

ICS 3207/MIT 3105 SOFTWARE/IT PROJECT MANAGEMENT

Chapter 5 Software Quality Management

Chapter Objectives

- Describe quality management and key quality management activities.
- Explain the roles of standards in quality management.
- Describe the concept of a software metric, predictor metrics and control metrics.
- Explain how measurement may be used in assessing software quality.

What is Software Quality Assurance (SQA)?

1. Conformance to explicitly stated functional and performance requirements, explicitly documented development standards, and implicit characteristics that are expected of all professionally developed software.

What is Software Quality Assurance (SQA)?

- A planned and systematic approach to the evaluation of the quality of and adherence to software product standards, processes and procedures.

SQA

- It includes:
 - Assuring that standards and procedures are established and are followed throughout the software acquisition life cycle.
 - Compliance with agreed-upon standards and procedures is evaluated through process monitoring, product evaluation and audits.

Emphasis of the definitions

1. Software requirements are the foundation from which quality is measured. Lack of conformance to requirements is lack of quality.

Emphasis of the definitions

2. Specified standards define a set of development criteria that guide the manner in which software is engineered. If the criteria is not followed, lack of quality results.

Emphasis of the definitions

3. There is a set of implicit requirements that often goes unmentioned e.g the desire for good maintainability. If software conforms to its implicit requirements, software quality is suspect.

Software Quality Management

- Concerned with ensuring that the required level of quality is achieved in a software product.
- Involves defining appropriate quality standards and procedures and ensuring that these are followed.

Software Quality Management

- Quality management is therefore not just concerned with reducing defects but also with other product qualities.

What is Quality?

- Simplistically -A product should meet its specification.

What is Quality?

- This definition is problematic for software systems since:
 - Tension between customer quality requirements (efficiency, reliability) and developer quality requirements (maintainability, reusability)
 - Some quality requirements are difficult to specify in an unambiguous way.
 - Software specification are usually incomplete and often inconsistent.

The quality Compromise

- Software developers cannot wait for specifications to improve before paying attention to quality management.
- Procedures must be put into place to improve quality in spite of imperfect specification.

Quality Compromise

- Quality management is therefore not just concerned with reducing defects but also with other product qualities.

Quality management Activities

- Quality Assurance
- Quality planning
- Quality Control

Quality Assurance

- Establish organizational procedures and standards for quality.

Quality Planning

- Select applicable procedures and standards for a particular project and modify these as required.

Quality Control

- Ensure that procedures and standards are followed by the software development team.
- Note:
 - Quality management should be separate from project management to ensure independence.

Standards

- Definition:

— *Established criteria* to which the software products are compared.

Standards Organizations

- **Software Engineering Institute:** Develops standards that help improve software development processes.
- **International Standards Organisation (ISO):** concerned with quality systems that are assessed by outside auditors.

Standards Organizations

- Institute of Electrical and Electronics Engineers (IEEE): standards for devices.
- American National Standards Institute (ANSI).

ISO 9000

- International set of standards for quality management.
- Applicable to a range of organisations from manufacturing to service industry.

ISO 9000

- ISO 9001 applicable to organisations which **design**, **develop** and **maintain** products.
- ISO 9001 is a **generic model** of the quality process and must be **instantiated** for each organisation.

Quality Assurance and Standards

- Standards are the **key** to effective quality management.
- They may be **international**, **national**, **organizational** or **project** standards.

Quality Assurance and Standards

- **Product standards** define characteristics that all components should exhibit e.g common programming style.
- **Process standards** define how the software process should be enacted.

Importance of Standards

- Encapsulation of **best practice**: this helps in avoiding repetition and mistakes.
- **Framework** for quality assurance process: it involves checking standard compliance.
- **Provide continuity**: New staff can understand the organisation by understanding the standards applied.

Problems with standards

- Not seen as relevant and up-to-date by software engineers.
- Involve too much bureaucratic form filling.
- Unsupported by software tools, so tedious manual work is involved to maintain standards.

Standards Development

- Involve practitioners in development.
 - They should understand the rationale underlying a standard.
- Review standards and their usage regularly.
 - Standards can quickly become outdated and this reduces their credibility amongst practitioners.

Standards Development

- Detailed standards should have associated tool support.
 - Excessive clerical work is the most significant complaint against standards.

Documentation standards

- Particularly important – documents are the **tangible manifestation** of the software.
- Documentation process:
 - Are concerned with how documents should be developed, validated and maintained.

Documentation Standards

- Document standards:
 - are concerned with document contents, structure, and appearance.
- Document interchange standards
 - are concerned with how documents are stored and interchanged between different documentation

Document standards

- Document identification standards
 - How documents are uniquely identified.
- Document structure standards
 - Standard structure for project documents.

Document Standards

- Document presentation standards
 - Define fonts and styles, use of logos
- Document update standards
 - Define how changes from previous versions are reflected in a document.

Document Interchange Standards

- Documents are produced using different systems and on different computers.
- Interchange standards allow electronic documents to be exchanged.

Document Interchange Standards

- Need for archiving.
 - The lifetime of word processing systems may be much less than the lifetime of the software being documented.
- XML is an emerging standard for document interchange.

Process and Product Quality

- The quality of a developed product is influenced by the quality of the production process.
- Particularly important in software development as some product quality attributes are hard to assess.

Process and Product Quality

- However, there is a very complex and poorly understood relationship between software processes and product quality.

Process-based quality

- There is a straight-forward link between process and product in manufactured goods.

Process-based quality

- It is more complex for software because:
 - The application of individual **skills** and **experience** is particularly important in software development.
 - External factors such as the **novelty** of an application or the **need for an accelerated development** schedule may **impair** product quality.

Process-based quality

- Care must be taken not to impose inappropriate process standards.

Practical process quality

- Define process standards such as how reviews should be conducted, configuration management, etc.
- Monitor the development process to ensure that standards are being followed.

Practical Process Quality

- **Report** on the process to project management and software procurement.

Quality Planning

- A quality plan sets out the desired product qualities and how these are assessed and define the most significant quality attributes.

Quality Planning

- It should:
 - Define the quality assessment process.
 - Set out which organizational standards should be applied and if necessary, define new standards.

Structure of a Quality Plan

- Product introduction.
- Product plans.
- Process descriptions.
- Quality goals.
- Risk and risk management.
- Quality plans should be short, succinct documents.

Quality Control

- Checking the software development process to ensure that procedures and standards are being followed.
- Two approaches to quality control are:
 - Quality reviews.
 - Automated software assessment and software measurement.

Quality Reviews

- The principal method of validating the quality of a process or of a product.
- A group examines part or all of a process or system and its documentation to find potential problems.

Quality Reviews

- There are 3 different types of reviews with different Objectives:
 - **Inspections** for defect removal(product).
 - Reviews for **progress assessment** (product and process).
 - **Quality reviews** (product and standards).

Quality Reviews

- A group of people carefully examine part or all of a software system and its associated documentation.
- Code, designs, specifications, test plans, standards can all be reviewed.

Quality Reviews

- Software or documents may be ‘signed off’ at a review which signifies that progress to the next development stage has been approved by management.

The review process

- Select a review team.
- Arrange place and date.
- Distribute documents.
- Hold review.
- Complete review forms.

Review Functions

- Quality function:
 - They are part of the general quality management process.
- Project management function:
 - They provide information for project managers.
- Training and communication function:
 - Product knowledge is passed between development team members.

Quality Reviews

- Objective is the discovery of system defects and inconsistencies.
- Any document produced in the process may be reviewed.
- Review teams should be relatively small and reviews should be fairly short.
- Review should be recorded and records maintained.

Review Results

- No action:
 - No change to the software or documentation is required.
- Refer for repair:
 - Designer or programmer should correct an identified fault.
- Reconsider overall design:
 - The problem identified in the review impacts other parts of the design. Some overall judgment must be made about the most cost-effective way of solving the problem.

Software Measurements and Metrics

- Software measurement is concerned with deriving a numeric value for an attribute of a software product or process.
- This allows for objective comparisons between techniques and processes.
- There are a few standards in this area.

Software Metric

- Definition:
 - Any **type of measurement** which relates to a software system, process or related documentation.
- Allows the software and the software process or product to be **quantified**.

Software Metric

- Measures of the software or product may be used to **predict** product attributes(predictor metrics) or to **control** the software process (control metrics).

Metrics Assumptions

- Any software property can be measured.
- The relationship exists between what we can measure and what we want to know.
- This relationship has been formalized and validated.
- It may be difficult to relate what can be measured to desirable quality attributes.

The Measurement Process

- A software measurement process may be **part of a quality control process**.
- Data collected during this process should be carried as an organizational resource.
- Once a measurement database has been established, comparisons across projects become possible.

Data collection

- A metrics programme should be based on a set of product and process data.
- Data should be collected immediately and if possible, automatically.
- Three types of automatic data collection:
 - Static product analysis, Dynamic product analysis and Process data collection.

Measurement Surprises

- Reducing the number of faults in a program leads to an increased number of help desk calls:?
 - The program is now thought of as more reliable and so has a wider more diverse market. The percentage of users who call the help desk may have decreased but the total may increase.

Measurement Surprises

- A more reliable system is used in a different way from a system where users work around the faults. This leads to more help desk calls.

The End