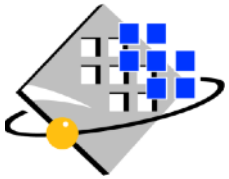

L3 Mention Informatique
Parcours Informatique et MIAGE

Génie Logiciel Avancé - Advanced Software Engineering

Standards and Legal Constraints

Burkhart Wolff
wolff@lri.fr

Plan of the Chapter

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- Introduction: The Role of Standards in SE

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- Objectives:

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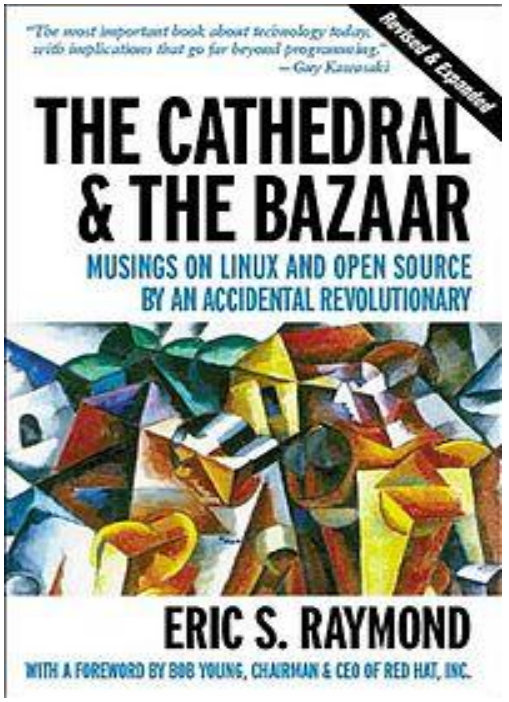
The Role of Norms and Standards in Software Engineering Processes

The Role of Norms in Software Engineering



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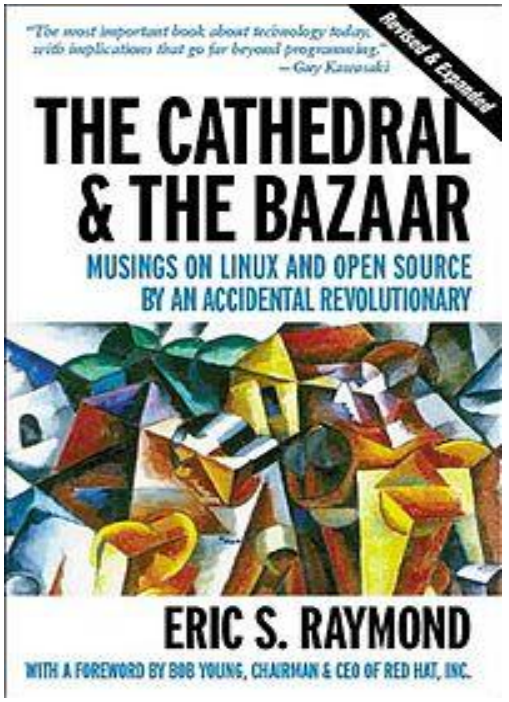

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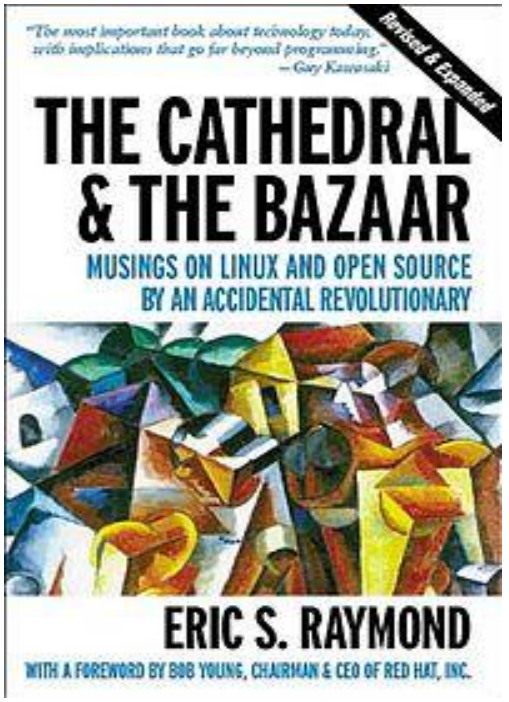

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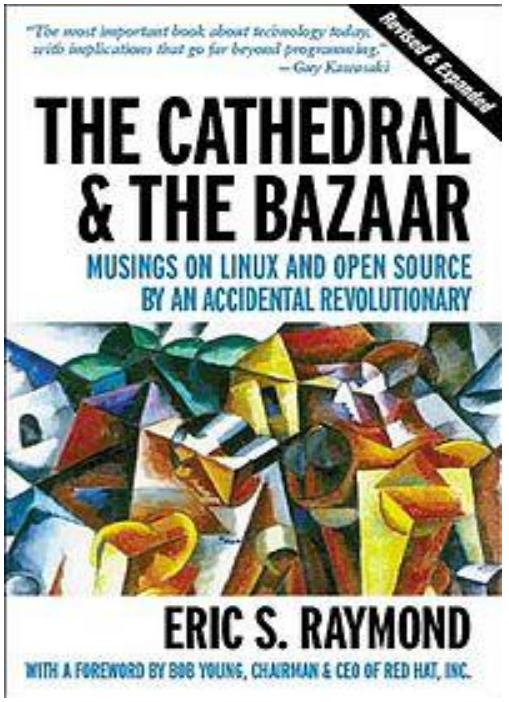

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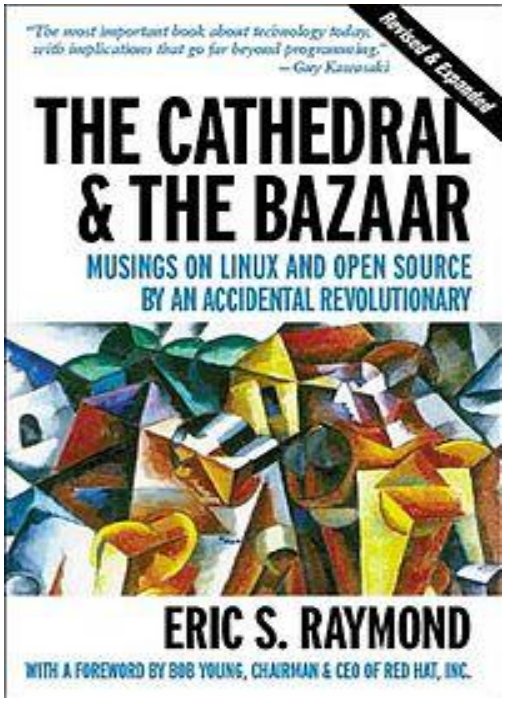

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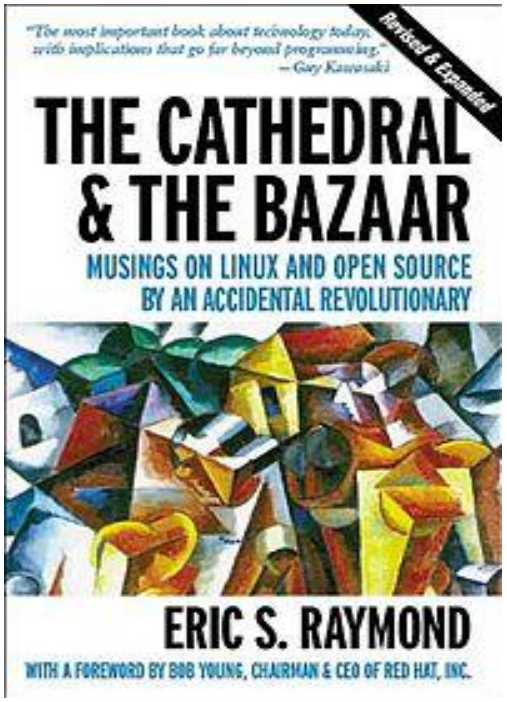

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(Which is the standard case in industrial projects …)

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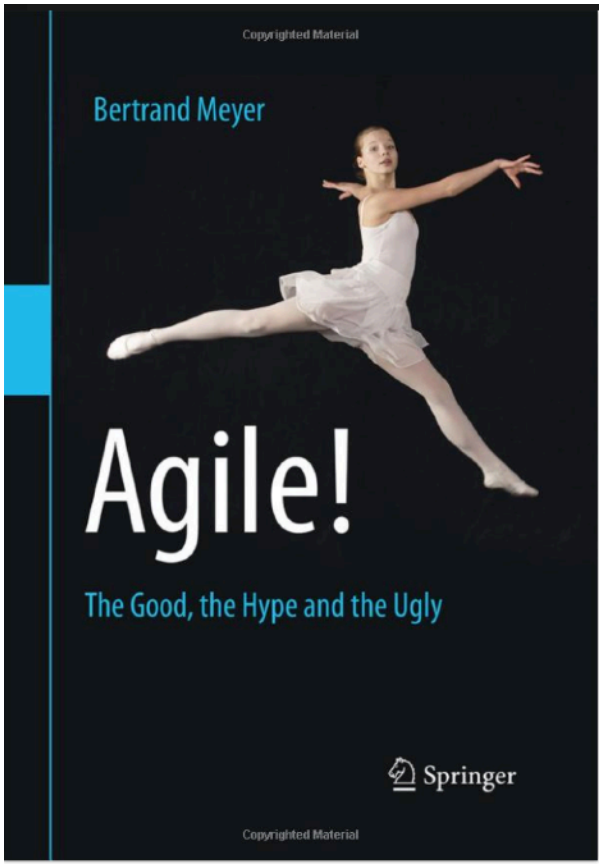

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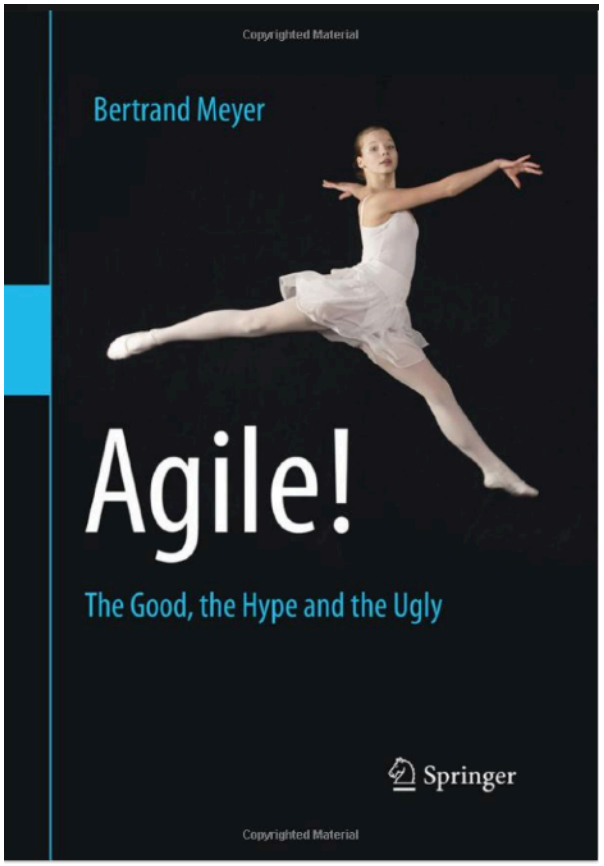

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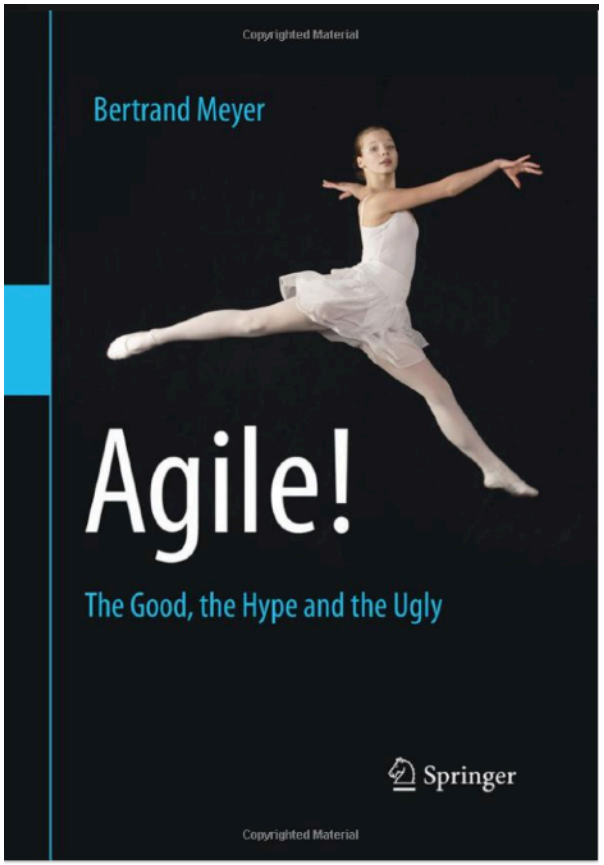

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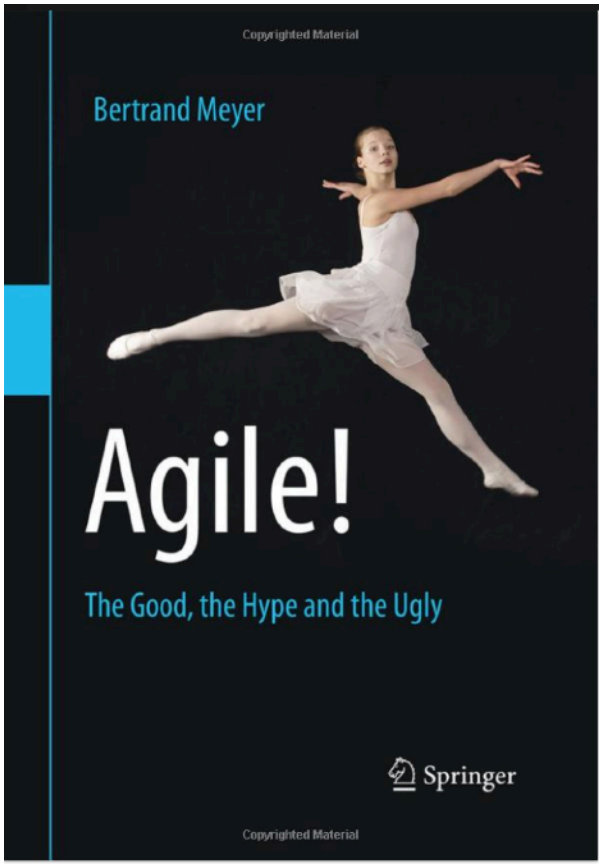

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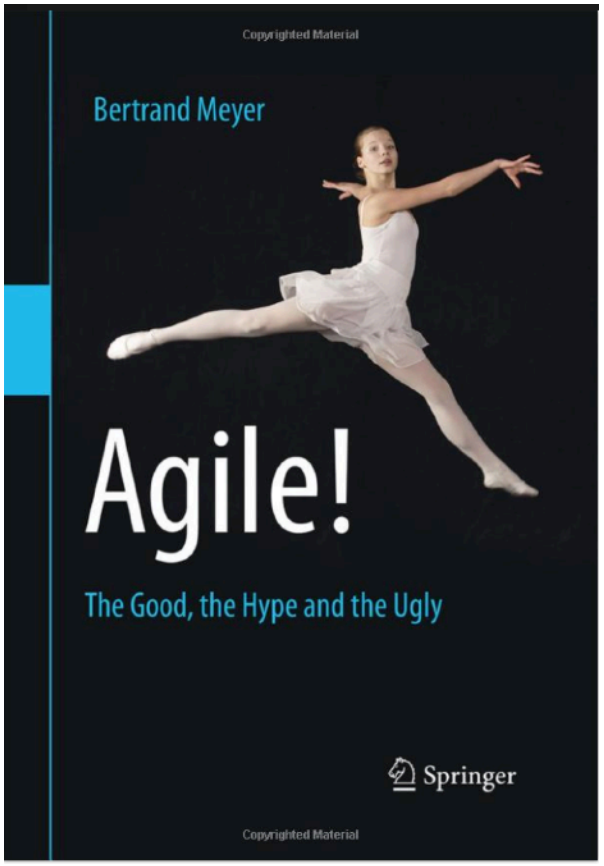

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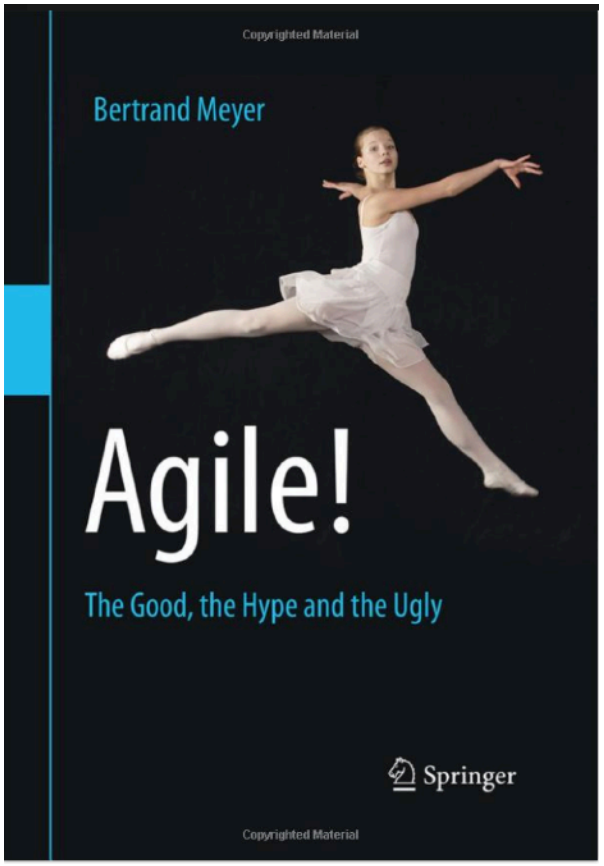

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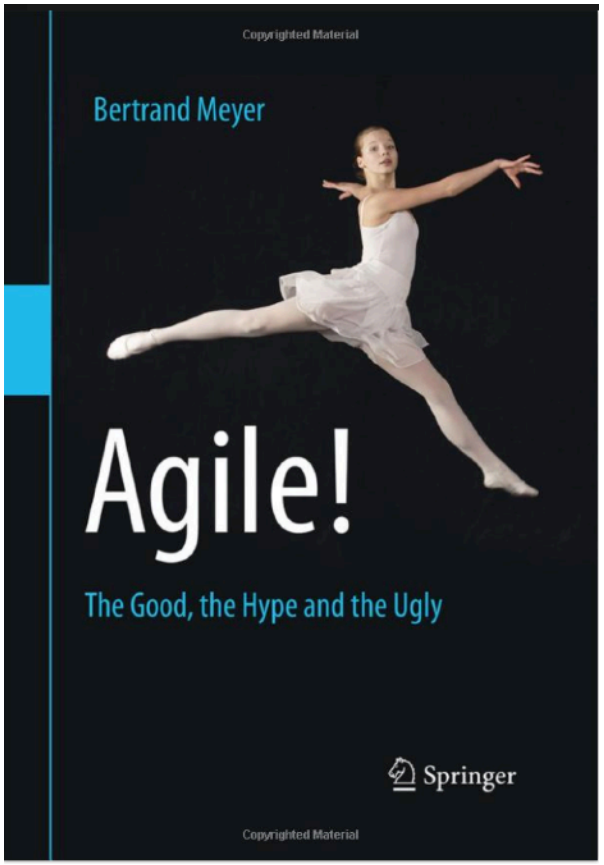

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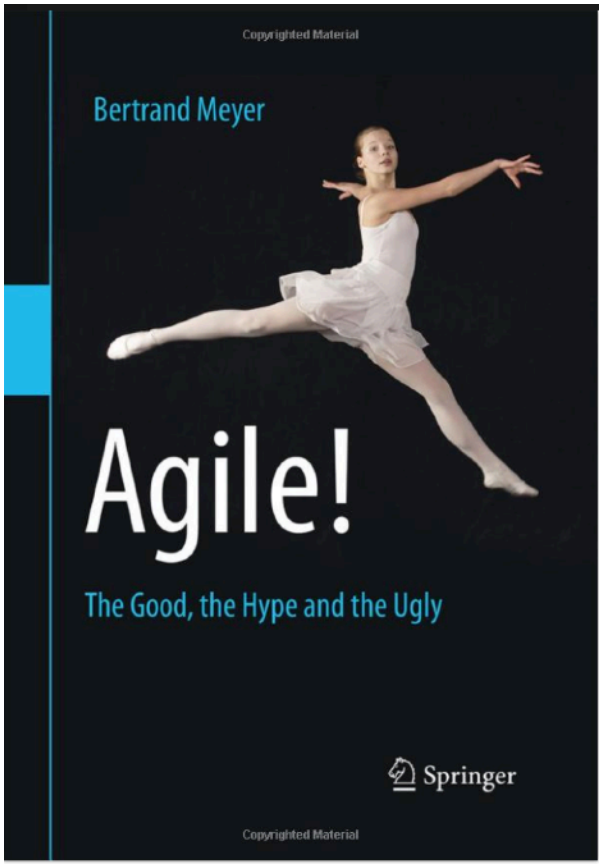

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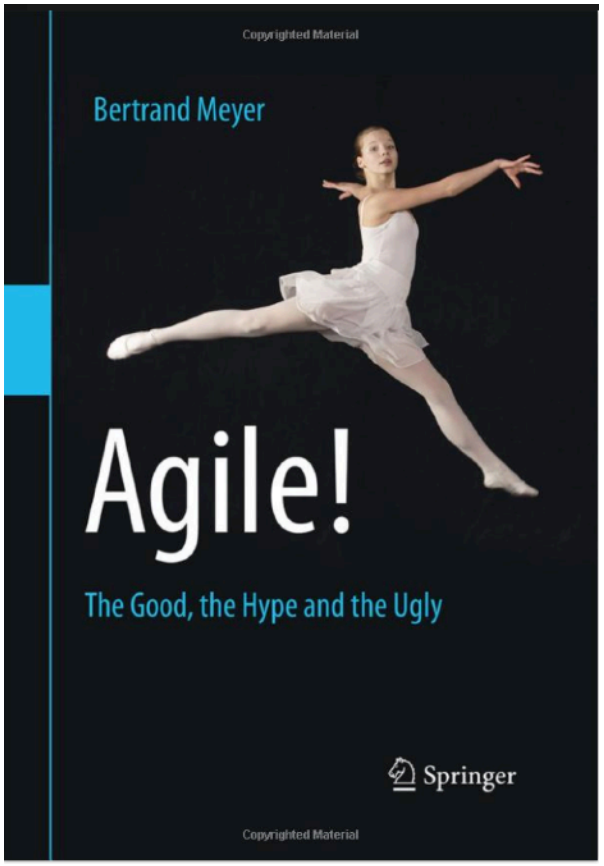

Review: https://www.infoq.com/articles/agile-good-hype-ugly/
Summary: https://se.inf.ethz.ch/~meyer/publications/methodology/agile_software.pdf

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Modern societies try to establish legal standards if safety, security, economic stability is concerned.

The Role of Norms in Software Engineering

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Standardisation organisations can be legal orgs (BIPM, ANSI,…) or industrial consortia (ISO, OMG, …)

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- ... few empirical data over the actual improvement of a process

Objectives of Standards in Software Engineering Processes

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Conference of Computer Safety: … **dependable** application of computers in safety-related and safety-critical systems. SAFECOMP is an annual event covering the state-of-the- art, experience and new trends in the areas of **safety**, **...** and **reliability** of **critical computer applications**.

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- More and more: Networks and Telecommunication

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- Availability: Making sure people cannot stop the computer from doing its job.

Objectives: Safety vs. Security vs. Quality

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Note: Slightly different to the french definition:

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Hm, a) correctness, but also “fitness to market”

b) extra-functional requirements such as extensibility, maintainability, …

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- Story: Sasser Worm spreading April 30, 2004. Named Sasser because it spreads by exploiting a buffer overflow in the component known as LSASS (Local Security Authority Subsystem Service) on the affected operating systems Windows XP /2000.
- Effect: Affected within hours several million machines . . .
  - Agence France Press had all its satellite connections blocked
  - Delta Airlines cancelled Cross-Atlantic Flights
  - Insurance company *If* and *Sampo Bank* had to shut down services
  - British Coastguard had its electronic mapping service disabled
  - Lund University Hospital : no X-Rays possible
  - University of Missoury had to unplug its network
  - ... experts estimated 100 casualties world-wide ...

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Still, you will find a lot of people disputing over this difference …

Objectives of Standards in Software Engineering Processes

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  - Likelyhood of Demand, Complexity of Device

Domain Specific Safety Standards

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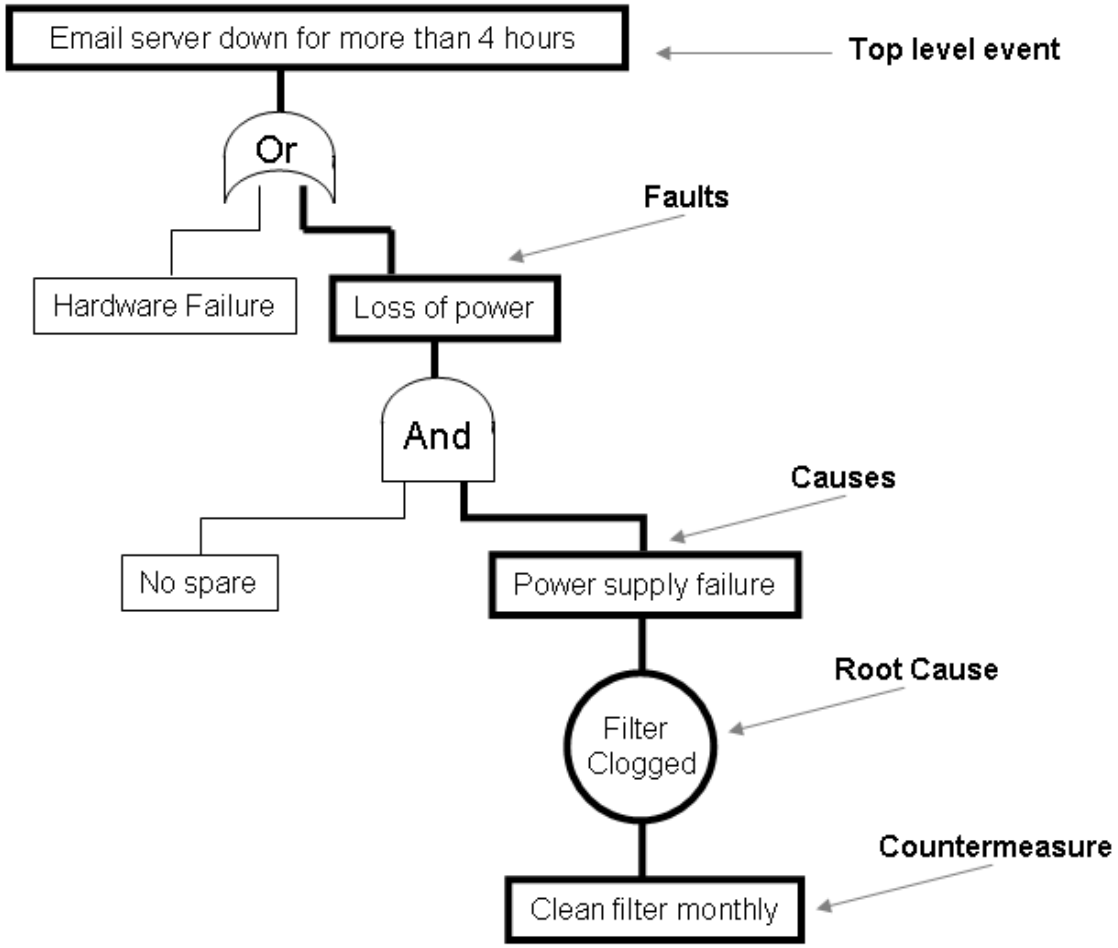
- Example: *A*

  Fault-Tree Model

Domain Specific Safety Standards

- Example: *A* Fault-Tree Model



Domain Specific Safety Standards

- Example: A Fault-Tree Model

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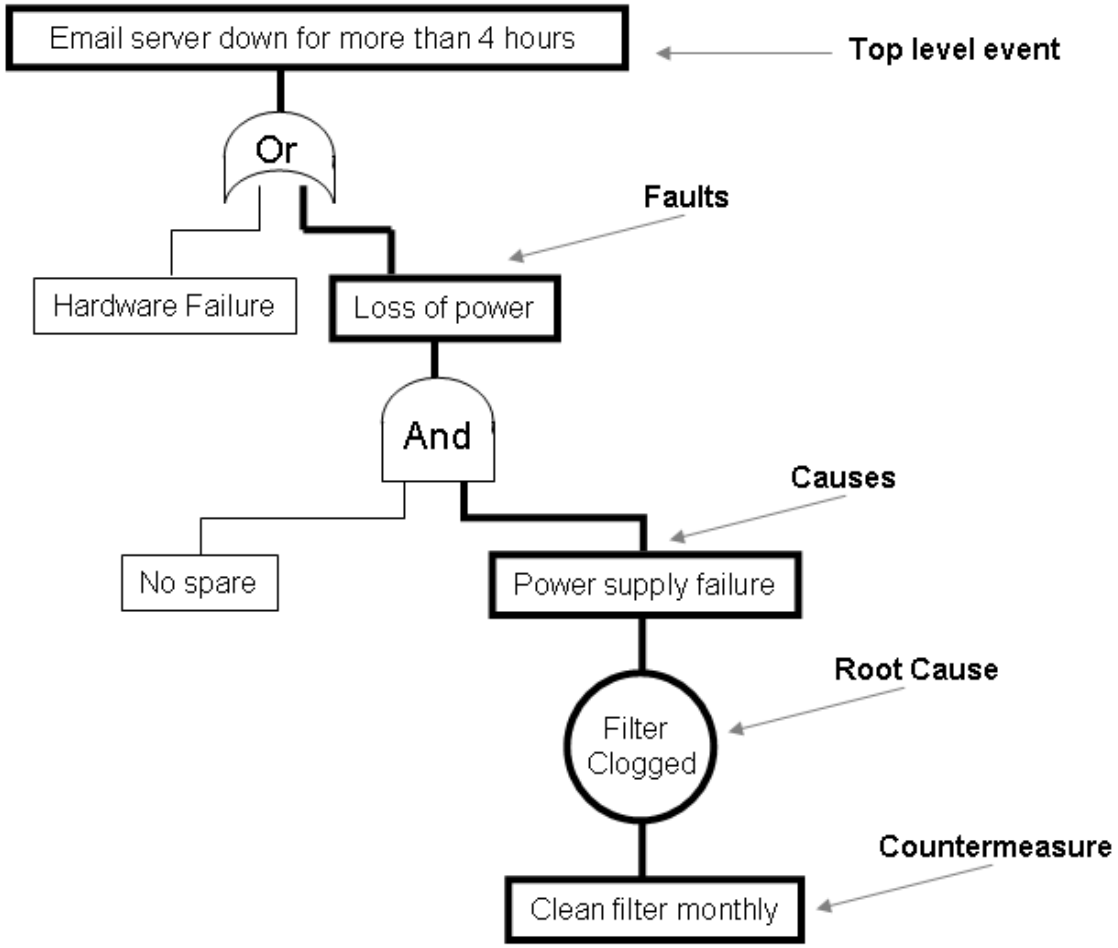

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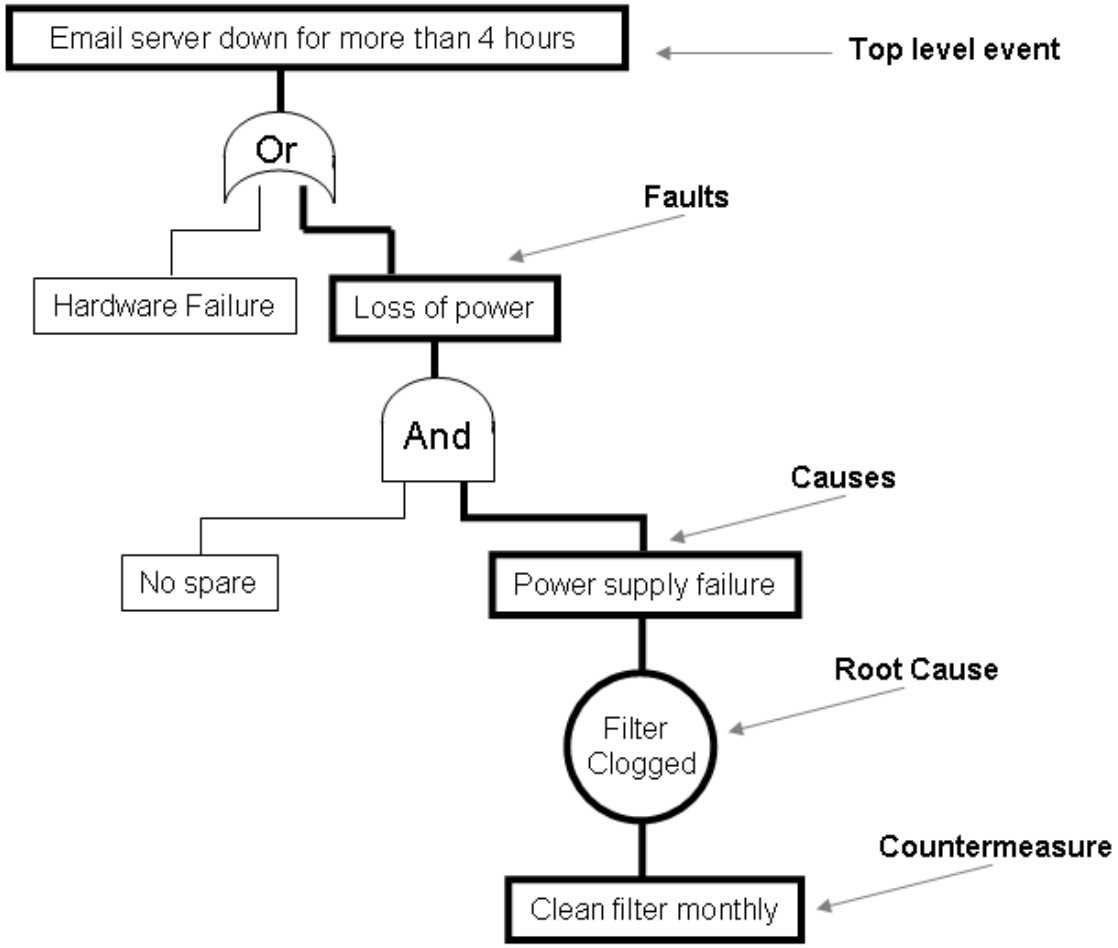

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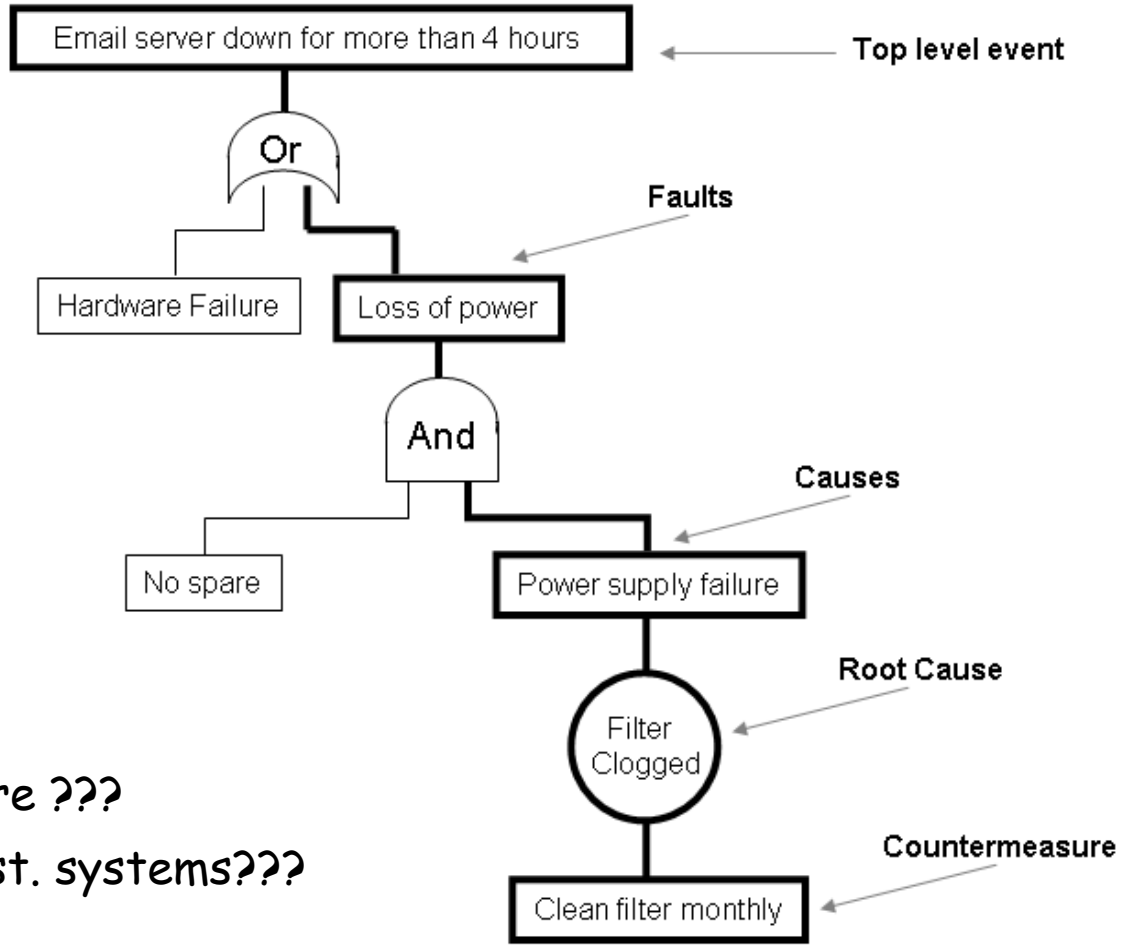

Domain Specific Safety Standards

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- Core notion:

SIL in Safety Standards

Domain Specific Safety Standards

- Core notion:

  Safety Integrity Level (SIL)

SIL in Safety Standards

Domain Specific Safety Standards

- Core notion:

Safety Integrity Level (SIL)

SIL	PFD	PFD (power)	RRF
1	0.1-0.01	10^{-1} - 10^{-2}	10-100
2	0.01-0.001	10^{-2} - 10^{-3}	100-1000
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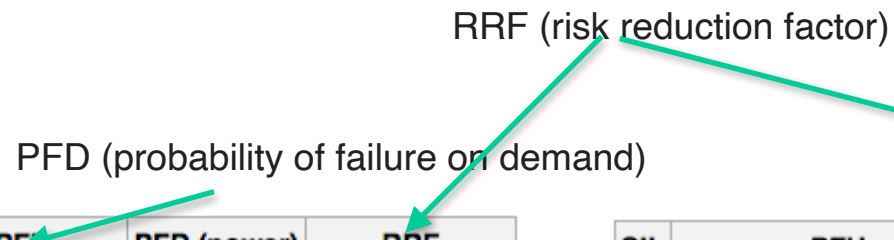

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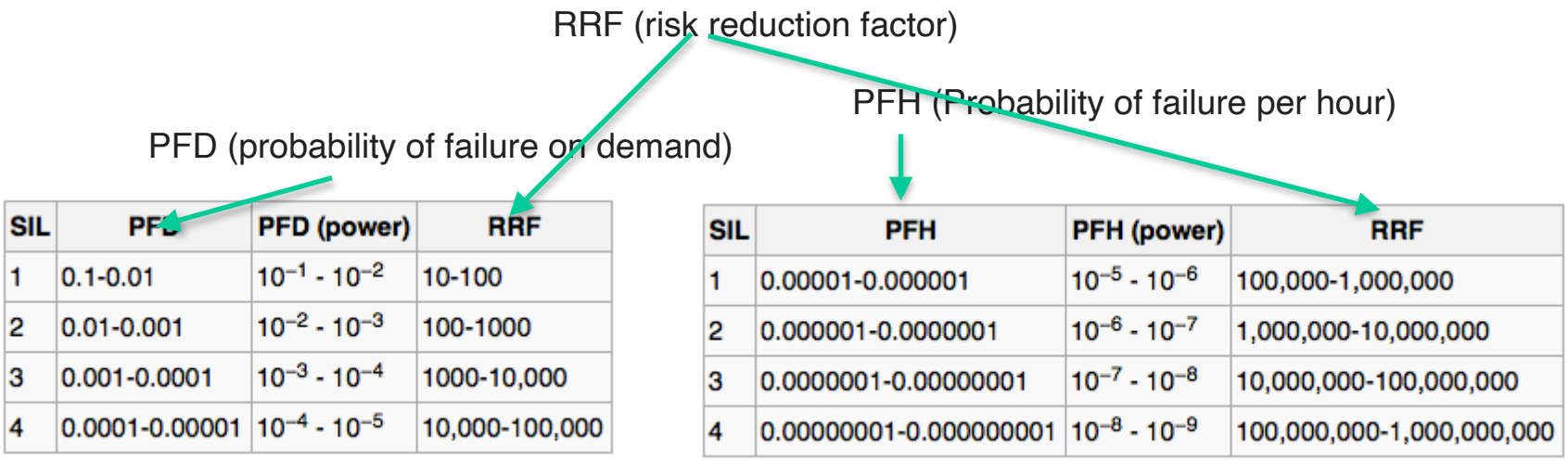

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D. Smith, K. Simpson, "Safety Critical Systems Handbook - A Straightforward Guide to Functional Safety, IEC 61508 (2010 Edition) and Related Standards" (3rd Edition, ISBN 978-0-08-096781-3, 270 Pages).

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  The use of a SIL in specific safety standards may apply different number sequences or definitions to those in IEC EN 61508.

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- Thus it is aimed at providing a trusted embedded real-time operating system, which is oriented to ECUs (Electronic Control Units) in automotive industry. (avionics similarly)

Domain Specific Safety Standards

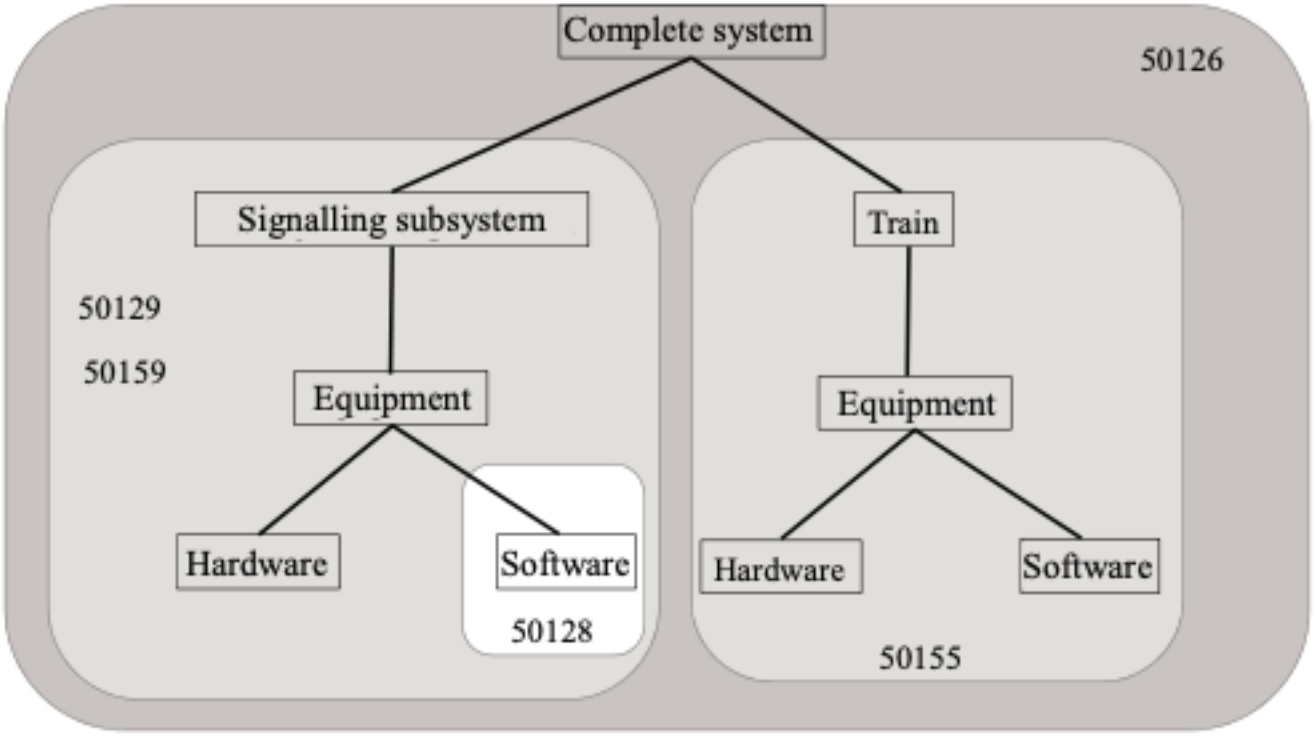
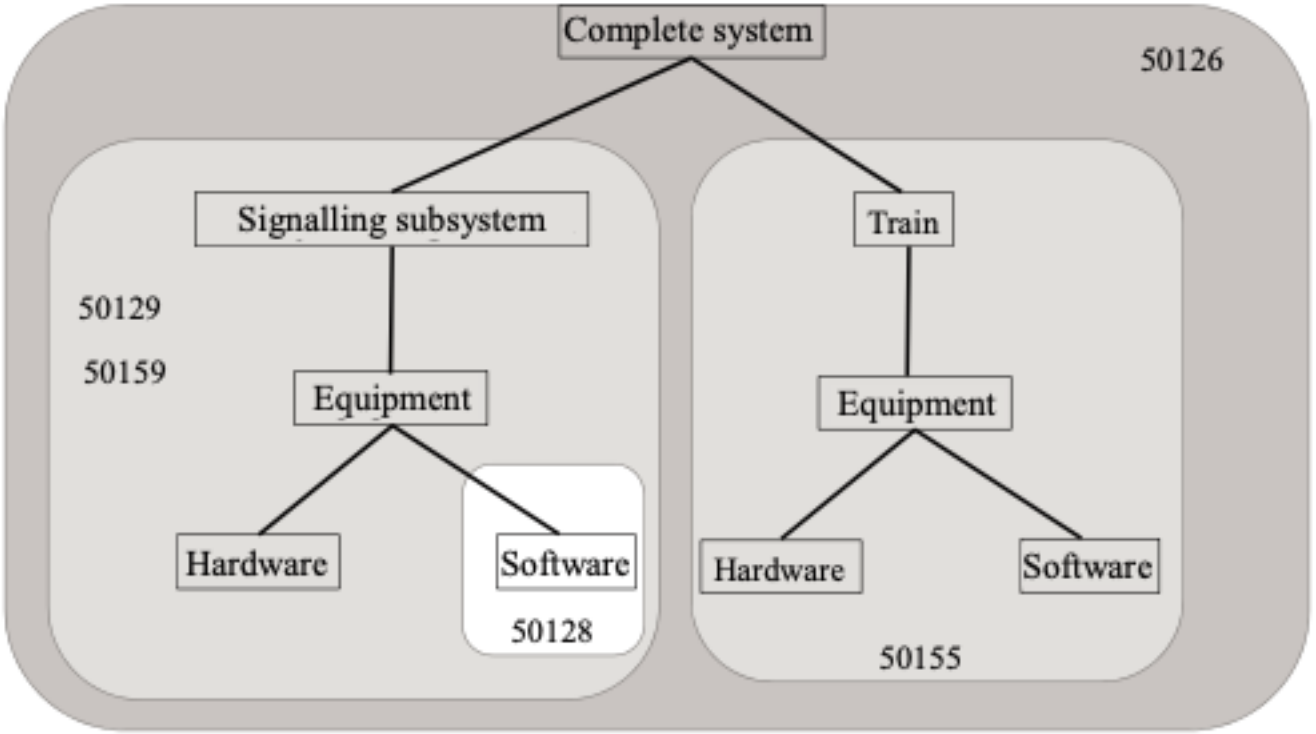


Figure I.1. *Normative context*

Domain Specific Safety Standards

- A well-established area:

Railway Systems



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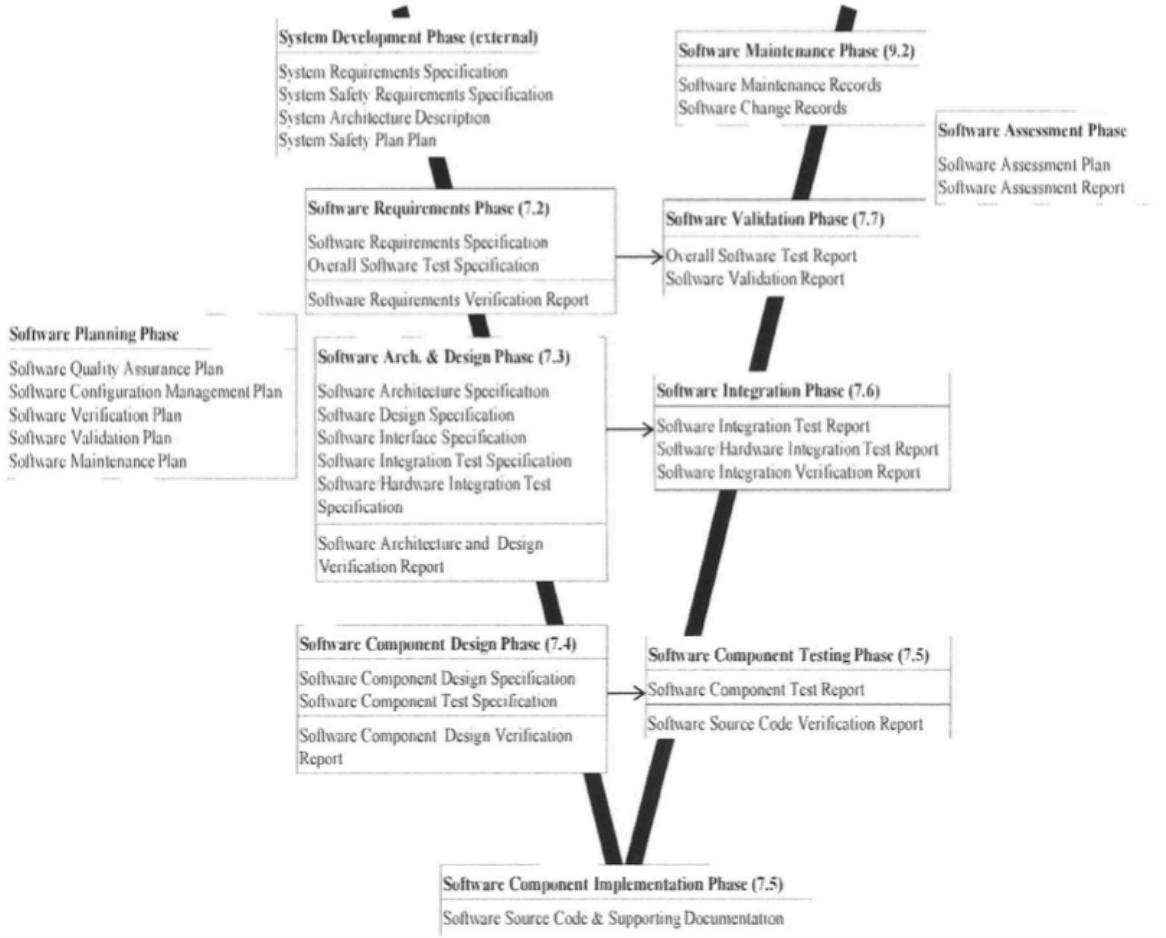
  - a number of milestone documents
  - quality levels (SIL 1 .. 4)
  - a bunch of techniques and measures

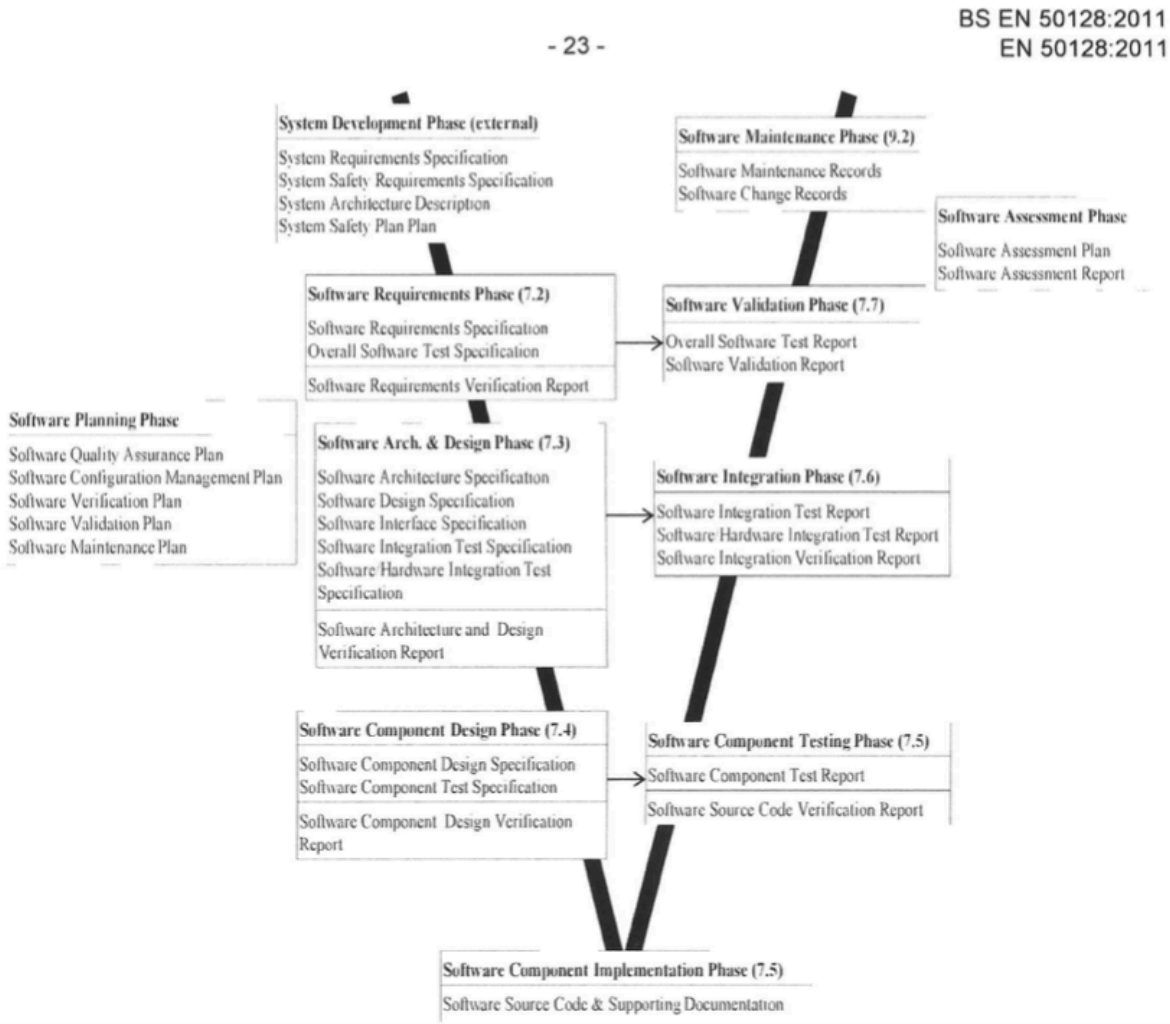
    (rather than statistic approaches)

Domain Specific Safety Standards



Domain Specific Safety Standards

- Phases and Milestones



Domain Specific Safety Standards

Table A.2 – Software Requirements Specification (7.2)

TECHNIQUE/MEASURE	Ref	SIL 0	SIL 1	SIL 2	SIL 3	SIL 4
1. Formal Methods (based on a mathematical approach)	D.28	-	R	R	HR	HR
2. Modelling	Table A.17	R	R	R	HR	HR
3. Structured methodology	D.52	R	R	R	HR	HR
4. Decision Tables	D.13	R	R	R	HR	HR

Requirements:

1) The Software Requirements Specification shall include a description of the problem in natural language and any necessary formal or semiformal notation.

2) The table reflects additional requirements for defining the specification clearly and precisely. One or more of these techniques shall be selected to satisfy the Software Safety Integrity Level being used.

Table A.5 – Verification and Testing (6.2 and 7.3)

TECHNIQUE/MEASURE	Ref	SIL 0	SIL 1	SIL 2	SIL 3	SIL 4
1. Formal Proof	D.29	-	R	R	HR	HR
2. Static Analysis	Table A.19	-	HR	HR	HR	HR
3. Dynamic Analysis and Testing	Table A.13	-	HR	HR	HR	HR
4. Metrics	D.37	-	R	R	R	R
5. Traceability	D.58	R	HR	HR	M	M
6. Software Error Effect Analysis	D.25	-	R	R	HR	HR
7. Test Coverage for code	Table A.21	R	HR	HR	HR	HR
8. Functional/ Black-box Testing	Table A.14	HR	HR	HR	M	M

Domain Specific Safety Standards

- Techniques and Measures

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Domain Specific Safety Standards: Medicine

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI IEC 62304

Première édition
First edition
2006-05

Logiciels de dispositifs médicaux – Processus du cycle de vie du logiciel

Medical device software – Software life cycle processes

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Première édition
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  Main proposals / milestones:

5.1 * Software development planning .....
5.2 * Software requirements analysis .....
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5.4 * Software detailed design .....
5.5 * SOFTWARE UNIT implementation and verification .....
5.6 * Software integration and integration testing .....
5.7 * SOFTWARE SYSTEM testing.....
5.8 * Software release .....

7 * Software RISK MANAGEMENT PROCESS .....
7.1 * Analysis of software contributing to hazardous situations ...
7.2 RISK CONTROL measures .....
7.3 VERIFICATION of RISK CONTROL measures .....
7.4 RISK MANAGEMENT of software changes .....

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- Emphasis on Risk Management (even for software - outdated ?)

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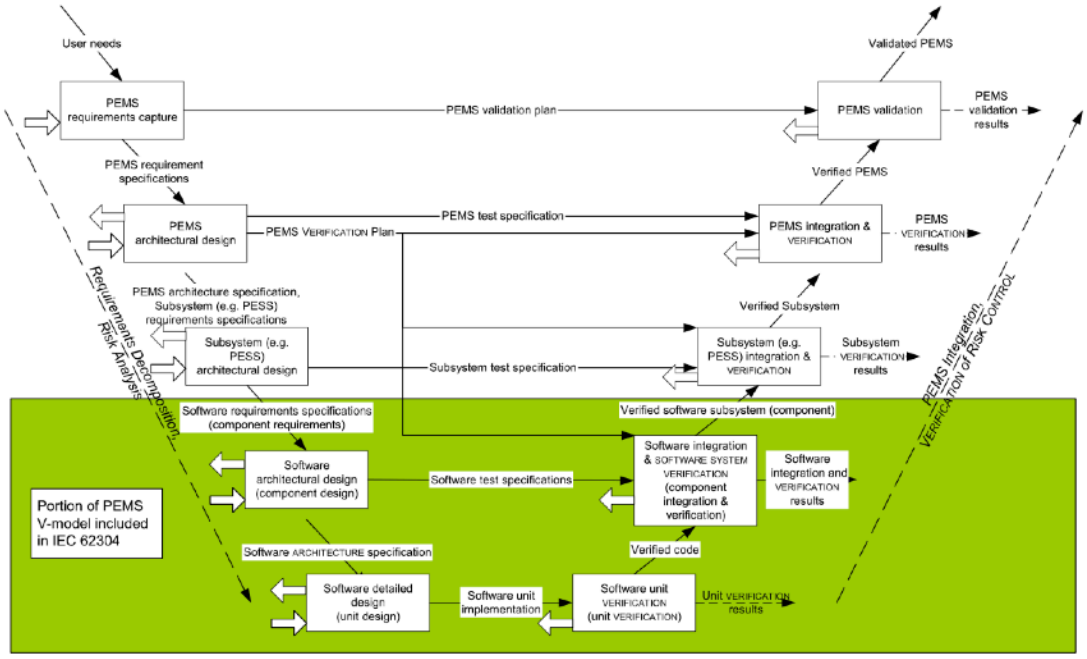
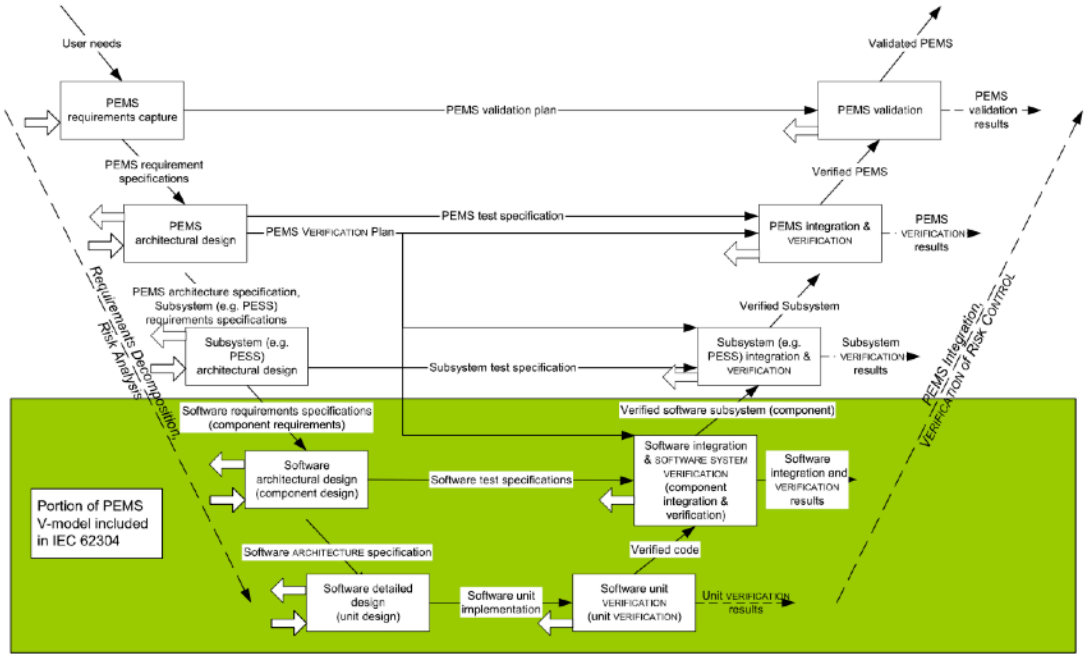


Domain Specific Safety Standards: Medicine

- The standard proposes a V-style life-cycle model:



In-between Generic and Specific SE Standards : DO 178B/C

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- … but adresses explicitly the needs of software:

The FAA applies DO-178B as the document it uses for guidance to determine if the software will perform reliably in an airborne environment,[1] when specified by the Technical Standard Order (TSO) for which certification is sought. The introduction of TSOs into the airworthiness certification process, and by extension DO-178B, is explicitly established in 14 Code of Federal Regulations (CFR) Part 21, Subpart O.

In-between Generic and Specific SE Standards : DO 178B

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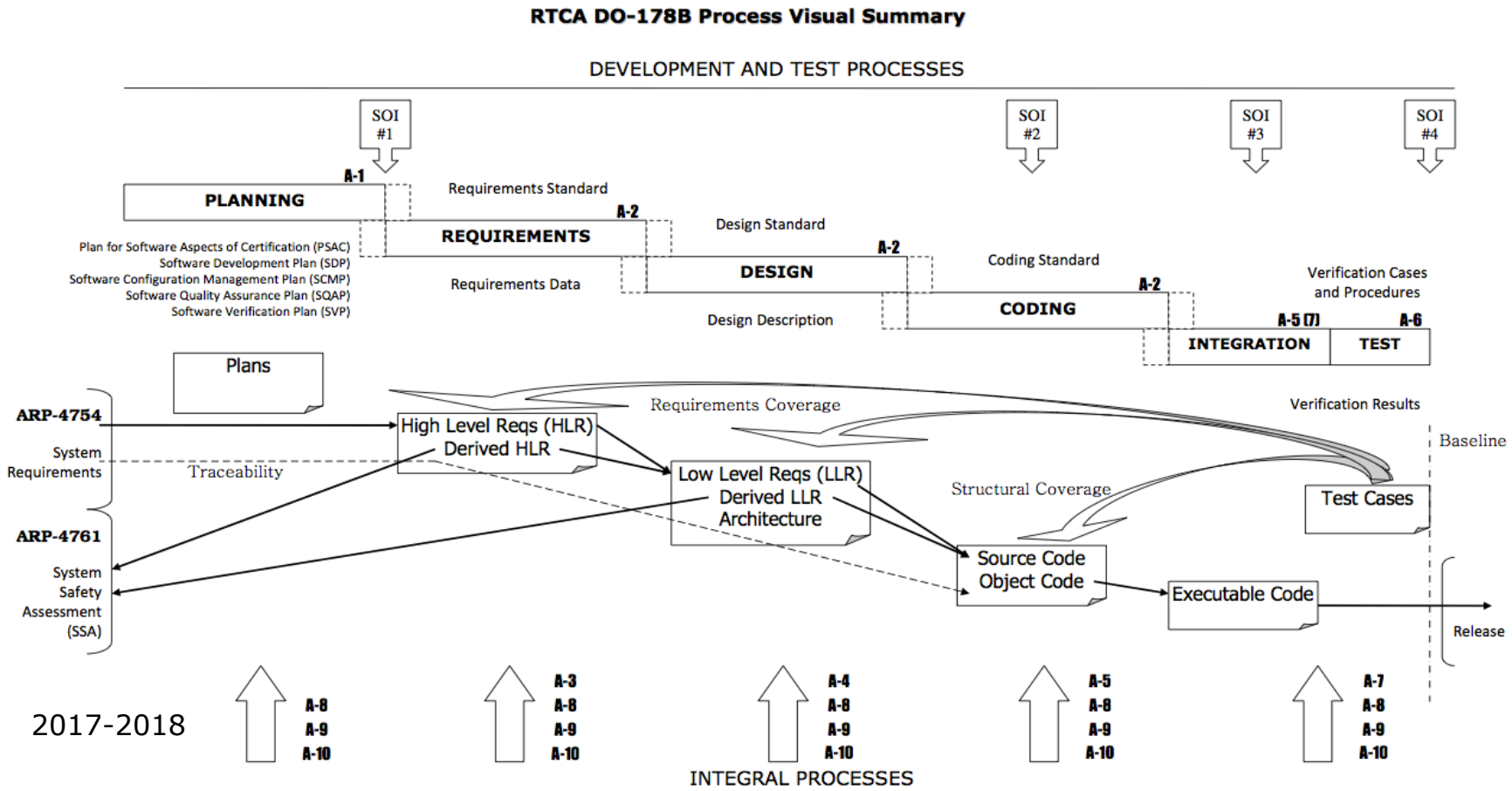

2017-2018

Security Standards : Consequences

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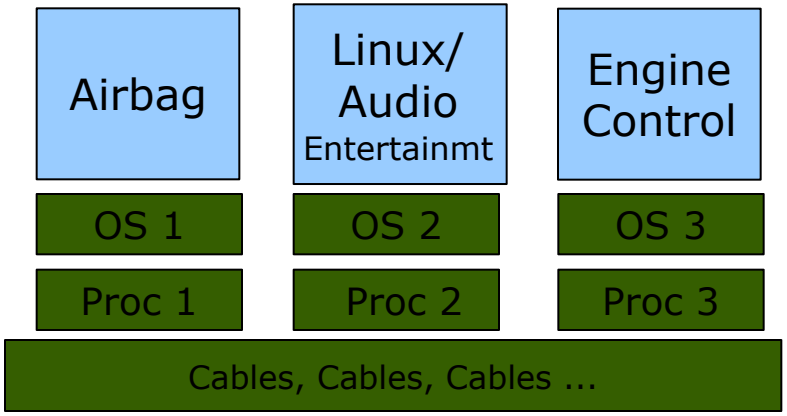

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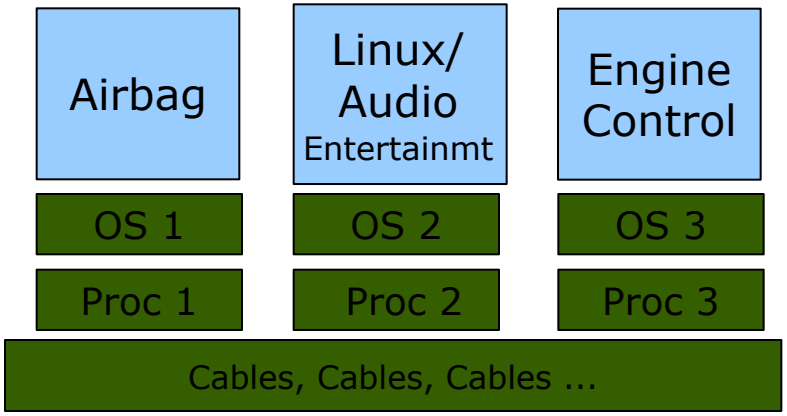
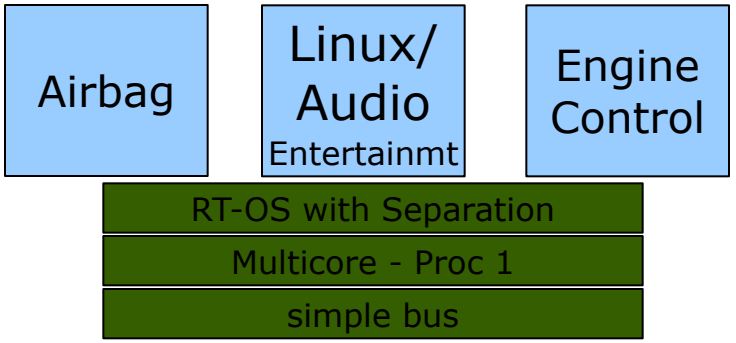
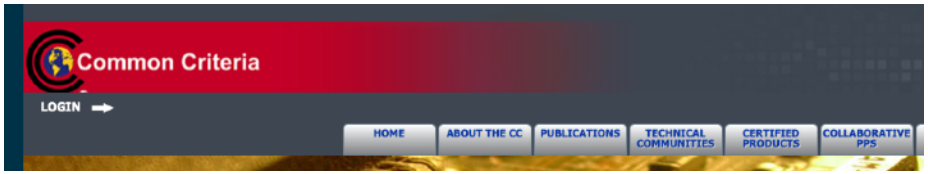




Generic Software Engineering Standards



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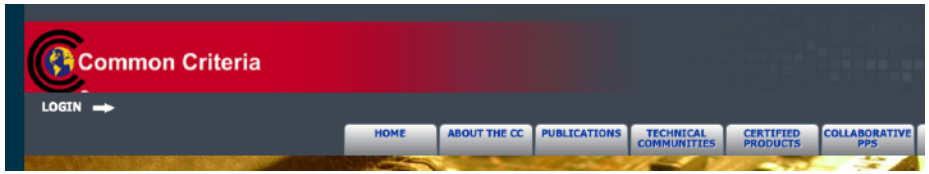

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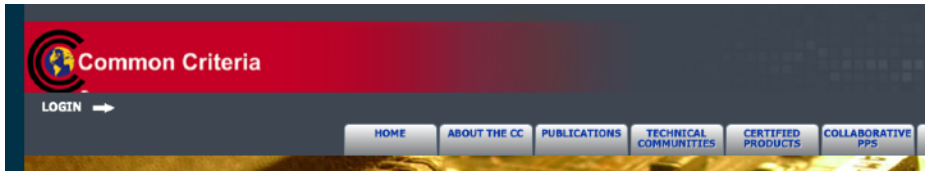

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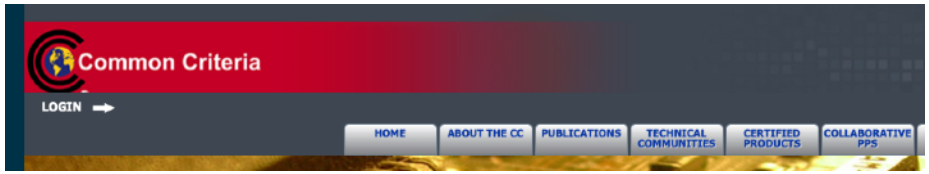

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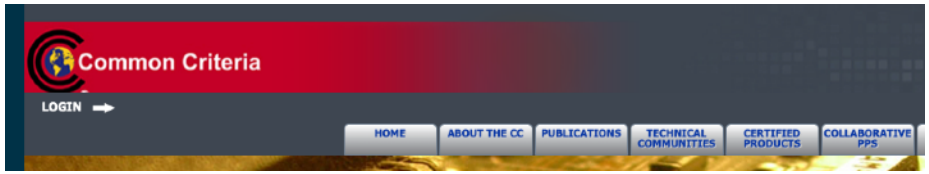

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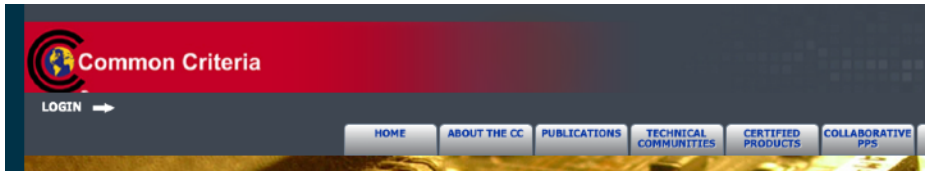

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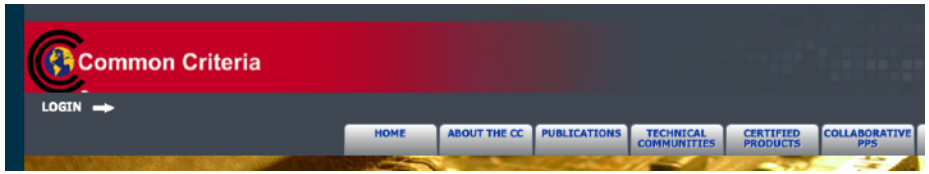

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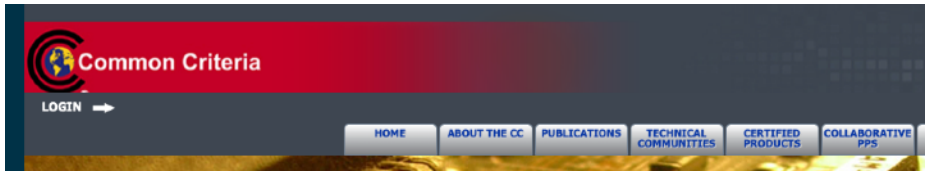

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Common criteria provides assurance that the process of specification, implementation and evaluation of a computer security product has been conducted in a rigorous and repeatable manner.

Source: https://www.commoncriteriaportal.org/

Generic Software Engineering Standards

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ISO/IEC/IEEE 15408 for computer security certification:

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Generic Software Engineering Standards

ISO/IEC/IEEE 15408 for computer security certification:

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Generic Software Engineering Standards

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- Evolved Terminology:
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  - TSFI: TSF Interface

Generic Software Engineering Standards

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ISO/IEC/IEEE 15408 for computer security certification:

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Generic Software Engineering Standards

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Generic Software Engineering Standards

ISO/IEC/IEEE 15408 for computer security certification:

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ISO/IEC/IEEE 15408 for computer security certification:

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Generic Software Engineering Standards

Network and Network-Related Devices and Systems – 230 Certified Products

Operating Systems – 52 Certified Products

Product	Vendor	Product Certificate	Date Certificate Issued	Certificate Validity Expiration Date	Compliance	Scheme
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The "security target" in this public data-base describes what security function has actually been certified, the EAL level the depth of the acquired guarantees.

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- Most serious and relevant standards (in France):
  - CENELEC 50128 (Railways)
  - DO 178B (Avionics)
  - ISO/IEC/IEEE 15408 «Common Criteria» for computer security certification requiring formal techniques for EAL 6 and EAL 7.
  - CEI/IEC 62304 (Medical Devices)
  - ISO/IEC/IEEE 29119 (Software Test)