Software Quality Assurance

Organization of this session:

- Introduction to Quality Engineering
- Quality Systems and Evolution
- ISO 9000
- SEI CMM
- Summary

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,

⌃fitness of purpose:

☒satisfying the requirements specified in SRS document

Introduction

- Consider a software product:
  - functionally correct,
    - i.e. performs all functions as specified in the SRS document,
  - but has an almost unusable user interface.
    - cannot be considered as a quality product.

Introduction

- Another example:
  - a product which does everything that users want.
  - but has an almost incomprehensible and unmaintainable code.

Software Quality Management System
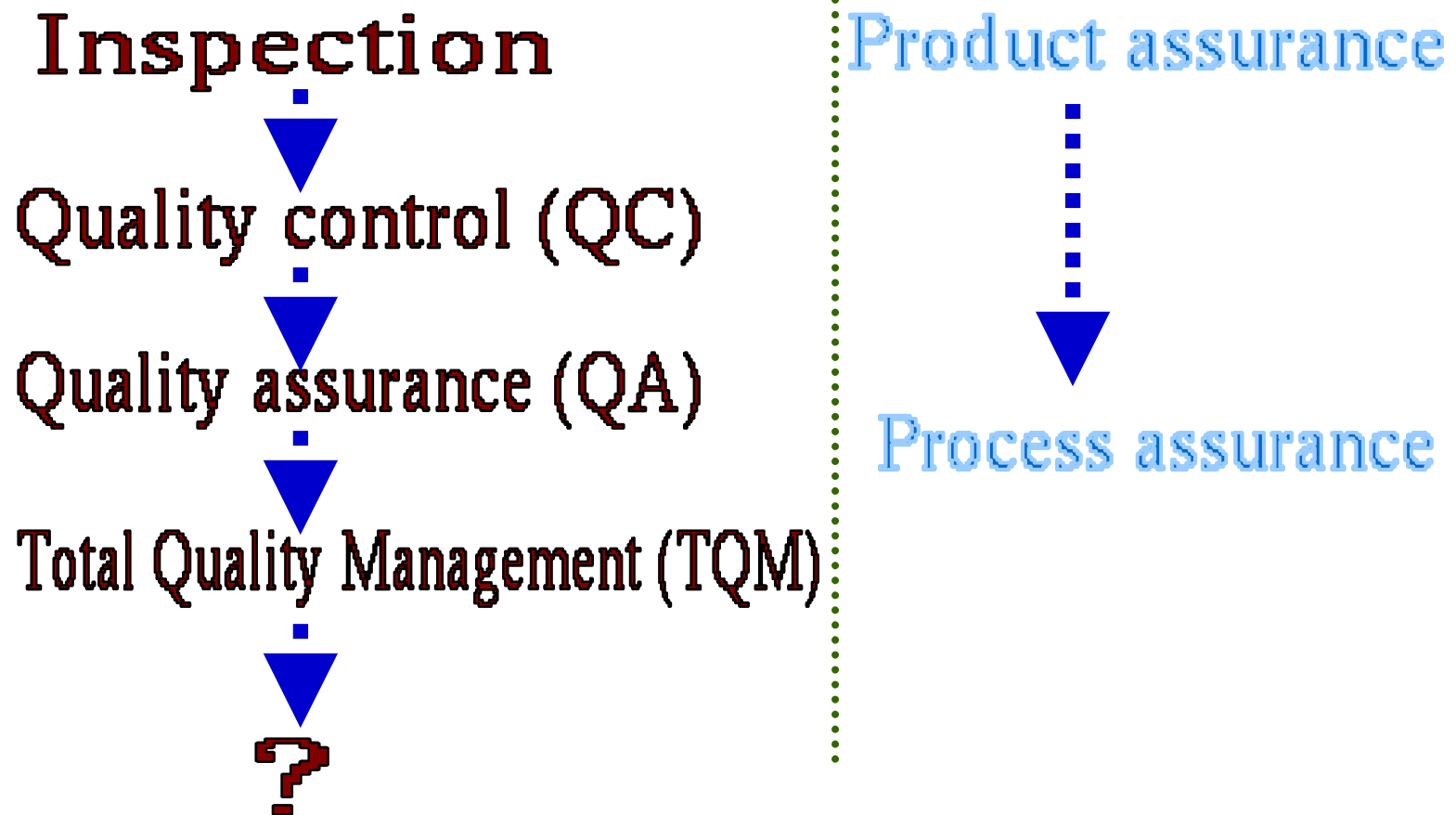
⌘Quality management system (or quality system):

⌂principal methodology used by organizations to ensure that the products have desired quality.

Evolution of Quality Systems

◇quality systems of organizations have undergone
  ☒four stages of evolution.

Evolution of Quality Systems

Inspection

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Quality control (QC)

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Quality assurance (QA)

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Total Quality Management (TQM)

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Product assurance

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Process assurance

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.

Quality control (QC)

- The next breakthrough,
  - development of quality assurance principles

Quality assurance

Basic premise of modern quality assurance is that:

- if an organization's processes are good and are followed rigorously,
  - then 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.
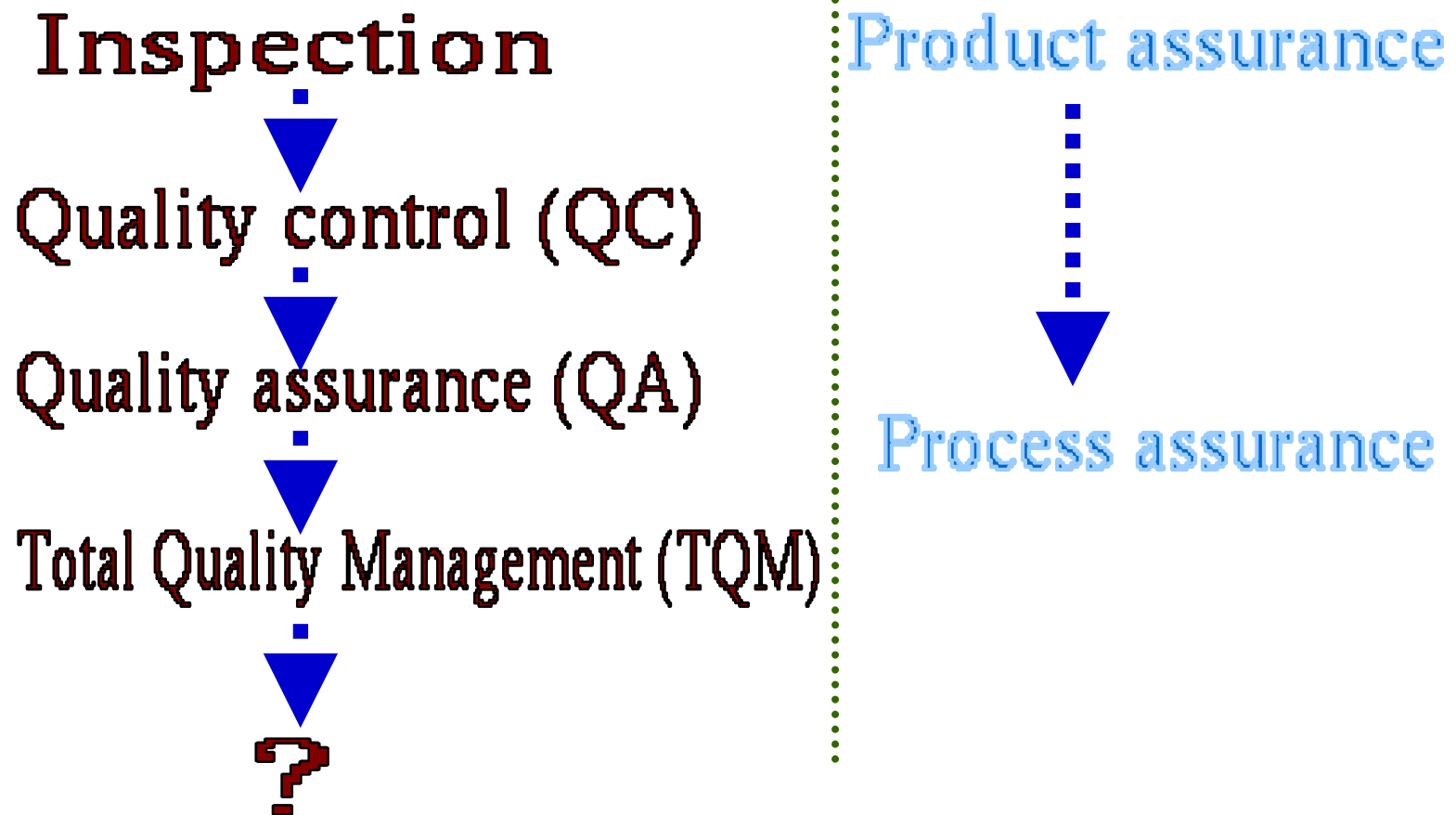
Total quality management (TQM)

⌘ Advocates:

⬆ continuous process improvements through process measurements

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.

Evolution of Quality Systems

Inspection

Quality control (QC)

Quality assurance (QA)

Total Quality Management (TQM)

?

Product assurance

Process assurance

ISO 9000

- ISO (International Standards Organization):
  - a consortium of 63 countries established to formulate and foster standardization.
- ISO published its 9000 series of standards in 1987.

What is ISO 9000 Certification?

- ISO 9000 certification:
  - serves as a reference for contract between independent parties
- The ISO 9000 standard:
  - specifies guidelines for maintaining a quality system

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What is ISO 9000 Certification?

- ISO 9000 specifies:
  - guidelines for repeatable and high quality product development
  - Also addresses organizational aspects:
    - responsibilities, reporting, procedures, processes, and resources for implementing quality management

ISO 9000

⌘ A set of guidelines for the production process.

⌃ not directly concerned about the product itself.

⌃ a series of three standards:

☒ ISO 9001, ISO 9002, and ISO 9003.

ISO 9000

- Based on the premise:
  - that if a proper process is followed for production:
    - good quality products are bound to follow.

ISO 9001:

⌘ Applies to:

- organizations engaged in design, development, production, and servicing of goods.

- applicable to most software development organizations.

ISO 9002:

- ISO 9002 applies to:
  - organizations who do not design products:
    - but are only involved in production.
- Examples of this category of industries:
  - steel or car manufacturing industries
  - buy the product and plant designs from external sources:
    - only manufacture products.
  - not applicable to software development organizations.

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ISO 9003

- ISO 9003 applies to:
  - organizations involved only in installation and testing of the products

ISO 9000 for Software Industry

- ISO 9000 is a generic standard:
  - it is applicable to many industries,
    - starting from a steel manufacturing industry to a service rendering company.
- Many clauses of ISO 9000 documents:
  - use generic terminologies
  - very difficult to interpret them in the context of software organizations.

SEI Capability Maturity Model

- Developed by Software Engineering Institute (SEI) of the Carnegie Mellon University, USA:
  - to assist the U.S. Department of Defense (DoD) in software acquisition.
  - The rationale was to include:
    - likely contractor performance as a factor in contract awards.

SEI Capability Maturity Model

✤ Major DoD contractors began CMM-based process improvement initiatives:

  ⬙ as they vied for DoD contracts.

✤ SEI CMM helped organizations:

  ⬙ Improve the quality of software they developed

  ⬙ Realize adoption of SEI CMM model had significant business benefits.

✤ Other organizations adopted CMM.

SEI Capability Maturity Model

- Can be used in two ways:
  - Capability evaluation
  - Software process assessment

SEI Capability Maturity Model

- The SEI CMM classifies software development industries into:
  - Five maturity levels
  - Stages are ordered so that improvements at one stage provide foundations for the next
  - Based on the pioneering work of **Philip Crosby**

Level 1: (Initial)

- ⌘ Organization operates
  - ⌃ without any formalized process or project plans
- ⌘ An organization at this level is characterized by
  - ⌃ ad hoc and often chaotic activities

Level 1: (Initial)

⌘ Software production processes are not defined,
- ⌃ different engineers follow their own process
- ⌃ development efforts become chaotic.
- ⌃ the success of projects depend on individual efforts and heroics.

Level 2: (Repeatable)

- Basic project management practices
  - tracking cost, schedule, and functionality are followed.
- Size and cost estimation techniques
  - function point analysis, COCOMO, etc. used
- Production process is ad hoc
  - not formally defined
  - also not documented

Level 2: (Repeatable)

⌘Process used for different projects might vary between projects:

⬦earlier successes on projects with similar applications can be repeated

⬦opportunity to repeat a process exists when a company produces a family of products

Level 3: (Defined)

⌘ The processes for management and development activities are:
- ⌃ defined and documented.
- ⌃ there is a common organization-wide understanding of activities, roles, and responsibilities.

Level 3: (Defined)

⌘ The process though defined, process and product qualities are not measured

⌘ ISO 9001 aims at achieving this level

Level 4: (Managed)

⌘ The focus is on software metrics.

⌘ Product metrics (such as size, reliability, time complexity, understandability, etc.) and process metrics (average defect correction time, average number of defects found per hour of inspection, average number of failures detected during testing, etc) are measured:

- The measured values are used to control the product quality
- Results of measurement used to evaluate project performance
  - rather than improve process.

Level 5: (Optimizing)

⌘Statistics collected from process and product measurements are analyzed:

⬆continuous process improvement based on the measurements.

☒known types of defects are prevented from recurring by tuning the process

☒lessons learnt from specific projects are incorporated into the process

Comparison between ISO 9001 and SEI CMM

- ⌘ SEI CMM was developed specifically for software industry:
  - ⌃ addresses many issues specific to software industry.
- ⌘ SEI goes beyond quality assurance
  - ⌃ aims for TQM
  - ⌃ ISO 9001 correspond to SEI level 3.

Summary

- Evolution of quality system:
  - product inspection
  - quality control
  - quality assurance
  - total quality management (TQM)
- Quality paradigm change:
  - from product to process

Summary

- ISO 9000:
  - basic premise:
    - if a good process is followed
    - good products are bound to follow
  - provides guidelines for establishing a quality system.

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Summary

- ISO 9000
  - series of three standards
    - 9001, 9002, and 9003
  - 9001 is applicable to software industry

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Summary

- SEI CMM
  - developed specially for software industry
  - classifies software organizations into five categories.
    - According to the maturity of their development process.

Just for laffs

Some definitions (with due respect to all)

Project Manager is a Person who thinks nine women can deliver a baby in One month.

Some definitions (with due respect to all)

Developer is a Person who thinks it will take 18 months to deliver a Baby.

Some definitions (with due respect to all)

Onsite Coordinator is one who thinks single woman can deliver nine babies in one month.

Some definitions (with due respect to all)

Client is the one who doesn't know why he wants a baby.

Some definitions (with due respect to all)

Marketing Manager is a person who thinks he can deliver a baby even if no man and woman are available.

Some definitions (with due respect to all)

Documentation Team thinks they don't care whether the child is delivered, they'll just document 9 months.

Some definitions (with due respect to all)

Quality Auditor is the person who is never happy with the PROCESS to produce a baby.

Some definitions (with due respect to all)

And lastly…

Tester is a person who always tells his wife that this baby has so many defects…………..