TECHNICAL REPORT

IEEE-EIA-12207.2™

Issued 1998-04
Stabilized 2015-07

Software Life Cycle Processes – Implementation Considerations

NOTICE

This document has been taken directly from the original TechAmerica document and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE Technical Standards. The release of this document is intended to replace the original with the SAE International document. Any numbers established by the original document remain unchanged.

The original document was adopted as an SAE publication under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of specifications and standards. TSB rules provide for (a) the publication of portions of unrevised specifications and standards without consensus voting at the SAE committee level, and (b) the use of the existing specification or standard format.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2016 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit http://www.sae.org/technical/standards/IEEEEIA12207_2

Documents Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

IEEE/EIA 12207.2-1997

(A Joint Guide Developed by IEEE and EIA)

IEEE/EIA Guide for Information technology

Software life cycle processes—Implementation considerations

April 1998

IEEE
Networking the World™

Electronic Industries Alliance

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

IEEE/EIA 12207.2-1997

(A Joint Guide Developed by IEEE and EIA)

IEEE/EIA Guide

Software life cycle processes—Implementation considerations

April 1998

Abstract: ISO/IEC 12207 provides a common framework for developing and managing software. IEEE/EIA 12207.0 consists of the clarifications, additions, and changes accepted by the Institute of Electrical and Electronics Engineers (IEEE) and the Electronic Industries Alliance (EIA) as formulated by a joint project of the two organizations. IEEE/EIA 12207.2 provides implementation consideration guidance for the normative clauses of IEEE/EIA 12207.0. The guidance is based on software industry experience with the life cycle processes presented in IEEE/EIA 12207.0.
Keywords: acquisition process, audit, configuration management, development process, maintenance process, operation process, quality assurance, supply process, tailoring process, validation, verification

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, USA

Print: ISBN 1-55937-991-X, SH94597
PDF: ISBN 0-7381-0430-2, SS94597

Copyright © 1998 by the Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 1998. Printed in the United States of America.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

April 1998

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

NOTICE

IEEE and EIA Standards and Publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Use of such Standards and Publications is wholly voluntary. Existence of such standards and Publications shall not in any respect preclude any member or nonmember of IEEE and EIA from manufacturing or selling products not conforming to such Standards and Publications, nor shall the existence of such Standards and Publications preclude their voluntary use by those other than IEEE and EIA members, whether the standard is to be used either domestically or internationally.

Standards and publications are approved by IEEE and EIA in accordance with the American National Standards Institute (ANSI) patent policy. By such action, IEEE and EIA do not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Standard or Publication.

Note: Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. IEEE and EIA shall not be responsible for identifying all patents for which a license may be required by an IEEE and EIA standard or for conducting inquiries into the legal validity or scope of those patents that are brought to their attention.

Authorization to photocopy portions of any individual standard for internal or personal use is granted by the Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; (508) 750-8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

Contents

Foreword v

Introduction vi

1. Scope 1

2. Normative references 1

3. Definitions 1

4. Application 2

5. Primary life cycle processes 3

5.1 Acquisition process 5
5.2 Supply process 13
5.3 Development process 20
5.4 Operation process 35
5.5 Maintenance process 38

6. Supporting processes 43

6.1 Documentation process 44
6.2 Configuration management process 46
6.3 Quality assurance process 48
6.4 Verification process 51
6.5 Validation process 54
6.6 Joint review process 56
6.7 Audit process 58
6.8 Problem resolution process 59

7. Organizational life cycle processes 60

7.1 Management process 61
7.2 Infrastructure process 63
7.3 Improvement process 64
7.4 Training process 65

Annexes

A—IEEE/EIA 12207.0 Annex A—Tailoring process 66

B—IEEE/EIA 12207.0 Annex F—Compliance 68

C—IEEE/EIA 12207.0 Annex G—Life cycle processes objectives 71

D—IEEE/EIA 12207.0 Annex H—Life cycle data objectives 77

E—IEEE/EIA 12207.0 Annex J—Errata 79

F—Use of reusable software products 81

G—Candidate joint management reviews 82

H—Software measurement categories 84

I—Guidance on development strategies and build planning 86

AVA Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

J—Category and priority classifications for problem reporting 94

K—Software product evaluations 95

L—Risk management 97

M—Life cycle processes references 99

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

Foreword

1. IEEE/EIA 12207.2 provides guidance in implementing the process requirements of IEEE/EIA 12207.0. The guidance is intended to summarize the best practices of the software industry in the context of the process structure provided by ISO/IEC 12207.

2. While this standard is appropriate for use within the U.S. and globally, it must be understood that some of its provisions are specific to the U.S.; their applicability to international trade situations should be carefully considered.

3. IEEE/EIA 12207.2 is intended for use as a guide to the application of IEEE/EIA 12207.0. To facilitate use, the normative text of IEEE/EIA 12207.0 is included in the guide and enclosed in boxes. The clauses in the boxes are continuous until reaching a clause with guidance. The box is then followed by the appropriate guidance material for the last clause in the box.

4. There are several clauses in section 5 of IEEE/EIA 12207.0 that use the verb “can.” “Can” does not equate to “shall” (a binding provision), “will” (a declaration), “should” (a recommendation), or “may” (a permissible action). As in ISO/IEC 12207, the verbal form “can” is used for statements of possibility and capability, whether material, physical, or causal. “Can” is used in the following clauses: 5.3.6.1, 5.4.4.3, 6.2.3.1, 6.4.2.4 c, 6.4.2.5 c, 6.5.2.3 c, F.2 c of annex B, G.14 and G.15 of annex C, and H.3 of annex D.

5. The preambles for clauses 5, 6, and 7 are informative only.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

Introduction

(This introduction is not a part of IEEE/EIA 12207.2-1997, Guide for ISO/IEC 12207, *Standard for information technology—Software life cycle processes—Implementation considerations*.)

At the time this guide was completed, the Joint Industrial Standards Working Group had the following membership:

Leonard L. Tripp, *IEEE Co-chair* **Perry DeWeese**, *EIA Co-chair*

Executive Committee Members

Dennis Ahern
Richard Evans
Lewis Gray
Robert Hegland
Dorothy Kuckuck
David Maibor
James Moore
George Newberry
Adrienne Scott
Raghu Singh
Norma A. Stopyra

Joint Industrial Standards Working Group Members

Chuck Baker
Barbara Bankeroff
Johnny Barrett
Ron Berlack
Barry Boehm
John Bolland
John Bowers
Max Brown
Don Calvert
Quyen Cao
Bruce Capehart
Dennis Carter
Myra M. Chern
John P. Chihorek
Jack Cooper
Raymond Coyle
Paul Croll
Chris Denham
Robert Didrikson
Jim Dobbins
Merlin Dorfman
Cheryl Dorsey
Bernadette Downward
Peter Eirich
Bob Elston
Dennis Faulkner
Marv Gechman
William Gess, Jr.
Marilyn Ginsberg-Finner
John Halase
John Hamlin
Rick Hefner
James H. Heil
Mark Henley
Doug Hewett
John Hoover
Helmut Hummel
Allan Jaworski
Larry Klos
Robert Knickerbocker
Richard Kreke
Jerome Lake
Doug Lange
Amy Laughlin
Milton Lavin
Jonathan Liles
Joan Lovelace
Marv Lubofsky
Ed Martin
Zyggy Martynowkcz
Richard McClellen
Judy McCloskey
Sandy McGill
Fred Mintz
Aretha Moore
Jackie Morman
Gary Motchan
Bart Nigro
George Nowinski
Al Olsen
Myrna L. Olson
Sherry Paquin
Alex Polack
Ken Ptack
Ralph Randall
Paul Reindollar
Walter Richter
Bill Schunk
Keith Shewbridge
Carl A. Singer
Terry Snyder
Reed Sorensen
Don Sova
John Stolzenthaler
Richard F. Storch
Duane Stratton
Robert Tausworthe
Booker T. Thomas
Frederick Tilsworth
Ann Turner
Howard Verne
Ronald L. Wade
David Waxman
Charles Wilson
Grady Wright

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

The following persons were on the IEEE balloting committee:

Mikhail Auguston
H. Ronald Berlack
William J. Boll
Juris Borzovs
Alan L. Bridges
Kathleen L. Briggs
M. Scott Buck
David W. Burnett
Leslie Chambers
Keith Chan
Antonio M. Cicu
Theo Clarke
François Coallier
Virgil Lee Cooper
W. W. Geoff Cozens
Bostjan K. Derganc
Audrey Dorofee
Carl Einar Dragstedt
Leo Egan
Richard L. Evans
William Eventoff
Jonathan H. Fairclough
John W. Fendrich
Julian Forster
Kirby Fortenberry
Eva Freund
Adel N. Ghannam
Marilyn Ginsberg-Finner
John Garth Glynn
Julio Gonzalez-Sanz
L. M. Gunther
Jon D. Hagar
John Harauz
Robert T. Harley
Herbert Hecht
William Hefley
Manfred Hein
Mark Heinrich
Mark Henley
Umesh P. Hiriyannaiah
John W. Horch
Jerry Huller
Peter L. Hung
Fabrizio Imelio
George Jackelen
Frank V. Jorgensen
Vladan V. Jovanovic
Judith S. Kerner
Robert J. Kierzyk
Dwayne L. Knirk
Thomas M. Kurihara
John B. Lane
J. Dennis Lawrence
Randal Leavitt
Michael Lines
Dieter Look
John Lord
David Maibor
John R. Matras
Tomoo Matsubara
Patrick McCray
Sue McGrath
Jerome W. Mersky
Alan Miller
James W. Moore
Pavol Navrat
Myrna L. Olson
Mike Ottewill
Gerald L. Ourada
Lalit M. Patnaik
Mark Paulk
John G. Phippen
Peter T. Poon
Lawrence S. Przybylski
Ann Reedy
Annette D. Reilly
Dennis Rilling
Andrew P. Sage
Helmut Sandmayr
Hans Schaefer
Robert W. Shillato
Katsutoshi Shintani
Carl A. Singer
Raghu P. Singh
Alfred R. Sorkowitz
Donald W. Sova
Luca Spotorno
Julia Stesney
Norma Stopyra
Fred J. Strauss
John Swearingen
Toru Takeshita
Douglas H. Thiele
Booker Thomas
Patricia Trellue
Theodore J. Urbanowicz
Glenn D. Venables
Charles J. Wertz
Scott A. Whitmire
P. A. Wolfgang
Paul R. Work
Weider D. Yu
Janusz Zalewski
Zhi Ying Zhou
Geraldine Zimmerman
Peter F. Zoll

When the IEEE Standards Board approved this standard on 9 December 1997, it had the following membership:

Donald C. Loughry, *Chair* **Richard J. Holleman,** *Vice Chair*
Andrew G. Salem, *Secretary*

Clyde R. Camp
Stephen L. Diamond
Harold E. Epstein
Donald C. Fleckenstein
Jay Forster*
Thomas F. Garrity
Donald N. Heirman
Jim Isaak
Ben C. Johnson
Lowell Johnson
Robert Kennelly
E. G. “Al” Kiener
Joseph L. Koepfinger*
Stephen R. Lambert
Lawrence V. McCall
L. Bruce McClung
Marco W. Migliaro
Louis-François Pau
Gerald H. Peterson
John W. Pope
Jose R. Ramos
Ronald H. Reimer
Ingo Rüsch
John S. Ryan
Chee Kiow Tan
Howard L. Wolfman

*Member Emeritus

Also included are the following nonvoting IEEE Standards Board liaisons:

Satish K. Aggarwal
Alan H. Cookson

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

Information technology—Software life cycle processes—Implementation considerations

1 Scope

This guide provides implementation consideration guidance for the normative clauses of IEEE/EIA 12207.0. The guidance is based on software industry experience with the life cycle processes presented in IEEE/EIA 12207.0.

1.1 Limitations

In this guide the use of "organizational process" denotes all of the processes as adapted by an organization, whereas the use of "organizational life cycle process" refers to the process(es) in clause 7. A thorough understanding of the organizational life cycle processes in clause 7 will help the user of IEEE/EIA 12207.0 understand what should be in place prior to performing the acquisition, supply, development, maintenance, and/or operation process(es).

1.2 Tailoring

The term "tailoring" is used frequently in the text quoted from ISO/IEC 12207. The concept of unconstrained tailoring is discouraged in IEEE/EIA 12207.0. In general, the term tailoring should be construed as meaning simply that tasks outside the scope of work of the relevant contract may be omitted. Additional guidance is provided in annex B of this guide.

2 Normative references

The following standard contains provisions which, through reference in this text, constitute provisions of this guide. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this guide are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below. When the following standard is superseded by an approved revision, the revision shall apply.

IEEE/EIA 12207.0-1996, *Information technology—Software life cycle processes*.

Refer to clause 2 of IEEE/EIA 12207.0 for normative references associated with IEEE/EIA 12207.0.

3 Definitions

GUIDANCE:

1—The definition of software unit in IEEE/EIA 12207.0 (3.28) is identical to that of ISO/IEC 12207. This definition, however, may represent one view of software unit. There may not be a common agreement within the software community on "software unit." The simplest notion of software unit is that it is what a project considers the smallest part of its software product. For this guide, the interpretation of the term "software unit" is the following: (a) "a separately compilable piece of code," (b) any other appropriate definition, or (c) replaced with other more useful terms and concepts for the project.

2—The term "compilable" refers to compilation, assembly, interpreting, translation, etc. The intent is for the computer to "translate" a unit written in a higher-order language to its machine instructions so that it can execute them. The computer can "compile" a software unit separately from other software units. However, compilation of a software unit with a test generator, for example, is not considered separate compilation. A software unit is the lowest element in one or more software components. A software component is not necessarily immediately partitioned into software units. A software component is refined into levels containing software units that can be coded, compiled, and tested.

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

4 Application

This guide is an implementation guide to IEEE/EIA 12207.0.

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

5 Primary life cycle processes

This clause defines the following primary life cycle processes:

1) Acquisition process;
2) Supply process;
3) Development process;
4) Operation process;
5) Maintenance process.

The activities and tasks in a primary process are the responsibility of the organization initiating and performing that process. This organization ensures that the process is in existence and functional.

GUIDANCE:

1—IEEE/EIA 12207.0 supports the use of integrated product teams (i.e., interdependent multidisciplinary teams, such as acquirer-supplier/developer, contractor-subcontractor, etc.) as one possible means to accomplish goals, identify and resolve issues, and make sound and timely recommendations to facilitate decision making.

2—IEEE/EIA 12207.0 uses “requirement” in many contextual ways. When a qualifier is provided (e.g., acquisition, system, software, test, contract), the qualifier implies the source(s) and receiver(s) of that requirement. When requirement is used without a qualifier, the meaning of that requirement is local to the specific activity or task.

3—Annexes A through E of this guide contain the normative annexes from IEEE/EIA 12207.0 and provide additional guidance on tailoring, additional guidance on compliance, additional guidance on life cycle processes objectives, additional guidance on life cycle data objectives, and ISO/IEC 12207 errata. Informative annexes F through M of this guide provide guidance on use of reusable software products, candidate joint management reviews, software measurement categories, guidance on development strategies and build planning, suggested category and priority classifications for problem reporting, guidance on software product evaluations, guidance on risk management, and life cycle processes references.

4—The activities within each of the primary life cycle processes may be performed iteratively and in any order deemed appropriate to produce the required software product or service. See 1.5 of IEEE/EIA 12207.0, third paragraph, for additional information.

5—Figure 1 shows the relationships between the life cycle processes of IEEE/EIA 12207.0 and roles.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

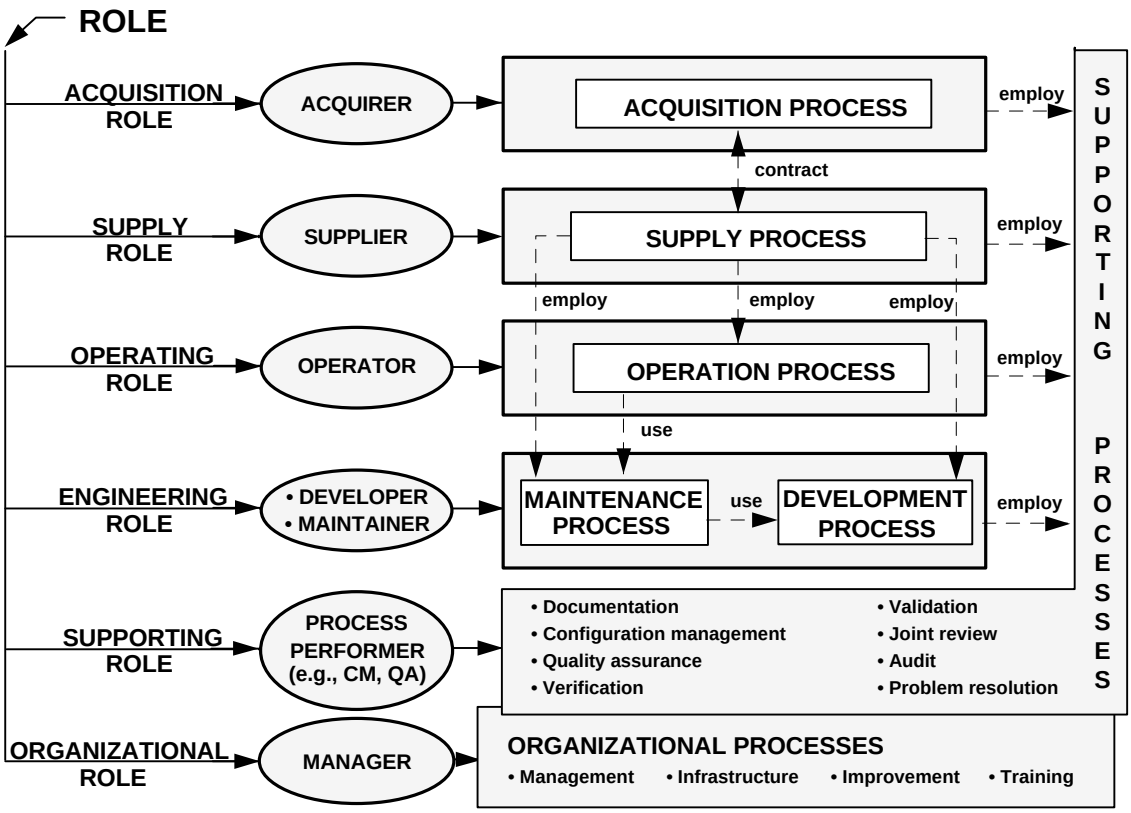

Figure 1—Relationship of primary life cycle processes and roles

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.1 Acquisition process

The Acquisition Process contains the activities and tasks of the acquirer. The process begins with the definition of the need to acquire a system, software product or software service. This process continues with the preparation and issue of a request for proposal, selection of a supplier, and management of the acquisition process through to the acceptance of the system, software product or software service.

The individual organization having the need may be called the owner. The owner may contract any or all of the acquisition activities to an agent who will in turn conduct those activities according to the Acquisition Process. The acquirer in this subclause may be the owner or the agent.

The acquirer manages the Acquisition Process at the project level following the Management Process (7.1), which is instantiated in this process; establishes an infrastructure under the process following the Infrastructure Process (7.2); tailors the process for the project following the Tailoring Process (annex A); and manages the process at the organizational level following the Improvement Process (7.3) and the Training Process (7.4).

List of activities: This process consists of the following activities:

1) Initiation;
2) Request-for-Proposal [-tender] preparation;
3) Contract preparation and update;
4) Supplier monitoring;
5) Acceptance and completion.

GUIDANCE:

1—Preferably, a project's implementation of IEEE/EIA 12207.0 should be specified with respect to the organization's claim of compliance to IEEE/EIA 12207.0. See annex B of this guide for further guidance on compliance.

2—An acquirer performing the acquisition process is conducting an "acquisition project." As part of the execution of the project, the acquirer should apply the organizational acquisition process. Nothing in this clause is intended to require that the acquirer should attempt to levy any specific process requirements upon the supplier, developer, operator, or maintainer beyond that of compliance with this standard.

3—IEEE/EIA 12207.0 uses "requirement" in many contextual ways. When a qualifier is provided (e.g., acquisition, system, software, test, contract), the qualifier implies the source(s) and receiver(s) of that requirement. When requirement is used without a qualifier, the meaning of that requirement is local to the specific activity or task.

4—The acquirer should assess the capability and qualifications of a potential supplier's processes both at an organizational level (if implemented) and as adapted for the specific project.

5—IEEE Std 1062[1] provides additional guidance regarding the acquisition process, including supplier selection.

6—Figure 2 represents the acquisition process.

[1] Life cycle process references can be found in annex M.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

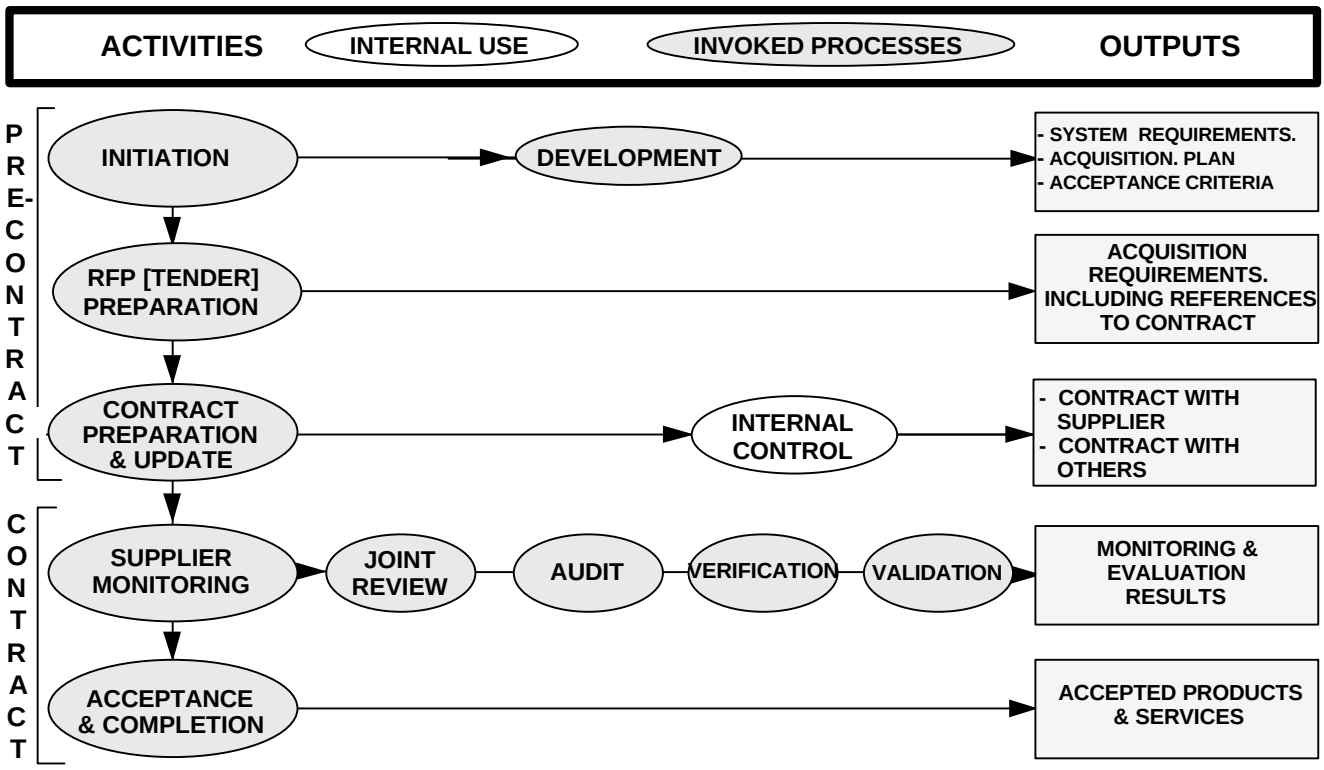

Figure 2—Acquisition process

5.1.1 Initiation. This activity consists of the following tasks:

5.1.1.1 The acquirer begins the acquisition process by describing a concept or a need to acquire, develop, or enhance a system, software product or software service.

GUIDANCE:

1—All disciplines affected by the system, software product, or software service to be acquired should be involved in concept definition. The operational concept should be modified/updated periodically to reflect current needs. The operational concept should address the full life cycle (acquisition, supply, development, operation, maintenance) of the system, software product, or software service. The description of the operational concept may be used to (1) obtain consensus among the acquirer, supplier, developer, maintenance, and user agencies on the operational and maintenance concept for the proposed system and (2) help users understand and adapt to operational and maintenance changes needed as a result of modifications to a currently operating system undergoing reengineering, addition of new capabilities, or other modifications.

2—Interpret “begins” as “will begin” to meet the intent of 5.1.1.1.

5.1.1.2 The acquirer will define and analyze the system requirements. The system requirements should include business, organizational and user as well as safety, security, and other criticality requirements along with related design, testing, and compliance standards and procedures.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

GUIDANCE:

1—The system requirements should be written at an appropriate level, based on the level of knowledge about the operational concept and the system to be acquired. The system requirements evolve as knowledge is gained by all parties involved. Many methods are available for use in defining system requirements (e.g., concept exploration, prototyping).

2—Definition of system safety and security requirements should also include what the system must not do.

3—In systems containing software with safety requirements, it may be appropriate to apply IEEE Std 1228. RTCA DO-178B may also be a useful reference.

4—In systems containing software with high reliability requirements, it may be appropriate to apply IEEE Std 982.1 to formulate quantifiable reliability requirements.

5.1.1.3 If the acquirer retains a supplier to perform system requirements analysis, the acquirer will approve the analyzed requirements.

GUIDANCE:

The acquirer should ensure the resulting system requirements provide appropriate flexibility for designing, modifying, or expanding the delivered system. For example, in appropriate situations, system requirements may include an “open systems” approach. Alternately, system requirements may call for use of, or consistency with, a domain specific architecture or the architecture of other software systems in the operating environment.

5.1.1.4 The acquirer may perform the definition and analysis of software requirements by itself or may retain a supplier to perform this task.

5.1.1.5 The Development Process (5.3) should be used to perform the tasks in 5.1.1.2 and 5.1.1.4.

GUIDANCE:

Specifically, 5.3.1 through 5.3.4.3 of IEEE/EIA 12207.0 should be used for performance of system requirements analysis and software requirements analysis.

5.1.1.6 The acquirer will consider options for acquisition against analysis of appropriate criteria to include risk, cost and benefits for each option. Options include:

a) Purchase an off-the-shelf software product that satisfies the requirements.
b) Develop the software product or obtain the software service internally.
c) Develop the software product or obtain the software service through contract.
d) A combination of a, b, and c above.
e) Enhance an existing software product or service.

GUIDANCE:

The acquirer should solicit inputs from potential suppliers when considering the options of 5.1.1.6.

5.1.1.7 When an off-the-shelf software product is to be acquired, the acquirer will ensure the following conditions are satisfied:

a) The requirements for the software product are satisfied.
b) The documentation is available.
c) Proprietary, usage, ownership, warranty and licensing rights are satisfied.
d) Future support for the software product is planned.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.1.1.8 The acquirer should prepare, document and execute an acquisition plan. The plan should contain the following:

a) Requirements for the system;
b) Planned employment of the system;
c) Type of contract to be employed;
d) Responsibilities of the organizations involved;
e) Support concept to be used;
f) Risks considered as well as methods to manage the risks.

GUIDANCE:

1—The acquisition plan should define the project acquisition process and should describe the relationship of the project's acquisition process to the organizational acquisition process.

2—For 5.1.1.8 d), the supplier is responsible for coordinating the contract with subcontractor(s). If the project uses multifunctional teams, the acquirer and subcontractor(s) may also be team participants.

3—The acquirer should establish and document in the acquisition plan a software measurement program. The program should be used to effectively plan and track software activities and tasks across the life cycle; aid in managing cost, schedule, and technical risks; and integrate software measurement with existing program management and software programming disciplines established for the project.

5.1.1.9 The acquirer should define and document the acceptance strategy and conditions (criteria).

GUIDANCE:

Since acceptance of the product or service usually relieves the supplier of contractual responsibilities, the acquirer should carefully consider the acceptance strategy and conditions. Factors to consider include (1) the extent, requirements, and location of developer-performed qualification testing; (2) support for acquirer-performed operational testing; (3) establishment of an appropriate maintenance concept, including spares, support equipment, etc.; (4) interim supplier/developer support; (5) successful software installation and transition to a maintenance activity; (6) training; and (7) warranties. The period of contractual responsibility, as well as obligations of the supplier following acquirer acceptance, should be defined.

5.1.2 Request-for-proposal [-tender] preparation. This activity consists of the following tasks:

5.1.2.1 The acquirer should document the acquisition requirements (e.g., request for proposal), the content of which depends upon the acquisition option selected in 5.1.1.6. The acquisition documentation should include, as appropriate:

a) System requirements;
b) Scope statement;
c) Instructions for bidders;
d) List of software products;
e) Terms and conditions;
f) Control of subcontracts;
g) Technical constraints (e.g., target environment).

GUIDANCE:

1—The acquirer should specify the level of acquirer participation throughout the supplier's project execution to provide the required software product or service.

2—The acquirer may request, in the request for proposal (RFP), access to project plans and planning data, proposed processes, standards, and practices. Access may be requested for (1) evaluation and reference during supplier selection and during development/maintenance/operation and (2) support after transition, if necessary. When appropriate to project characteristics, acquirer review of plans and other specifically identified procedures, practices, and work products should occur during source selection and contract negotiations. In

AVA Documents Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

some cases, review may take place after contract award. The identification of items for review may be done using table 1 of IEEE/EIA 12207.1.

3—The acquirer may specify in the RFP use of IEEE/EIA 12207.0 and other criteria as the basis for evaluation of supplier processes and plan(s) and make the evaluation criteria known. When more than one standard is specified as a basis, a clear order of precedence should be established in order to prevent conflicting interpretations.

4—The acquirer should use the draft RFP process to elicit inputs from suppliers to refine requirements and contractual considerations.

5—In the RFP, the acquirer should request the description of a framework for capturing software measures. The software measurement framework should define a flexible measurement process that directly supports the software life cycle process and related tasks and activities as implemented for the project. The measurement process should be based on the selection and analysis of appropriate software measures to address the specific project software issues, constraints, and objectives as determined by the acquirer and supplier. Software measurement data should be made available, preferably by automated data access methods, to the acquirer and supplier as part of the acquirer-supplier agreement.

6—The acquirer should include in the RFP the definition of the need for independent validation and verification, joint reviews, audits, and the process to be used to flow information to the acquirer from the operations/maintenance/development processes.

5.1.2.2 The acquirer should determine which processes, activities, and tasks of the International Standard are appropriate for the project and should tailor them accordingly. Especially, the acquirer should specify the applicable supporting processes (clause 6) and their performing organizations, including responsibilities (if other than supplier), so that the suppliers may, in their proposals, define the approach to each of the specified supporting processes. The acquirer will define the scope of those tasks that reference the contract.

GUIDANCE:

1—Performing organization, as intended in this clause, refers to the acquirer or supplier organization, not the functional organization (e.g., configuration management, quality assurance) within either.

2—The acquirer should review the established documentation standards and the proposed project-specific application of the supplier and determine if the proposed documentation will meet the acquirer's needs. If the acquirer needs additional or different documentation than that offered in the supplier's proposal, all affected parties should come to an agreement regarding the documentation during contract negotiation or establish a framework for post-award agreement.

3—The purpose of the acquirer's tailoring of the standard is to specify the scope of activities to be covered by the contract. The process framework of the standard can be very helpful in achieving effective communication between acquirer and supplier regarding the activities to be performed in the anticipated work.

4—When appropriate to project characteristics, acquirer review of plans and other specifically identified procedures, practices, and work products should occur during source selection and contract negotiations. In some cases, further refinement and review may take place after contract award. The identification of items for review may be done using table 1 of IEEE/EIA 12207.1.

5—The acquirer should only acquire life cycle data that it expects to use during the contractual period or afterward. Information items described in 4.3 of IEEE/EIA 12207.1 should be tailored to their component level to avoid developing and acquiring useless data. Deliverable data should have content, location, format, media, and packaging that is appropriate for the organization or project where they are developed and recorded. The acquirer should ensure the delivered data meet the intended needs.

5.1.2.3 The acquisition documentation will also define the contract milestones at which the supplier's progress will be reviewed and audited as part of monitoring the acquisition (see 6.6 and 6.7).

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

GUIDANCE:

Software review schedules should support system-level and milestone reviews. Contract milestones should be based on clearly defined entry and exit criteria.

5.1.2.4 The acquisition requirements should be given to the organization selected for performing the acquisition activities.

5.1.3 Contract preparation and update. This activity consists of the following tasks:

5.1.3.1 The acquirer should establish a procedure for supplier selection including proposal evaluation criteria and requirements compliance weighting.

GUIDANCE:

Evaluation criteria may include compliance with national standards, including IEEE/EIA 12207.0, and process maturity.

5.1.3.2 The acquirer should select a supplier based upon the evaluation of the suppliers' proposals, capabilities, and other factors that need to be considered.

GUIDANCE:

Other factors for consideration include capability/maturity, domain expertise, past performance, financial stability, commitment to continuous improvement, location, and staffing.

5.1.3.3 The acquirer may involve other parties, including potential suppliers, before contract award, in tailoring this International Standard for the project. However, the acquirer will make the final decision on the tailoring. The acquirer will include or reference the tailored International Standard in the contract.

GUIDANCE:

In some cases, the requirements in 5.1.3.3 may be inappropriate or difficult to implement. The following is provided as a means of achieving the intent of the clause. Acquirer tailoring should be applied only to define the scope of work to be acquired. Rather than develop a unique tailoring for a project, the acquirer should solicit proposals based upon suppliers' organizational processes and evaluate the suppliers' proposed processes. Additional guidance on tailoring and compliance may be found in annexes A and B, respectively, of this guide.

5.1.3.4 The acquirer will then prepare and negotiate a contract with the supplier, that addresses the acquisition requirements, including the cost and schedule, of the software product or service to be delivered. The contract will address proprietary, usage, ownership, warranty and licensing rights associated with the reusable off-the-shelf software products.

GUIDANCE:

1—The acquirer should identify for the supplier the retention period for records, either directly or indirectly by reference to other legal requirements.

2—Acquisition requirements should also address the trade-offs between cost, schedule, performance, business objectives, safety, product quality level, etc.

3—The acquirer should establish with the supplier a means for controlling and making changes to both contractual requirements and requirements of the delivered system or service.

4—The contract should address proprietary, usage, ownership, warranty, and licensing rights associated with all the software products to be acquired.

5—The acquirer should define requirements and preferences and negotiate with the supplier to define (1) what information should be delivered to the acquirer, (2) what information should be accessible to the acquirer,

AVA Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

(3) what information requires approval from the acquirer when first created or subsequently modified, (4) any format and content requirements for the information, and (5) when information should be produced.

5.1.3.5 Once the contract is underway, the acquirer will control changes to the contract through negotiation with the supplier as part of a change control mechanism. Changes to the contract will be investigated for impact on project plans, costs, benefits, quality, and schedule.

NOTE—The acquirer determines whether the term "contract" or "agreement" is to be used in the application of this International Standard.

GUIDANCE:

1—The investigation of the impact of changes to the contract should include all potential significant risks.

2—Changes to the contract should not be used as a method to force changes in a supplier's organizational processes.

5.1.4 Supplier monitoring. This activity consists of the following tasks:

5.1.4.1 The acquirer will monitor the supplier's activities in accordance with the Joint Review Process (6.6) and the Audit Process (6.7). The acquirer should supplement the monitoring with the Verification Process (6.4) and the Validation Process (6.5) as needed.

GUIDANCE:

1—The acquirer should have the opportunity to examine the supplier's/developer's/maintainer's/operator's processes for developing, modifying, or otherwise supporting the system/software to ensure cost-effective expenditure of resources and a quality product that meets user needs within project cost and schedule constraints.

2—The acquirer and supplier should both participate in joint reviews. The requirements/responsibilities of all parties involved in joint management and joint technical reviews should be documented. Annex G of this guide contains candidate joint management reviews.

3—One or more methods may be used to monitor supplier's activities. These methods include software measurements, integrated product teams, on-site or remote access to digital data, and joint reviews.

4—The acquirer may use data from the supplier's software measurement program as input to its own software measurement program for supplier monitoring.

5.1.4.2 The acquirer will cooperate with the supplier to provide all necessary information in a timely manner and resolve all pending items.

GUIDANCE:

Arrangements should be established to ensure both the acquirer and the supplier cooperate to provide necessary information and work together to resolve problems and risks.

5.1.5 Acceptance and completion. This activity consists of the following tasks:

5.1.5.1 The acquirer should prepare for acceptance based on the defined acceptance strategy and criteria. The preparation of test cases, test data, test procedures, and test environment should be included. The extent of supplier involvement should be defined.

GUIDANCE:

1—The acquirer should consider including the user in preparation for acceptance testing. Depending on the life cycle support plans for the system/software, the acquirer should also include operations and maintenance organizations in preparation for acceptance testing.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

2—The results of other processes (e.g., qualification test, verification, validation) may be used as part of acceptance and completion.

5.1.5.2 The acquirer will conduct acceptance review and acceptance testing of the deliverable software product or service and will accept it from the supplier when all acceptance conditions are satisfied. The acceptance procedure should comply with the provisions of 5.1.1.9.

GUIDANCE:

1—Depending on the nature of the product developed, the acquirer may accept only the software product, the software product and associated computer hardware, or the entire system, which includes embedded software.

2—As specified in 5.1.5, the acquirer determines the acceptance strategy. The acquirer may elect to perform separate acceptance testing and review with developer support, task the developer to perform all testing and base acceptance upon adequate review of the developer's test results, or some variation.

5.1.5.3 After acceptance, the acquirer should take the responsibility for the configuration management of the delivered software product (see 6.2).

NOTE—The acquirer may install the software product or perform the software service in accordance with instructions defined by the supplier.

No further guidance provided.

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

5.2 Supply process

The Supply Process contains the activities and tasks of the supplier. The process may be initiated either by a decision to prepare a proposal to answer an acquirer's request for proposal or by signing and entering into a contract with the acquirer to provide the system, software product or software service. The process continues with the determination of procedures and resources needed to manage and assure the project, including development of project plans and execution of the plans through delivery of the system, software product or software service to the acquirer.

The supplier manages the Supply Process at the project level following the Management Process (7.1), which is instantiated in this process; establishes an infrastructure under the process following the Infrastructure Process (7.2); tailors the process for the project following the Tailoring Process (annex A); and manages the process at the organizational level following the Improvement Process (7.3) and the Training Process (7.4).

List of activities: This process consists of the following activities:

1) Initiation;
2) Preparation of response;
3) Contract;
4) Planning;
5) Execution and control;
6) Review and evaluation;
7) Delivery and completion.

GUIDANCE:

1—IEEE/EIA 12207.0 uses "requirement" in many contextual ways. When a qualifier is provided (e.g., acquisition, system, software, test, contract), the qualifier implies the source(s) and receiver(s) of that requirement. When requirement is used without a qualifier, the meaning of that requirement is local to the specific activity or task.

2—Figure 3 represents the supply process.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

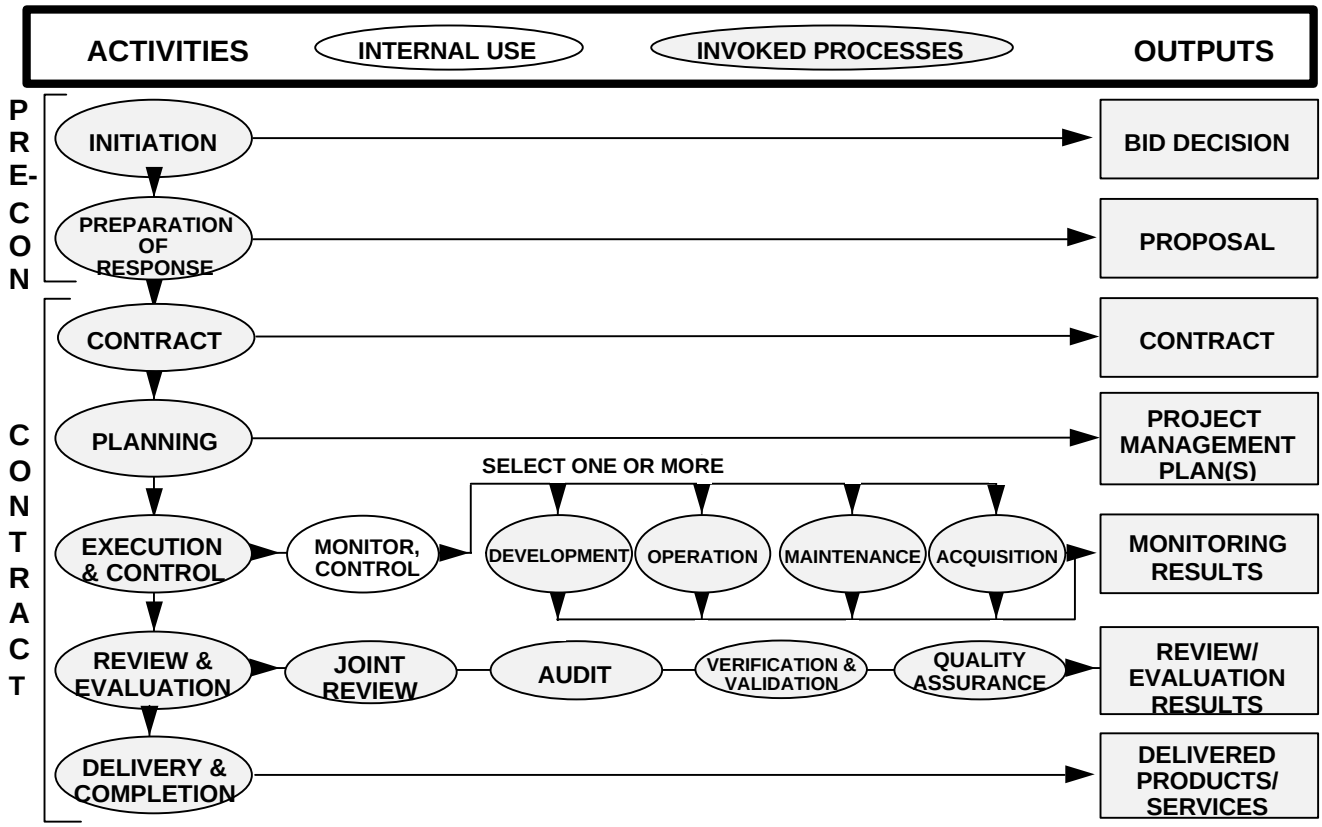

Figure 3—Supply process

5.2.1 Initiation. This activity consists of the following tasks:

5.2.1.1 The supplier conducts a review of requirements in the request for proposal taking into account organizational policies and other regulations.

GUIDANCE:

Preferably, a project's implementation of IEEE/EIA 12207.0 should be specified with respect to the organization's claim of compliance to IEEE/EIA 12207.0. See annex B of this guide for further guidance on compliance.

5.2.1.2 The supplier should make a decision to bid or accept the contract.

5.2.2 Preparation of response. This activity consists of the following task:

5.2.2.1 The supplier should define and prepare a proposal in response to the request for proposal, including its recommended tailoring of this International Standard.

GUIDANCE:

1—The supplier should obtain inputs from the developer, operator, maintainer, selected support, and organizational entities, as applicable, to assist in proposal preparation.

2—The proposal is a means for the supplier to propose the defined processes of the supplier's organization or to recommend contract considerations (e.g., contract type, life cycle considerations, milestones).

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.2.3 Contract. This activity consists of the following tasks:

5.2.3.1 The supplier shall negotiate and enter into a contract with the acquirer organization to provide the software product or service.

5.2.3.2 The supplier may request modification(s) to the contract as part of the change control mechanism.

5.2.4 Planning. This activity consists of the following tasks:

5.2.4.1 The supplier shall conduct a review of the acquisition requirements to define the framework for managing and assuring the project and for assuring the quality of the deliverable software product or service.

GUIDANCE:

The project management framework should be in the context of the organization's defined processes as adapted for the project.

5.2.4.2 If not stipulated in the contract, the supplier shall define or select a software life cycle model appropriate to the scope, magnitude, and complexity of the project. The processes, activities, and tasks of this International Standard shall be selected and mapped onto the life cycle model.

GUIDANCE:

1—The software life cycle model selected should be jointly agreed upon by the acquirer and the supplier. The software life cycle model(s) should be constructed with the activities and tasks of the supply, development, operation, maintenance, and applicable supporting and organizational processes, even if only one of the aforementioned primary processes would be executed.

2—Typically, a project premise is that the organization's selected and approved life cycle models exist and are available for use by the projects. The organization, using clause 7 of IEEE/EIA 12207.0, has determined and documented its business requirements and has determined the life cycle model for use to support the business. A project then selects which life cycle model to use based on the need of its project(s). The project, based on its project plan, will map the activities and tasks to the life cycle. The mapping of the activities and tasks of the Primary Processes to the selected life cycle model should be accompanied by the relevant Supporting Processes. This mapping is required for each iteration or pass through the incremental and evolutionary models. Other project activities should also be mapped to the model.

3—See annex I of this guide for further guidance on determining the model types.

5.2.4.3 The supplier shall establish requirements for the plans for managing and assuring the project and for assuring the quality of the deliverable software product or service. Requirements for the plans should include resource needs and acquirer involvement.

GUIDANCE:

1—The supplier should establish the framework for capturing software measures consistent with the acquirer's guidance in the RFP. This measurement framework should directly support the project software life cycle process and related tasks and activities. It should provide an overall structure for identifying and prioritizing software issues, selecting appropriate measures to address the identified issues, integrating the measurement requirements into the engineering and management processes, analyzing and reporting the measurement results, and taking appropriate action. The measurement framework should be implemented to support supplier and acquirer information throughout the project life cycle and should address the analysis of the feasibility of the project plans and the tracking of project performance against the plans.

2—Supplier's plans should be developed in accordance with IEEE/EIA 12207.1.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.2.4.4 Once the planning requirements are established, the supplier shall consider the options for developing the software product or providing the software service, against an analysis of risks associated with each option. Options include:

a) Develop the software product or provide the software service using internal resources.
b) Develop the software product or provide the software service by subcontracting.
c) Obtain off-the-shelf software products from internal or external sources.
d) A combination of a, b, and c above.

5.2.4.5 The supplier shall develop and document project management plan(s) based upon the planning requirements and options selected in 5.2.4.4. Items to be considered in the plan include but are not limited to the following:

a) Project organizational structure and authority and responsibility of each organizational unit, including external organizations;

b) Engineering environment (for development, operation, or maintenance, as applicable), including test environment, library, equipment, facilities, standards, procedures, and tools;

c) Work breakdown structure of the life cycle processes and activities, including the software products, software services and non-deliverable items, to be performed together with budgets, staffing, physical resources, software size, and schedules associated with the tasks;

d) Management of the quality characteristics of the software products or services. Separate plans for quality may be developed.

e) Management of the safety, security, and other critical requirements of the software products or services. Separate plans for safety and security may be developed.

f) Subcontractor management, including subcontractor selection and involvement between the subcontractor and the acquirer, if any;

g) Quality assurance (see 6.3);

h) Verification (see 6.4) and validation (see 6.5); including the approach for interfacing with the verification and validation agent, if specified;

i) Acquirer involvement; that is, by such means as joint reviews (see 6.6), audits (see 6.7), informal meetings, reporting, modification and change; implementation, approval, acceptance, and access to facilities;

j) User involvement; by such means as requirements setting exercises, prototype demonstrations and evaluations;

k) Risk management; that is management of the areas of the project that involve potential technical, cost, and schedule risks;

l) Security policy; that is, the rules for need-to-know and access-to-information at each project organization level;

m) Approval required by such means as regulations, required certifications, proprietary, usage, ownership, warranty and licensing rights;

n) Means for scheduling, tracking, and reporting;

o) Training of personnel (see 7.4).

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

GUIDANCE:

1—In developing and documenting project management plan(s), the supplier should obtain support from the developer, operator, maintainer, selected support and organizational entities, as applicable, based on organizational processes conforming to IEEE/EIA 12207.0.

2—For 5.2.4.5 i) and 5.2.4.5 j), the supplier should list the areas and levels of acquirer participation in the supply process as specified in the contract (e.g., review of project plans, testing). This information should be added to the appropriate sections of the project management plan.

3—For 5.2.4.5 k), the annex on risk management, annex L of this guide, should be referenced.

4—For 5.2.4.5 n), the software measurement framework established in 5.2.4.3 should be used to capture data.

5—The supplier's processes for the project should be specified with respect to the supplier's organizational processes and policies.

6—The supplier should record the transition strategy and approach in the project management plan(s).

5.2.5 Execution and control. This activity consists of the following tasks:

5.2.5.1 The supplier shall implement and execute the project management plan(s) developed in 5.2.4.

GUIDANCE:

1—The project management plan(s) should be updated/modified, as needed, to reflect changes in requirements, policies, and procedures.

2—The acquirer should be kept informed of updates to the plan(s).

5.2.5.2 The supplier shall:

a) Develop the software product in accordance with Development Process (5.3).
b) Operate the software product in accordance with Operation Process (5.4).
c) Maintain the software product in accordance with Maintenance Process (5.5).

GUIDANCE:

Each of these processes are implementations of the respective organization's processes.

5.2.5.3 The supplier shall monitor and control the progress and the quality of the software products or services of the project throughout the contracted life cycle. This shall be an ongoing, iterative task, which shall provide for:

a) Monitoring progress of technical performance, costs, and schedules and reporting of project status;

b) Problem identification, recording, analysis, and resolution.

GUIDANCE:

1—Risk management should be included in the ongoing activities listed in 5.2.5.3 a).

2—The supplier should use the problem resolution process (6.8) for the items in 5.2.5.3 b).

3—The software measurement framework established in 5.2.4.3 should be used for capturing data.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.2.5.4 The supplier shall manage and control the subcontractors in accordance with the Acquisition Process (5.1). The supplier shall pass down all contractual requirements necessary to ensure that the software product or service delivered to the acquirer is developed or performed in accordance with the prime-contract requirements.

GUIDANCE:

1—The subcontract should define only those tasks the subcontractor is to perform and flow down only those requirements from the prime contract that are applicable to the work the subcontractor is to perform.

2—When the supplier passes requirements down to subcontractor(s), the supplying contractor assumes the role of an acquirer, and the subcontractor assumes the role of a supplier. The resulting acquirer-supplier relationship is distinct from the existing higher-level acquirer-supplier relationship. This illustrates the principle that "acquirer" and "supplier" refer to roles that may be assumed by various parties applying the standard and that a particular party may assume several different roles.

5.2.5.5 The supplier shall interface with the independent verification, validation, or test agent as specified in the contract and project plans.

GUIDANCE:

The acquirer or supplier may employ independent verification and validation (IV&V) or test agents. These agents may evaluate the work of the suppliers and subcontractor(s). To ensure that IV&V and test agent resources are used most effectively, it is important for these agents to receive the proper training and experience in the processes, tools, and techniques used by the organization evaluated.

5.2.5.6 The supplier shall interface with other parties as specified in the contract and project plans.

5.2.6 Review and evaluation. This activity consists of the following tasks:

5.2.6.1 The supplier should coordinate contract review activities, interfaces, and communication with the acquirer's organization.

GUIDANCE:

The supplier should conduct the activities in 5.2.6.1 as defined in the project management plan(s).

5.2.6.2 The supplier shall conduct or support the informal meetings, acceptance review, acceptance testing, joint reviews, and audits with the acquirer as specified in the contract and project plans. The joint reviews shall be conducted in accordance with 6.6, audits in accordance with 6.7.

5.2.6.3 The supplier shall perform verification and validation in accordance with 6.4 and 6.5 respectively to demonstrate that the software products or services and processes fully satisfy their respective requirements.

5.2.6.4 The supplier shall make available to the acquirer the reports of evaluation, reviews, audits, testing, and problem resolutions as specified in the contract.

5.2.6.5 The supplier shall provide the acquirer access to the supplier's and subcontractors' facilities for review of software products or services as specified in the contract and project plans.

GUIDANCE:

If the project utilizes multifunctional teams [e.g., within the supplier's organization or between the supplier and subcontractor(s)], the acquirer's participation should be clearly identified and understood by all team participants. For example, the acquirer may be a passive observer of all team activities, occasional visitor, active participant, or chairman and final authority of all team decisions.

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

5.2.6.6 The supplier shall perform quality assurance activities in accordance with 6.3.

5.2.7 Delivery and completion. This activity consists of the following tasks:

5.2.7.1 The supplier shall deliver the software product or service as specified in the contract.

5.2.7.2 The supplier shall provide assistance to the acquirer in support of the delivered software product or service as specified in the contract.

GUIDANCE:

The supplier should record the transition strategy and approach in the project management plan.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5.3 Development process

The Development Process contains the activities and tasks of the developer. The process contains the activities for requirements analysis, design, coding, integration, testing, and installation and acceptance related to software products. It may contain system related activities if stipulated in the contract. The developer performs or supports the activities in this process in accordance with the contract.

The developer manages the Development Process at the project level following the Management Process (7.1), which is instantiated in this process; establishes an infrastructure under the process following the Infrastructure Process (7.2); tailors the process for the project following the Tailoring Process (annex A); and manages the process at the organizational level following the Improvement Process (7.3) and the Training Process (7.4). When the developer is the supplier of the developed software product, the developer performs the Supply Process (5.2).

List of activities: This process consists of the following activities:

1) Process implementation;
2) System requirements analysis;
3) System architectural design;
4) Software requirements analysis;
5) Software architectural design;
6) Software detailed design;
7) Software coding and testing;
8) Software integration;
9) Software qualification testing;
10) System integration;
11) System qualification testing;
12) Software installation;
13) Software acceptance support.

GUIDANCE:

1—Preferably, a project's implementation of IEEE/EIA 12207.0 should be specified with respect to the organization's claim of compliance to IEEE/EIA 12207.0. See annex B of this guide for further guidance on compliance.

2—If a system or software item is developed in multiple builds, activities within a process may not be complete until the final build. The developer's plans should identify (1) overall plans for each activity for the contract, (2) detailed planning for each activity for the current build, and (3) planning for future builds covered under the contract to a level of detail compatible with the information available.

3—IEEE/EIA 12207.0 uses "requirement" in many contextual ways. When a qualifier is provided (e.g., acquisition, system, software, test, contract), the qualifier implies the source(s) and receiver(s) of that requirement. When requirement is used without a qualifier, the meaning of that requirement is local to the specific activity or task.

4—In the system activities, (5.3.2 - System requirements analysis, 5.3.3 - System architectural design, 5.3.10 - System integration, and 5.3.11 - System qualification testing), the developer is tasked to perform or support as required by the contract. As discussed in the Acquisition Process (5.1), the acquirer may elect to perform system requirements analysis activities. In similar fashion, the acquirer may (a) elect to perform system design, integration, and qualification testing; (b) task the supplier to perform these activities; or (c) employ other organizations to perform them.

5—Regardless of who actually performs or supports these activities, the role of the software professionals typically varies depending on the type of system developed. If the software is part of a hardware-software system, the software professionals take part in the system activities as described in plans. If the software (possibly with its computer hardware) is considered to constitute a system, or only the software in an existing hardware-software system is changed, the software professional is responsible for performing or supporting these system activities.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

6—See IEEE/EIA 12207.1 for guidance on documentation of life cycle data.

7—Figure 4 represents the development process. The following abbreviations are used in figure 4: ACCEPT = acceptance; ARCH = architectural; HW = hardware; MO = manual operations; JT = joint; QUALIF = qualification; REQ = requirements; SW = software; SYS = system.

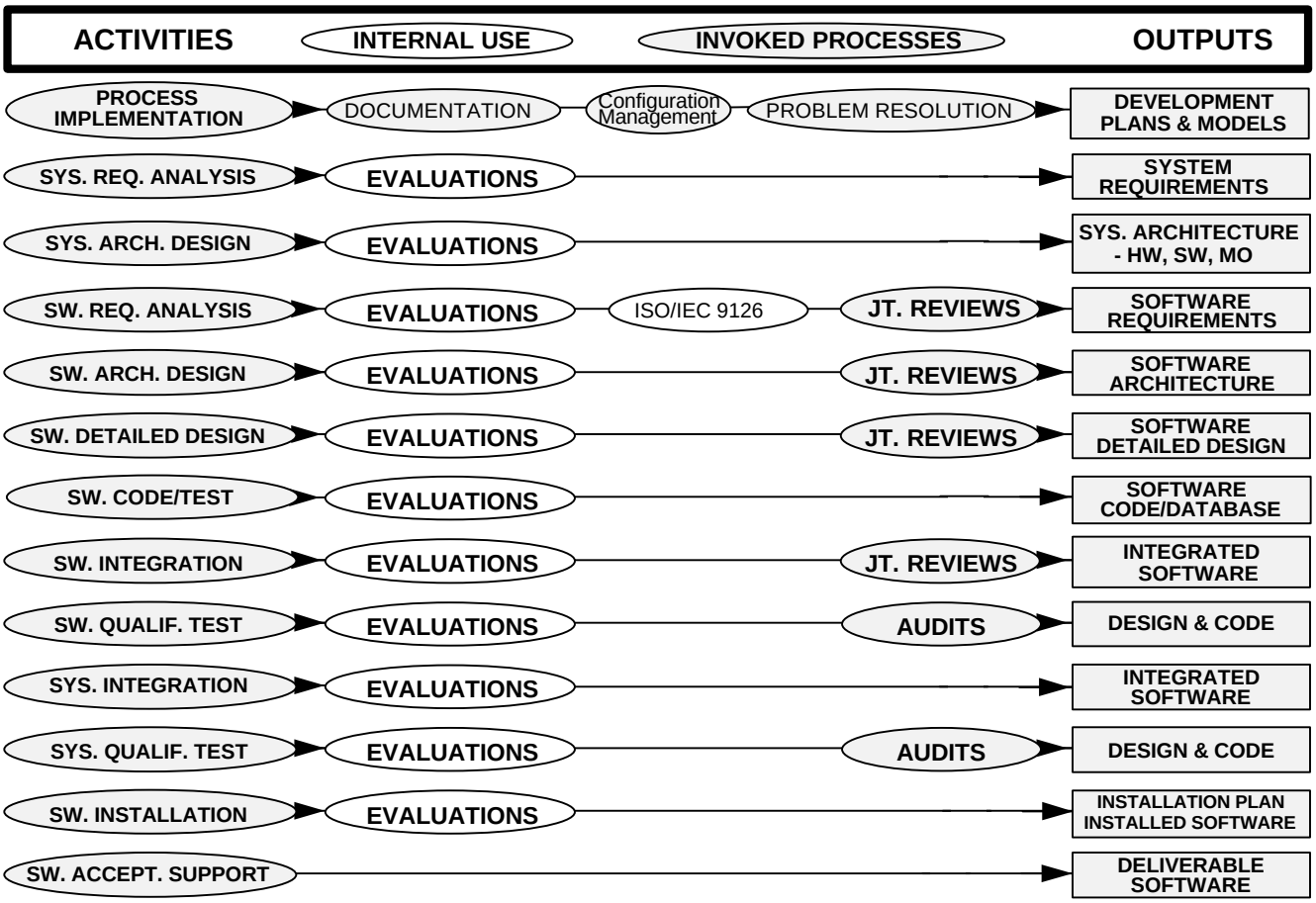

Figure 4—Development process

5.3.1 Process implementation. This activity consists of the following tasks:

5.3.1.1 If not stipulated in the contract, the developer shall define or select a software life cycle model appropriate to the scope, magnitude, and complexity of the project. The activities and tasks of the Development Process shall be selected and mapped onto the life cycle model.

NOTE—These activities and tasks may overlap or interact and may be performed iteratively or recursively.

GUIDANCE:

If not proposed by the acquirer or established by the supplier, the developer should establish an appropriate life cycle model(s) before continuing with the development process. The details of the mapping of the development process onto the life cycle model(s) should include activities and tasks to be conducted, when the activities and tasks would be conducted, and person(s) responsible for conducting the activities and tasks. Additional guidance on use of software life cycle models may be found in IEEE Std 1074.

5.3.1.2 The developer shall:

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

a) Document the outputs in accordance with the Documentation Process (6.1).

b) Place the outputs under the Configuration Management Process (6.2) and perform change control in accordance with it.

c) Document and resolve problems and nonconformances found in the software products and tasks in accordance with the Problem Resolution Process (6.8).

d) Perform the supporting processes (clause 6) as specified in the contract.

e) Establish baselines for each configuration item at appropriate times, as determined by the acquirer and the supplier.

GUIDANCE:

1—For 5.3.1.2 a), implementation of the documentation process is the recording of information in any media and may include the preparation of paper documents. Rationale for key decisions made in conducting the development of the system/software should be documented. The rationale should include trade-offs considered, analysis methods, and criteria used to make those decisions. The meaning of "key decisions" and the approach for providing the rationale should be described in the plans. The development and recording of information is an intrinsic part of the development process. The documentation process addresses the presentation and management of this information. The information generated during the development process should comply with the objectives of annex H of IEEE/EIA 12207.0. Guidance on the format and content of information developed is provided in IEEE/EIA 12207.1.

2—For 5.3.1.2 b), the developer should consider including different states through which identified items, products, or entities pass as part of configuration control (e.g., author control, developer's project control, acquirer control). These states can then determine when other processes may be employed. (For example, only products at project-level-or-higher configuration control may be listed in configuration status accounting records and employ the problem resolution process to officially report and track any problems.) The developer should also document the persons or groups with the authority to authorize changes and to make changes at each level, if applicable. The developer should document the steps to be followed to request authorization for changes, process change requests, track changes, distribute changes, and preserve past versions. Changes that affect an item, product, or entity already under acquirer control should be proposed to the acquirer in accordance with contractually established forms and procedures, if any. Baselines may be used during the development process as a form of control of a configuration item. (Additional information on baselines may be found in E.14 of IEEE/EIA 12207.0.)

5.3.1.3 The developer shall select, tailor, and use those standards, methods, tools, and computer programming languages (if not stipulated in the contract) that are documented, appropriate, and established by the organization for performing the activities of the Development Process and supporting processes (clause 6).

GUIDANCE:

A developer's selection of standards, methods, tools, and computer languages may include selection of the developer's own standard practices, including software reuse practices. (See annex F of this guide for further information on reusable software products.)

Documents
Document Sharing Hub

Full document details: SAE IEEEEIA12207_2

5.3.1.4 The developer shall develop plans for conducting the activities of the development process. The plans should include specific standards, methods, tools, actions, and responsibility associated with the development and qualification of all requirements including safety and security. If necessary, separate plans may be developed. These plans shall be documented and executed.

GUIDANCE:

1—The developer may reference, rather than include, specific standards, methods, tools, practices, and computer programming languages in the plans for conducting the activities.

2—Planning for development describes the approach (methods/procedures/tools) to applicable activities and tasks of the development process, covers all applicable clauses regarding development, identifies applicable risks/uncertainties regarding those activities and tasks, and describes plans for dealing with the risks/uncertainties.

3—Software development planning should be based on the software life cycle model (see 5.3.1.1).

4—Plans to be included may be project management plans and/or software development plans.

5.3.1.5 Non-deliverable items may be employed in the development or maintenance of the software product. However, it shall be ensured that the operation and maintenance of the deliverable software product after its delivery to the acquirer are independent of such items, otherwise those items should be considered as deliverable.

GUIDANCE:

The developer should bring to the attention of the supplier (and to the acquirer) those nondeliverable items that would be needed during operations and maintenance of the deliverable products to allow the supplier and the acquirer to negotiate usage or delivery of the deliverable products.

5.3.2 System requirements analysis. This activity consists of the following tasks, which the developer shall perform or support as required by the contract:

5.3.2.1 The specific intended use of the system to be developed shall be analyzed to specify system requirements. The system requirements specification shall describe: functions and capabilities of the system; business, organizational and user requirements; safety, security, human-factors engineering (ergonomics), interface, operations, and maintenance requirements; design constraints and qualification requirements. The system requirements specification shall be documented.

GUIDANCE:

1—To fully understand what is required of the intended product, the system requirements analysis activity should include elicitation from the user community.

2—If a system consists of subsystems, the activities in 5.3.2 - System requirements analysis, should be performed iteratively with the activities in 5.3.3 - System architectural design, to define system requirements, design the system and identify subsystems, define the requirements for those subsystems, design the subsystems and identify their components, and so on.

3—Each requirement should be stated in such a way that an objective test can be defined for it.

4—The developer should analyze acquisition requirements concerning computer hardware resource utilization (e.g., maximum allowable use of processor capacity, memory capacity, input/output device capacity, auxiliary storage device capacity, communications/network equipment capacity). If there are no acquisition requirements concerning computer hardware resource utilization, or they are very general, the developer should establish appropriate utilization requirements as part of the system requirements activity. Establishing utilization requirements should be an activity iterated with design activities.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2

5—The definition of system safety and security requirements should also include what the system must not do.

5.3.2.2 The system requirements shall be evaluated considering the criteria listed below. The results of evaluations shall be documented.

a) Traceability to acquisition needs;
b) Consistency with acquisition needs;
c) Testability;
d) Feasibility of system architectural design;
e) Feasibility of operation and maintenance.

GUIDANCE:

The requirements to perform evaluations 5.3.2.2 d) and 5.3.2.2 e) are intended to task the developer to determine the feasibility of creating a system architectural design based on the requirements and the feasibility of operating and maintaining such a system. It may be necessary to perform selected aspects of design, such as prototyping or simulation, to determine whether it is feasible to develop a product(s) meeting those requirements.

5.3.3 System architectural design. This activity consists of the following tasks, which the developer shall perform or support as required by the contract:

5.3.3.1 A top-level architecture of the system shall be established. The architecture shall identify items of hardware, software, and manual-operations. It shall be ensured that all the system requirements are allocated among the items. Hardware configuration items, software configuration items, and manual operations shall be subsequently identified from these items. The system architecture and the system requirements allocated to the items shall be documented.

GUIDANCE:

1—IEEE/EIA 12207.0 places few requirements upon the goals or conduct of system architectural design, recognizing that this area of technology and practice is undergoing rapid evolution. The following guidance may be helpful in selecting a method and a set of goals.

2—In many cases, it is appropriate to view the system architecture as a mechanism for facilitating communications between the acquirer, the developer, the supplier, and other key stakeholders regarding clarification of requirements and their impact on the structure of the system. Although such a usage is not a requirement of the standard, it does contribute to the achievement of the evaluation criteria listed in 5.3.3.2.

3—IEEE/EIA 12207.0 does not require the use of any particular architectural method, e.g., functional decomposition. That selection should be made based upon the characteristics of the development effort. In some cases, it is appropriate to view the software architectural efforts as an extension of the system architectural effort, continuing at a greater level of detail and with greater attention to software-specific concerns.

4—IEEE/EIA 12207.0 does not require any particular output from the architectural effort aside from identification of items and allocation of requirements. It is often appropriate (and supportive of the evaluation criteria) to use the architecture as a means for formulating and recording system-wide design decisions (that is, decisions about the system's concept of execution and interface characteristics, and other decisions affecting the selection and design of system items). The results of such decisions may be recorded in the form of the system-wide design. Results of decisions regarding item identification and requirements traceability may be recorded in the form of the architectural design and traceability cross reference.

5—In many cases, architectural design should be regarded as an iterative activity. Final identification of all items and allocation of all requirements may be completed during iterations other than the first one.

6—The top-level architectural design of a system (i.e., the first partition) may include subsystems. The system architectural design may incorporate alternative views of architecture.

Documents
Document Sharing Hub
Full document details: SAE IEEEEIA12207_2