

SE-3002 SOFTWARE QUALITY ENGINEERING

RUBAB JAFFAR

RUBAB.JAFFAR@NU.EDU.PK

SQA Plan and Development Plan

Overview and Basics

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TODAY'S OUTLINE

- SQA Activities
- SQA plan
- SQA metrics

SOFTWARE QUALITY ASSURANCE (SQA)

- Software Quality Assurance (SQA) consists of a means of monitoring the software engineering processes and methods used to ensure quality.
- The methods by which this is accomplished are many and varied, and may include ensuring conformance to one or more standards, such as ISO 9000 or a model such as CMMI.
- SQA encompasses the entire software development process
 - such as requirements definition, software design, coding, source code control, code reviews, software configuration management, testing, release management, and product integration.
- SQA is organized into goals, commitments, abilities, activities, measurements, and verifications.

SQA-THE IEEE DEFINITION

- Software quality assurance 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. Contrasts with quality control.

SOFTWARE QUALITY ASSURANCE PLAN

- Abbreviated as SQAP, the software quality assurance plan comprises of the procedures, techniques, and tools that are employed to make sure that a product or service aligns with the requirements defined in the SRS(software requirement specification).
- The plan identifies the SQA responsibilities of a team, lists the areas that need to be reviewed and audited. It also identifies the SQA work products.

SQA PLAN SECTION

- Purpose section
- Reference section
- Software configuration management section
- Problem reporting and corrective action section
- Tools, technologies and methodologies section
- Code control section
- Records: Collection, maintenance and retention section
- Testing methodology

- #I) Creating an SQA Management Plan:
- The foremost activity includes laying down a proper plan regarding how the SQA will be carried out in your project.
- Along with what SQA approach you are going to follow, what engineering activities will be carried out, and it also
 includes ensuring that you have a right talent mix in your team.
- #2) Setting the Checkpoints:
- The SQA team sets up different checkpoints according to which it evaluates the quality of the project activities at each checkpoint/project stage. This ensures regular quality inspection and working as per the schedule.

- #3) Apply software Engineering Techniques:
- Applying some software engineering techniques aids a software designer in achieving high-quality specification. For gathering information, a designer may use techniques such as interviews and FAST (Functional Analysis System Technique).
- Later, based on the information gathered, the software designer can prepare the project estimation using techniques like WBS (work breakdown structure), SLOC (source line of codes), and FP(functional point) estimation.

- #4) Executing Formal Technical Reviews:
- An FTR is done to evaluate the quality and design of the prototype.
- In this process, a meeting is conducted with the technical staff to discuss regarding the actual quality requirements of the software and the design quality of the prototype. This activity helps in detecting errors in the early phase of SDLC and reduces rework effort in the later phases.
- #5) Having a Multi-Testing Strategy:
- By multi-testing strategy, we mean that one should not rely on any single testing approach, instead, multiple types
 of testing should be performed so that the software product can be tested well from all angles to ensure better
 quality.

#6) Enforcing Process Adherence:

- This activity insists the need for process adherence during the software development process. The development process should also stick to the defined procedures.
- This activity is a blend of two sub-activities:
- (i) Product Evaluation:
- This activity confirms that the software product is meeting the requirements that were discovered in the project management plan. It ensures that the set standards for the project are followed correctly.
- (ii) Process Monitoring:
- This activity verifies if the correct steps were taken during software development. This is done by matching the actually taken steps against the documented steps.

#7) Controlling Change:

- In this activity, we use a mix of manual procedures and automated tools to have a mechanism for change control.
- By validating the change requests, evaluating the nature of change and controlling the change effect, it is ensured
 that the software quality is maintained during the development and maintenance phases.
- #8) Measure Change Impact:
- If any defect is reported by the QA team, then the concerned team fixes the defect.
- After this, the QA team should determine the impact of the change which is brought by this defect fix. They need
 to test not only if the change has fixed the defect, but also if the change is compatible with the whole project.
- For this purpose, we use software quality metrics which allows managers and developers to observe the activities and proposed changes from the beginning till the end of SDLC and initiate corrective action wherever required.

#9) Performing SQA Audits:

- The SQA audit inspects the entire actual SDLC process followed by comparing it against the established process.
- It also checks whatever reported by the team in the status reports were actually performed or not. This activity also exposes any non-compliance issues.
- #10) Maintaining Records and Reports:
- It is crucial to keep the necessary documentation related to SQA and share the required SQA information with the stakeholders. The test results, audit results, review reports, change requests documentation, etc. should be kept for future reference.

#11) Manage Good Relations:

- In fact, it is very important to maintain harmony between the QA and the development team.
- We often hear that testers and developers often feel superior to each other. This should be avoided as it can affect the overall project quality.

ELEMENTS OF SQA

- Standards
- Reviews and audits
- Testing
- Error/defect collection and analysis
- Change management
- Educational programs
- Vendor management
- Security management
- Safety
- Risk management

- The charter of the SQA group is to assist the software team in achieving a high quality end product. The Software Engineering Institute recommends a set of SQA activities that address quality assurance planning, oversight, record keeping, analysis and reporting.
- It is these activities that are performed (or facilitated) by an independent SQA group that
 - Prepares an SQA plan for a project
 - Participates in the development of the project's software process description
 - Reviews software engineering activities to verify compliance with the defined software process
 - Audits designated software work products to verify compliance with those defined as part of the software process
 - Ensures that deviations in software work and work products are documented and handled according to a documented procedure
 - Records any noncompliance and reports to senior management

SQA TASKS, GOALS, ATTRIBUTES, AND METRICS

Software quality assurance (SQA) is a process which assures that all software engineering processes, methods, activities and work items are monitored and comply against the defined standards. These defined standards could be one or a combination of any like ISO 9000, CMMI model, ISO 15504, etc.

SQA incorporates all software development processes starting from defining requirements to coding until release. Its prime goal is to ensure quality.

SQA GOALS

Requirement quality: The correctness, completeness, and consistency of the requirements model will have a strong influence on the quality of all work products that follow. SQA must ensure that the software team has properly reviewed the requirements model to achieve a high level of quality.

Design quality: Every element of the design model should be assessed y the software team to ensure that it exhibits high quality and that the design itself conforms to requirements.

SQA GOALS

 Code quality: Source code and related work products must conform to local coding standards and exhibit characteristics that will facilitate maintainability.

Quality control effectiveness: A software team should apply limited resources in a way that has the highest likelihood of achieving a high—quality result. SQA analyzes the allocation of resources for reviews and testing to assess whether they are being allocated in the most effective manner.

Goal	Attribute	Metric
Requirement quality	Ambigully	Number of ambiguous modifiers
	Completeness	Number of TBA, TBD
	Understandability	Number of sections/subsections
	Volatility	Number of changes per requirement Time (by activity) when change is requested
	Traceability	Number of requirements not traceable to design/code
	Model clarity	Number of UML models
ARE QUALITY ENGINEERING		Number of descriptive pages per model
		Number of UML errors

Design quality	Architectural integrity	Existence of architectural model
	Component completeness	Number of components that trace to architectural model
		Complexity of procedural design
	Interface complexity	Average number of pick to get to a typical function or content
		Layout appropriateness
	Patterns	Number of patterns used

Code quality	Complexity	Cyclomatic complexity
	Maintainability	Design factors
	Understandability	Percent internal comments
		Variable naming conventions
	Reusability	Percent reused components
	Documentation	Readability index

QC effectiveness	Resource allocation Completion rate	Staff hour percentage per activity Actual vs. budgeted completion time
	Testing effectiveness	Number of errors found and criticality Effort required to correct an error Origin of error

TOPICS

- Planning Quality and Selecting QA activities
- Development Plan and Quality Plan Objectives
- Quality Plans and Their Importance
- Purpose

INTRODUCTION

- Project managers prepare
 - development and
 - quality plans
- Arduous task,
 - Senior level management on one end and
 - Developers on the other
- These plans are vitally important to meet contractual commitments.
- Thus, we need to look at both development and quality plans.

INTRODUCTION...

- We have proposal plans and internal documents. Enough? No!
- These plans typically included time tables, estimates, staffing requirements, scheduled reviews, risks and more.
 - Seems like enough....
- But the **time invested** in developing a development plan and a quality plan will play dividends.

INTRODUCTION...

- The project needs development and quality plans that:
 - Are based on proposal materials that have been re-examined and thoroughly updated.
 - Are more comprehensive than the approved proposal, especially with respect to schedules, resource estimates, and development risk evaluations.
 - Were prepared at the beginning of the project to sound alerts regarding scheduling difficulties, potential staff shortages, scarcity of development facilities, problems with meeting contractual milestones, modified development risks, and so on.

INTRODUCTION...

- Development and quality standards (ISO 9000.3 and CMM) require viable plans.
- We need to look at development plans and quality plans their objectives and elements.
- They are <u>related</u> but NOT the same.

DEVELOPMENT AND QUALITY PLANS - OBJECTIVES

- Planning is meant to prepare adequate foundations for successful and timely completion of the project. The planning process includes:
 - Scheduling development activities and <u>estimating</u> the required manpower resources and budget
 - Recruiting team members and allocating development resources
 - Resolving development <u>risks</u>
 - Implementing required <u>SQA activities</u>
 - Providing management with <u>data needed for project control</u>

- 1. Project products, specifying "deliverables"
- 2. Project interfaces
- 3. Project methodology and development tools
- 4. Software development standards and procedures
- 5. Map of the development process
- 6. Project milestones
- 7. Project staff organization
- 8. Required development facilities
- 9. Development risks and risk management actions
- 10. Control methods

- Project Products, specifying "Deliverables"
- Must specify items to be delivered to customer
 - documents, user manuals
- Must specify specific <u>software</u> <u>products</u> (along with completion and installation dates
- Must specify or discuss <u>training</u>.
 - Who and how does training take place?
- Must specify customer support!

EXAMPLES OF DELIVERABLES

No.	Deliverables/Release	Media	Qty	Due date
1	Proposal	Hard copy	4	12-12-2011
2	SRS	Hard copy	1	20-12-2011
3	Acceptance test report	Hard copy	1	30-01-2012
4	Software	DVD	10	1-02-2012

Project <u>Interfaces</u>

- Interfaces with <u>existing</u> software packages (software interface)
 - (A course enrollment system might interface with an existing Billing System or Course Scheduling System...)
- Interfaces with other software / hardware development and maintenance teams working on similar system or extension of the system (cooperation and coordination links)
- Interface with existing or new hardware (hardware interface).

Project methodology and development tools

- Process used, tools / environment needed
- Requirements capture and technologies used
- Design approaches
 - architectural; interface; communications; databases
 - Programming methodology
- ■Testing Approaches etc.
 - What are the testing responsibilities and who does what? Individual testing? Separate testing shop?
- Deployment
 - One shot; parallel; incremental...

■Software Development Standards and Procedures

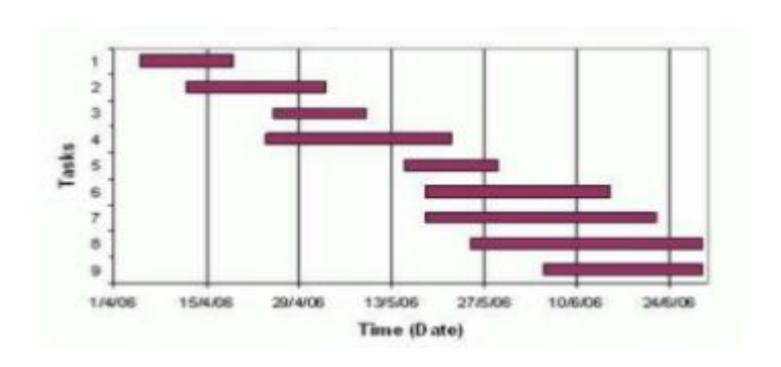
■ A list should be prepared of the software development standards and procedures to be applied in the project software quality engineering

Map of the Development Process

- Detailed definition of project's phases:
 - inputs, activities, outputs (artifacts), specific activities
- ■Estimates of each activity's duration:
 - design reviews (managerial and technical), tests, design and code correction activities
- Sequencing and dependency of activities.
- List of professional resources needed overall and for each activity.
 - ■Can show these in GANTT charts, which show various activities by horizontal bars and whose lengths are proportional to the activity's duration.

- ■Can use PERT and CPM and other activities to communicate activities, durations, deliverable dates, ...
 - ■Both the PERT and CPM consider sequence dependencies into account in addition to duration of activities.
 - ■They enable calculation of the earliest and latest acceptable start times for each activity.
 - ■The difference between start times determines the activity's scheduling flexibility. Special attention is awarded to those activities lacking scheduling flexibility (which explains their being called "critical path" activities), and whose delayed completion may cause delay in the conclusion of the entire project.
- ■Some like Microsoft Project.
- Can use more modern tools too, like IBM's Rational Team Concert (RTC).

GANTT CHART



■Project staff organization and coordination with <u>external</u> participants

- ■Organizational structure defines teams and tasks;
 - Defines expertise needed (certifications, experience, specialties), programming languages, development tools, levels of expertise, numbers of individuals needed and for specific periods of time; names of team leaders and team members (sometimes).
- Long term leadership; team losses due to many factors;
 - Estimates of staff availability is crucial and can cause the flag to be raised when certain levels are not met.

Project Milestones

■ For each milestone, its completion time and project products (documents and code) are to be defined.

Required development facilities

■ Required hardware, software, tools, space, infrastructure, ...

Development Risks and Risk Management Actions

- Development Risk: "a state or property of a development task or environment, which, if ignored, will increase the likelihood of project failure".
- Risk Areas
 - Technology Risks lack of expertise; not correct / needed tools
 - Personnel / Staff Shortages loss of people; inability to recruit
 - Environmental Risk:
 - Where / how is application to be deployed?
 - Where / how is app to be developed?

SOFTWARE QUALITY Financial Risks

Control methods

■ Progress reports and coordination meetings are planned to control project implementation

Project Cost Estimates

- These are based on proposal cost estimates followed by thorough review and continuous updating.
- Changes can/will occur and these can be major budget impacts, such as subcontractors don't fulfill their obligations or other unplanned expenditures arise.
- Some projects are 'successes' but way over budget.
- Ultimately, the approval of the development plan will take place within the organization(s).

CLASS ACTIVITY 1

- George Wise is an exceptional programmer. Testing his software modules reveals very few errors, far fewer than the team's average. He keeps his schedule promptly, and only rarely is he late in completing his task. He always finds original ways to solve programming difficulties, and uses an original, individual version of the coding style. He dislikes preparing the required documentation, and rarely does it according to the team's templates.
- A day after completing a challenging task, on time, he was called to the office of the department's chief software engineer. Instead of being praised for his accomplishments (as he expected), he was warned by the company's chief software engineer that he would be fired unless he began to fully comply with the team's coding and documentation instructions.
- I. Do you agree with the position taken by the department's chief software engineer?
- 2. If yes, could you suggest why his or her position was so decisive?

CASE STUDY

Imagine that you have been appointed as a head of a big project. As it often is the case in the software industry, you come under serious time pressure from the very first day. Because you were MEMBER of the proposal team and participated in most of the meetings held with customer, you are confident that you know all that is necessary to do the job. You INTEND to use the proposal plans and internal documents that the team had prepared as your DEVELOPMENT and QUALITY plans. You are prepared to RELY on these materials because you know that the proposal and its estimates, including the timetable, staff requirements, list of project documents, scheduled design reviews, and list of development risk.

CASE STUDY

You, therefore, were a bit disappointed that at this CRUCIAL point of the project, the Development Department Manager demands that you immediately prepare new and separate project development plans ("Development Plan") and project quality plan ("Quality Plan"). When you claim that the completed proposal could serve as the requested plans. BUT the manager still insists that they must be updated with new and more comprehensive topics should be added to plan. "By the way, don't forget that a period of 7 months has gone between the proposal preparation and the final signing of the contract" mentioned the manager.

DEVELOPMENT DEPARTMENT MANAGER IS RIGHT?

- Because, it may be discovered that some team members will not be available at the scheduled dates due to delays in completion of their current assignment or
- The consulting company that had agreed to provide professional support in a specialized and crucial area has gone bankrupt.



That is all