Course Introdction TDDE46

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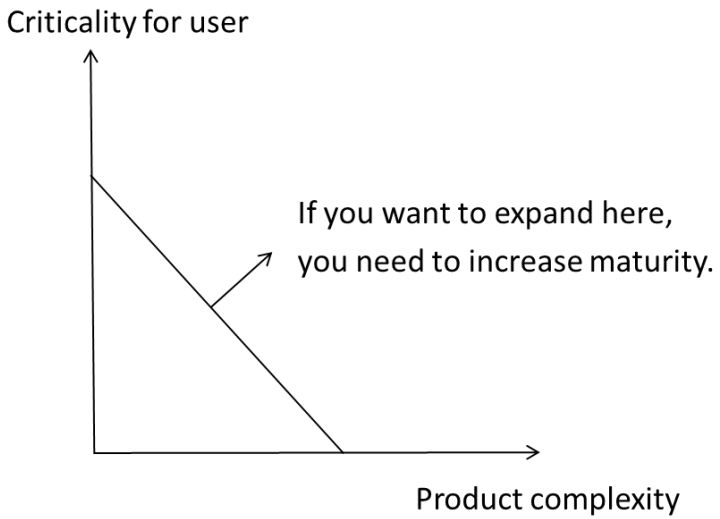
LINKÖPING UNIVERSITY

Quality work in a software company is done for different reasons

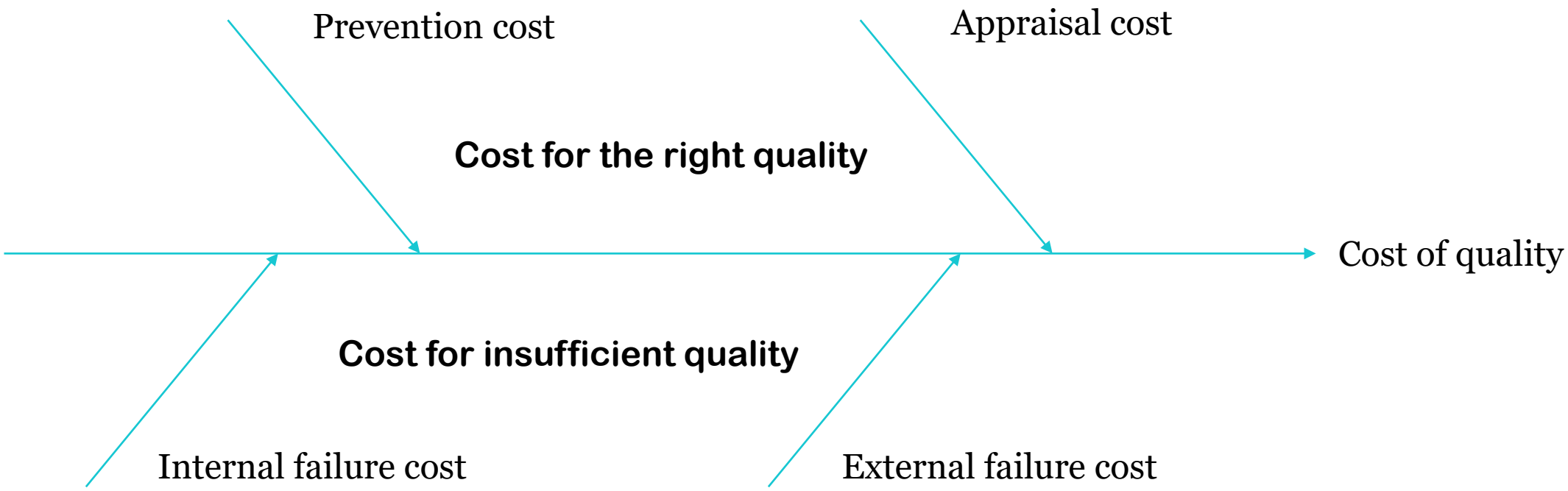


Take new challenges

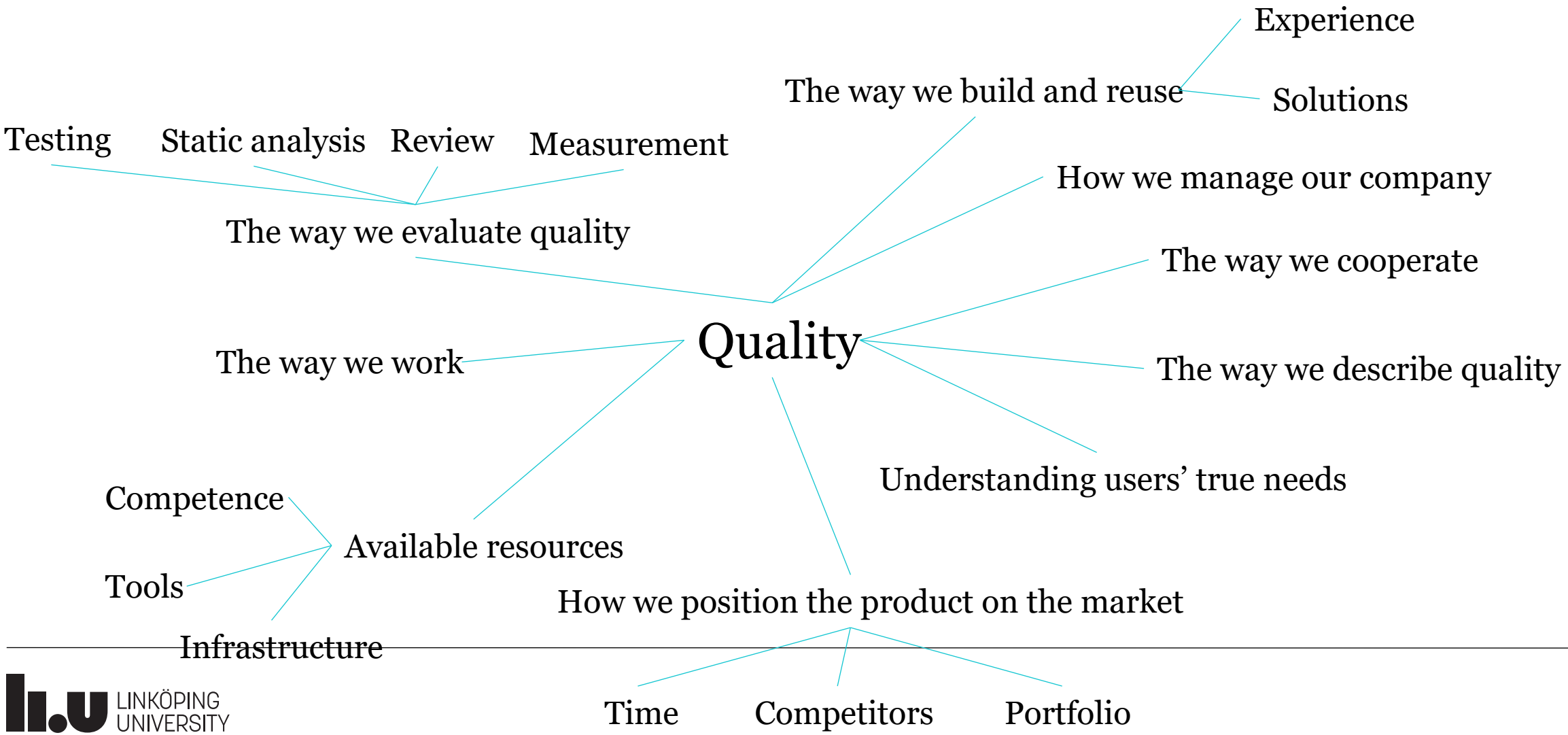
Grow your assets

Avoid complaints

Quality is free?



Drivers for quality

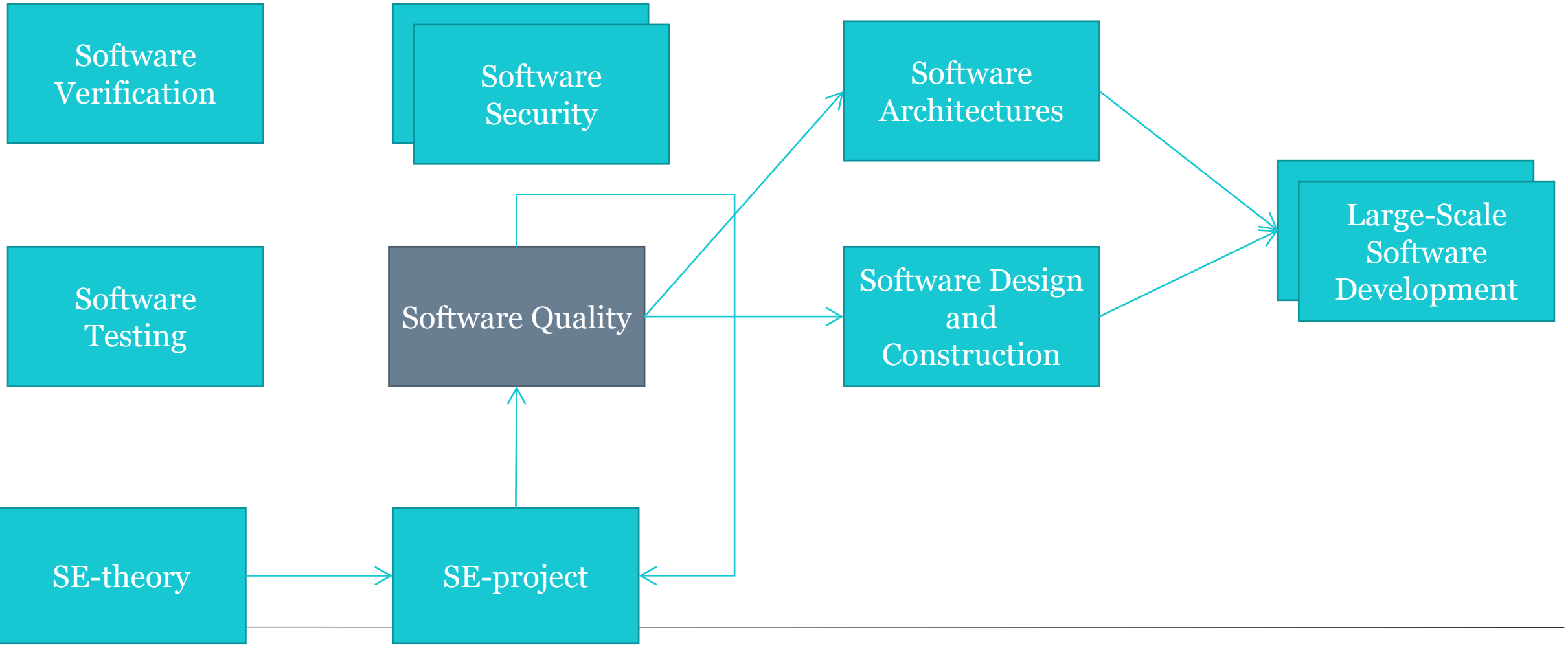


Course content

- Metrics for product, process and resources
- The Goal-Question-Metric method
- Tools for measurement, verification and fault detection
- The Essence-standard for describing and working with software development practices
- Quality assurance methods
- Evaluation of an ongoing project
- Coaching of members of an ongoing project
- Write a quality report

- Taught in other courses:
  - Software reviews
  - Formal verification
  - Software testing
  - Design for quality factors
- Taught at IEI:
  - Quality management
  - Statistical process control

The position in the course programme



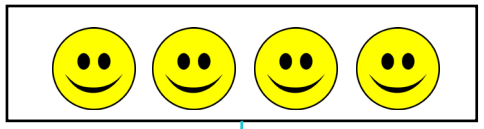
You will coach the bachelor thesis projects to get the process and people experience

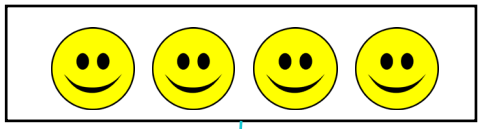
- This is a true need
- You will help them to achieve:
  - Measurable quality requirements
  - A useful quality plan
- You will practice:
  - Identify, suggest and evaluate a process improvement
  - Evaluate a product

http://www.culturaltravelguide.com/wp-content/uploads/2012/05/plan-a-trip-tourist-guide1.j

Organisation

Project and seminar groups





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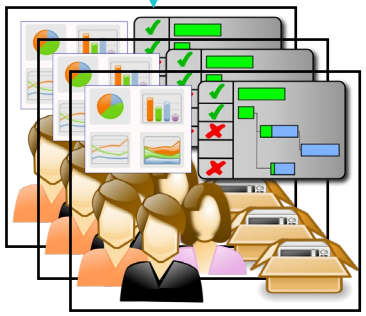
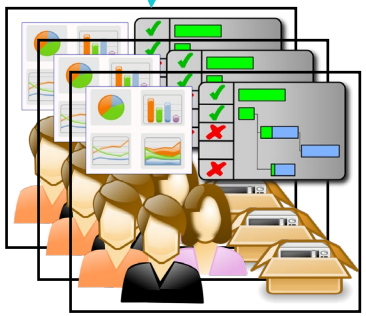
Bachelor projects





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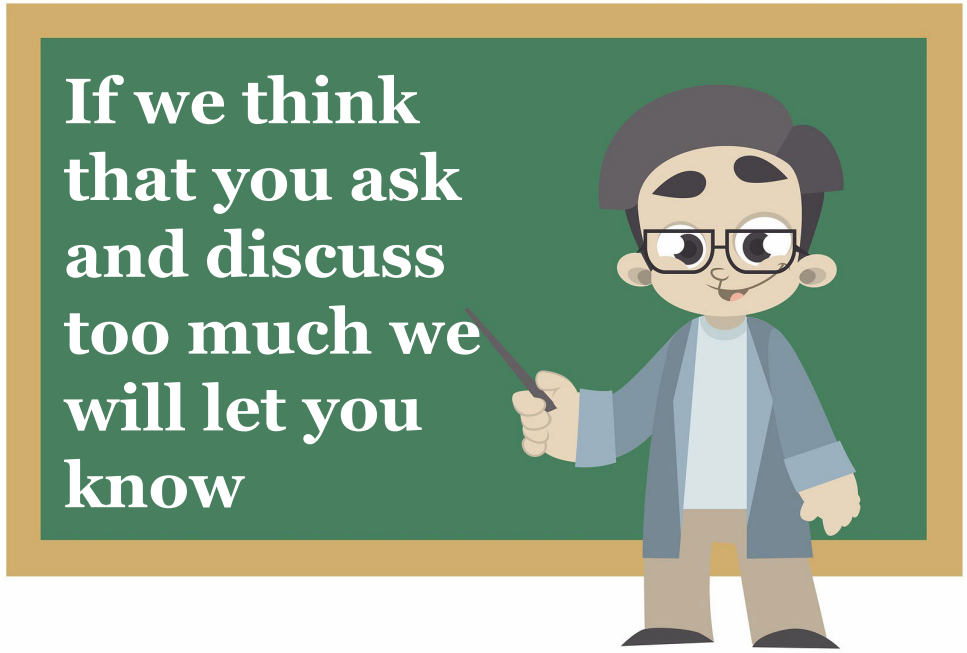
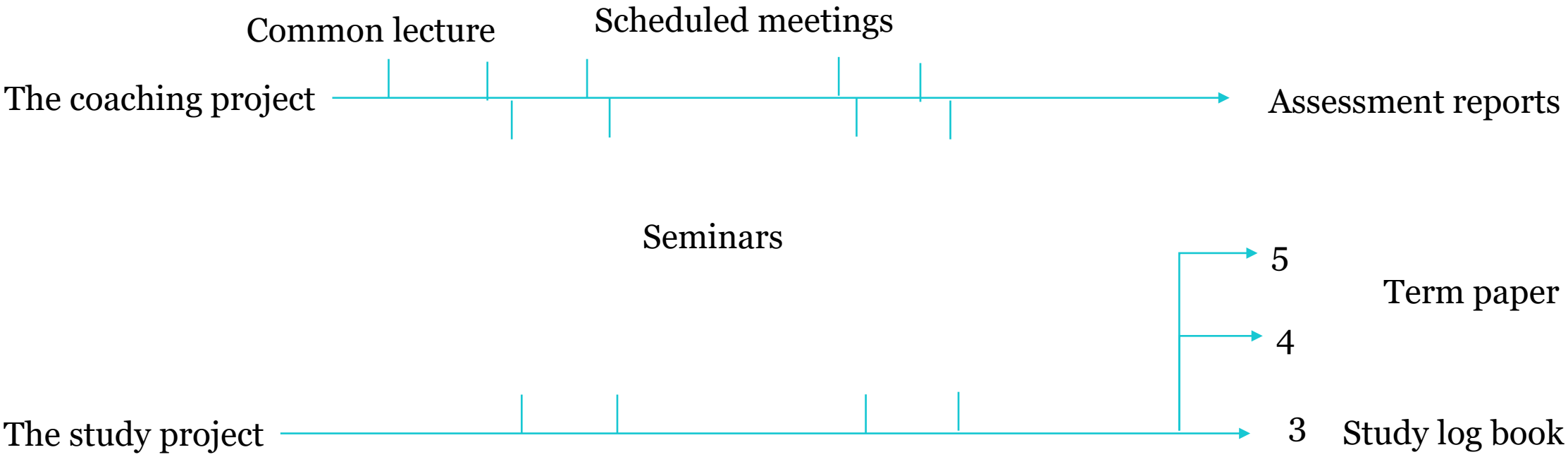
A few lectures give the most common theoretical aspects of software quality

- To help you getting in shape fast for the coaching tasks
  - ISO/IEC 25010
  - Metrics
  - IEEE 730
  - Essence



Organization: Two projects



Most of knowledge acquisition is self-studies

- Study logbook entry
  - What did you study?
  - Major take-aways
  - Reflection (not needed for every source, a must after each seminar)
- Typical subjects to study: Article, book, standard, experiment with tool, interview with companies

- Constraints
  - Must cover experiments with at least three tools
  - Activities each week

Experiment with tools

- Tools for software measurement
- Tools for data analysis
- Visualizing metrics with a dashboard
- Tools for performance and energy consumption
- Process modeling
- Tools for robustness and availability
- … Other tools not covered in TDDD04, TDDC90, or TDDE34

In seminars we discuss articles and account for coaching activities

- Study project:
- Prepare a presentation of a summary of a recent logbook item
- Present and discuss in the own group
- Present in a cross-group
- Each group will also give a presentation on a selected topic
- 20 min discussion of challenges in the coaching project

- Write a short reflection on major take-aways from the seminar in the logbook

Assessment reports

- Common part about the coaching project
- Processes and their improvement
- Product assessment
- Final report ending with deviations, and recommendataion

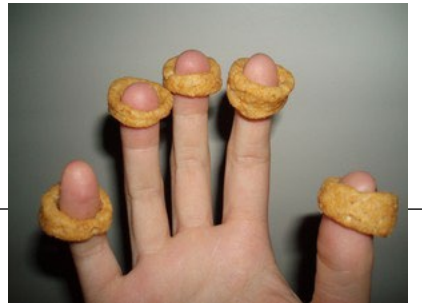
Grading rewards your ambition and achievements

- Individual appendix:
- 10-line abstracts with major results
- 10 good references
- Good, fault-free English
- 4-8 pages excluding pictures and references

= grade 4

- Same as grade 4 and:
- Clear comparison between 2-3 distinct findings in the coaching projects and the literature

= grade 5



Changes since last year

- Students take much more responsibility of the subject studies
- On the other hand, there is much more freedom in selecting subject of studies. Methods, tools, metrics, quality factors, challenges, …
- Opportunity to collaborate in the seminar groups around a theme
- Skipped term paper for grade 3

Objectives for next 45 minutes

- What is software quality?
- Different views on quality
- What are software quality factors?
- ISO/IEC 25010 standard in detail

What does Quality mean to you?

- You are a project manager of the BlaBla communication AB in Sweden. Your company develops networking products such as routers and switches. Your company also develops software for routers and switches to make it easy to use for customers. You are competing with five other companies to get the contract for 1 million devices for third world countries as part of United Nation campaign. This contract is very important for your financial planning otherwise you can go bankrupt. The contract is to submit the following documentation by just filling the blanks. Your answer (i.e. for the blank) must be between 1-5 words.
- Go to https://www.menti.com/
- Enter code **2631 0305**


We offer three kinds of service:
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GOOD service CHEAP won't be FAST
GOOD service FAST won't be CHEAP
FAST service CHEAP won't be GOOD
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What is Software Quality?

- Quality is a complex and multifaceted concept (David Garvin)
- Quality = Fitness for Purpose (Juran)
- Quality = Zero Defect (Crosby)
- An effective software process applied in a manner that creates a **useful product** that provides **measurable value** for those who produce it and those who use it

Different Views of Quality

- Five different views according to David Garvin:[1]
  - **Transcendental view**: that quality is something that you immediately recognize, but cannot explicitly define.
  - **User view**: sees quality in terms of an end user's specific goals. If a product meets those goals, it exhibits quality.
    - A product is of good quality, if it satisfy a large number of users
  - **Manufacturer view**: defines quality in terms of the original specification of the product. If the product conforms to the specification, it exhibits quality.
    - Does the product satisfy the specification/requirements?
  - **Product view**: suggests that quality can be tied to inherent characteristics (e.g., module approach and feature's re-usability) of a product.
  - **Value-based view**: measures quality based on how much a customer is willing to pay for a product.
    - How much a customer is willing to pay for a certain level of quality

1. Garvin, D., "What Does 'Product Quality' Really Mean?" Sloan Management Review, Fall 1984, pp. 25–45

Software Quality Factors

- To know that quality has improved, it would be helpful to be able to measure quality in term of factors.
- Quality Factors (Availability, Reliability, Maintainability, Security .....):
  - Goal-oriented methodology for measuring software quality
  - Identification of important attributes in the product that will have impact on its life cycle.

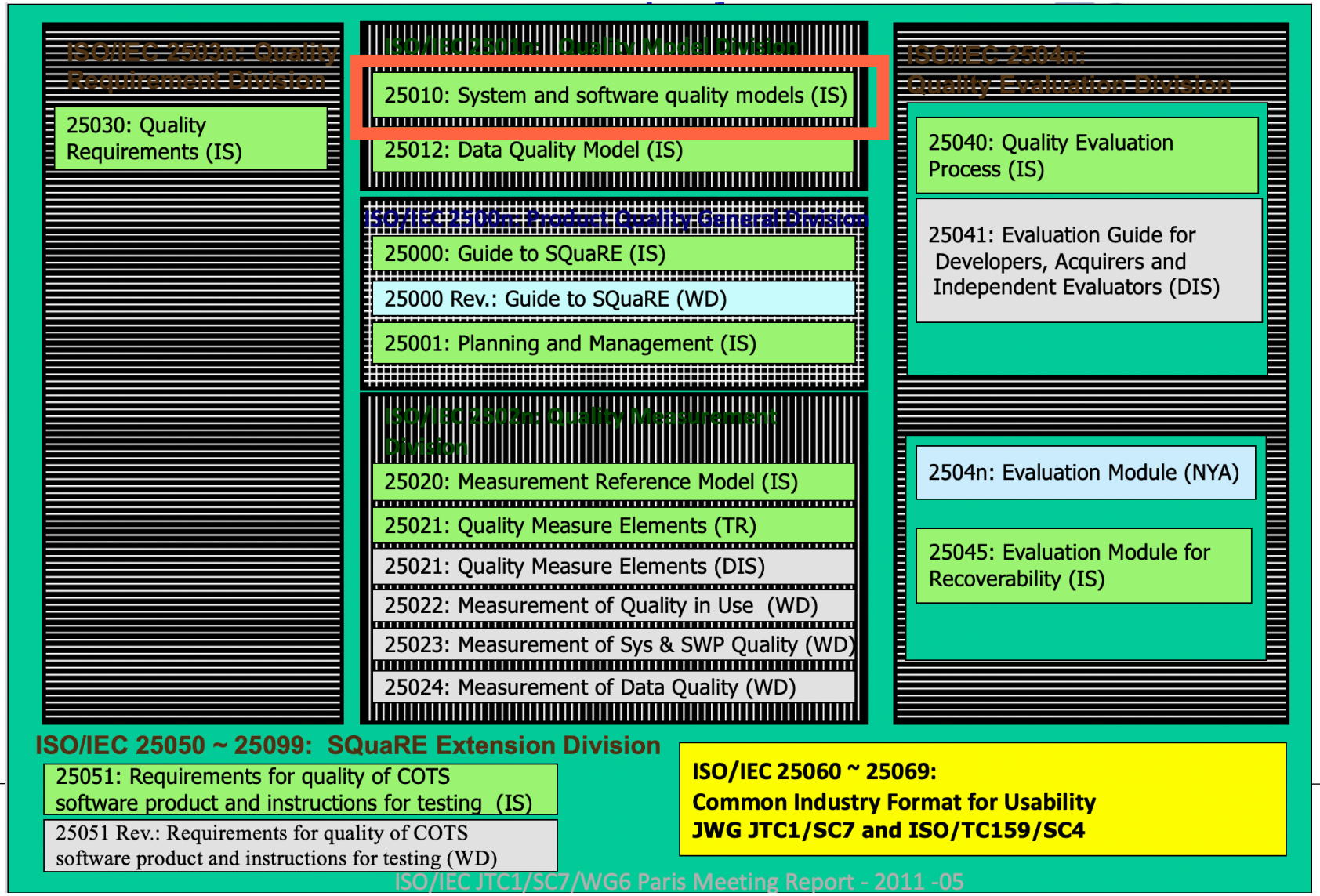
Software Quality Standards & Models

- Standards (i.e. international, regional, national or organizational):
  - Increase customer's confidence in the products
  - Help to achieve effective quality management
  - Avoid repetitions of past mistakes
  - Helps staff understand the organization by understanding the standard
  - Developed by:
    - IEEE, ISO, DOD (US Department of Defence), ANSI (American National Standard Organization), EIA (Electronic Industries Association) and others
- Models:
  - McCall -> 11 quality factors (1977)
  - Deutsch and Willis -> 12 quality factors (1988)
  - Evans and Marciniak-> 15 quality factors (1987)
  - Many others

Following a standard is not necessarily doing something good

Software Quality Standards – ISO 250XX

Software Product Quality Requirements and Evaluation (SQuaRE)



ISO/IEC 25010 (replaced with ISO 9126)

"The quality of a system is the degree to which the system satisfies the stated and implied needs of its various stakeholders, and thus provides value. Those stakeholders' needs (functionality, performance, security, maintainability, etc.) are precisely what is represented in the quality model, which categorizes the product quality into characteristics and sub-characteristics" (www.iso2500.com)

ISO/IEC 25010

Functional Suitability	Functional Completeness	degree to which the set of functions covers all the specified tasks and user objectives.
	Functional Correctness	degree to which the functions provides the correct results with the needed degree of precision.
	Functional Appropriateness	degree to which the functions facilitate the accomplishment of specified tasks and objectives.

- Functional Suitability refers to the identification of suitability of functionality related to business requirements in software application.
  - Check if all use cases have been written
  - Use traceability matrices to make sure that software matched with all business requirements completely and correctly

  - *Everyone in Sweden should pay tax -> complete?.*
  - *REQ1 Car rental prices shall show all applicable taxes (including 6% communal tax) ->correct?.*

ISO/IEC 25010

Performance Efficiency	Time-behavior	degree to which the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.
	Resource Utilization	degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.
	Capacity	degree to which the maximum limits of the product or system, parameter meet requirements.

- Performance efficiency is associated with time and resource utilization by software code during runtime.
  - Select appropriate data structure when writing code
  - Select appropriate algorithm
  - Consider data cashing, memory leakage, multi-threading, locking and other issues

ISO/IEC 25010

Compatibility	Co-existence	degree to which a product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product.
	Interoperability	degree to which two or more systems, products or components can exchange information and use the information that has been exchanged.

- Degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment
  - Write code that can communicate with different platforms such as Windows, Mac, Linux, …
  - Ability to use different functions to make one complete program

ISO/IEC 25010

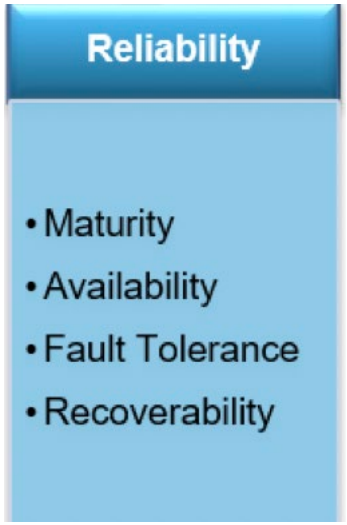
Usability

- Appropriateness Recognizability
- Learnability
- Operability
- User Error Protection
- User Interface Aesthetics
- Accessibility

Usability	Appropriateness recognisability	degree to which users can recognize whether a product or system is appropriate for their needs.
	Learnability	degree to which a product or system enables the user to learn how to use it with effectiveness, efficiency in emergency situations.
	Operability	degree to which a product or system is easy to operate, control and appropriate to use.
	User error protection	degree to which a product or system protects users against making errors.
	User interface aesthetics	degree to which a user interface enables pleasing and satisfying interaction for the user.
	Accessibility	degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.

- Keep it Simple
- Keep it Consistent

ISO/IEC 25010



Reliability	Maturity	degree to which a system, product or component meets needs for reliability under normal operation.
	Availability	degree to which a product or system is operational and accessible when required for use.
	Fault tolerance	degree to which a system, product or component operates as intended despite the presence of hardware or software faults.
	Recoverability	degree to which, in the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.

- Degree to which a system, product or component performs specified functions under specified conditions for a specified period of time
  - Pay attention to exception handling
  - Keep the state save, when crashing and load program back to that state

ISO/IEC 25010

Security

- Confidentiality
- Integrity
- Non-repudiation
- Authenticity
- Accountability

Security	Confidentiality	degree to which the prototype ensures that data are accessible only to those authorized to have access.
	Integrity	degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data.
	Non-repudiation	degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later.
	Accountability	degree to which the actions of an entity can be traced uniquely to the entity.
	Authenticity	degree to which the identity of a subject or resource can be proved to be the one claimed.

- Degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization
  - Pay attention to three AAAs (Authentication, Authorization & Access Control) for taking care of CIA (Confidentiality, Integrity and Availability) attributes
  - Pay attention to OWASP vulnerabilities' recommendation and focus on doing input validation to take care of issues related with CIA
  - Make sure that there are test cases (security testing) to test the above aspects

ISO/IEC 25010

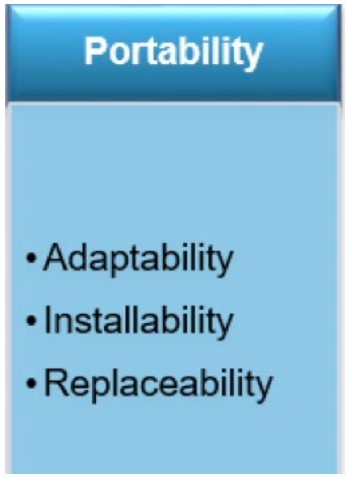
Maintainability

- Modularity
- Reusability
- Analysability
- Modifiability
- Testability

Maintainability	Modularity	degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components.
	Reusability	degree to which an asset can be used in more than one system, or in building other assets.
	Analyzability	degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.
	Modifiability	degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.
	Testability	degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.

- Maintainability is related with ease with which code could be changed and maintained
  - Apply object-oriented principles to take care of concerns such as reusability & modularity while doing both, design and coding.
  - Plan to use static code analysis tools

ISO/IEC 25010



Portability	Adaptability	degree to which a product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments.
	Installability	degree of effectiveness and efficiency in which a product or system can be successfully installed and/or uninstalled in a specified environment.
	Replaceability	degree to which a product can replace another specified software product for the same purpose in the same environment.

The capability of a software system to be transferred from one environment to another or be adapted to some changed or new environment

- Either write N software version for N platform or use JVM (Java Virtual Machine)
- Either the executable code is portable or the source code must be re-compiled for each platform

Key Points with Thanks

- Consider activities related to software quality as early as possible in SDLC.
- Software quality often depends on the eyes of beholder.
- There is no universally applicable model or standard for software quality. Each organization can choose model or standard according to their needs.
- Different products emphasize different quality characteristics.
- For people with LiU-id:

https://login.e.bibl.liu.se/login?url=https://www.sis.se/produkter/informationsteknik-kontorsutrustning/programutveckling-och-systemdokumentation/isoiec250102011/

Read more on the LiU graphic profile

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