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...
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

Copyright © 2012 Software Quality Consulting Inc.

Systems Nature of Software

- Software exists in context of some system

Copyright © 2012 Software Quality Consulting Inc.
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
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.

---

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](http://www.computer.org/portal/web/sqa)
    - [FILE LIBRARY](http://www.computer.org/portal/web/sqa) 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](http://www.computer.org/portal/web/s2esc/work_grp)
What’s Changed in Draft Standard?

<table>
<thead>
<tr>
<th>IEEE 730-2002</th>
<th>Draft Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>This standard applies to development of a software quality assurance plan (SQAP).</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>To provide uniform, minimum acceptable requirements for preparation and content of Software Quality Assurance Plans.</td>
</tr>
</tbody>
</table>

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
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.

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.
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.

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.
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.

<table>
<thead>
<tr>
<th>Integrity Level</th>
<th>Description</th>
</tr>
</thead>
</table>
| **4** | An error in a function or system feature that causes:  
  - 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** | An error in a function or system feature that causes:  
  - 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. |
### Software Integrity Level Schemes

**Example of Four Level Integrity Scheme (cont’d.)**

<table>
<thead>
<tr>
<th>Integrity Level</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2               | An error in a function or system feature that causes:  
|                 | • 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               | An error in a function or system feature that causes:  
|                 | • 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. |

IEEE 1012 Draft Version 1.4 Nov 2011

---

### 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.**
### Assurance Cases

<table>
<thead>
<tr>
<th>Assurance Case Part</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claim</td>
<td>A claim made about some aspect of a software system</td>
</tr>
<tr>
<td>Arguments</td>
<td>Specific arguments supporting the claim:</td>
</tr>
<tr>
<td></td>
<td>• Argument #1</td>
</tr>
<tr>
<td></td>
<td>• Argument #2</td>
</tr>
<tr>
<td></td>
<td>• ...</td>
</tr>
<tr>
<td></td>
<td>• Argument #n</td>
</tr>
<tr>
<td>Evidence</td>
<td>Factual evidence (including reviews, records, and test results) that support each of the arguments.</td>
</tr>
<tr>
<td></td>
<td>• Evidence #1</td>
</tr>
<tr>
<td></td>
<td>• Evidence #2</td>
</tr>
<tr>
<td></td>
<td>• ...</td>
</tr>
<tr>
<td></td>
<td>• Evidence #n</td>
</tr>
</tbody>
</table>

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

---

### 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
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

SQA Plan Outline

<table>
<thead>
<tr>
<th>IEEE 730-2002</th>
<th>Draft Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Purpose</td>
<td>1) Purpose and scope</td>
</tr>
<tr>
<td>2) Reference documents</td>
<td>2) Definitions and acronyms</td>
</tr>
<tr>
<td>3) Management</td>
<td>3) Reference documents</td>
</tr>
<tr>
<td>4) Documentation</td>
<td>4) SQA Plan Overview</td>
</tr>
<tr>
<td>5) Standards, practices, conventions, and metrics</td>
<td>4.1 Organization and independence</td>
</tr>
<tr>
<td>6) Software reviews</td>
<td>4.2 Software Product Risk</td>
</tr>
<tr>
<td>7) Test</td>
<td>4.3 Tools</td>
</tr>
<tr>
<td>8) Problem reporting and corrective action</td>
<td>4.4 Standards, practices, and conventions</td>
</tr>
<tr>
<td>9) Tools, techniques, and methodologies</td>
<td>4.5 Effort, resources, and schedule</td>
</tr>
<tr>
<td>10) Media control</td>
<td>5) Tasks, activities, and outcomes</td>
</tr>
<tr>
<td>11) Supplier control</td>
<td>5.1 Product Assurance</td>
</tr>
<tr>
<td>12) Records collection, maintenance, and retention</td>
<td>5.2 Process Assurance</td>
</tr>
<tr>
<td>13) Training</td>
<td>6) Additional processes</td>
</tr>
<tr>
<td>14) Risk management</td>
<td>6.1 Contract Review</td>
</tr>
<tr>
<td>15) Glossary</td>
<td>6.2 Quality Measurement</td>
</tr>
<tr>
<td>16) SQAP change procedure and history</td>
<td>6.3 Waivers and Deviations</td>
</tr>
<tr>
<td></td>
<td>6.4 Task Repetition</td>
</tr>
<tr>
<td></td>
<td>6.5 Risks to performing SQA</td>
</tr>
<tr>
<td></td>
<td>6.6 Communications strategy</td>
</tr>
<tr>
<td></td>
<td>7 QSA Records</td>
</tr>
<tr>
<td></td>
<td>7.1 Analyze, identify, collect, file, maintain, dispose</td>
</tr>
<tr>
<td></td>
<td>7.2 Availability of records</td>
</tr>
</tbody>
</table>

Copyright © 2012 Software Quality Consulting Inc.
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

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
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

Next Steps...

- **Balloting Process**
  - [http://standards.ieee.org/develop/balloting.html](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!**
Thank you...

• If you have questions, please call or e-mail...

• Subscribe to my e-newsletter... Food for Thought™

• For a free subscription and to view past newsletters, visit www.swqual.com

Copyright © 2012 Software Quality Consulting Inc.