OHT 3.1

Software Quality Factors

- The need for comprehensive Software Quality Requirements
- Classification of requirements into Software Quality Factors
- Product Operation Factors
- Product Revision Factors
- Product Transition Factors
- Alternative models of software quality factors
- Who is interested in defining quality requirements?
- Software compliance with Quality Factors

OHT 3.2

The Requirements Document

- Requirement Documentation (Specification) is one of the **most important elements** for achieving software quality
- Need to explore what constitutes a good software requirements document.
- Some SQA Models suggest 11-15 factors categorized; some fewer; some more
- Want to become familiar with these quality factors, and
- Who is really interested in them.
- The need for comprehensive software quality requirements is pervasive in numerous case studies (see a few in this chapter).
- (Where do the quality factors go??)

OHT 3.3

Need for Comprehensive Software Quality Requirements

- Need for improving poor requirements documents is widespread
- Frequently lack quality factors such as: usability, reusability, maintainability, …
- Software industry groups the long list of related attributes into what we call ***quality factors. (Sometimes non-functional requirements)***
- Natural to assume an unequal emphasis on all quality factors.
- Emphasis varies from project to project
  - Scalability; maintainability; reliability…
- Let's look at some of the categories…

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Extra Thoughts

- Seems like in Software Engineering we concentrate on capturing, designing, implementing, and deploying with emphasis on **functional requirements.**
- Little (not none!) emphasis on the **non-functional requirements** (quality factors).

- In the RUP, non-functional requirements are captured in the Software Requirements Specification (SRS); functional requirement usually captured in Use Case stories.

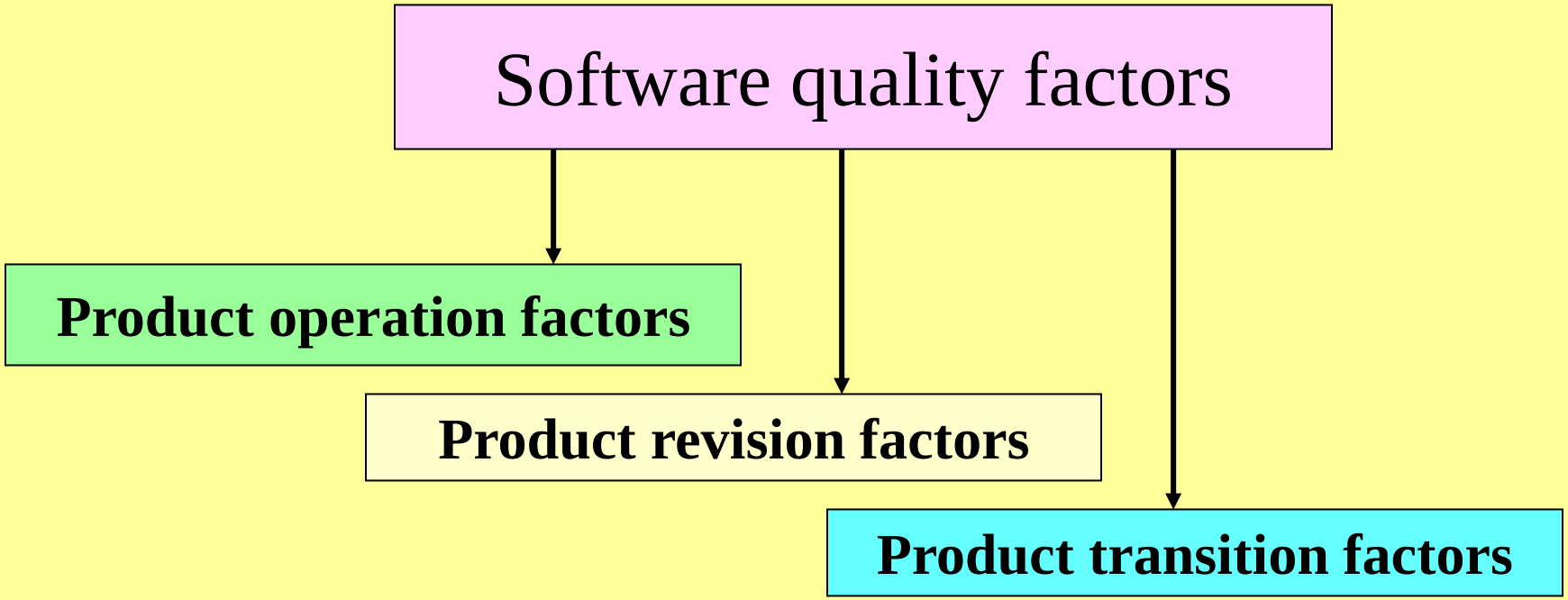
OHT 3.5

McCall's Quality Factors

- McCall has 11 factors; Groups them into categories.
  - 1977; others have added, but this still prevail.
- Three categories:
  - Product Operation Factors
    - How well it runs….
    - Correctness, reliability, efficiency, integrity, and usability
  - Product Revision Factors
    - How well it can be changed, tested, and redeployed.
    - Maintainability; flexibility; testability
  - Product Transition Factors
    - How well it can be moved to different platforms and interface with other systems
    - Portability; Reusability; Interoperability
- Since these underpin the notion of quality factors and others who have added, reword or add one or two, we will spend time on these factors.

OHT 3.6

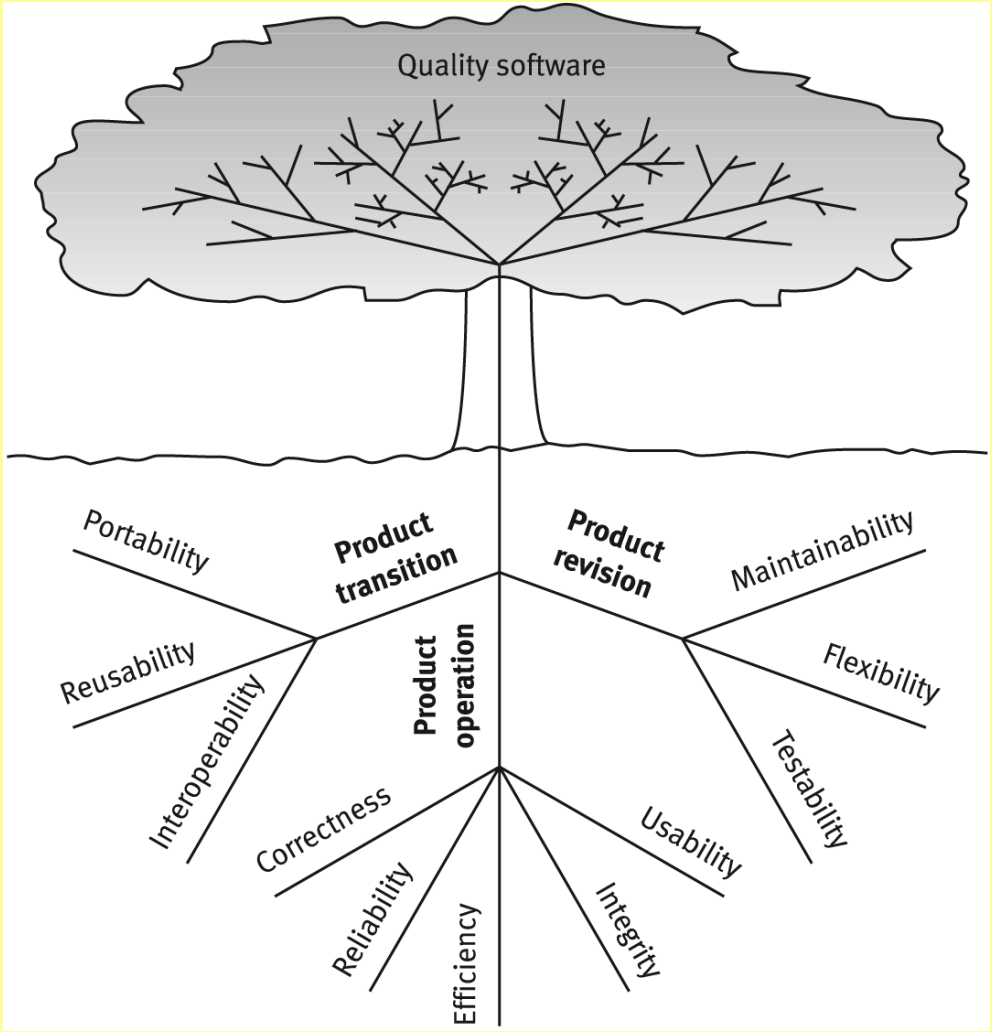
McCall's software quality factors model



Note: not much apparent emphasis on functionality – only in correctness.

OHT 3.7

McCalls factor model tree



OHT 3.8

Product operation factors

- Correctness
- Reliability
- Efficiency
- Integrity
- Usability

How well does it run and ease of use.

OHT 3.9

McCall's Quality Factors
Category: Product Operation Factors

- **1. Correctness**.
- **Please note that we are asserting that 'correctness' issues are arising from the requirements documentation and the specification of the outputs…**
- **Examples include:**
  - **Specifying accuracies for correct outputs** at, say, NLT <1% errors, that could be affected by inaccurate data or faulty calculations;
  - **Specifying** the **completeness of the outputs** provided, which can be impacted by incomplete data
  - **Specifying the timeliness of the output** (time between event and its consideration by the software system)
  - **Specifying the standards** for coding and documenting the software system

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McCall's Quality Factors
Category: Product Operation Factors

- **2. Reliability Requirements**. (remember, this quality factor is specified in the specs!)
- Reliability requirements deal with the failure to provide service.
  - Address failure rates either overall or to required functions.

- Example specs:
  - A heart monitoring system must have a failure rate of less than one per million cases.
  - Downtime for a system will not be more than ten minutes per month (me)

- **3. Efficiency Requirements.** Deals with the hardware resources needed to perform the functions of the software.
  - Here we consider MIPS, MHz (cycles per second); data storage capabilities measured in MB or TB; communication lines (usually measured in KBPS, MBPS, or GBPS).

  - Example spec: simply very slow communications…

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McCall's Quality Factors
Category: Product Operation Factors

- **4. Integrity** – deal with system security that prevent unauthorized persons access.

- **5. Usability Requirements** – deals with the scope of staff resources needed to train new employees and to operate the software system.

  – Deals with learnability, utility, and more. (me)

  – Example spec: A staff member should be able to process n transactions / unit time. (me)

OHT 3.12

Product revision factors

- **Maintainability**
- **Flexibility**
- **Testability**

Can I fix it easily, retest, version it, and deploy it easily?

OHT 3.13

McCall's Quality Factors

Category: Product Revision Software Factors

- These deal with requirements that affect the complete range of software maintenance activities:
  - corrective maintenance,
  - adaptive maintenance, and
  - perfective maintenance

- **1. Maintainability Requirements**
  - The degree of effort needed to identify reasons (find the problem) for software failure and to correct failures and to verify the success of the corrections.
  - Deals with the modular structure of the software, internal program documentation, programmer manuals
  - Example specs: size of module <= 30 statements.

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McCall's Quality Factors
Category: Product Revision Software Factors

- **2. Flexibility Requirements** – deals with resources to change (adopt) software to different types of customers that use the app perhaps a little differently;
  - May also involve a little perfective maintenance to perhaps do a little better due to the customer's perhaps slightly more robust environment.

- **3. Testability Requirements –**
  - Are intermediate results of computations predefined to assist testing?
  - Are log files created?
  - Does the software diagnose itself prior to and perhaps during operations?

Product transition factors

- **Portability**
- **Reusability**
- **Interoperability**

Can I move the app to different hardware? Interface easily with different hardware / software systems; can I reuse major portions of the code with little modification to develop new apps?

OHT 3.16

McCall's Quality Factors
Category: Product Transition Software Quality Factors

- **1. Portability Requirements:** If the software must be ported to different environments (different hardware, operating systems, …) and still maintain an existing environment, then portability is a must.

- **2. Reusability Requirements:** Are we able to reuse parts of the app for new applications?
  - Can save immense development costs due to errors found / tested.
  - Certainly higher quality software and development more quickly results.
  - Very big deal nowadays.

OHT 3.17

McCall's Quality Factors
Category: Product Transition Software Quality Factors

- **3. Interoperability Requirements:** Does the application need to interface with other existing systems

  - Frequently these will be known ahead of time and plans can be made to provide for this requirement during design time.
    - Sometimes these systems can be quite different; different platforms, different databases, and more

  - Also, industry or standard application structures in areas can be specified as requirements.

OHT 3.18

McCall's factor model and alternative models

No.	Software quality factor	McCall's classic model	Alternative factor models	
			Evans and Marciniak model	Deutsch and Willis model
1	Correctness	+	+	+
2	Reliability	+	+	+
3	Efficiency	+	+	+
4	Integrity	+	+	+
5	Usability	+	+	+
6	Maintainability	+	+	+
7	Flexibility	+	+	+
8	Testability	+		
9	Portability	+	+	+
10	Reusability	+	+	+
11	Interoperability	+	+	+
12	Verifiability		+	+
13	Expandability		+	+
14	Safety			+
15	Manageability			+
16	Survivability			+