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software engineering dependability

Quality Management of Software and Systems: Terminology

- System, technical system
- Quality, quality requirement, quality characteristic, quality measure
- Safety, technical safety
- Correctness, completeness
- Robustness
- Reliability, availability
- Failure, fault, error

- System
 - Technical and organizational means for the autonomous fulfillment of a task (based on Birolini, ETH)
 - Generally, a system can consist of hardware, software, people (service and maintenance personnel) and logistic assistance
- Technical System
 - System where influences by people and logistics are ignored

- **Quality**
 - Property of an entity concerning its qualification to fulfill defined and derived requirements (quality requirements) /DIN 55350-11/
 - Degree in which the inherent attributes of an entity fulfill quality requirements /DIN EN ISO 9000 05/
- **Quality Requirement**
 - Total of single requirements of an entity which concern the property of this entity /DIN 55350-11/
 - Expectation or demand defined (by a customer) that is generally assumed or mandatory /DIN EN ISO 9000 05/
- **Quality Characteristic**
 - Property of an entity on the basis of which its quality is described and estimated, but which makes no statement about the degree of fulfillment of the characteristic
 - A quality characteristic can be refined incrementally into partial characteristics
 - Inherent attribute of a process, product or a system that relates to a quality requirement /DIN EN ISO 9000 05/.
- **Quality Measure**
 - Measure which allows to draw conclusions on the fulfillment of specific quality characteristics. For instance, MTTF (Mean Time To Failure) is a quality measure of the quality characteristic Reliability.

- Safety

- State where the danger of a personal or property damage is reduced to an acceptable value (DIN EN ISO 8402)
- Absence of unacceptable risks /IEC 61508 98/
- Birolini defines safety as a measure for the ability of an item to endanger neither persons, property nor the environment
- A distinction is drawn between the safety of a failure-free system (accident prevention) and the technical safety of the failure afflicted system

 Safety analysis aims at proving that the actual risk is below the acceptable risk

- Technical Safety

- Measure for the ability of a failure afflicted item to endanger neither persons, property nor the environment

- **Correctness**
 - Correctness has a binary character, i.e., an item is either correct or incorrect
 - An fault-free realization is correct
 - An artifact is correct if it is consistent to its specification
 - If no specification exists for an artifact, correctness is not defined
- **Completeness**
 - A system is functional complete, if all functions required in the specification are implemented. This concerns the treatment of normal cases as well as the interception of failure situations

- Robustness

- Property to deliver an acceptable behavior also in exceptional situations (e.g. ability of a software to detect hardware failures)
- A correct system – as measured by the specification – can have a low robustness, actually
- Accordingly, robustness is rather a property of the specification than of the implementation
- A robust program is the result of the correct implementation of a good and complete specification
- Robustness has a gradual character

- Reliability

- Part of the quality with regard to the behavior of an entity during or after given time periods with given working conditions (DIN 40041)
- Collective term for the description of the power concerning availability and its influencing factors: power concerning functionality, maintainability and maintainability support (DIN EN ISO 8402)
- Property of an entity regarding its qualification to fulfill the reliability requirements during or after given time periods with given application requirements (DIN ISO 9000)
- Measure for the ability of an item to remain functional, expressed by the probability that the required function is executed failure-free under given working conditions during a given time period (based on Birolini, ETH)

- Availability

- Measure for the ability of an item to be functional at a given time

- Failure, Fault, Error
 - Failure: Inconsistent behavior w.r.t. specified behavior while running a system (happens dynamically during the execution) → Each failure has a time-stamp
 - Fault, defect: Statically existent cause of a failure, (i.e., a „bug“). Usually the consequence of an error made by the programmer
 - Error: Basic cause for the fault (e.g., misunderstanding of a particular statement of the programming language)