Software Quality Assurance

Module 3

Software Quality Assurance

Objectives

- Identify software quality assurance
- Describe software quality control
- Introduce total software quality management

Module 3 - Content Outline (Agenda)

- ➔Software quality assurance
  - Definitions of SQA
  - Objectives of SQA activities
  - SQA system component classes
  - Main considerations affecting the use of the SQA components
- Software quality control
- Total software quality management

Definitions of SQA

- The IEEE definition
  - Software quality assurance (SQA) is:
    - 1. A planned and systematic pattern of all actions necessary to provide adequate confidence that an item or product conforms to established technical requirements.
    - 2. A set of activities designed to evaluate the process by which the products are developed or manufactured. Contrast with quality control.

Definitions of SQA

- Expanded definition
  - Software quality assurance (SQA) is:
    - A systematic, planned set of actions necessary to provide adequate confidence that the software development process or the maintenance process of a software system product conforms to established functional and technical requirements as well as with the managerial requirements of keeping the schedule and operating within the budgetary confines.

Objectives of SQA activities

- Software development (process-oriented):
  - 1. Assuring an acceptable level of confidence that the software will conform to functional and technical requirements.
  - 2. Assuring an acceptable level of confidence that the software will conform to managerial scheduling and budgetary requirements.
  - 3. Initiating and managing of activities for the improvement and greater efficiency of software development and SQA activities. This means improving the prospects that the functional and managerial requirements will be achieved while reducing the costs of carrying out the software development and SQA activities.

Objectives of SQA activities (cont.)

- Software maintenance (product-oriented):
  - 1. Assuring with an acceptable level of confidence that the software maintenance activities will conform to the functional technical requirements.
  - 2. Assuring with an acceptable level of confidence that the software maintenance activities will conform to managerial scheduling and budgetary requirements.
  - 3. Initiating and managing activities to improve and increase the efficiency of software maintenance and SQA activities. This involves improving the prospects of achieving functional and managerial requirements while reducing costs.

SQA system component classes

1. Pre-project quality components
2. Project life cycle quality components
3. Infrastructure error preventive and improvement components
4. Software quality management components
5. Standardization, certification and SQA assessment components
6. Organizing for SQA – the human components

1. Pre-project components

- Contract review
  - Clarification of the customer's requirements
  - Review of the project's schedule and resource requirement estimates
  - Evaluation of the professional staff's capacity to carry out the proposed project
  - Evaluation of the customer's capacity to fulfill his obligations
  - Evaluation of development risks

Pre-project components

- Development and quality plans
  - Main issues in development plan:
    - Schedules
    - Required manpower and hardware resources
    - Risk evaluations
    - Organizational issues: team members, subcontractors and partnerships
    - Project methodology, development tools, etc.
    - Software reuse plans
  - Main issues treated in the project's quality plan:
    - Quality goals, expressed in the appropriate measurable terms
    - Criteria for starting and ending each project stage
    - Lists of reviews, tests, and other scheduled verification and validation activities

2. Software project life cycle components

- Reviews
- Expert opinions
- Software testing
- Software maintenance
- Assurance of the quality of the subcontractors' work and the customer-supplied parts.

3. Infrastructure components for error prevention and improvement

- Procedures and work instructions
- Templates and checklists
- Staff training, retraining, and certification
- Preventive and corrective actions
- Configuration management
- Documentation control

4. Management SQA components

- Project progress control (including maintenance contract control)
- Software quality metrics
- Software quality costs

5. SQA standards, system certification, and assessment components

- Main objectives:
  - (1)Utilization of international professional knowledge.
  - (2) Improvement of coordination with other organizations' quality systems.
  - (3) Objective professional evaluation and measurement of the achievements of the organization's quality systems

5. SQA standards, system certification, and assessment components

- Quality management standards:
  - SEI CMM assessment standard
  - ISO 9001 and ISO 9000-3 standards
- Project process standards:
  - IEEE 1012 standard
  - ISO/IEC 12207 standard

6. Organizing for SQA – the human components

- Main objectives:
  - To develop and support implementation of SQA components.
  - To detect deviations from SQA procedures and methodology.
  - To suggest improvements to SQA components.

The main considerations affecting the use of the SQA components

- Organizational considerations
  - Type of software development clientele
  - Type of software maintenance clientele
  - Range of software products
  - Size of the organization
  - Degree and nature of cooperation with other organizations carrying out related projects
  - Optimization objectives

The main considerations affecting the use of the SQA components

- Project and maintenance service considerations
  - Level of complexity and difficulty
  - Degrees of experience with the project technology
  - Extent of software reuse in the new projects
- Professional staff considerations
  - Professional qualifications
  - Level of acquaintance with team members

Module 3 - Content Outline (Agenda)

- Software quality assurance
- ➔Software quality control
- Total software quality management

Definition of software quality control

- **Software Quality Control** (SQC) is the set of procedures used by organizations to ensure that a software product will meet its quality goals at the best value to the customer, and to continually improve the organization's ability to produce software products in the future.
- Software quality control refers to specified functional requirements as well as non-functional requirements such as supportability, performance and usability.
- It also refers to the ability for software to perform well in unforeseeable scenarios and to keep a relatively low defect rate.

Quality Control Activities

- Check that assumptions and criteria for the selection of data and the different factors related to data are documented
- Check for transcription errors in data input and reference
- Check the integrity of database files
- Check for consistency in data
- Check that the movement of inventory data among processing steps is correct
- Check for uncertainties in data, database files etc.
- Undertake review of internal documentation
- Check methodological and data changes resulting in recalculations
- Undertake completeness checks
- Compare Results to previous Results

Software Quality Control Methods

- Rome laboratory Software framework
- Goal Question Metric Paradigm
- Risk Management Model
- The Plan-Do-Check-Action Model of Quality Control
- Total Software Quality Control
- Spiral Model Of Software Developments

SQA vs. SQC

- (1) Quality control and quality assurance activities serve different objectives.
  - The main objective of QC is the withholding of any productthat does not qualify.
  - The main objective of quality assurance is to minimize the cost of guaranteeing quality by a variety of activities performed throughout the development and manufacturing processes/stages.
- (2) Quality control activities are only a part of the total range of quality assurance activities.

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Quality management

- **Quality management** ensures that an organization, product or service is consistent.
- It has **four** main components: quality planning, quality control, quality assurance and quality improvement.
- Quality management is focused not only on product and service quality, but also on the means to achieve it.
- Quality management, therefore, uses quality assurance and control of processes as well as products to achieve more consistent quality.

Total quality management

- Total quality management (TQM) is derived from a Japanese-style of management where quality assurance was implemented at all levels of the company to improve customer satisfaction.
- TQM describes a management approach to long–term success through customer satisfaction. In a TQM effort, all members of an organization participate in improving processes, products, services, and the culture in which they work.
- The Principles are management of product quality with customer quality via process improvement and monitoring.

Total quality management

- Key elements:
  - A Customer Focus to achieve total customer satisfaction
  - Process improvement on business and product processes
  - The Human Element to quality, to advocate a company wide quality culture
  - Measurement and analysis of quality metrics to achieve the goal of improved quality
  - There is also a need for Executive leadership in the corporation

Total quality management

- Six fundamental steps of the quality improvement paradigm:
  - Characterize the project audits environment
  - Set the goals
  - Choose the appropriate process
  - Execute the process
  - Analyze the data
  - Package the experience for reuse

Module 3 - Review

- What is Software Quality Assurance?
- What is the objectives of SQA?
- What are the SQA system component classes?
- What are the differences of SQA and SQC?
- What is TQM?