



IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying System Behavior

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Software and Systems Engineering Standards Committee

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IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying System Behavior

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Software and Systems Engineering Standards Committee
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IEEE Computer Society

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Abstract: A reference model that provides a common interpretation basis by which tools can express and communicate the observable features of system/software behavior to users and to other tools is presented. This standard specifies a Conceptual Metamodel for understanding and describing the causal behavior for a system. The purpose of this Conceptual Metamodel is to express causal behavior and compositions of causal behavior in a model that integrates all observable operational features of a system into one behavior specification. This Conceptual Metamodel is useful for analyzing systems, for constructing particular system behavior models, and for using those models in the specification, design, and evaluation of engineered systems. It provides the necessary semantic elements for describing general hardware/software systems, including hardware-only, software-only, or mixed system components, and it allows these different types of components to be treated in a consistent manner, providing a basis for representing a wide variety of systems.

Keywords: behavior model, behavior specification, Computer-Aided Software Engineering (CASE) tools, engineering model, model-based testing, modeling principles, requirements, software specification, specification-based testing, system, system testing

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Introduction

This introduction is not part of IEEE Std 1175.4-2008, IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying System Behavior.

The 1175™ family of standards

NOTE—References to “P1175.X” in this standard refer to members of the 1175 family of standards that were not yet approved at the time that this standard was published.^a

This standard is a member of the 1175 family of IEEE standards. The members of this family include the following:

Standard number	Title
IEEE Std 1175.1™-2002 [B4] * †	IEEE Guide for CASE Tool Interconnections—Classification and Description
IEEE Std 1175.2™-2006 [B5]	IEEE Recommended Practice for CASE Tool Interconnection—Characterization of Interconnections
IEEE Std 1175.3™-2004 [B6]	IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying Software Behavior
IEEE Std 1175.4™-2008	IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying System Behavior
IEEE P1175.5™ ‡ **	Draft Standard for Computer-Aided Software Engineering (CASE) Tool Interconnections—Reference Data Model for System Behavior Specifications

* The numbers in brackets correspond to those of the bibliography in Appendix A.

† IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854-1331, USA (<http://standards.ieee.org/>).

‡ This IEEE standards project was not approved by the IEEE-SA Standards Board at the time this publication went to press. For information about obtaining a draft, contact the IEEE.

** The title and description of IEEE P1175.5 are current as of the IEEE Std 1175.4-2008 publication date. Because the P1175.5 draft was not yet approved as of March 2009, this information is subject to change. For the most current P1175.5 information, please consult IEEE Xplore at <http://ieeexplore.ieee.org/xpl/standards.jsp>.

This family of standards replaces IEEE Std 1175-1991 [B3].^b IEEE Std 1175-1991 was advanced to a full-use standard in 1994. It covered a number of closely related subjects, and the scope of material contained was able to serve a number of divergent interests.

This family of standards preserves and substantially augments the material in IEEE Std 1175-1991. It has been divided into several individually useful documents in order to facilitate its use by different communities of interest. These guides, recommended practices, and standards generally address issues involved in characterizing the kinds of interconnections that exist between a computing system tool and its environment. Although particularly intended to address the implementation and use of Computer-Aided Software Engineering (CASE) tools, the discussion of interconnections in this family actually has wider applicability to computing system tools in general, beyond only CASE tools.

Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

^b Although approved in 1991, IEEE Std 1175-1991 was actually published in 1992 and is sometimes found referenced as IEEE Std 1175-1992. It appears in the standards numerical listing on the IEEE Xplore Web site (<http://ieeexplore.ieee.org/>) as IEEE Std 1175-1992, with the title IEEE Trial-Use Standard Reference Model for Computing System Tool Interconnections. In 1994, the term trial-use was removed from the title when the standard was approved for full-use status. The 1994 version, which was identical to the 1992 publication except for the title and minor editorial corrections, is not available on the IEEE Web site.

Four kinds of interconnections with a computing system tool are addressed: interconnections with organizations, users, platforms, and other computing system tools. Consideration of interconnections is important to understanding, selecting, implementing, and using computing system tools. Also, although many computing system tools do not need to communicate behavior descriptions of subject systems, their creators need to develop such behavior descriptions for the tools themselves.

A brief summary overview of each of the members of this family of standards is given in the following paragraphs. A more complete overview is available in IEEE Std 1175.1-2002 [B4], which provides an integrated overview of the members of the 1175 family of standards, and it describes the fundamental concepts that provide a basis for organizing the material.

IEEE Std 1175.1-2002, IEEE Guide for CASE Tool Interconnections— Classification and Description

IEEE Std 1175.1-2002 [B4] is a guide to the IEEE 1175 family of standards. It describes how these standards are intended to be used to accomplish the effective integration of computing system tools into a productive engineering environment and sets forth the fundamental concepts on which these standards are based. These concepts establish the integrating framework for the other members of this family of standards. IEEE Std 1175.1-2002 describes the scope of application of each member standard, the various issues addressed in each standard, and the interrelationships among the members of the 1175 family of standards.

IEEE Std 1175.2-2006, IEEE Recommended Practice for CASE Tool Interconnection—Characterization of Interconnections

The IEEE Std 1175.2-2006 [B5] recommended practice presents four contexts for a computing system tool's interconnections that offer insight into the operational problems of interconnecting computing system tools with their environment. This recommended practice establishes recommended collections of standard contextual attributes describing relationships between a computing system tool and its organizational deployment, its human user, its executable platform, and its peer tools, as illustrated in Figure a. These contextual attributes are of the “news story” form that includes: who, what, when, where, and why. The values of these contextual attributes are references to organizational, industrial, and professional standards. By assisting users to reach a clear understanding of the context of operation for a computing system tool, this recommended practice contributes to the effective implementation and application of computing system tools.

IEEE Std 1175.3-2004, IEEE Standard for CASE Tool Interconnections— Reference Model for Specifying Software Behavior

IEEE Std 1175.3-2004 [B6] is an expansion of Part 3 of IEEE Std 1175-1991. It focuses specifically on a common set of modeling concepts found in commercial CASE tools for describing the operational behavior of a software product, and it provides a formal, logical model for describing this behavior. IEEE Std 1175.3-2004 also defines a Semantic Transfer Language (STL) for communicating software behavior descriptions from one tool to another. A notable feature of the STL is its design for human readability, which makes STL text files suitable for use in software design reviews by users unfamiliar with computing system tool diagramming notations. In addition, the design of the STL syntax readily permits analysts to prepare and edit STL descriptions using a text editor or word processor.

To permit backward compatibility with Part 3 of IEEE Std 1175-1991, IEEE Std 1175.3-2004 makes no changes to the STL syntax or to the rules for conformance to this syntax as originally defined in that

standard. However, some aspects of the 1991 syntax that were previously left as user-defined have now been specified in order to increase the consistency and reliability with which the STL may be used for exchanging software specification information. In addition, improvements have been made in how the STL syntax is defined and explained. Finally, the STL Interconnection Profile has been replaced with more straightforward, “user-friendly” tabular and comma-separated-value formats to define a Tool Interconnection Profile that can serve the same purpose as the original form of the profile.

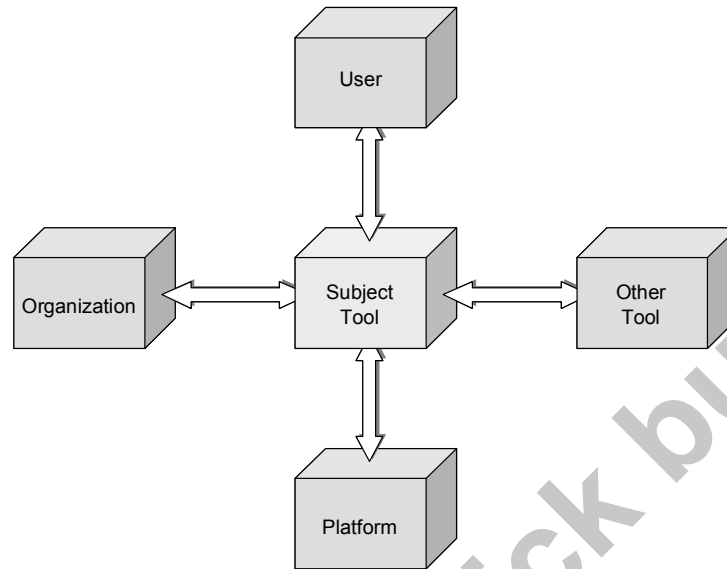


Figure a

IEEE Std 1175.4-2008, IEEE Standard for CASE Tool Interconnections—Reference Model for Specifying System Behavior

IEEE Std 1175.4-2008 encompasses the description of the types of the computing systems supported by IEEE Std 1175.3-2004 [B6], but it goes further, providing a basis for representing a wider variety of systems. Specifically, IEEE Std 1175.4-2008 provides the necessary semantic elements for describing general hardware/software systems including hardware-only, software-only, or mixed system components, and it allows these different types of components to be treated in a consistent manner.

IEEE P1175.5, Draft Standard for Computer-Aided Software Engineering (CASE) Tool Interconnections—Reference Data Metamodel for System Behavior Specifications

This standard defines a Data Metamodel for system behavior specifications. Figure b illustrates one use for such a behavior specification metamodel in the context of supporting information transfer from one user’s tool to another user’s tool. The Data Metamodel provides explicit definitions of typed data elements, information representations, and relationships with which behavior models for subject systems can be instantiated. These elements, representations, and relations serve to reify the Conceptual Metamodel for system behavior specification described in IEEE Std 1175.4-2008.

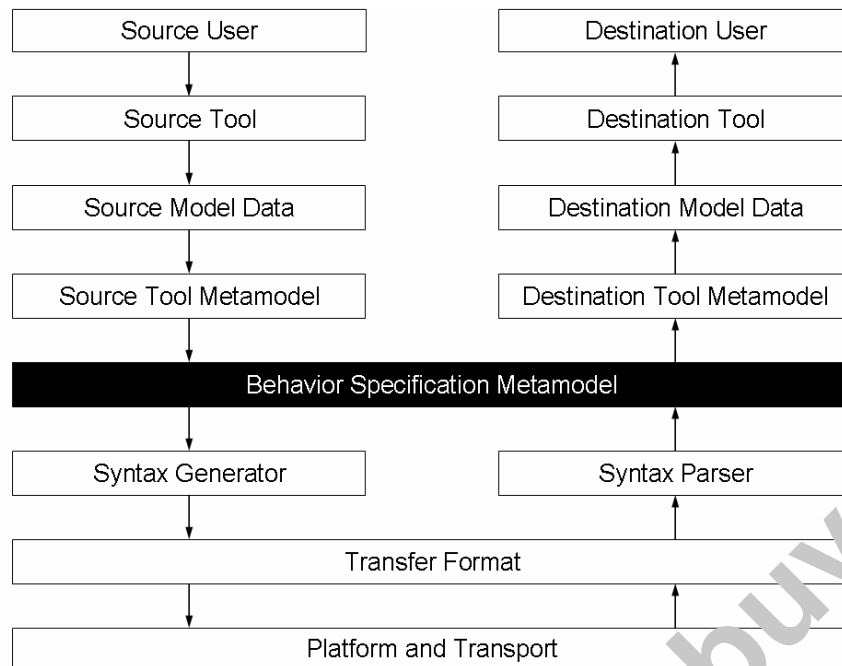


Figure b

When multiple tools are being used to describe a system, each may maintain its own information metamodel. However, as depicted in Figure b, to share information about a subject system, each tool must map its own individual metamodel into a common Behavior Specification Metamodel.

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1. Overview

1.1 Scope

Most inter-tool data transfer standards deal with protocol and syntax of the transfer, with a shared semantic basis assumed. This standard provides an explicitly defined metamodel (and meta-metamodel) for specifying system and software behavior. It defines a semantic basis of observables that allows each tool, whatever its own internal ontology, to communicate facts about the behavior of a subject system as precisely as the tool’s metamodel allows. Conventional tool model elements are reduced into simpler, directly observable fact statements about system behavior. This metamodel is much expanded over the original metamodel for software behavior in Part 3 of IEEE Std 1175TM-1991 [B3].¹

1.2 Purpose

This reference model provides a common interpretation basis by which tools may express and communicate the observable features of system/software behavior to users and to other tools. Tools incorporating this metamodel in their import/export facilities enable engineers to interconnect best-in-class analysis and specification tools for integrated problem solving. Another feature of this metamodel is that it

¹ The numbers in brackets correspond to those of the bibliography in Annex A.