

Introducing the IEEE Standards for Software Quality

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1



Presentation Objectives

- Learn about the nature of the IEEE standards for software engineering.
- Raise awareness of the standards and their value.
- See how to apply the standards to your projects.

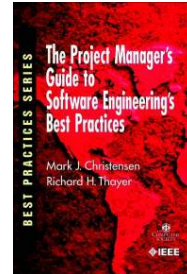
2



Introducing the IEEE Standards for Software Quality

Highly Recommended Reading

- This is a very readable and thorough guide to applying the most common IEEE Software Engineering Standards
- This book is organized into three parts.
 - **Software Systems Engineering**
 - Proposes that software development projects are most successful when developed using a systems level viewpoint.
 - **Process Management and Control**
 - Describes the key activities needed to define, support, and manage a project's software development processes.
 - **Project Planning and Management**
 - Completes the book by integrating the elements of cost and schedule estimation and control, risk management, and the role metrics play in performing those tasks.



3

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What is Systems Engineering?

- A system is “A collection of components organized to accomplish a specific function or set of functions.”
 - IEEE Standard 610.12-1990
- A related definition is “A collection of *related* or associated entities that *together* accomplish one or more *specific objectives*.”
 - Roger Pressman, 1982



Source: *The Project Manager's Guide to Software Engineering's Best Practices*, Christensen and Thayer, Pg 7

4

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What is Systems Engineering? (2)

- “The practical application of the scientific, engineering and management skills required to transform a user’s need into a description of a system configuration that best satisfies that need in an effective and efficient way.”

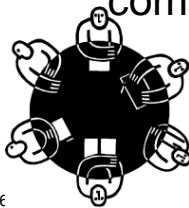
– *The Project Manager’s Guide to Software Engineering’s Best Practices*, Christensen and Thayer, Pg 8

5



What is Systems Engineering? (3)

- SE provides the overall technical management of a systems development project.
- IEEE Standard 1220-1998 defines the environment and processes that comprise systems engineering.



6



Activities of Systems Engineering

- Systems engineering includes the following functions:
 - Problem definition
 - Solution analysis
 - Process planning
 - Process control
 - Product evaluation



7

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What is Software Systems Engineering?

- “It is a process and mind-set that should be adopted when approaching software engineering at the highest levels.”
 - *The Project Manager's Guide to Software Engineering's Best Practices*, Christensen and Thayer, Pg 12
- It fosters a holistic view of systems as opposed to a code-centric view.
- The term is credited to Dr. Winston W. Royce in the early 1980's.

8

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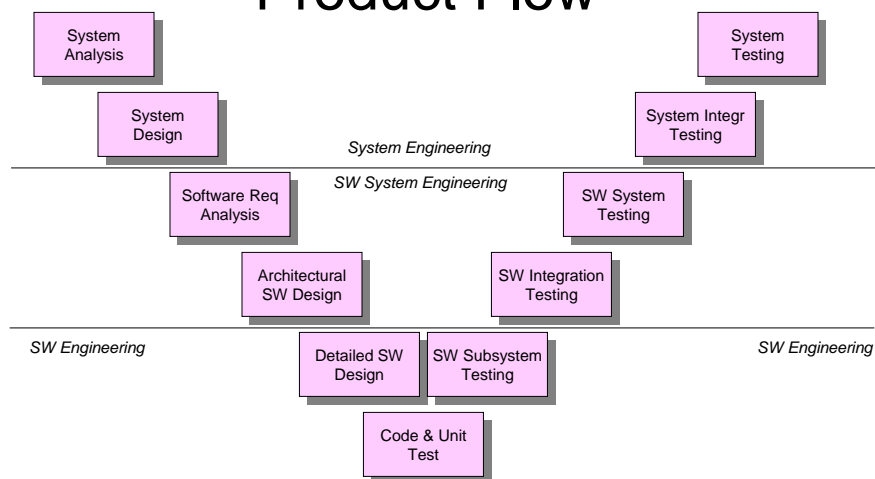
Activities of Software Systems Engineering

- Software systems engineering (SwSE) includes the following functions:
 - Requirements analysis (problem definition)
 - Architectural software design (solution analysis)
 - Process planning
 - Process control
 - Verification, validation and testing (product evaluation)

9

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Engineering Activities and Product Flow

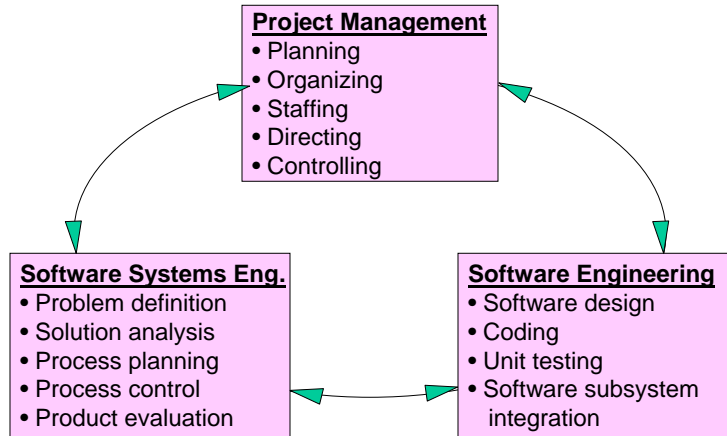


Source: *The Project Manager's Guide to Software Engineering's Best Practices*,
10 Christensen and Thayer, Pg 17

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The Relationship to Project Management



Source: *The Project Manager's Guide to Software Engineering's Best Practices*, Christensen and Thayer, Pg 18

11

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Why Should We Use Standards?

- They show industry best practices to:
 - Improve the product
 - Protect the buyer
 - Protect the business or organization
 - Increase professional discipline
 - Introduce technology
- They provide guidance in how to perform an activity.
- They provide consistency of work products and methods between groups.
- They facilitate transferability and understanding of work products between groups



12

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Basic Principles for Standards

- Standards change and evolve in response to changes in the world around us.
- Most organizations will need to tailor the standards to meet their needs.
- Standards help people develop project deliverables by building on proven formats.
- Standards do not apply themselves. The organization must intelligently apply them.

13



ISO Compared to IEEE

- | | |
|--|---|
| <ul style="list-style-type: none">• ISO Standards<ul style="list-style-type: none">– Created by committees of national representatives– Inspire national implementations– Used voluntarily– Used by businesses– Used to simplify trade | <ul style="list-style-type: none">• IEEE Standards<ul style="list-style-type: none">– Created by committees of professional individuals– Used voluntarily– Used by businesses and individuals– Used for self-improvement |
|--|---|

Source: Lewis Gray, A Comparison of IEEE/EIA 12207, ISO/IEC 12207, J-STD-016 and MIL-STD-498 for Acquirers and Developers

14



How Standards are Developed

- Standards development is:
 - A committee-driven process
 - People from all types of organizations contribute
 - Often, tradeoffs are needed
 - The assumption is that users of the standard will tailor the standard to meet their specific needs.
 - An evolving process
 - As technology and best practices change, so must the standards.



15

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The IEEE Software Engineering Standards Committee (SESC)

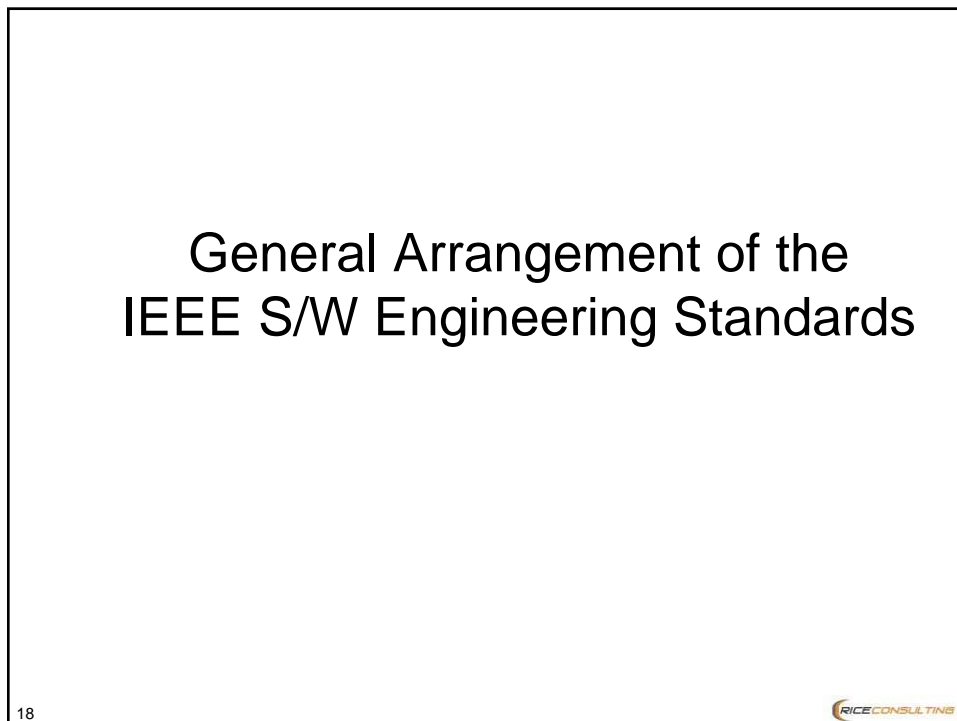
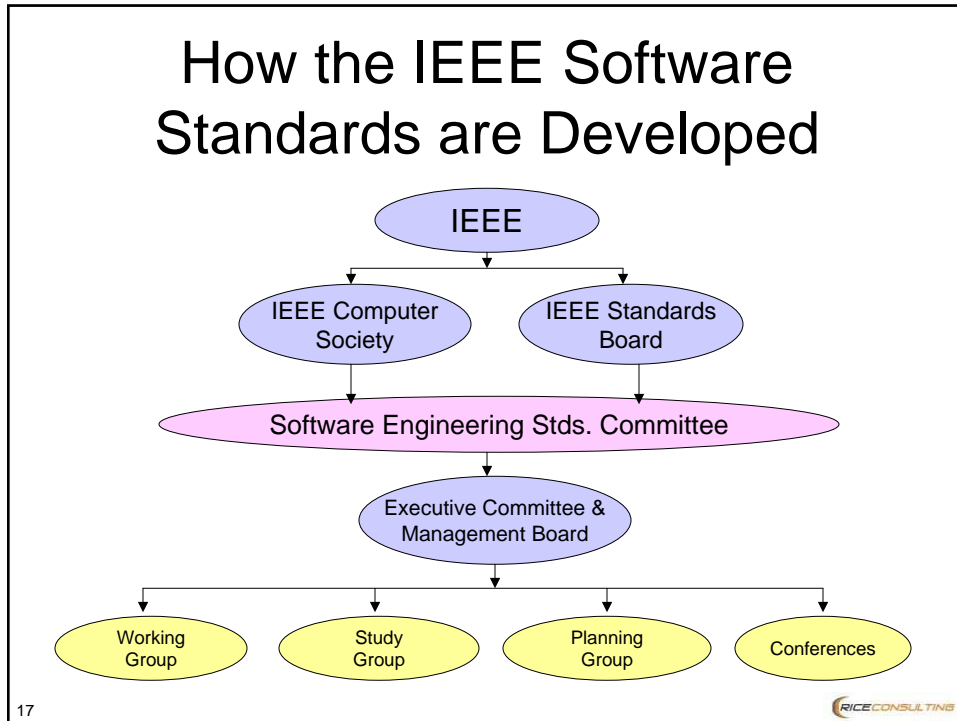
- The vision of the SESC is to be “the leading supplier and promoter of a family of software engineering standards and related products and services.”



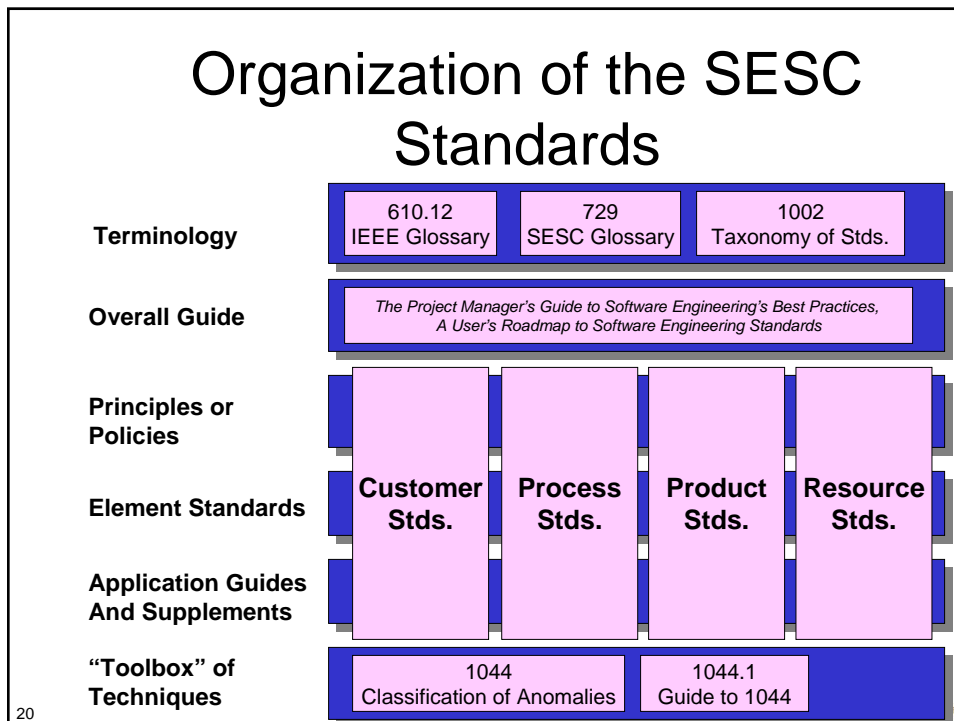
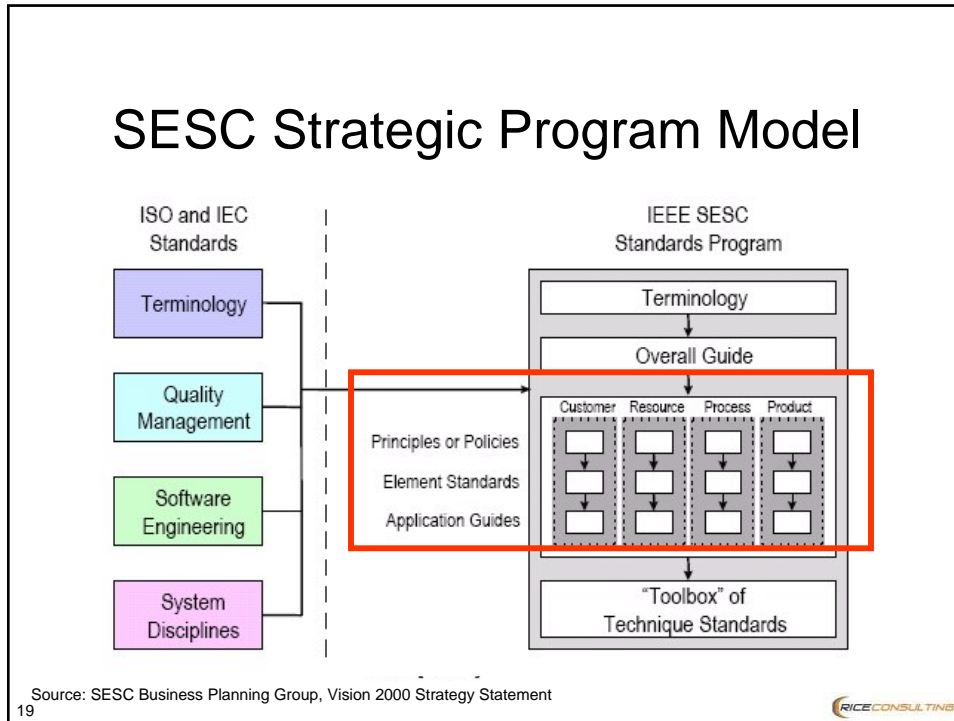
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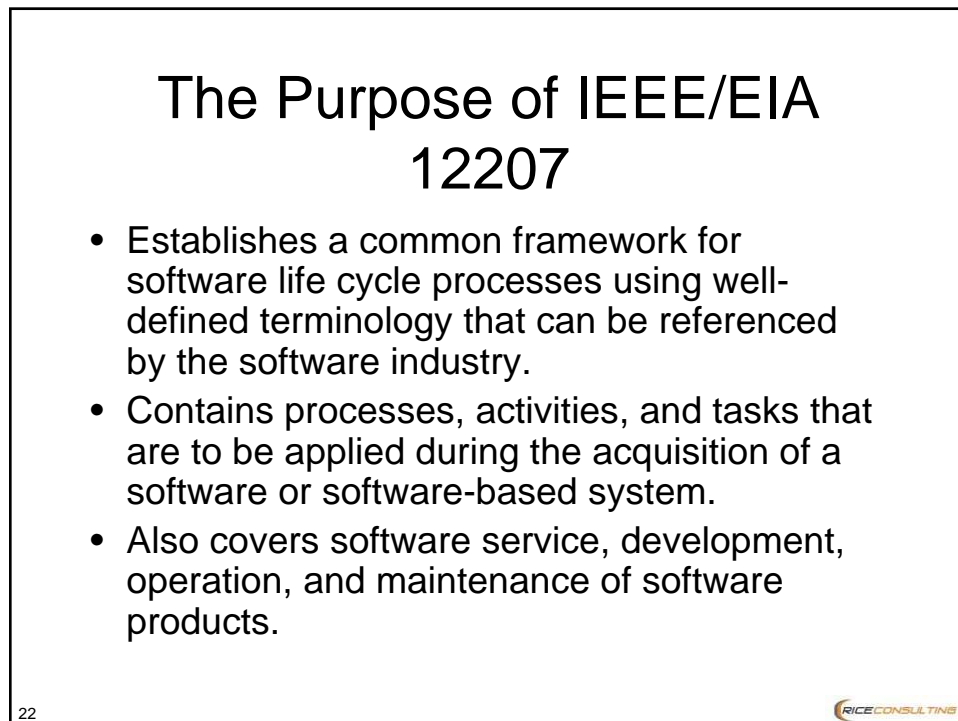
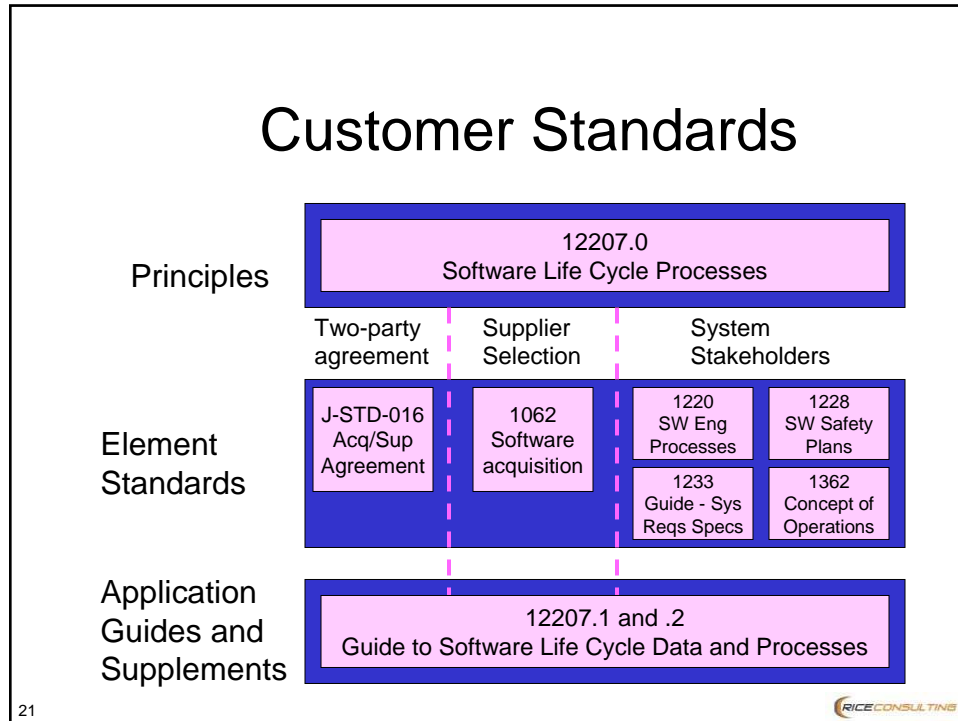
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In Other Words...

IEEE/EIA 12207 provides a process that can be employed for defining, controlling, and improving software life cycle processes.



23

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Resource Standards

Principles

Data storage and exchange Notation Reuse Libraries Tools and environments

Element Standards

1175 Tool inter-connection	P1320.X IDEF	1420.X Data model For reuse lib interoperability	1209 Selection of CASE tools
830 SW reqmts specs	P1471 Architectural description		1348 Adoption of CASE tools
1016 SW design descriptions			
829 SW test documentation			

Application Guides and Supplements

1016.1 Guide to 1016		1430 Guide to 1420.x	
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24

IEEE Standard 830-1998

- This standard is recommended practice for software requirements specifications.
- Specifically, practices are described to:
 - Gather and define requirements.
 - Know what comprises a good requirement.

25



IEEE 830-1998 Goals

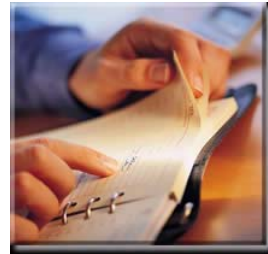
- Help software customers to accurately describe what they wish to obtain;
- Help software suppliers to understand exactly what the customer wants;
- Help individuals to accomplish the following goals:
 - Develop a standard software requirements specification (SRS) outline for their own organizations;
 - Define the format and content of their specific software requirements specifications;
 - Develop additional local supporting items such as an SRS quality checklist, or an SRS writer's handbook.

26



Overview of the Standard

- IEEE 829-1998 describes three major forms of test documentation:
 - Test plans
 - Test specifications
 - Test design specification
 - Test case specification
 - Test procedure specification



27

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Overview of the Standard (2)

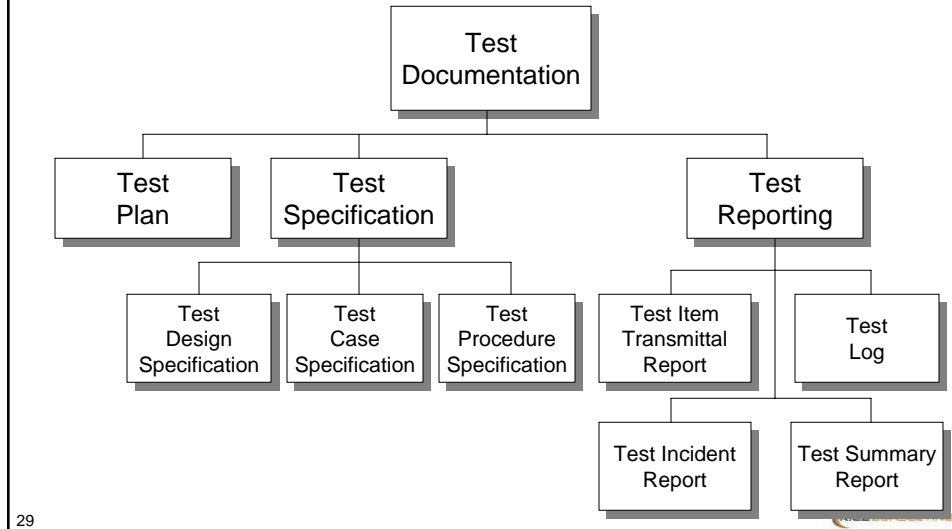
- Test reporting
 - Test item transmittal report
 - Test log
 - Test incident report
 - Test summary report



28

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Test Documentation Structure



Scope of the Standard

- The standard defines the purpose, outline, and content of each basic document.
- The documents have a focus toward dynamic testing, but can also be applied to static testing (reviews, etc.)
- Documents in this standard may be used in any environment and application area.
 - Not restricted by software size or complexity.
 - Not restricted to new development
- Methodologies for testing or test document control are not prescribed.

Scope of the Standard (2)

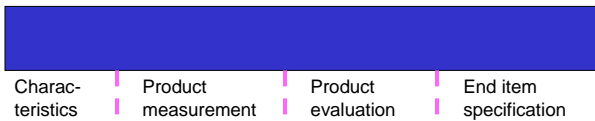
- Each test document can be tailored to apply to:
 - A specific application
 - A certain type of project
 - A phase of testing
- Documents may be in either paper-based or electronic form.

31

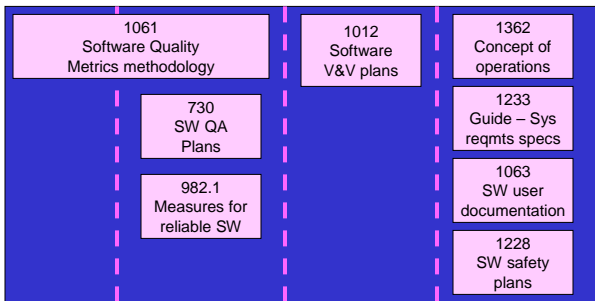


Product Standards

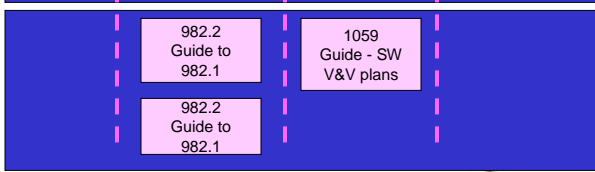
Principles



Element Standards

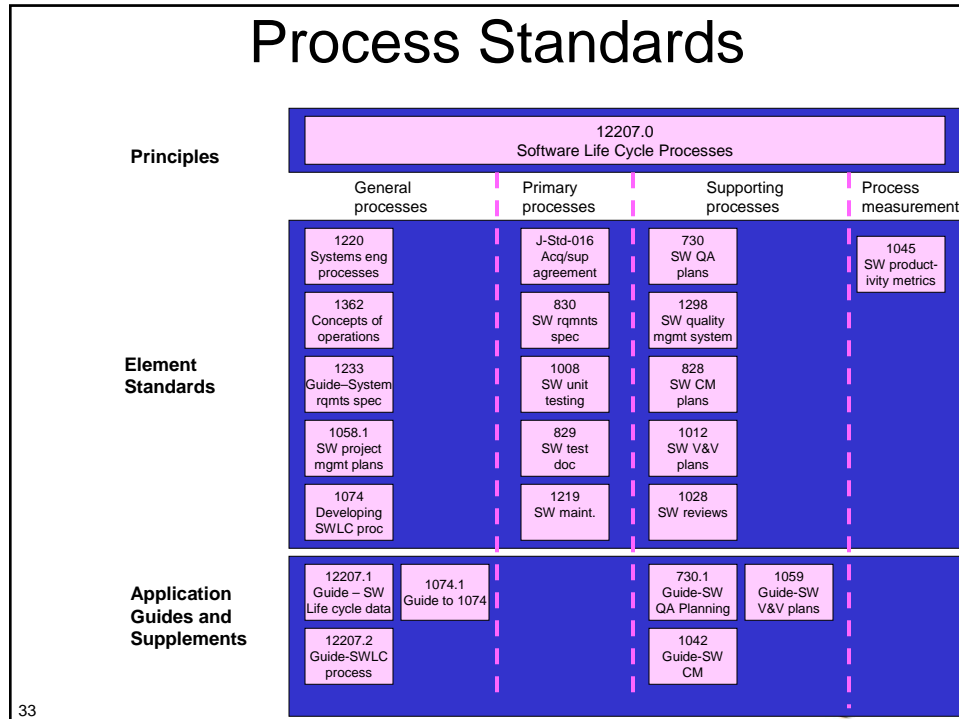


Application Guides and Supplements



32

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Key Concepts Introduced by IEEE 1012-1998 for Software Verification & Validation

- Uses software integrity levels to describe the criticality of the software.
- Defines the minimum V&V tasks for each software integrity level.
- Bases the intensity and rigor applied to V&V on the software integrity level.
- Defines specific criteria for each V&V task.
- Defines compliance with International and IEEE standards.

34



Clauses

- A clause is an identifiable (numbered) statement.
- Example:
 - **5.1.1.9** The acquirer should define and document the acceptance strategy and conditions (criteria).



35

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Normative vs. Informative

- Normative standards are those with which something should comply.
- Informative standards are those which provide helpful information and guidance.
- Most standards contain both normative and informative sections or clauses.

36

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What Is in a Standard?

- Structure
 - Outlines
 - Templates
- Processes
- Examples



37

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What Is Not in a Standard?

- How to tailor and apply the standard to your world:
 - Environments
 - Tools
 - Technology
 - Processes
 - People



38

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Where Standards Can Be Obtained

- Institute of Electrical and Electronics Engineers (IEEE)
- International Standards Organization (ISO)
- National Institute of Standards and Technology (NIST)



39

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Tailoring the Processes

- The process of tailoring means that the standard must be adapted to meet your specific needs.
- “The user of this standard should select, tailor, and assemble those processes and their activities and tasks that are cost-effective for the organization and the project.” IEEE/EIA 12207 pg 18 (Annex E)

40

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Tailoring (2)

- Tailoring is not intended to be a license to modify requirements of the standard.
- Tailoring is intended to:
 - Delete “out of scope” parts of the standard
 - Interpret “contract” provisions in the standard



Source: IEEE/EIA/EIA 12207.2 pg 67 (Annex A)

41

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Tailoring (3)

- Tailoring is intended to be performed in a “constrained and disciplined” manner.
- The approach should be to
 - Select the appropriate parts of the standard
 - Parameterize the standard based on specific requirements



42

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The Tailoring Process (IEEE 12207.0)

1. Identify project environment
2. Solicit input
3. Select processes, activities and tasks
4. Document tailoring decisions and rationale

Not mentioned in this process is that a Software Life Cycle Model (SLCM) must be selected and the standards mapped to the SLCM.

43



How to Tailor and Apply Standards

- Understand your own needs and environment.
- Critically review the standard to see:
 - What is most useful in the standard
 - What can be most realistically implemented in the short term
 - What can be improved by applying the standard



44



How to Tailor and Apply Standards (Cont'd.)

- Study your own organization and environment to learn:
 - Who will be supportive
 - Who will be non-supportive
 - Who will be impacted the most (and least)
- Involve affected people to help tailor the standard as risk and feasibility indicate.



45

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How to Tailor and Apply Standards (Cont'd.)

- Identify items to change in the standard.
- Implement the standard by process directives and training.



46

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What is Compliance?

- The performance of all the processes, activities and tasks selected from this Standard in the Tailoring Process for the software project.
- The performance of a process or activity is complete when all its required tasks are performed in accordance with the pre-established criteria and the requirements specified as applicable.

Source: IEEE/EIA Std. 12207.0 – 1996 Annex F

47



Examples of Compliance

- Organization level
- Project level
- Multi-supplier level
- Regulatory constraints

48



Levels of Compliance

- Tailored
 - The minimum set of required processes, activities and tasks is determined by the tailoring process:
 1. Identifying the project environment
 2. Soliciting inputs
 3. Soliciting processes, activities and tasks
 4. Documenting tailoring decisions and rationale



49

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Levels of Compliance

- Absolute
 - The minimum set of required processes, activities and tasks are all of those specified as mandatory in the text of the standard.
 - Clauses containing “shall” or “will”



50

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Criteria for Compliance

- There are two criteria for determining the extent of compliance:
 - Meeting all requirements in clauses 5, 6 and 7 of IEEE/EIA 12207.0-1996:
 - Clause 5: Primary lifecycle processes
 - Clause 6: Supporting lifecycle processes
 - Clause 7: Management processes



51

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Criteria for Compliance (2)

- Meeting process objectives with alternate methods, which
 - Accomplish the process objectives in Annex G
 - Accomplish the lifecycle objectives in Annex H
 - Must not hamper compliance of any other processes
 - Must be specified by plans, standards or other documents
- The alternative method and the means of compliance shall be specified or cited in the claim of compliance.

52

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Which Standards Are Good to Places to Start

- IEEE 12207 – Standard for Software Life Cycle Processes
- IEEE 829 – Standard for Software Test Documentation
- IEEE 1540 – Standard for Software Risk Management
- IEEE 1058 – Standard for Software Project Plans
- IEEE 830 – Standard for Software Requirement Specifications
- IEEE 1012 – Standard for Verification and Validation

53



Other Resources

- IEEE Web Site
 - www.computer.org
- Software Technology Support Center
 - www.stsc.hill.af.mil
 - A great source of articles (Crosstalk Journal)
- *Software Engineering Standards: A User's Roadmap* by James W. Moore
- *Implementing the IEEE Standards* by Michael Schmidt

54



Introducing the IEEE Standards for Software Quality

Summary

- Standards are your friend!
 - They help you build on other people's success.
 - They help define what is in a process.
 - They give guidance and examples.
 - They save you time.
- You can tailor standards to meet your own needs.
- You must decide how to implement and apply the standards to your own situation and needs.

55



Bio - Randall W. Rice

- Over 28 years experience in building and testing information systems in a variety of industries and technical environments
- ASTQB Certified Tester, Foundation level
- Certified Software Quality Analyst
- Certified Software Tester
- Certified Software Test Manager
- Member of the Board of Directors of the American Software Testing Qualification Board
- Chairperson, 1995 - 2000 QAI's annual software testing conference
- Co-author with William E. Perry, *Surviving the Top Ten Challenges of Software Testing and Testing Dirty Systems*
- Principal Consultant and Trainer, Rice Consulting Services, Inc.



56



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