IEEE Standard for Information Technology—System and Software Life Cycle Processes—Reuse Processes

IEEE Computer Society

Sponsored by the
Software & Systems Engineering Standards Committee

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Abstract: A common framework for extending the system and software life cycle processes of IEEE Std 12207™-2008 to include the systematic practice of reuse is provided. The processes, activities, and tasks to be applied during each life cycle process to enable a system and/or product to be constructed from reusable assets are specified. The processes, activities, and tasks to enable the identification, construction, maintenance, and management of assets supplied are also specified.
Keywords: asset, domain engineering, process, reuse, software life cycle, system life cycle

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Introduction

This introduction is not part of IEEE Std 1517-2010, IEEE Standard for Information Technology—System and Software Life Cycle Processes—Reuse Processes.

This standard replaces IEEE Std 1517-1999 [B3].[a] The revision of this standard is a step in the strategy of harmonizing IEEE software and systems engineering standards with those of ISO/IEC JTC 1/SC 7 in order to achieve a fully integrated suite of system and software life cycle processes and guidance for their application.

This revision is closely integrated with IEEE Std 12207-2008.[b] To that end, this revision does not define processes but instead adds tasks and outcomes to processes and activities defined in IEEE Std 12207-2008.

Clause 3 has been modified in this revision to more closely hew to the definitions in Clause 4 of IEEE Std 12207-2008.

Subclause 7.3 of IEEE Std 12207-2008 encompasses many processes specified in IEEE Std 1517-1999, and so those processes have been removed from this revision.

In order to couple more tightly with IEEE Std 122207-2008, the structure of this revision differs from that of IEEE Std 1517-1999. The clauses correspond with clauses of IEEE Std 12207-2008. Clause 5 corresponds to Clause 6 of IEEE Std 12207-2008. Clause 6 corresponds to Clause 7 of IEEE Std 12207-2008.

The objectives defined in Annex C of IEEE Std 1517-1999 have been integrated into the processes of Clause 5 and Clause 6 of this revision. They comprise the reuse-related outcomes specified for the processes.

Software reuse entails capitalizing on existing software and systems to create new products. An organization cannot benefit from reuse by simply creating and employing libraries of assets. Rather, successful reuse requires the integration of reuse-related activities into the life cycle processes used to create the reuse assets associated with software and system development. Unless reuse is explicitly defined in software and system life cycle processes, an organization will not be able to repeatedly exploit reuse opportunities in multiple software projects or products.

Systematic reuse is the practice of reuse according to a consistent, repeatable process. Practicing systematic reuse requires a focus on the use of engineering principles for all reuse assets involved in development. The major benefits that systematic reuse can deliver are as follows:

- Increase software productivity
- Shorten software development and maintenance time
- Reduce duplication of effort
- Move personnel, tools, and methods more easily among projects
- Reduce software development and maintenance costs
- Produce higher quality software products
- Increase software and system dependability

[a] The numbers in brackets correspond to those of the bibliography in Annex A.
[b] Information on references can be found in Clause 2.

— Improve software interoperability and reliability

— Provide a competitive advantage to an organization that practices reuse

There are a variety of approaches to implement the concept of reuse, including systematic and ad hoc reuse. What distinguishes systematic reuse from other methods is the avoidance of multiple versions of otherwise common elements. For example, suppose a reuse approach results in multiple instantiations of a common element. If the instantiations are modified by software developers, then the element is no longer common and can no longer be maintained as a single element. In the context of this standard, systematic reuse excludes such approaches.

The majority of software products can be built with reuse assets—items, such as designs or test plans, that have been designed to be used in multiple contexts. Because reuse assets can apply to software products, implementations of software products, or systems, reuse assets present tremendous opportunity for software reuse.

One major problem encountered by organizations attempting to practice reuse is that reuse is simply missing from their life cycle processes. To harness the benefits of reuse, an organization must incorporate reuse throughout its system and software processes. An organization that creates systems and software first and considers reuse second may not fully benefit from reuse practices. This standard endeavors to address this problem by defining a common framework for reuse activities and by defining how to integrate the practice of reuse into traditional system and software life cycle processes.

Reuse activities describe how software products are built with assets and how to build and manage these assets. The reuse framework presented in this standard covers both the life cycle of a system and the life cycle of a software product.

IEEE Std 12207-2008 establishes a common framework for software and system life cycle processes. This standard provides additional life cycle activities and tasks that augment the practice of systematic reuse. In addition to supplementing the activities defined in IEEE Std 12207-2008, this standard defines outcomes and tasks applicable throughout the life cycle process. Thus, the use of this standard requires access to and understanding of IEEE Std 12207-2008.

For organizations that already employ systematic reuse activities, this standard may be used to determine the conformity of those activities to this standard and as a basis for improvement of those activities where warranted. When establishing or improving systematic reuse activities, organizations are encouraged to assess the business case. Although systematic reuse fosters significant benefits such as those already described, certain costs and risks may prevent benefits of reuse from being fully realized. These factors include the following:

— *The degree to which reuse benefits are relevant to the organization.* For example, a small organization, or an organization that has few resources allocated to developing and maintain software products, may not be in a position to benefit sufficiently from systematic reuse to justify the required commitments and investments.

— *The availability of suitable tools and assets that are designed for reuse.* The capital costs entailed by new software tools can be significant. The costs of acquiring and/or developing assets may not be justified in relation to the expected benefits.

— *The software maturity of the organization.* Although the organization may wish to undertake systematic reuse, its capability maturity may be insufficient to implement the processes in this standard. Moreover, the organization may lack the means to change its infrastructure to support the processes of systematic reuse while continuing to operate its business as usual. Capability maturity should be objectively assessed in relation to this standard, and missing prerequisites, both as to capability maturity and as to infrastructure, need to be put in place before attempting to undertake systematic reuse.

— *The willingness of the people within the organization to make the necessary changes to the way in which they work.* Many software organizations have cultures that are not conducive to systematic reuse. Producing original software is sometimes more well-regarded than reusing existing software. Changing attitudes and associated non-reuse behaviors can be difficult. Policy changes and capital in vestments, which require senior management to be firmly committed to the achievement of systematic reuse, may be necessary.

Organizations interested in undertaking systemic reuse are advised to analyze their abilities to adopt this standard. A business case that clearly describes the goals, investments, costs, risks, and benefits, along with a time line for achieving the transition to systematic reuse, is an excellent way to ensure success.

This standard provides the basis for practices that enable the incorporation of reuse into the system and software life cycle processes.

IEEE Std 1517-2009 may be used to

— Acquire, supply, develop, manage, and maintain reuse assets;

— Acquire, supply, develop, operate, and maintain software products that are built in whole or in part with reuse assets;

— Manage and improve the organization's life cycle processes with respect to the practice of reuse; Establish software management and engineering environments based on reuse activities;

— Foster improved understanding among customers and vendors and parties involved in the reuse-based life cycle of a software product or system and assets;

— Facilitate the use of reuse assets to develop software products and systems;

— Facilitate the development of reuse assets.

IEEE Std 1517-2009 has been written to work with and integrate into IEEE Std 12207-2008.

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Participants

At the time this standard was submitted to the IEEE-SA Standards Board for approval, the Reuse Processes Working Group had the following membership:

Elena Strange, *Chair*

Joshua Brody
Teresa Doran
Lisa Lippincott
James Moore

The following members of the individual balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Johann Amsenga
Bakul Banerjee
Juris Borzovs
Pieter Botman
Lyle Bullock
Juan Carreon
Lawrence Catchpole
Michael Chonoles
Keith Chow
Paul Croll
Geoffrey Darnton
David Deighton
Thomas Dineen
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Mark Jaeger
Piotr Karocki
Rameshchandra Ketharaju
Dwayne Knirk
Ronald Kohl
Thomas Kurihara
George Kyle
Marc Lacroix
Susan Land
David J. [illegible]n
Daniel [illegible]berg
W[illegible] Lumpkins
G. [illegible]ri
F[illegible]marz Maghsoodlou
Edward McCall
James Moore
Finnbarr Murp[illegible]y
Michael S[illegible]wman
William [illegible]tit
Ulrich [illegible]ohl
G[illegible] K[illegible]ack
[illegible]neta Reilly
Ro[illegible]rt Robinson
Terence Rout
Randall Safier
Bartien Sayogo
Robert Schaaf
David J. Schultz
Stephen Schwarm
Gil Shultz
Carl Singer
Luca Spotorno
Friedrich Stallinger
Thomas Starai
Walter Struppler
Marcy Stutzman
Thomas Tullia
David Walden
Paul Work
Oren Yuen
Janusz Zalewski

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Jim Hughes	Ted Olsen	Don Wright

*Member Emeritus

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Richard DeBlasio, *DOE Representative*
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Malia Zaman
IEEE Standards Program Manager, Technical Program Development

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