SQA

Software Quality Assurance

S/W Quality

- Quality definition
- Quality requirements
- Quality Measures
  - Mc Call's Quality Factors
  - ISO 9126 Quality Factors

Intro

- Planned and systematic method that
  - Evaluate the quality of s/w products, standards, process & procedures
- Ensure that development follow Standards and Procedures
- Done by
  - Continuous Monitoring
  - Product Evaluation
  - Conducting Audits

Standards & Procedures

- Standards
  - Established criteria to which product will be compared
- Procedures
  - Established criteria to which development process & control process are compared
- Hence,
  - These both establish the method for developing s/w application
  - Role of SQA to provide existence & adequacy of standards and procedures
  - SQA Activities
    - Continuous Monitoring, Product Evaluation, Conducting Audits

Type of Standards

- Documentation
  - Define the proper content for planning and control
  - Provide consistency throughout development life of project
- Design
  - Define the proper form and content of the design product
  - Methods for translating the software requirements specification into the actual software design
- Code
  - Specify the programming language
  - Also specify various constraints that should be put for usage of the language features (i.e use of data structures, patterns etc.)

- Procedures must be followed in carrying out a development process
- All the development processes must have documented procedures
- Procedures like i.e.
  - Configuration Management
  - Non-conformance Reports
  - Corrective Actions
  - Testing & formal inspection

SQA Activities

- Product Evaluation & Process Monitoring are two important activities
  - Ensures development processes and the control processes written in the management plan are carried out effectively
  - Ensure that all the procedures and standards are correctly followed
- Products are continuously monitored for checking that it is following the standards and processes

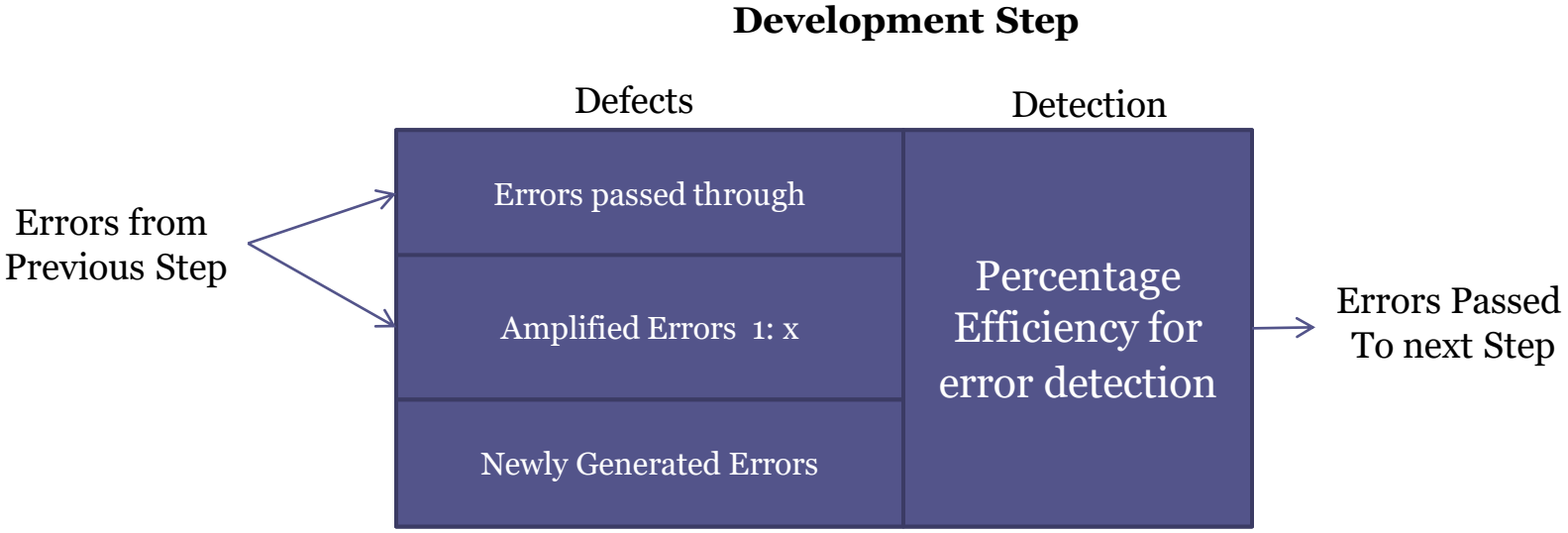
- Product Evaluation
  - Assures standards are being followed
  - Ensures that the software application product is developed by conforming all the applicable standards as illustrated in the Management Plan
- Product Monitoring
  - Ensures that the appropriate steps are carried out during the development process
  - Comparing the actual steps carried out with those in the documented procedures
  - Ensures that the Management Plan specifies the methods that should be used by the monitoring activity

- Product Audits
  - That looks the entire product and all the processes in depth
  - Done by comparing them with the established standards and procedures
  - It's an important activity to review the management plan, technical processes and assurance processes to provide the actual status of the software application product
  - Main idea behind this is control procedures are properly followed and desired documentation is properly maintained
- SQA Product
  - Is nothing but an audit report to display findings and recommendations to obey standards and procedures

S/W Review

- “filter” for software process
- Servers to uncover errors and defects that can then be removed
- “purify” s/w including
  - Requirements
  - Design models
  - Code
  - Testing data
- Primary objective is to find errors during the process so that do not become defects after release of the s/w

Defect Amplification & Removal



Reviews: A Formality Spectrum

- Formality of review increase when,
  - Distinct roles are defined for reviewers
  - Sufficient amount of planning and preparation is available
  - Distinct structure of review is defined (task and time)
  - Follow-up by the reviewers for any correction that are made

Informal Review

- Simple desk check or casual meeting held for a review
- No advanced planning or preparation
- No agenda or meeting structure
- No follow-up on the errors

Effectiveness of such review is lower then more formal approaches

- To improve the efficiency,
  - Develop a set of simple review checklists for each major work product

Formal Technical Review (FTR)

- S/Q QC activity performed by s/w engineers
- Objectives
  - To uncover errors in function, logic or implementation of s/w
  - To verify s/w review meets its requirements
  - To ensure s/w represented as per followed Standards
  - To achieve s/w that is developed in uniform manner
  - To make project more manageable
- It serves as a training ground, enabling Juniors to observe different approaches of s/w life cycle
- Serve to promote backup and Continuty

- Its class of review that contain,
  - Walkthroughs and Inspections
- FTR is conducted as meeting and only be successful if it is well planned, controlled and attended
- ***The Review Meeting***
  - 3-5 people should be involved in the review
  - Advanced preparation should occurred (no more then 2 hours)
  - Duration should be 2 hours for review meeting
- FTR focus on a specific part of the overall software
- Higher likelihood of uncovering the errors

- FTR focus on work product
- ***Producer*** (who has developed the work product) → informs Project Leader about completion of their work & review should be done
- Project Leader informs ***Review Leader***
  - Who evaluate product for its readiness, generate product material & distribute them to the ***reviewers*** for advance preparation
  - Create notes, reviewing product & establish agenda for review meeting
- Presence of all above three characters required in a review meeting
- ***Reviewers*** become ***Recorders*** (who records all important issues raise during the review)

- At the end of the review, FTR must decide whether
  - Accept the product without further modification
  - Reject the product due to several errors (once modified another review must be performed)
  - Accept the product provisionally (minor errors have been encountered & must be corrected but no further review required)
- After final decision
  - Attendees complete the sign off.
- ***Review Reporting & Report Keeping***
  - Recorder list out all the issues raised during meeting
  - Summarized at the end of review and ***review issue list*** is prepared

- A ***formal technical review summary report*** in completed that answers,
  - What was reviewed?
  - Who reviewed it?
  - What were the findings & conclusions?

  (it is of one single page)
- Review issue list serves two purpose
  - To identify problem areas within the product
  - An action item check list that guides the producer as correction are made

  (normally attached to summary report)

Software Reliability

- “the probability of failure free operation of a computer program in a specified environment for a specific time”
- Measure of reliability
  - MTBF – (mean – time – between - failure)

    $$MTBF = MTTF + MTTR$$

    (MTTF - mean time to failure & MTTR - mean time to repair)
  - Useful measure than other quality related software metrics
  - Alternative measure of reliability is FIT (failure – in – time)
    - A measure of how many failures a component will have over one billion hours of operation

- Software Availability
  - The probability that a program is operating according to requirement at a given point in time

$$\frac{MTTF}{MTTF + MTTR} \; x\, 100\%$$

- Software Safety
  - Focus on identification and assessment of potential hazards that may affect s/w negatively & cause an entire system to fail

Quality Standards – ISO 9001

- Issued by International Organization for Standardization (ISO)
- Important part of an ISO 9001 is a Proper Documentation
- ISO 9001 applies to S/W engineering
- It address the topics such as

s/w organization must establish policies & procedures to address each of the requirements & able to demonstrates that these all are being followed

- Management Responsibility
- Quality System
- Contract Review
- Design Control
- Document
- Data Control
- Product Identification
- Traceability
- Process Control
- Inspection
- Testing
- Prevention Action
- Control of Quality Records
- Internal Quality
- Audits
- Training
- Servicing

Six Sigma

- A generic quantitative approach to improvement that applies to any process
- Is a ***disciplined***, ***data driven approach*** and ***methodology*** for eliminating in any process from manufacturing to transactional and from product to service
- Improve the process for the development of the products faster and at reasonable cost
- Is a systematic approach to achieve perfection
- Is based on measurement strategy and obviously focuses on process improvement

- Six Sigma have two methodologies,
  - **DMAIC**
    - **Define** – define the problem & process to improve upon
    - **Measure** – How can you measure this process in systematic way?
    - **Analyze** – identify the way in which it can be improved – find root cause within the process to improve it
    - **Improve** – present solution to improve and implement them
    - **Control** – Utilize Statistical Process Control to continuously measure your results and ensure that you're improving continuously
  - **DMADV**
    - **Define**, **Measure** and **Analyze** are same as previous method
    - **Design** – avoid root cause of defects and meet the customer requirements (redesign)
    - **Verify** – compare the process with standard plan and find differences

CMM (Capability Maturity Model)

- determine an organization's current state of process maturity that result in five point grading scheme
- Is a process meta model developed by SEI
- defines the process characteristics that should exist if an organization want to establish a software process that is complete
- 5 process maturity levels are there
  - Level 1 – **Initial**
  - Level 2- **Repeatable**
  - Level 3- **Defined**
  - Level 4- **Managed**
  - Level 5 - **Optimizing**

- Initial
  - s/w process is characterized as ad hoc
  - Few process are defined & success depends on individual effort
- Repeatable
  - Basic project management processes are defined to track cost, schedule & functionality
  - Process discipline is in place to repeat success of similar kind of projects
- Defined
  - Both management & engineering activities Is documented, standardized & integrated in the organization
  - All project use documented and approved version of organization's process to proceed further
  - Includes all characteristics defined for CMM level 2

- Managed
  - Detailed measure of s/w process & product quality is collected
  - Products and processes are controlled using detailed measures
  - Includes all characteristics defined for CMM level 3
- Optimizing
  - Continuous process improvement is done by quantitative feedback from process and from testing innovative ideas & technologies
  - Includes all characteristics defined for CMM level 4

SQA Plan

- Main aim is to control the quality of the product and cover all quality assurance activities
- Provides clear idea to produce Quality Product & is a backbone of SQA activities
- Various section of SQA plan is as follow
  - Documentation Section
    - Contain docs related to work of plan of the project, models like ERD & class, technical docs like test plan and user manual
  - Standards, Practices & Conventions Section
    - List of standards and practices that are followed for development
    - Like coding standards, document standards etc.

- Review and Audit Section
  - Provides overview of the approach of all the reviews and audits conducted
- Test Section
  - Use all possible testing techniques & procedures
  - Record all errors uncovered and corrective action taken
- Management Section
  - Uses tools & methods to assure quality of the product like,
  - Configuration management procedures to control the change
  - Define procedures to maintain the records
  - Identified methods to handle risk management activities (RMMM plan)

SQA ENDS HERE