Software Project Management

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Software quality

Introduction

- Traditional definition of quality:
  - Fitness of purpose:
    - A quality product does exactly what the users want it to do.
- Fitness of purpose for software products:
  - Satisfaction of the requirements specified in SRS document.

Introduction cont …

- A satisfactory definition of quality for many products:
  - A car, a table fan, a food mixer, microwave oven, etc.
- But, not satisfactory for software products.
  - Why?

Quality for Software Products

- Consider a software product:
  - Functionally correct:
    - Performs all functions as specified in the SRS document.
  - But, has an almost unusable user interface.
    - Cannot be considered as a quality product.

Quality for Software Products

- Consider another example:
  - A product which does everything that users want.
  - But has an almost incomprehensible and unmaintainable code.
  - Will you call it a quality product?

Modern View of Quality

- Several quality factors are associated with a software product :
  - Correctness
  - Reliability
  - Efficiency (includes efficiency of resource utilization)
  - Portability
  - Usability
  - Reusability
  - Maintainability

Correctness

- A software product is correct:
  - If different requirements as specified in the SRS document have been correctly implemented.
  - Results are accurate.

Portability

- A software product is said to be portable:
  - If it can be easily made to work
    - In different operating systems.
    - In different machines,
    - With other software products, etc.

Reusability

- A software product has good reusability:
  - If different modules of the product can easily be reused to develop new products.

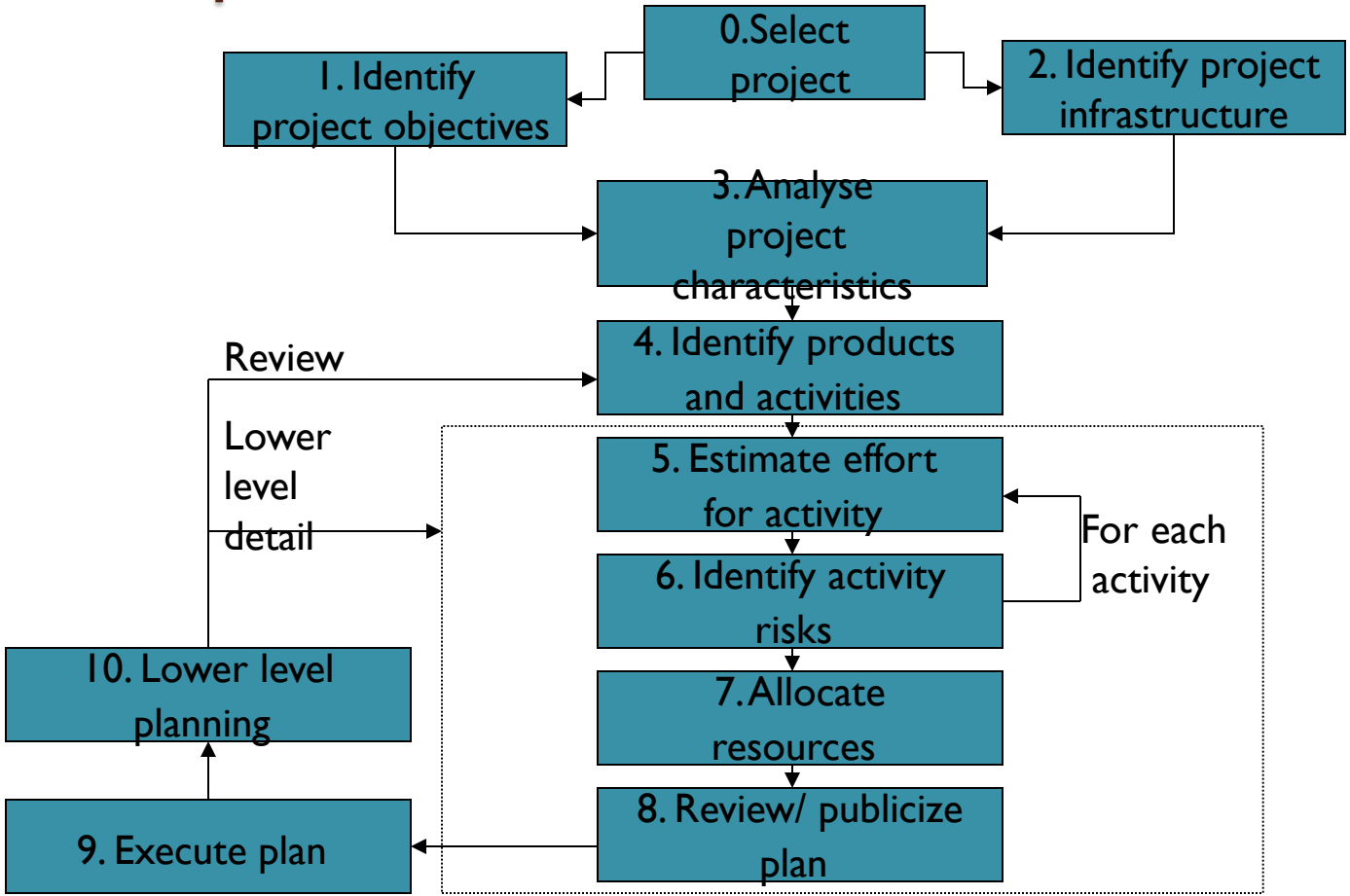
Usability

- A software product has good usability:
  - If different categories of users (i.e. both expert and novice users) can easily invoke the functions of the product.

Maintainability

- A software product is maintainable:
  - If errors can be easily corrected as and when they show up,
  - New functions can be easily added to the product,
  - Functionalities of the product can be easily modified.

‘Step Wise’ - an overview



Place of software quality in project planning

- Quality will be of concern at all stages of project planning and execution, but it will be of particular interest at the following points in the step wise framework.

- *Step 1: identify product scope and objectives* – some objectives could relate to the qualities of the application to be delivered.
- *Step 2: identify project infrastructure* – within this step activity 2.2 identifies installation standards and procedures. Some of these will almost certainly be about quality.

- *Step 3: Analyse project characteristics* – In activity 3.2 ('analyse other project characteristics – including quality based ones') the application to be implemented is examined to see if it has any special quality requirements.

- If, for example, it is safety critical then a range of activities could be added, such as n-version development where a number of teams develop versions of the same software which are then run in parallel with the outputs being cross-checked for discrepancies.

- *Step 4: identify the products and activities of the project* – It is at this point that the entry, exit and process requirements are identified for each activity.
- *Step 8: review and publicize plan* – At this stage the overall quality aspects of the project plan are reviewed.

The importance of software quality

- Increasing criticality of software – e.g. software is increasingly being used in systems that can threaten or support human life and well-being
- The intangibility of software – it is difficult for observers to judge the quality of software development, especially during its early stages

The importance of software quality

- Project control concerns:
  - errors accumulate with each stage
    i. The products of one sub-process in the development process are the inputs to subsequent sub-processes, thus
    ii. errors accumulate with each stage e.g. at the design stage, the specification errors are incorporated into the design, and at the coding stage specification and design errors are incorporated into the software
  - errors become more expensive to remove the later they are found
  - it is difficult to control the error removal process (e.g. testing)

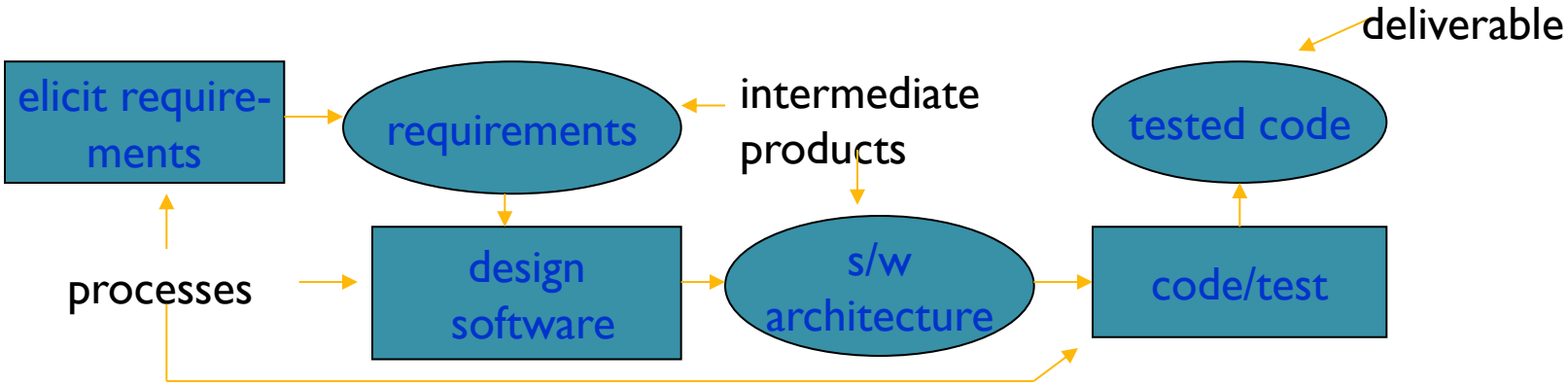
Quality specifications

Where there is a specific need for a quality, produce a quality specification

- Definition/description of the quality
- Scale: the unit of measurement
- Test: practical test of extent of quality
- Minimally acceptable: lowest acceptable value, if compensated for by higher quality level elsewhere
- Target range: desirable value
- Now: value that currently applies

ISO standards: development life cycles

A development life cycle (like ISO 12207) indicates the sequence of *processes* that will produce the software *deliverable* and the *intermediate products* that will pass between the processes.



- The *deliverables* are the products that are handed over to the client at the end of the project, typically the executable code.
- *Intermediate products* are things that are produced during the project, but which are not (usually) handed to the client at the end. Typically they are things that are produced by one sub-process (e.g. a requirements document created by the requirements elicitation and analysis processes) and used by others (e.g. a design process which produces a design that fulfils the requirements).
- These sub-processes will fit into the overall framework of a *development cycle*.
- Some software quality models focus on evaluating the quality of software products, others on the processes by which the products are created.

ISO standards

- The ISO 9000 series of standards establishes requirements for quality management systems for the creation/supply of all types of goods and services.

Software Quality Management System

- Quality management system (or quality system):
  - Principal methodology used by organizations to ensure that the products have desired quality.

Quality System

- A quality system consists of the following:
  - Managerial Structure
  - Individual Responsibilities.
- Responsibility of the organization as a whole.

Quality System

- Every quality conscious organization has an independent quality department:
  - Performs several quality system activities.
  - Needs support of top management.
  - Without support at a high level in a company:
    - Many employees may not take the quality system seriously.

Quality System Activities

- Auditing of projects
- Development of:
  - standards, procedures, and guidelines.
- Production of reports for the top management:
  - Summarizing the effectiveness of the quality system in the organization.
- Review of the quality system itself.

Quality System

- A good quality system must be well documented.
  - Without a properly documented quality system,
    - Application of quality procedures become ad hoc,
    - Results in large variations in the quality of the products delivered.

Quality System

- An undocumented quality system:
  - Sends clear messages to the staff about the attitude of the organization towards quality assurance.
- International standards such as ISO 9000 provide:
  - Guidance on how to organize a quality system.

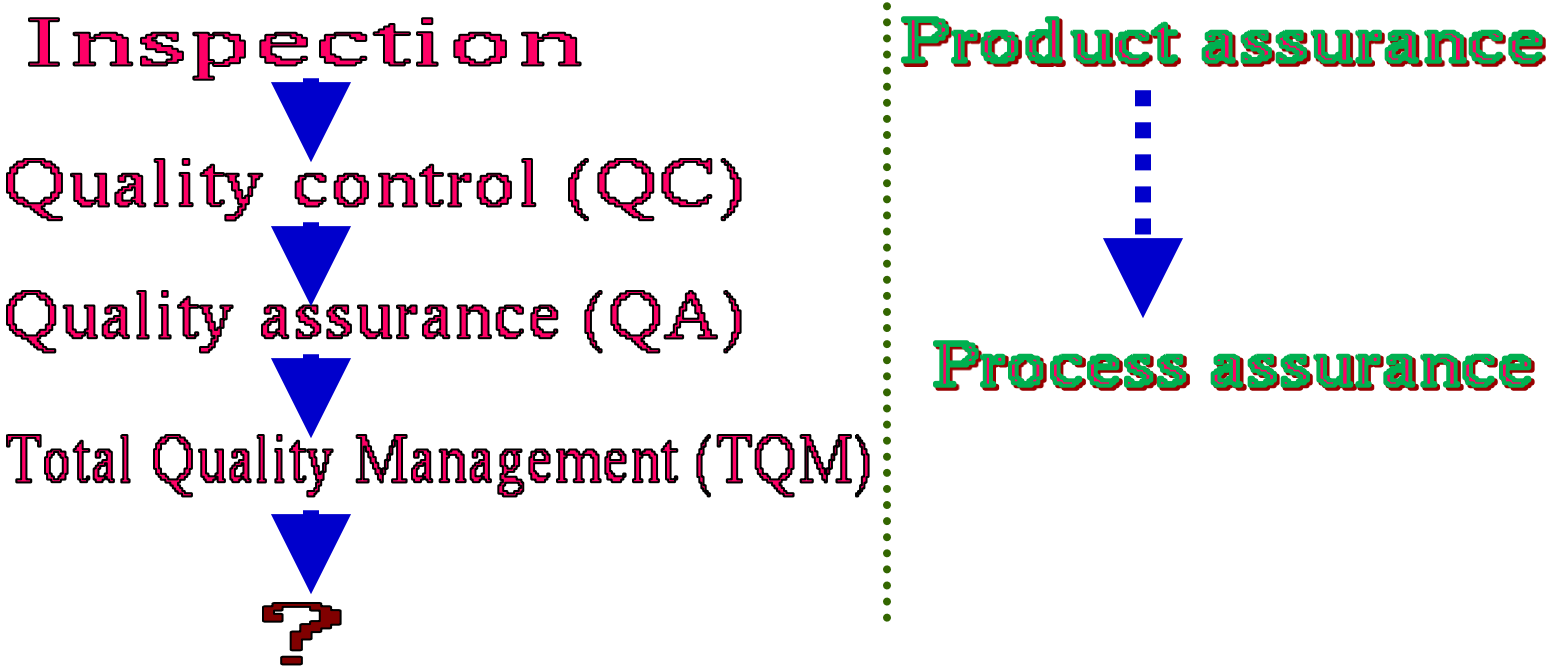
Evolution of Quality Systems

- Quality systems have evolved:
  - Over the last six decades.
- Prior to World War II:
  - Accepted way to produce quality products:
    - Inspect the finished products
    - Eliminate defective products.

Evolution of Quality Systems

- Since World war II,
  - Quality systems of organizations have undergone:
    - Four stages of evolution.
- Many advances came from Japanese:
  - Helped resurrect Japanese economy.

Evolution of Quality Systems



Evolution of Quality Systems

- Initial product inspection method:
  - Gave way to quality control (QC).
- Quality control:
  - Not only detect the defective products and eliminate them
  - But also determine the causes behind the defects.

Quality Control (QC)

- Quality control aims at correcting the causes of errors:
  - Not just rejecting defective products.
- Statistical quality control (SQC):
  - Quality of the output of the process is inferred using statistical methods.
  - In stead of inspection or testing of all products.

Quality Control (QC)

- The next breakthrough:
  - Development of quality assurance principles.

Quality Assurance

- Basic premise of modern quality assurance:
  - If an organization's processes are good and are followed rigorously:
    - The products are bound to be of good quality.

Quality Assurance

- All modern quality paradigms include:
  - Guidance for recognizing, defining, analyzing, and improving the production process.

Total Quality Management (TQM)

- TQM advocates:
  - Continuous process improvements through process measurements.

Business Process Reengineering

- BPR:A term related to TQM.
- Process reengineering goes a step further than quality assurance:
  - Aims at continuous process improvement.

Business Process Reengineering

- TQM focuses on reengineering of the software process.
  - Whereas BPR aims at reengineering the way business is carried out in any organization:
    - Not just software development.

Total Quality Management (TQM)

- TQM goes beyond documenting processes
  - Optimizes them through redesign.
- Over the years the quality paradigm has shifted:
  - From product assurance to process assurance.

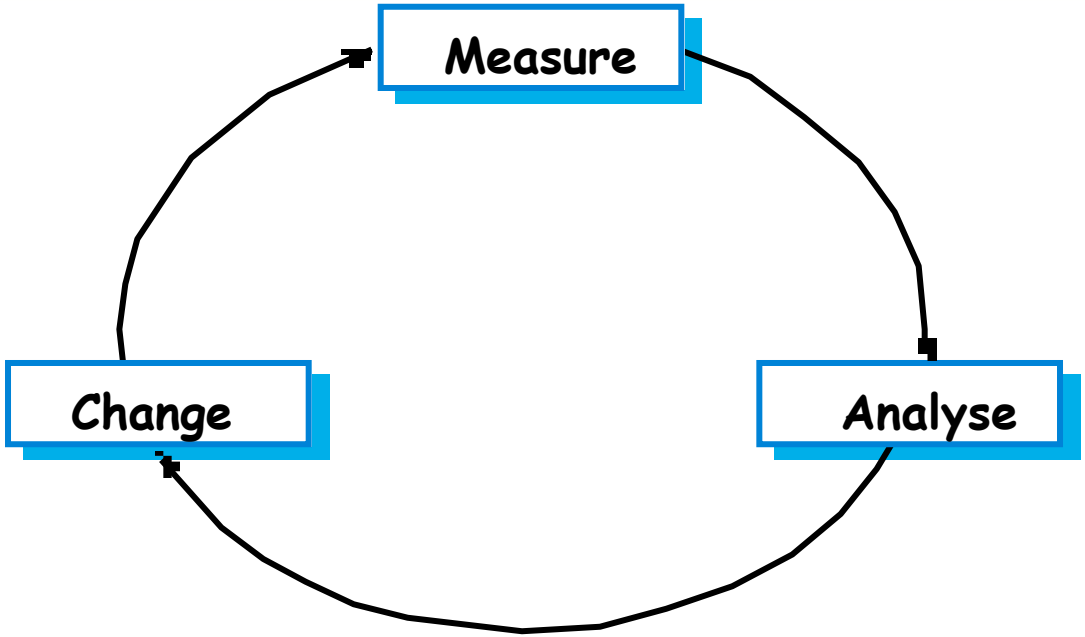
Process Improvement

- Implies introducing process changes to improve:
  - Product quality
  - Reduce costs
  - Accelerate schedules.
- Most process improvement work so far has focused on defect reduction.

Process Attributes

Process characteristic	Description
Understandability	To what extent is the process explicitly defined and how easy is it to understand the process definition?
Visibility	Do the process activities culminate in clear results so that the progress of the process is externally visible?
Supportability	To what extent can CASE tools be used to support the process activities?
Acceptability	Is the defined process acceptable to and usable by the engineers responsible for producing the software product?
Reliability	Is the process designed in such a way that process errors are avoided or trapped before they result in product errors?
Robustness	Can the process continue in spite of unexpected problems?
Maintainability	Can the process evolve to reflect changing organisational requirements or identified process improvements?
Rapidity	How fast can the process of delivering a system from a given specification be completed?

The Process Improvement Cycle



Process Improvement Stages

- Process measurement
  - Attributes of the process are measured.
  - Form a baseline for assessing improvements.
- Process analysis
  - The process is assessed and bottlenecks and weaknesses are identified.
- Process change
  - Changes to the process that have been identified during the analysis are introduced.

Process and Product Quality

- A good process is usually required to produce a good product.
- For manufactured goods, process is the principal quality determinant.
- For design-based activity, other factors are also involved:
  - For example, the capabilities of the designers.

Summary

- Discussed basic concepts of quality systems.
- Explained the quality factors associated with a software product.
- Discussed the Evolution of Quality Systems
- Explained the Process Improvement Cycle

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Thank you