Université de Paris

# Génie Logiciel
## Software quality

Sylvain Lobry

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Software Quality

# Definition of software quality

- ISO 9000:2015 standard
  - **“degree to which a set of inherent characteristics of an object fulfils requirements”**
  - Requirements can be implicit or explicit

- Side note: ISO = International Organization for Standardization

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# Examples of desirable properties

- **Fiability**: the software is valid (obtains desired outcome) and robust (able to cope with errors during the execution or erroneous input)
- **Safety**: when software is safety-critical, additional requirements
- **Performances**: expression of requirements in execution or processing speed and in terms of resources (e.g. memory)
- **Compatibility**: the software can be used with other softwares (either defined or meeting a specific format)
- **Portability**: the software can be used in various environments (e.g. OS)
- **Ergonomics**: the software can be easily (or naturally) used by the end-user
- Many more in few slides

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# I want it all!

- Quality comes at a cost. Non qualitative software as well -> Notion of “Cost of Software Quality”
- Often “level of quality in a software product can be inferred from the cost of activities related to dealing with the consequences of poor quality”
- 4 types of cost of quality:
  - Prevention (training, infrastructure, tools)
  - Appraisal (review, testing)
  - Internal failure (before delivery of the product)
  - External failure (after delivery of the product)

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# Software Quality Assurance (SQA)

- Set of activities to ensure that the software is of suitable quality (at every stage of the developement)
- In other words, SQA will check the conformity of the product to standards
- Often, people from SQA are independent from the project
- NOT testing, e.g.:
  - Checking that 90% of the code is unit tested -> SQA
  - Writing the unit tests -> testing

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# Standardization bodies

- International System Organization (**ISO**)
- Institute of Electrical and Electronic Engineers (**IEEE**)
- Association Française de Normalisation (**AFNOR**)
- American National Standard Institute (**ANSI**)

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# Quality standards – ISO 25000 series

- *Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE)*
- Published from 2005
- Framework for the evaluation of software product quality
- 5 parts:
  - 2500x: Quality Management
  - 2501x: Quality Model
  - 2502x: Quality Measurements
  - 2503x: Quality Requirements
  - 2504x: Quality Evaluation

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# Quality standards – ISO 25010

- Follows ISO 9126
- 8 **product quality characteristics**, each with *sub characteristics*:
  - **Functional suitability**: how well the software provides functions satisfying explicit and implicit needs. *Functional Completeness, Functional Correctness, Functional Appropriateness*
  - **Reliability**: under specific conditions, what functionalities? *Maturity, Availability, Recoverability, Fault tolerance*
  - **Performance Efficiency**: performances vs resources. *Time behaviour, Resource utilization, Capacity*
  - **Usability**: Effort needed for use and assessment of such use by users. *Appropriateness Recognizability, Learnability, Operability, User error protection, UI aesthetics, Accessibility*
  - **Security**: How well the system protects user and data from vulnerabilities. *Confidentiality, Integrity, Non-repudiation, Accountability, Authenticity*
  - **Compatibility**: 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. *Co-existence, Interoperability*
  - **Maintainability**: to which extent the software can be modified to improve it, correct it or adapt it to changes in environment, and in requirements. *Modularity, Reusability, Analysability, Modifiability, Testability*
  - **Portability**: Can the software be transferred from one environment to another? *Adaptability, Installability, Replaceability*

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# Formal software inspection

- Definition from NASA-STD-8739.9 : “[…] Technical evaluation process during which a product is examined with the purpose of finding and removing defects and discrepancies as early as possible in the software life cycle“
- In general, formal inspection has the following characteristics:
  - Control is made by technically competent persons
  - Product’s author is actively involved
  - Involves the following persons:
    - Moderator
    - Reader
    - Recorder
    - Author

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# Formal software inspection

- 5 stage process:

1. Planification and presentation by the author
2. Preparation (inspectors study the product, potentially with control list(s))
3. Inspection
4. Rework
5. Follow-up

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# Control lists

- List of (technical) elements to be verified during the actual inspection
- For instance, one list per programming language
- Errors found should belong to the control list and identified
- Needs to be concise

Elements of a software project

# To conclude…