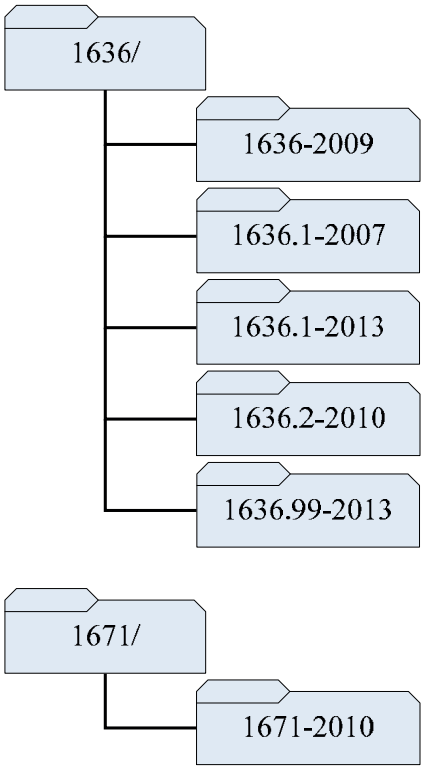

Figure 1—SIMICA-related IEEE download site structure

The IEEE Std 1636.99–associated XML schema's name, and the IEEE download site folder locations; where the XML schema shall be located, is as defined in Table 1. Where the IEEE 1636.99 associated EXPRESS model shall be located, is as defined in Table 2.

Table 1—IEEE Std 1636.99 XML schema names and folder locations

Component	Defined in	XML schema name	IEEE download site folder (see Figure 1)
SIMICA Common	Annex A	SIMICACommon.xsd	1636/1636.99-2013

Table 2—IEEE Std1636.99 EXPRESS model and diagram names and folder locations

Component	Defined in	EXPRESS model name	IEEE download site folder (see Figure 1)
SIMICA Common EXPRESSS Model	Annex B.1	1636.99.exp	1636/1636.99-2013

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The XML schema identified in Table 1 includes the ATML common XML schema. The ATML common element XML schema name and the IEEE download site folder locations and where the XML schema shall be located is as defined in Table 3.

Table 3—ATML common element XML schema names and locations

Component	Defined in	XML schema name	IEEE download site folder
Common	IEEE Std 1671-2010 Annex B.1	Common.xsd	1671/1671-2010

6. Conformance

The minimal expectation for XML instance documents conformant with this document shall be that a populated XML instance is considered valid if it complies with:

a) The SIMICA Common XML schema (defined in Annex A of this document, and available as described in Clause 5).

b) The SIMICA Common EXPRESS model (defined in Annex B of this document, and available as described in Clause 5).

c) The ATML Common XML schema (defined in Annex B.1 of IEEE Std 1671, and available as described in Clause 5).

7. XML schema extensibility

A provision in the XML schema of an extension mechanism is necessary to ensure the viability of the specification and allow producers and consumers of SIMICA XML instance documents to interoperate in those cases where there is a requirement to exchange relevant data that is not included in the SIMICACommon.xsd schema. The use of the extensions shall be done in a way that ensures that a conformant consumer can utilize the extended file without error, discard, or otherwise sidestep the extended data and use the non-extended portions of the data as it is intended—without error or loss of functionality.

Extensions shall be additional information added to the content model of the element being extended.

Extensions shall not repackage existing information entities that are already supported by this standard.

An extended instance document shall be accompanied by the extension XML schema and documentation sufficient to explain the need for the extension as well as the underlying semantics and relationship(s) to the base schema.

SIMICACommon.xsd supports two forms of extension:

a) Wildcard-based extensions allow for the extension of SIMICA schemas with additional elements.

b) Type derivation allows for extending the set of data types by deriving a new type from an existing type.

XML schemas control the location and type of extension allowed.

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An element has an extensible content model if in instance documents that element can contain elements and data beyond that specified by the schema. SIMICA schemas should explicitly identify where they can be extended. Only elements from a namespace different from the document namespace should be allowed in an extension. The schema shall use the SIMICACommon `<Extension>` type to identify where extension is allowed.

Allowing the extension of a schema using type substitution should be avoided. Schemas should mark elements defined via a simple or complex type with the block attribute set to #all if type substitution is to be avoided. Elements which use type substitution as their means of definition should set the abstract attribute to true.

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Annex A

(normative)

SimicaCommon XML schema

Should the reader not have a general understanding of XML schemas, there are several XML schema tutorials available for reference. The *XML Schema Part 0: Primer* [B13], the *XML Schema Tutorial* [B14] and the *XML Schema Tutorial, Part 1* [B15] are three available on the World Wide Web. These tutorials will help with the understanding of the contents of the TestResults.xsd schema that this Annex is defining the elements of.

Prefixes utilized in this Annex are as follows:

a) The namespace prefix "c:" identifies that the type, element, or attribute is contained in the XML schema defined in Annex B.1 of IEEE Std 1671 (Common.xsd).

b) The namespace prefix "sc:" identifies that the type, element, or attribute is contained in the XML schema defined in this Annex (SIMICACommon.xsd).

A.1 SIMICACommon.xsd

A.1.1 Root element

attributeFormDefault	unqualified
elementFormDefault	qualified
targetNamespace	urn:IEEE-P1636.99:2013:SimicaCommon

A.1.2 complexType Extension

properties	**final** #all
annotation	**documentation** The Extension complex type is provided for the convenience of XML schema developers. The Extension type shall be used only as the base type of extension elements in XML schemas. Such elements are provided to permit implementers to extend a XML schema as required to meet the unique needs of their use case. Use follows the W3C standard XML extension mechanism.

A.1.3 complexType HardwareInstance

type	extension of c:HardwareInstance
properties	**base** c:HardwareInstance
children	c:DescriptionDocumentReference c:Definition c:SerialNumber c:ManufactureDate c:Calibration c:Components c:ParentComponent c:PowerOn IssueDate Warranty
annotation	**documentation** Base type for any element containing information characterizing a hardware item.

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A.1.4 complexType IdentificationNumber

type	extension of c:IdentificationNumber					
properties	**base** c:IdentificationNumber					
attributes	**Name**	**Type**	**Use**	**Default**	**Fixed**	**Annotation**
	number	c:NonBlankString	required			**documentation** The part number of the entity.
	type	derived by: xs:string	required			**documentation** An indication of whether this is a part number, model number, or other.
	manufacturerName	c:NonBlankString	optional			**documentation** Identifies the name of the manufacturer.
	qualifier	c:NonBlankString	optional			**documentation** Provides additional descriptive data that further specifies or identifies the Identification Number.
annotation	**documentation** Base type for any element that needs to be identified.					

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A.1.5 complexType MaintenanceAction

children	InstallAction RepairAction RemoveAction NoAction Description					
attributes	**Name**	**Type**	**Use**	**Default**	**Fixed**	**Annotation**
	actionID	xs:ID	required			**documentation** A unique identifier for the maintenance action.
	name	c:NonBlankString	required			**documentation** A user-friendly textual name for the maintenance action.
	startTime	xs:dateTime	required			**documentation** The date and time for the initiation of a maintenance event.
	endTime	xs:dateTime	optional			**documentation** The date and time for the termination of a maintenance event.
	totalTime	xs:duration	required			**documentation** The aggregate personnel time for the actual work duration of a maintenance event.
	preventative	xs:boolean	required			**documentation** Identifies whether or not the MaintenanceAction was performed as part of preventative maintenance (true) or not (false).
	actionCode	c:NonBlankString	optional			**documentation** The code that best describes the maintenance action performed. Maintenance organizations typically have a list of organization-unique codes that best describe the reasons for maintenance action performed. This attribute provides a place to record that code. The meaning and interpretation of the code is implementation-specific.
annotation	**documentation** Base type for any element defining a specific action taken in the maintenance of some item or entity.					

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A.1.6 element MaintenanceAction/Description

type	c:NonBlankString
properties	**content** simple
Facets	**Kind** **Value** **Annotation** minLength 1 whiteSpace replace
annotation	**documentation** A detailed textual description of the maintenance action performed.

A.1.7 element MaintenanceAction/InstallAction

type	SystemInstance
properties	**content** complex
children	c:DescriptionDocumentReference c:Definition c:SerialNumber IssueDate Warranty
annotation	**documentation** Installation of either a repaired or new component into a unit to complete the repair.

A.1.8 element MaintenanceAction/NoAction

type	c:ItemDescription
properties	**content** complex
children	c:Description c:Identification c:Extension
attributes	**Name** **Type** **Use** **Default** **Fixed** **Annotation** version c:NonBlankString optional **documentation** A string designating the version of the described item. name c:NonBlankString optional **documentation** A descriptive or common name for the described item.
annotation	**documentation** The reason for not being able to perform maintenance on the unit.

A.1.9 element MaintenanceAction/RemoveAction

type	SystemInstance
properties	**content** complex
children	c:DescriptionDocumentReference c:Definition c:SerialNumber IssueDate Warranty
annotation	**documentation** The removal of a component to affect a maintenance action.

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