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Standard for automatic test markup language (ATML) instrument description

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Contents

1. Overview 1
1.1 General 1
1.2 Application of this document's annexes 2
1.3 Scope 2
1.4 Application 2
1.5 Conventions used within this document 3

2. Normative references 4

3. Definitions, abbreviations, and acronyms 4
3.1 Definitions 4
3.2 Abbreviations and acronyms 5

4. InstrumentDescription schema 7
4.1 General 7
4.2 Elements 7
4.3 Child elements 10
4.4 Complex types 13
4.5 Simple types 28

5. InstrumentDescription instance schema 28
5.1 Elements 28
5.2 Complex types 29
5.3 Simple types 31

6. ATML InstrumentDescription XML schema names and locations 31

7. ATML XML schema extensibility 33

8. Conformance 33

Annex A (informative) IEEE download Web site material associated with this document 34

Annex B (informative) Users information and examples 35

Annex C (informative) Glossary 38

Annex D (informative) Bibliography 39

Annex E (informative) IEEE List of Participants 41

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STANDARD FOR AUTOMATIC TEST MARKUP LANGUAGE (ATML) INSTRUMENT DESCRIPTION

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IEEE Std 1671.2™-2012
(Revision of
IEEE Std 1671.2-2008)

IEEE Standard for Automatic Test Markup Language (ATML) Instrument Description

Sponsor

IEEE Standards Coordinating Committee 20 on Test and Diagnosis for Electronic Systems

Approved 5 December 2012

IEEE-SA Standards Board

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Abstract: An exchange format is specified in this standard, using extensible markup language (XML), for identifying instrumentation that may be integrated in an automatic test system (ATS) that is to be used to test and diagnose a unit under test (UUT).

Keywords: ATML instance document, ATS, automatic test equipment (ATE), Automatic Test Markup Language (ATML), automatic test system, IEEE 1671.2, instrument, instrumentation, synthetic instrument, XML schema

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IEEE Introduction

This introduction is not part of IEEE Std 1671.2-2012, IEEE Standard for Automatic Test Markup Language (ATML) Instrument Description.

This child, or "dot," standard, also known as an ATML component standard, provides for the definition of the *InstrumentDescription* and *InstrumentInstance* XML schemas, and contains references to examples. These XML schemas and examples accompany this standard and provide for the identification and definition of an instrument.

XML schemas define the basic information required within any test application and provide a vehicle for formally defining the test environment by defining a class hierarchy corresponding to these basic information entities and providing several methods within each to enable basic operations to be performed on these entities. ATML component standards within the ATML framework define the particular requirements within the test environment.

The Synthetic Instrument Working Group (SIWG) was formed, at Department of Defense request, to define synthetic instrumentation and its attributes and develop a framework that balances user and supplier objectives, facilitates rapid technology advancements and adaptation throughout the test life cycle, and complements/supports other relevant test and measurement industry activities.

The goals or desired effects of the SIWG activities were to:

a) Reduce the total cost of ownership of the automatic test system (ATS).

b) Reduce time to develop and field new or upgraded ATSs.

c) Provide greater flexibility to the war fighter through U.S. and coalition partner's interoperable ATSs.

d) Reduce the ATS's logistics footprint.

e) Reduce the ATS's physical footprint.

f) Improve the quality of test.

The SIWG addressed the reductions from the test and measurement perspective. The SIWG efforts resulted in both the definition of synthetic instruments and the specifications of their respective attributes.

Synthetic instruments were originally part of the IEEE Std 1671.2™-2008[1] standard, as both an example of *InstrumentDescription* instances as well as to provide a definition of the necessary parameters/attributes to document a synthetic instrument as defined by the SIWG. These synthetic instrument definitions have now been incorporated into their own IEEE project (P1871.2), and therefore their associated Annexes have been removed from later revisions of IEEE Std 1671.2. The *InstrumentDescription* template instance example for synthetic instruments are still provided as downloads of this standard to ensure continuity and support for existing users.

Template instance documents are used by vendors developing/providing synthetic instruments as the basis for documenting the synthetic instrument. The template instance document provides examples for each instrument vendor to follow. These templates will not validate against the schemas documented within this standard until actual values for the specifications are incorporated into the SI-based *InstrumentDescription* instance document.

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Standard for Automatic Test Markup Language (ATML) Instrument Description

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1. Overview

1.1 General

Automatic test markup language (ATML) is a collection of IEEE standards and associated extensible markup language (XML) schemas that allows automatic test system (ATS) and test information to be exchanged in a common format adhering to the XML standard.[1]

The ATML framework and the ATML family of standards have been developed and are maintained under the guidance of the Test Information Integration (TII) Subcommittee of IEEE Standards Coordinating Committee 20 (SCC20) to serve as a comprehensive environment for integrating design data, test strategies, test requirements, test procedures, test results management, and test system implementations, while allowing test program (TP), test asset interoperability, and unit under test (UUT) data to be interchanged between heterogeneous systems.

This standard (as well as the XML schemas and XML instance document examples[2] that accompany this standard) is intended to be used in identifying and documenting instrumentation which may be utilized

[1]This information is given for the convenience of users of this standard and does not constitute an endorsement by the IEEE of this consortium standard. Equivalent standards or products may be used if they can be shown to lead to the same results.
[2]The schemas and examples that accompany this standard are available at http://standards.ieee.org/downloads/1671/1671.2-2012/.

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during the testing of a particular unit under test. This information includes the mechanical, electrical, and software interfaces of the instrument.

1.2 Application of this document's annexes

This document includes four annexes.

Annex A, Annex B, Annex C, and Annex D are informative, and thus are provided strictly as information, for users, implementers, and maintainers of this document.

1.3 Scope

This standard defines an exchange format, utilizing extensible markup language (XML), for both the static description of instrument models, and the specific description of instrument instance information.

1.4 Application

This standard provides for the specification and identification of instrumentation that will be used for the purposes of testing a UUT. The specification and identification consist of, but are not limited to: physical characteristics, power requirements, operational requirements, calibration requirements, factory defaults, configuration options, capabilities, and interfaces (both hardware [HW] and software [SW]). This collection of information represents an entire "data package" for either a class or type of instrument (as represented by the InstrumentDescription.xsd schema defined in Clause 4 or a specific instrument (as represented by the InstrumentInstance.xsd schema defined in Clause 5).

Identifying an instrument provides for the unambiguous specification of a particular instrument, which may be utilized in a bench-test scenario, a piece of manual test equipment, or within automatic test equipment (ATE). This unambiguous specification shall be readable by both humans and machines. Humans may use the specification to identify and assemble the instrument into their test application. Machines may use the specification to verify that the testing need can be accomplished by the instrument in place.

Synthetic instruments link a series of HW and SW components with standardized interfaces to generate signals or make measurements using algorithmic numeric processing techniques. The goal is to decrease the total cost of ownership of ATS, to lessen the time to develop and field new or upgraded ATS, to reduce the test system logistics footprint, and finally, to improve the quality of test.

The information contained in XML documents conforming to this standard will be useful to the following:

a) Test program set (TPS) developers

b) TPS maintainers

c) ATE system developers

d) ATE system maintainers

e) Developers of ATML-based tools and systems

f) Instrument manufactures

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1.5 Conventions used within this document

1.5.1 General

In accordance with the *IEEE Standards Style Manual* [B6][3], any schema examples will be shown in `Courier` font. In cases where instance document examples are necessary to depict the 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.

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 will 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 that extend the source type will be listed; details regarding the base type will be listed along with the base type.

When referring to an attribute of an XML element, the convention of *[element]@[attribute]* will be used. In cases where an attribute name is referred to with no associated element, the attribute name will be enclosed in single quotes. Element and type names will always be set in italics when appearing in 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, 2) The *IEEE Standards Dictionary Online*.[B5]

1.5.2 Precedence

The *InstrumentDescription* schema (InstrumentDescription.xsd) element, child element, and annotation information shall take precedence over the descriptive information contained in Clause 4.

The *InstrumentDescription* schema and the material contained in Clause 4 shall take precedence over the *InstrumentDescription* instance document information represented in Clause 5 as well as the examples in Annex B.

The *InstrumentInstance* schema (InstrumentInstance.xsd) element, child element, and annotation information shall take precedence over the descriptive information contained in Clause 5.

The *InstrumentInstance* schema and the material contained in Clause 5 shall take precedence over the *InstrumentDescription* instance document information represented in Clause 5 as well as the examples in Annex B.

1.5.3 Word usage

In accordance with the *IEEE Standards Style Manual* [B6], 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*).

[3] The numbers in brackets correspond to those of the bibliography in Annex D.

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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*).

2. Normative references

The following referenced document is 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 1671™, IEEE Standard for Automatic Test Markup Language (ATML) for Exchanging Automatic Test Equipment and Test Information via XML.[4,5]

3. Definitions, abbreviations, and acronyms

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* [B5][6] 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 ATML component standard, the component standards definition shall be normative for that ATML component standard.

abstract type: A declared type that can be used to define other types through derivation. Only non-abstract types derived from the declared type can be used in instance documents. When such a type is used, it must be identified by the xsi:type attribute.

automatic test markup language (ATML) instance document: See: instance document.

dynamic current: The rated current capacity of a particular VersaModule Eurocard (VME) extensions for instrumentation (VXI) or Peripheral Component Interconnect (PCI®) extensions for instrumentation (PXI®) backplane voltage for the frequencies from 20 Hz to 1 GHz.[7]

element: A bounded component of the logical structure of an extensible markup language (XML) document that has a type and that may have XML attributes and content.[8]

entity: Something that has a distinct separate existence.

extensible markup language (XML) attribute: Name-value pair associated with an XML element.

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http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html
[7] Adapted from VXI-1, VXIbus System Specification, Revision 3, 24 Nov. 2003.
[8] Adapted from Extensible Markup Language (XML) 1.0 (Fifth Edition). This document is available from the World Wide Web Consortium (W3C®) (http://www.w3.org/xml).

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extensible markup language (XML) document: A data object that conforms to the XML requirements for being well formed. In addition, the data object is valid if it additionally conforms to semantic rules of the XML schema.

extensible markup language (XML) schema: The definition of a class of XML document, typically expressed in terms of constraints on the structure and the content of documents of that class, above and beyond the basic syntax constraints imposed by XML itself.

instance document: An extensible markup language (XML) document which conforms to a particular XML schema.

instrument: Devices (chemical, electrical, hydraulic, magnetic, mechanical, optical, pneumatic) that may be utilized to test, observe, measure, monitor, alter, generate, record, calibrate, manage, or control physical properties, movements, or other characteristics.[9]

object: An object consists of state and behavior. An object stores its states in fields (variables in some programming languages) and exposes it behavior through methods (functions in some programming languages).

peak current: The rated dc current of a particular VersaModule Eurocard extensions for instrumentation (VXI) or peripheral component interconnect extensions for instrumentation (PXI) backplane voltage.[10]

synthetic instrument: A series of hardware and software components, with standardized interfaces, to generate signals or make measurements using algorithmic/numeric processing techniques.

well formed: Conforming to all extensible markup language (XML) syntax rules.

3.2 Abbreviations and acronyms

ANSI	American National Standards Institute
ATE	automatic test equipment
ATML	automatic test markup language
ATS	automatic test system
dc	direct current
DHCP	dynamic host configuration protocol
ECL	emitter coupled logic
ECLTRIG0-1	ECL triggers 0 and 1
EIA	Electronics Industry Association
GHz	gigahertz
HW	hardware
Hz	hertz
I/O	input/output
ID	identifier

[9] Adapted from MIL-STD-1309D, Definitions of Terms for Test, Measurement and Diagnostic Equipment, Naval Electronics Systems Command (ELEX-8111), Washington, DC, 12 Feb. 1992.
[10] Adapted from VXI-1, VXIbus System Specification, Revision 3, 24 Nov. 2003.

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