Lecture 12- Software Quality (Sommerville Ch. 24)

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Objectives

- To introduce the quality management process and key quality management activities
- To explain the role of standards in quality management
- To explain the concept of software metrics
- To explain how measurement may be used in assessing software quality

- Today's seminar
  - Do we need quality software?

What is quality?

- Quality, simplistically, means that a product should meet its specification
- This is problematical for software systems
  - Tension between customer quality requirements (efficiency, reliability, etc.) and developer quality requirements (maintainability, reusability, etc.)
  - Some quality requirements are difficult to specify in an unambiguous way
  - Software specifications are usually incomplete and often inconsistent
- Quality is whatever you want it to mean!

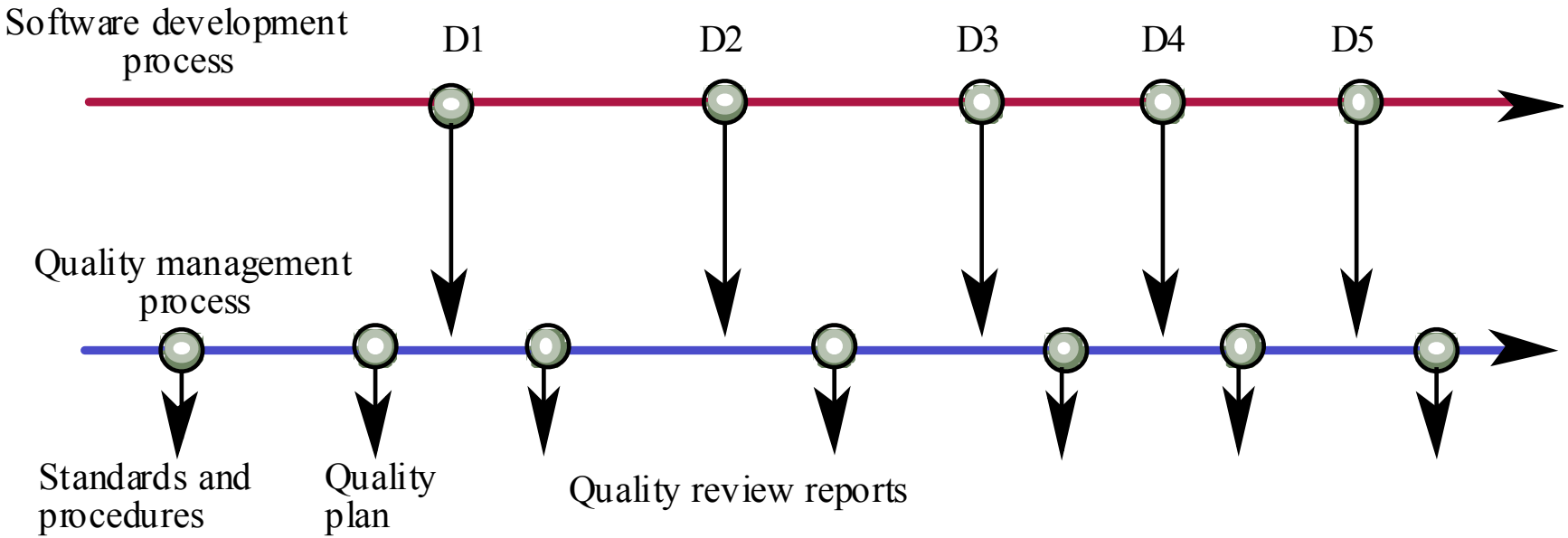
The quality compromise

- We cannot wait for specifications to improve before paying attention to quality management
- Must put procedures into place to improve quality in spite of imperfect specification
- Quality management is therefore not just concerned with reducing defects but also with other product qualities

Quality management activities

- **Quality assurance**
  - Establish organisational procedures and standards for quality
- **Quality planning**
  - Select applicable procedures and standards for a particular project and modify these as required
- **Quality control**
  - Ensure that procedures and standards are followed by the software development team
- **Quality management should be separate from project management to ensure independence**

Quality management and software development



Quality assurance and standards

- Standards are the key to effective quality management
- They may be international, national, organizational or project standards
- Product standards define characteristics that all components should exhibit e.g. a common programming style
- Process standards define how the software process should be enacted

Importance of standards

- Encapsulation of best practice- avoids repetition of past mistakes
- Framework for quality assurance process - it involves checking standard compliance
- Provide continuity - new staff can understand the organisation by understand the standards applied

ISO 9000

- International set of standards for quality management
- Applicable to a range of organisations from manufacturing to service industries
- ISO 9001 applicable to organisations which design, develop and maintain products
- ISO 9001 is a generic model of the quality process Must be instantiated for each organisation

ISO 9000 certification

- Quality standards and procedures should be documented in an organisational quality manual
- External body may certify that an organisation's quality manual conforms to ISO 9000 standards
- Customers are, increasingly, demanding that suppliers are ISO 9000 certified

- (We will cover ISO 9000 in more detail in the second year)

Certification Warnings

- ISO 9000 is a *process* based standard
- Certification means that your *process* adheres to standards
  - I.e. that the process is documented, repeatable, traceable and contains a mechanism for review and improvement
- Can we be certain that a quality process results in a quality product?
- Conversely, a quality product is not always the result of a certified process
  - Certification may simply not be seen as relevant

Problems with standards

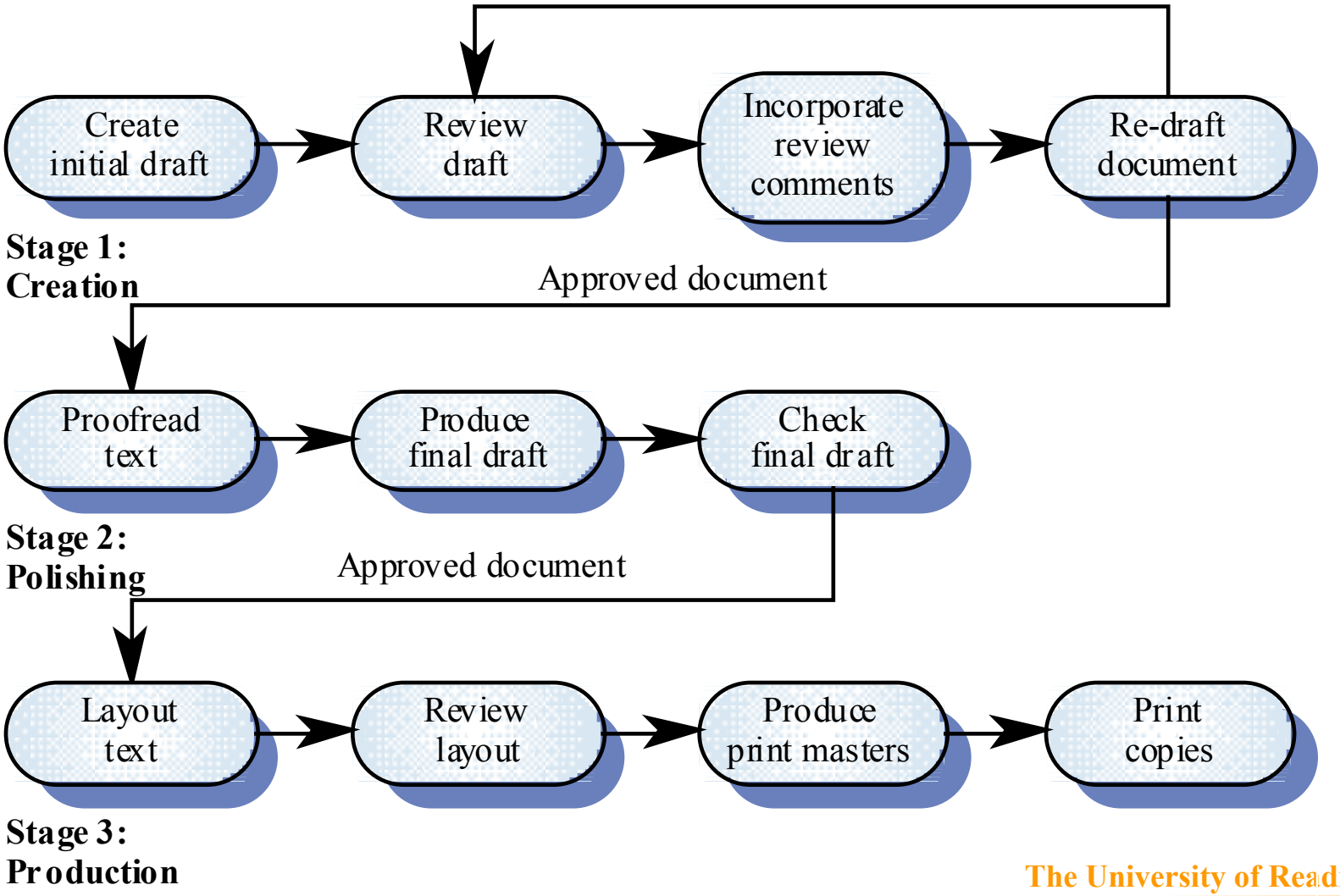
- Not seen as relevant and up-to-date by software engineers
- Involve too much bureaucratic form filling
- Unsupported by software tools so tedious manual work is involved to maintain standards
- Quality standards and processes are generally disliked by developers!

Standards development

- Involve practitioners in development. Engineers should understand the rationale underlying a standard
- Review standards and their usage regularly. Standards can quickly become outdated and this reduces their credibility amongst practitioners
- Detailed standards should have associated tool support. Excessive clerical work is the most significant complaint against standards

Documentation standards

- Particularly important - documents are the tangible manifestation of the software
- Documentation process standards
  - How documents should be developed, validated and maintained
- Document standards
  - Concerned with document contents, structure, and appearance
- Document interchange standards
  - How documents are stored and interchanged between different documentation systems



Documentation process

Process and product quality

- The quality of a developed product is influenced by the quality of the production process
- Particularly important in software development as some product quality attributes are hard to assess
- However, there is a very complex and poorly understood relationship between software processes and product quality

Process-based quality

- Straightforward link between process and product in manufactured goods
- More complex for software because:
  - The application of individual skills and experience is particularly important in software development
  - External factors such as the novelty of an application or the need for an accelerated development schedule may impair product quality
- Care must be taken not to impose inappropriate process standards

Quality planning

- A quality plan sets out the desired product qualities and how these are assessed and defines the most significant quality attributes
- It should define the quality assessment process
- It should set out which organisational standards should be applied and, if necessary, define new standards

Quality plan structure

- Product introduction
- Product plans
- Process descriptions
- Quality goals
- Risks and risk management
- Quality plans should be short, succinct documents
  - If they are too long, no-one will read them

Software quality attributes

Safety	Understandability	Portability
Security	Testability	Usability
Reliability	Adaptability	Reusability
Resilience	Modularity	Efficiency
Robustness	Complexity	Learnability

Quality control

- Checking the software development process to ensure that procedures and standards are being followed
- Two approaches to quality control
  - Quality reviews
  - Automated software assessment and software measurement
- There may be a “Quality Manager” role
  - But then quality is seen as their problem
- If you really need quality then it should be pervasive
  - Quality is everybody’s problem

Quality reviews

- The principal method of validating the quality of a process or of a product
- Group examined part or all of a process or system and its documentation to find potential problems
- There are different types of review with different objectives
  - Inspections for defect removal (product)
  - Reviews for progress assessment(product and process)
  - Quality reviews (product and standards)

Quality reviews

- A group of people carefully examine part or all of a software system and its associated documentation.
- Code, designs, specifications, test plans, standards, etc. can all be reviewed.
- Software or documents may be 'signed off' at a review which signifies that progress to the next development stage has been approved by management.

Software measurement and metrics

- Software measurement is concerned with deriving a numeric value for an attribute of a software product or process
- This allows for objective comparisons between techniques and processes
- Although some companies have introduced measurement programmes, the systematic use of measurement is still uncommon
- There are few standards in this area

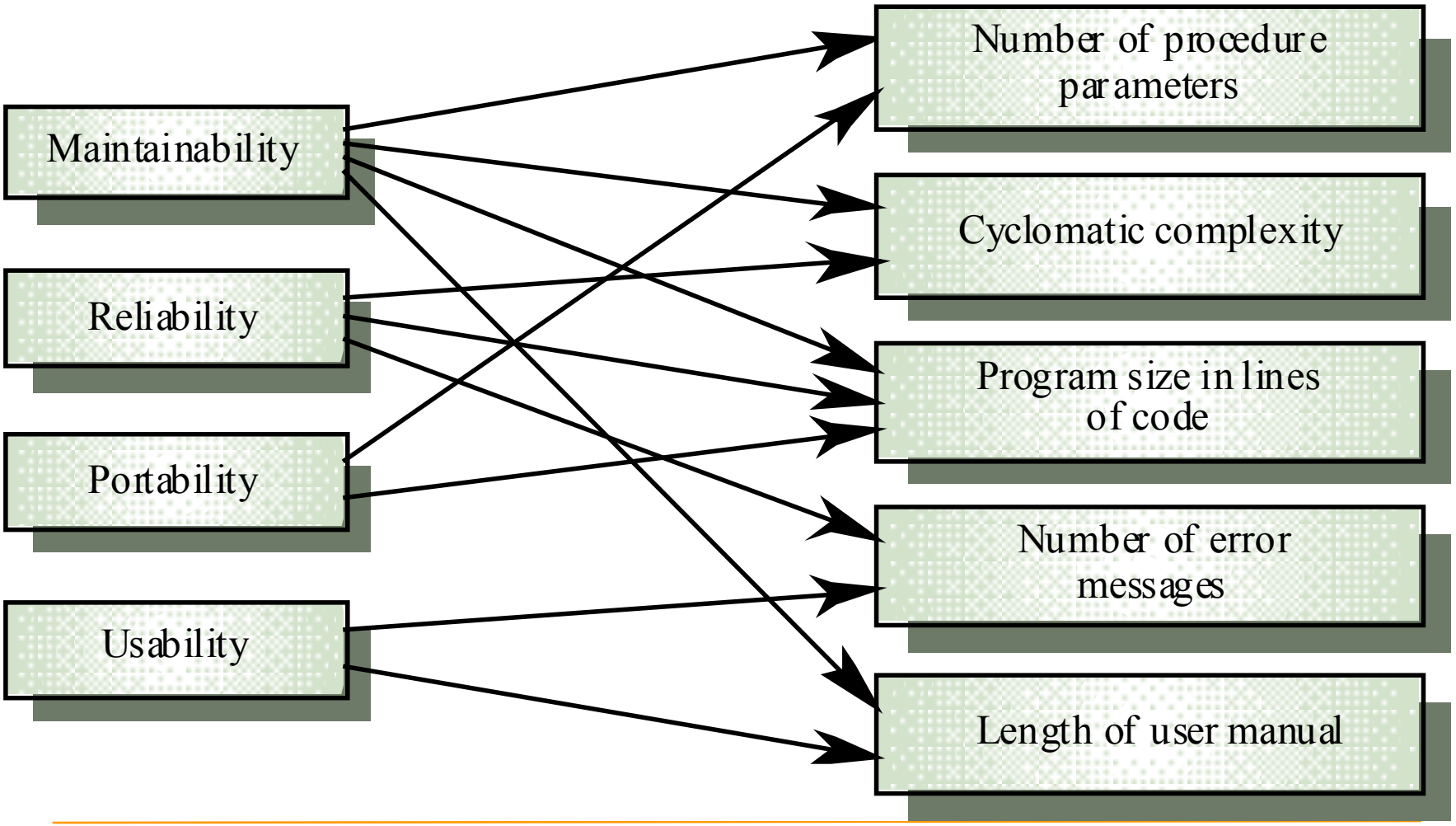
Software metric

- Any type of measurement which relates to a software system, process or related documentation
  - Lines of code in a program, the Fog index, number of person-days required to develop a component
- Allow the software and the software process to be quantified
- Measures of the software process or product
- May be used to predict product attributes or to control the software process

Metrics assumptions

- A software property can be measured
- The relationship exists between what we can measure and what we want to know
- This relationship has been formalized and validated
- It may be difficult to relate what can be measured to desirable quality attributes

Internal and external attributes



The measurement process

- A software measurement process may be part of a quality control process
- Data collected during this process should be maintained as an organisational resource
- Once a measurement database has been established, comparisons across projects become possible

Key points

- Software quality management is concerned with ensuring that software meets its required standards
- Quality assurance procedures should be documented in an organisational quality manual
- Software standards are an encapsulation of best practice
- Reviews are the most widely used approach for assessing software quality

Key points

- Software measurement gathers information about both the software process and the software product
- Product quality metrics should be used to identify potentially problematical components
- There are no standardised and universally applicable software metrics

Preparation for Lecture 13

- Please read through the technical proposal provided (and also on Blackboard)
- This is a real proposal document
  - The names have been changed to protect the innocent!
- Next week we will analyse this document for Technical Risks

Seminar Questions

- Does all software need to be of high “quality”?
  - One definition of quality is “conformance to requirements”
  - I need something quick and dirty and I need it now…
- Is there a place for “throw-away” software?
  - Write once, use once, throw-away
- What if we didn’t have a quality assurance process?
  - What is the effect on development teams?
  - What is the effect on the product?
- What other definitions of quality are there?