

Software Quality Engineering

Course Code: CSC4133

Course Title: Software Quality and Testing



Dept. of Computer Science
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Lecture Outline



- SQE: Software Quality Engineering
- Key SQE Activities
 - Quality planning
 - Executing planned QA activities & handling discovered defects
 - Quality Measurement, Assessment & Improvement
- SQE in Software Process

Objectives and Outcomes



- **Objectives:** To understand the key activities in Software Quality Engineering (SQE) process.
- **Outcomes:** Students are expected to be able to explain the quality planning; be able to explain how to execute the planned QA and activities and handle the discovered defect; be able to explain the need for quality assessment and improvement.

SQE : Activities & Process



- Different customers & users have different quality expectations under different market environments. Therefore, we need to move beyond just performing QA activities toward quality engineering by managing these quality expectations as an engineering problem.
- **Our goal** ==> To meet or exceed these quality expectations through the selected & execution of appropriate QA activities while minimizing the cost and other project risks under the project constraints.

SQE : Activities & Process



- In order to ensure that these quality goals are met through the selected QA activities, various measurements need to be taken parallel to QA activities themselves. Post-mortem data often need to be collected as well. Both in-process & post-mortem data need to be analyzed using various models to provide an objective quality assessment.
- **Quality Assessment help us –**
 - Determine if the preset goals have been achieved
 - Provide information to improve overall product quality

QA to SQE



- **QA activities need additional support:**
 - **Planning & goal setting**
 - ▶ Management:
 - When to stop?
 - Adjustment & improvement , etc.
 - All based on assessment/prediction
 - **Assessment of quality/reliability/etc. :**
 - ▶ Data collection needed
 - ▶ Analysis & modeling
 - ▶ Providing feedback for management
- **QA + Above ==> Software Quality Engineering (SQE)**

SQE Process



- There are three major groups of activities in the software quality engineering(SQE) process –
 - 1) Pre-QA activities: Quality planning
 - 2) In-QA activities: Executing planned QA activities & handling discovered defects
 - 3) Post-QA activities: Quality Measurement, Assessment & Improvement



(1) Pre-QA activities: Quality Planning

1) Pre-QA activities: **Quality Planning**

- These are the activities that should be carried out **before** carrying out the regular QA activities.
- There are **two major types of pre-QA activities** in quality planning:
 - a) **Set specific quality goals**
 - b) **Form an overall QA strategy, which includes two sub-activities:**
 - Select **appropriate QA activities to perform**
 - Choose appropriate quality measurements & models to provide feedback, quality assessment and improvement

Quality planning: Setting Quality Goals



- Setting quality goals by matching customer's quality expectations with what can be economically achieved by the software development organizations in the following sub-steps:
 - a) Identify quality views & attributes meaningful to target customers & users
 - b) Select direct quality measures that can be used to measure the selected quality attributes from customer's perspective
 - c) Assess quality **expectations vs. cost**: Quantify these quality measures to set quality goals while considering the market environment & cost of achieving different quality goals

Quality planning: Setting Quality Goals



- One important fact in managing customer's quality expectations is that different quality attributes may have different levels of importance to different customers & users. Relevant quality views & attributes need to be identified first.
- Examples:
 - **Reliability** is typically the **primary concern** for various *business & commercial software systems* because of people's reliance on such systems & the substantial financial loss if they are malfunctioning
 - If a software is used in various *real-time control situations*, such as air traffic control software & embedded software in automobile, medical devices, etc. accidents due to failures may be catastrophic. So, **safety** is the **major concern**
 - For mass market *software packages*, such as various auxiliary utilities for personal computers, **usability**, instead of reliability or safety, is the **primary concern**

Quality planning: Forming a QA strategy



- Once specific quality goals are set, we can select *appropriate QA alternatives* as part of a QA strategy to achieve these goals.
- Factors to be considered:
 - The influence of quality perspectives & attributes
 - The influence of different quality levels

Quality planning: Forming a QA strategy



- QA activity planning
 - Evaluate individual QA alternatives
 - Strength/weakness/cost/applicability/etc.
 - Match against goals
 - Integration/ cost considerations
- Measurement/feedback planning:
 - Define measurements (defect & others)
 - Planning to collect data
 - Preliminary choices of models/analyses
 - Feedback & follow-up mechanism

(2) In-QA activities



- (2) In-QA activities:** Executing planned QA activities & handling discovered defects
- In addition to performing selected QA activities, an important part of this normal execution is to deal with the discovered problems (**these activities were covered in the last lecture**).

(3) Post-QA activities



3) Post-QA activities: Quality Measurement, Assessment & Improvement

- Activities that are carried out after normal QA activities have started but not as part of these normal activities.
- Primary purpose: To provide quality assessment & feedback so that various management decisions(e.g., product release) can be made and possible quality and process improvement initiatives can be carried out.
- Major activities:
 - Measurement
 - Analysis & modeling
 - Providing feedback & identifying improvement potentials
 - Follow-up activities

(3) Post-QA activities



- Note:

“**post-QA**” does **not** mean **after** the finish of QA activities. In fact, many of the measurement & analysis activities are carried out parallel to QA activities after they are started. In addition, pre-QA activities may overlap with the normal QA activities as well.

SQE in Software Processes



- The SQE process forms an integral part of the overall software engineering process, where other concerns, such as cost & schedule, are also considered & managed.
- Individual QA activities can be carried out & integrated into the software process.
- SQE activities ← development activities
 - ▶ Quality planning ← product planning
 - ▶ QA activities ← development activities
 - ▶ Analysis/feedback ← project management

SQE in Software Processes



Fitting SQE in software processes:

- ▶ Different start/end time
- ▶ Different sets of activities, sub-activities, and focuses
- ▶ In **Waterfall process**: **more staged** (planning, execution, analysis/feedback)
- ▶ In **other processes**: more **iterative** or **other variations**

SQE : Summary



- To manage the quality assurance (QA) activities and to provide realistic opportunities of quantifiable quality improvement, we need to go beyond QA.
- $SQE = \text{Quality Planning} + \text{QA Activities} + \text{Quality Assessment \& Improvement}$
- SQE process can be integrated into the overall software development and maintenance process.



Books

- *Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement*, by Jeff Tian



References

1. *Software Testing and Quality Assurance: Theory and Practice*, by Kshirasagar Naik, Priyadarshi Tripathy
2. *Software Quality Assurance: From Theory to Implementation*, by Daniel Galin
3. *Software Testing and Continuous Quality Improvement*, by William E. Lewis
4. *The Art of Software Testing*, by Glenford J. Myers, Corey Sandler and Tom Badgett