

IEEE Standard 730 Software Quality Assurance



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Topics

- History of IEEE Software Engineering Standards
- Overview of ISO/IEC 12207
- Key concepts in new standard
- What's new and what's changing?
- Next steps...

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History

- IEEE software engineering standards overseen by IEEE Software and Systems Engineering Standards Committee (S2ESC) formed in 1976
- First software engineering standard published:

?????
- Today there are over 230 active and archived software engineering standards
- S2ESC mandated ALL software engineering standards be revised to reflect systems nature of software and be consistent with ISO/IEC 12207 Software Life Cycle Processes

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Systems Nature of Software

- Software exists in context of some system

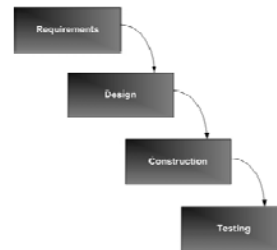
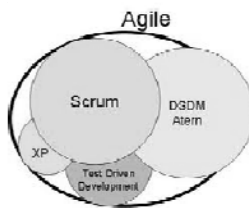


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ISO/IEC 12207-2008

- Establishes common framework for software life cycle processes in a methodology agnostic manner.
- ISO 12207 identifies 43 process areas
 - Each process area: Purpose, Outcomes, Activities and Tasks
- Software Lifecycle Phases:
 - Acquisition
 - Supply
 - Development
 - Operation
 - Maintenance
 - Disposal

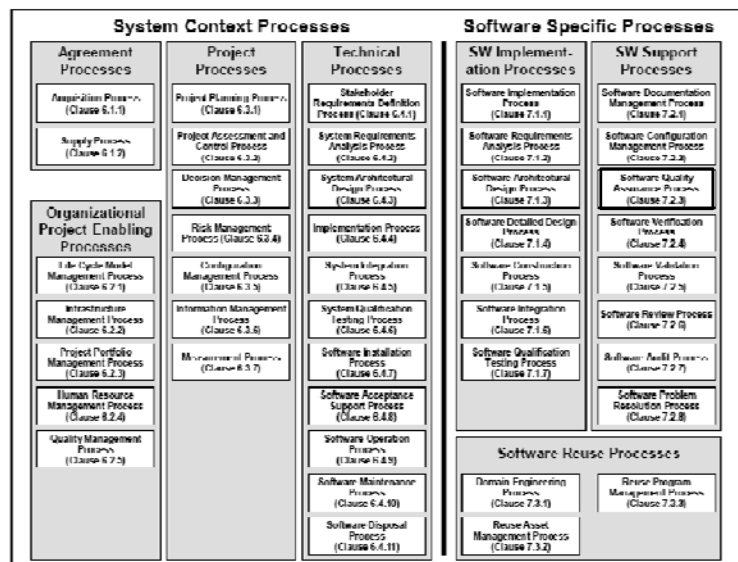


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ISO/IEC 12207-2008

43 Process Areas



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ISO/IEC 12207-2008

7.2.3 Software Quality Assurance Process

Purpose

Software Quality Assurance Process provides assurance that work products and processes comply with predefined provisions and plans.

Outcomes

As a result of successful implementation of SQA Process:

- strategy for conducting quality assurance is developed;
- evidence of software quality assurance is produced and maintained;
- problems and/or non-conformances with requirements are identified and recorded; and
- adherence of products, processes and activities to applicable standards, procedures and requirements is verified.

ISO/IEC 12207-2008

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IEEE 730 Working Group

- IEEE Standards are developed by working groups which are volunteers from industry, academia and government agencies
- IEEE 730 WG formed in March 2009
 - 11 in-person meetings to date
 - many web meetings
 - <http://www.computer.org/portal/web/sqa>
 - FILE LIBRARY to view draft standard and annexes



For a current list of IEEE Software Engr working groups visit:
http://www.computer.org/portal/web/s2esc/work_grp

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What's Changed in Draft Standard?

	IEEE 730-2002	Draft Standard
Scope	This standard applies to development of a software quality assurance plan (SQAP).	This standard establishes requirements for initiating, planning, controlling, and executing Software Quality Assurance activities of a software development or maintenance project.
Purpose	To provide uniform, minimum acceptable requirements for preparation and content of Software Quality Assurance Plans.	To provide uniform, minimum acceptable requirements for Software Quality Assurance activities in support of a software project.

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Key Concepts in draft standard

- **Management Responsibility**
- **SQA = Product Assurance + Process Assurance**
- **Software Product Risk**
 - Software Integrity Levels
 - Assurance Cases
- **Non-conformance**
 - Corrective and Preventive Actions
 - Root Cause Analysis

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Management Responsibility

- **Management support for SQA**
 - Management is familiar with and understands SQA purposes, concepts, practices, and needs.
 - Management shall provide the SQA organization with an appropriate level of skilled resources (people and equipment, knowledge, methods, facilities, tools) as requested by the SQA organization in order to accomplish their project responsibilities.
 - Management shall receive and act upon information provided by SQA organization throughout course of a project.

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Product Assurance

- **An important aspect of software quality assurance is establishment of confidence in quality of software products produced**
 - These products include not only software and related documentation but also plans associated with development, operation, support, maintenance, and retirement of software
 - A product may also be a software service
- **Product assurance activities provides evidence that software services, products and related documentation comply with contract and any non-conformances are identified and addressed.**

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Process Assurance

- **Process Assurance activity makes certain that lifecycle model processes used to develop, install, operate, and maintain software are adequate, efficient and effective.**
- **Process Assurance provides evidence that the processes that create software products comply with the contract and any non-conformances are identified and recorded.**

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Software Product Risk

- **A fundamental principle of this standard is making sure that SQA Plan is commensurate with inherent product risk.**
- **Product risks may include safety, security, and liability, and other defined risks.**
- **Two techniques for addressing product risks are software integrity levels and assurance cases.**

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Software Integrity Levels

- A software integrity level scheme is a set of discrete values used to define level of rigor (applied by Software Development and SQA) to be applied to portions of system – often from lowest to highest – as determined by some critical project attribute, such as consequences associated with system failures.



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Software Integrity Level Schemes

- Example of Four Level Integrity Scheme

Integrity Level	Description
4	<p>An error in a function or system feature that causes:</p> <ul style="list-style-type: none"> • catastrophic consequences to the system with reasonable, probable, or occasional likelihood of occurrence of an operating state that contributes to the error; or • critical consequences with reasonable or probable likelihood of occurrence of an operating state that contributes to the error.
3	<p>An error in a function or system feature that causes:</p> <ul style="list-style-type: none"> • catastrophic consequences with occasional or infrequent likelihood of occurrence of an operating state that contributes to the error; or • critical consequences with probable or occasional likelihood of occurrence of an operating state that contributes to the error; or • marginal consequences with reasonable or probable likelihood of occurrence of an operating state that contributes to the error.

IEEE 1012 Draft Version 1.4 Nov 2011

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Software Integrity Level Schemes

• Example of Four Level Integrity Scheme (cont'd.)

Integrity Level	Description
2	<p>An error in a function or system feature that causes:</p> <ul style="list-style-type: none"> critical consequences with infrequent likelihood of occurrence of an operating state that contributes to the error; or marginal consequences with probable or occasional likelihood of occurrence of an operating state that contributes to the error; or negligible consequences with reasonable or probable likelihood of occurrence of an operating state that contributes to the error.
1	<p>An error in a function or system feature that causes:</p> <ul style="list-style-type: none"> critical consequences with infrequent likelihood of occurrence of an operating state that contributes to the error; or marginal, sequences with probable, occasional or infrequent occurrence of an operating state that contributes to the error; or negligible consequences with probable, occasional, or infrequent likelihood of occurrence of an operating state that contributes to the error.

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Assurance Cases

- A documented body of evidence that provides a convincing and valid level of confidence that a specified set of critical claims about a software system's properties are adequately justified for a given application in a given context.
- Presents a claim that is supported by arguments and evidence that a software system is acceptably safe, secure, reliable, in a given context.



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Assurance Cases

Assurance Case Part	Explanation
Claim	A claim made about some aspect of a software system
Arguments	Specific arguments supporting the claim: <ul style="list-style-type: none"> • Argument #1 • Argument #2 • ... • Argument #n
Evidence	Factual evidence (including reviews, records, and test results) that support each of the arguments. <ul style="list-style-type: none"> • Evidence #1 • Evidence #2 • ... • Evidence #n

Additional details on assurance cases can be found in ISO/IEC Standard 15026 Systems and software engineering — Systems and software assurance

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Non-conformance

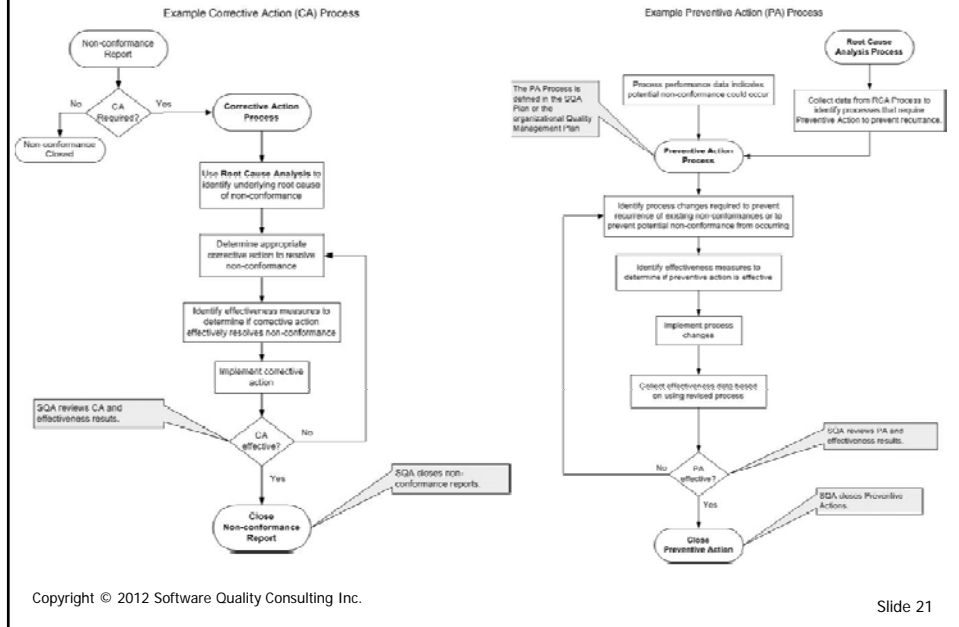
- A non-conformance is a general term used to indicate that actual results do not match expected results...
- Typically raised by SQA as a result of performing an activity defined in SQA Plan
 - Product Assessments such as reviews and inspections and testing
 - Process Assessments such as audits
- Corrective and Preventive Actions
- Root Cause Analysis



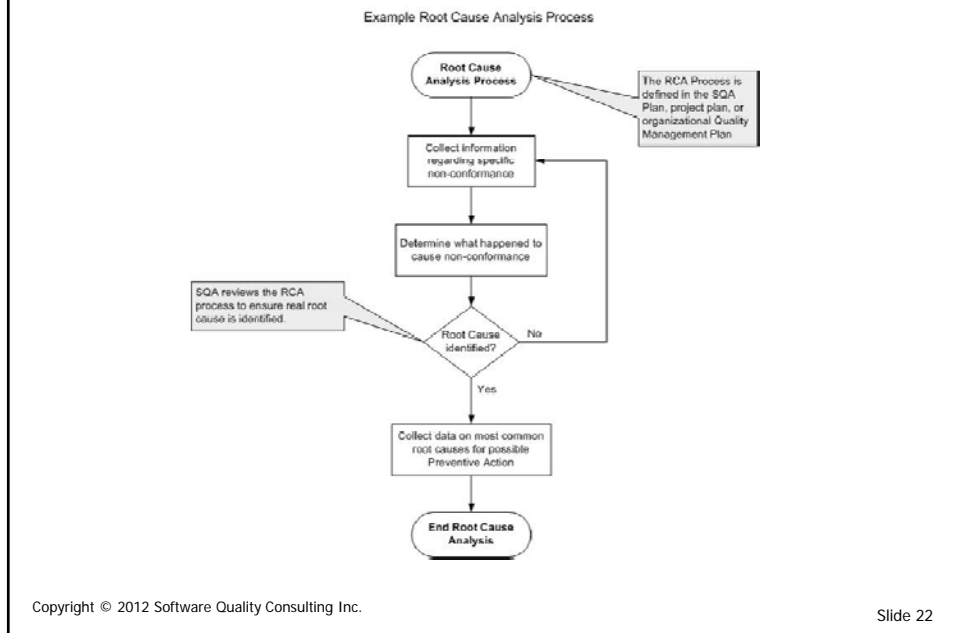
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Corrective and Preventive Action



Root Cause Analysis



Main Body of Draft Standard

5.4.1 Process Implementation Activities

- 5.4.1.1 Establish the SQA Processes
- 5.4.1.2 Coordinate with related software processes
- 5.4.1.3 Plan SQA activities
- 5.4.1.4 Execute SQA Plan
- 5.4.1.5 Manage SQA records
- 5.4.1.6 Evaluate organizational objectivity
- 5.4.1.7 Harmonize quality systems and standards

5.4.2 Product Assurance Activities

- 5.4.2.1 Definition of Product Assurance
- 5.4.2.2 Evaluate plans for conformance
- 5.4.2.3 Evaluate product for conformance
- 5.4.2.4 Evaluate product for acceptability

5.4.3 Process Assurance Activities

- 5.4.3.1 Definition of Process Assurance
- 5.4.3.2 Evaluate lifecycle processes for conformance
- 5.4.3.3 Evaluate environments for conformance
- 5.4.3.4 Evaluate subcontractor processes for conformance
- 5.4.3.5 Evaluate product lifecycle support for conformance
- 5.4.3.6 Measure products and processes
- 5.4.3.7 Assess staff skill and knowledge

- Purpose
- Outcomes
- Tasks

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SQA Plan Outline

IEEE 730-2002	Draft Standard
1) Purpose 2) Reference documents 3) Management 4) Documentation 5) Standards, practices, conventions, and metrics 6) Software reviews 7) Test 8) Problem reporting and corrective action 9) Tools, techniques, and methodologies 10) Media control 11) Supplier control 12) Records collection, maintenance, and retention 13) Training 14) Risk management 15) Glossary 16) SQAP change procedure and history	1 Purpose and scope 2 Definitions and acronyms 3 Reference documents 4 SQA Plan Overview <ul style="list-style-type: none"> 4.1 Organization and independence 4.2 Software Product Risk 4.3 Tools 4.4 Standards, practices, and conventions 4.5 Effort, resources, and schedule 5 Tasks, activities, and outcomes <ul style="list-style-type: none"> 5.1 Product Assurance 5.2 Process Assurance 6 Additional processes <ul style="list-style-type: none"> 6.1 Contract Review 6.2 Quality Measurement 6.3 Waivers and Deviations 6.4 Task Repetition 6.5 Risks to performing SQA 6.6 Communications strategy 7 SQA Records <ul style="list-style-type: none"> 7.1 Analyze, identify, collect, file, maintain, dispose 7.2 Availability of records

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SQA Plan Outline

5.1 Product Assurance

- 5.1.1 Evaluate plans for conformance
- 5.1.2 Evaluate product for conformance
- 5.1.3 Evaluate product for acceptability

5.2 Process Assurance

- 5.2.1 Evaluate lifecycle processes for conformance
- 5.2.2 Evaluate environments for conformance
- 5.2.3 Evaluate subcontractor processes for conformance
- 5.2.4 Evaluate product lifecycle support for conformance
- 5.2.5 Measure products and processes
- 5.2.6 Assess staff skill and knowledge

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Annexes Proposed for Draft Standard

- **Guidance in Preparing SQA Plans**
- **Comparison of Old/New SQA Plan Outlines**
- **SQA in Agile Development Environments**
- **SQA in Very Small Entities**
- **Product Risk - Software Integrity Levels and Assurance Cases**
- **Corrective / Preventive Action and RCA**

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Supporting Materials

- CMMI-DEV PPQA mapping to IEEE 730 Tasks
- SQA support for SPICE ISO 15504
- Cross-references to BOKs:
 - CSQE Body of Knowledge
 - PMBOK
 - SWEBOK v IEEE 730
 - QAI CSQA CBOK
- Industry-specific Guidance:
 - Medical Device Industry
 - Nuclear Power Industry
 - Telecom Industry
 - Pharmaceutical Industry
- Software Tool Validation

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Next Steps...

- **Balloting Process**
 - <http://standards.ieee.org/develop/balloting.html>
 - Balloting begins when **S2ESC** decides the draft of the full standard is stable.
 - **S2ESC** forms a balloting group containing persons interested in the standard.
 - While anyone can contribute comments, only votes that count toward approval are those of eligible members of balloting group.
 - IEEE-SA membership is required to vote on a ballot on a standard (ballot or vote on a standard outside of working group).
- **IEEE Std 730 should be balloted this year!**

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