*L3 Mention Informatique*
*Parcours Informatique et MIAGE*

# Génie Logiciel Avancé - Advanced Software Engineering

## An Introduction

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  SE addresses the problems of

  « Development in the Large »

  ... so for teams with 100 or 1000 of developers, and budgets of sometimes billions of dollars.

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- Some (anecdotal) empirical data based on the common criteria “lines of code” (LOC)

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| Software | Software Type | Year (approx) | LOC | |
|---|---|---|---|---|
| Space Shuttle | Embedded + Services | 1980 | 50M | |
| Windows 90 | OS | 1990 | 10M | |
| Peugeot 607 | Embedded | 2000 | 2M | |
| Win2000 | OS | 2000 | 30M | |
| Hyper V | V-OS (Azure core) | 2008 | 50K | |
| X Window | Unix Windowing Sys. | 2008 | 1.8M | |
| Azure | Virtualising Services | 2009 | 110M | |
| Mozilla Firefox | Browser (Application) | 2020 | 23M | * |
| | | | | |

* https://www.openhub.net/p/firefox/analyses/latest/languages_summary

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|---|---|---|---|
| Version 1 | Business Application Suite | 1973 | ??? |
| Version 5.1 | Business Application Suite | 2004 | <60M |
| Version 5.2 | Business Application Suite | 2000 | 90M |
| Version 6.0 | Business Application Suite | 2000 | 100M |
| Version 7.0 | Business Application Suite | 2008 | 105M |
| Version 7.1 | Business Application Suite | 2008 | 118 |
| | | | |
| | | | |
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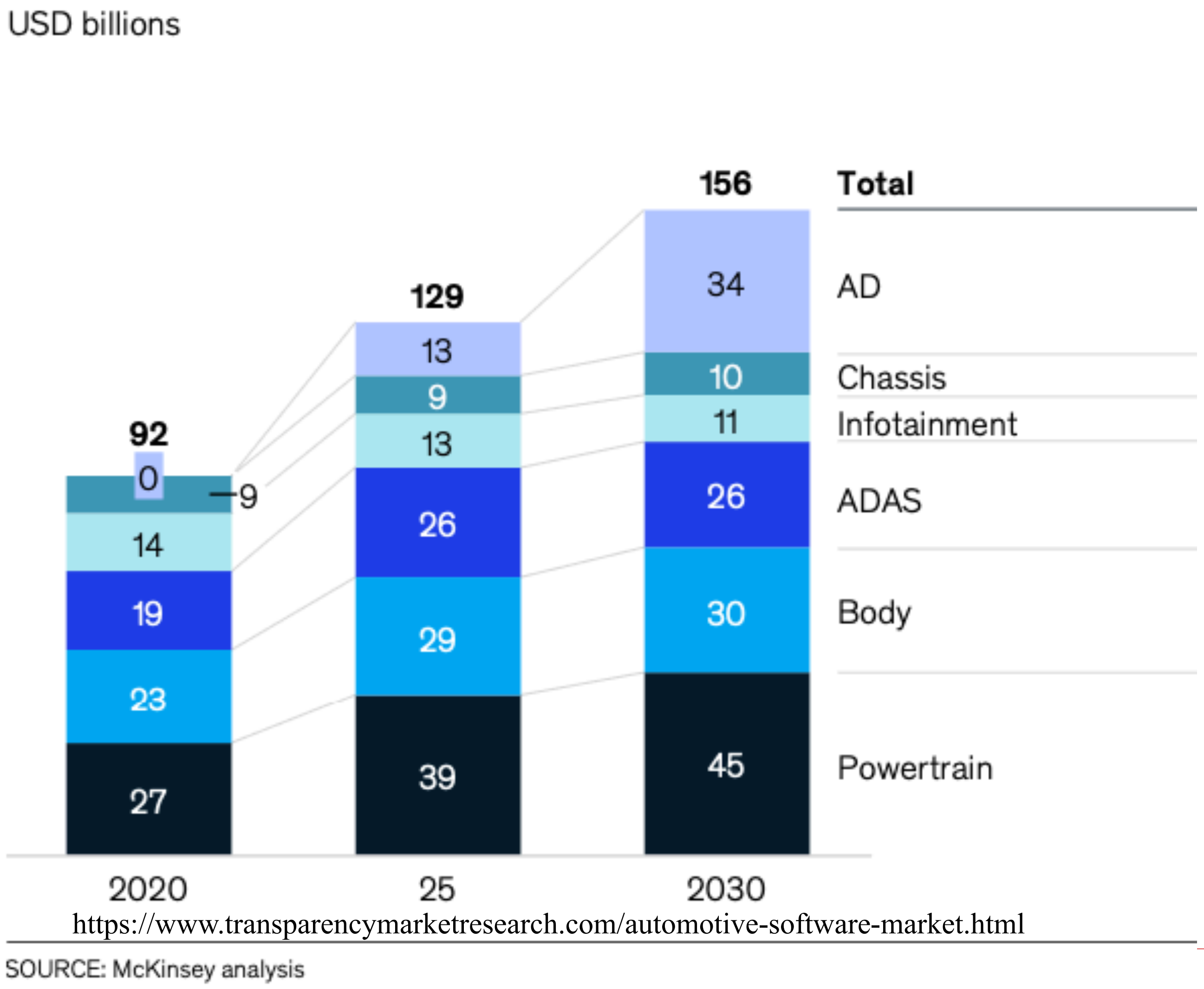

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  and thorough verification techniques
  are unfortunately ways more costly than shallow testing !

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- … these are in practice often the real questions for the management of a software process …

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  - Consider the application domains with obvious criticality:
    - transport systems (Cars, Métros, TGV), aviation controls, aerospace, ...
    - critical industrial processes, nuclear power plants, weapons, ...
    - medical technologies: tele-surgery, radiation control...
    - critical telecommunication infrastructures and networks,
    - electronic commerce

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- For most of them exist certification processes, legal requirements, etcpp.

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- This should be the most important reason, but, actually, it isn't.

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- The complexity of large software-projects can simply not be mastered without advanced software engineering techniques …

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    [Again: this is not what we do in this course: it requires more experience and a concrete process to do this ...]
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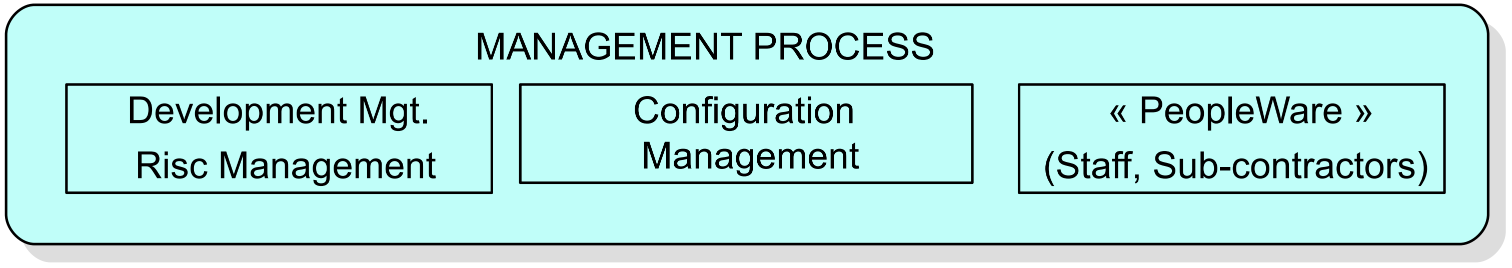

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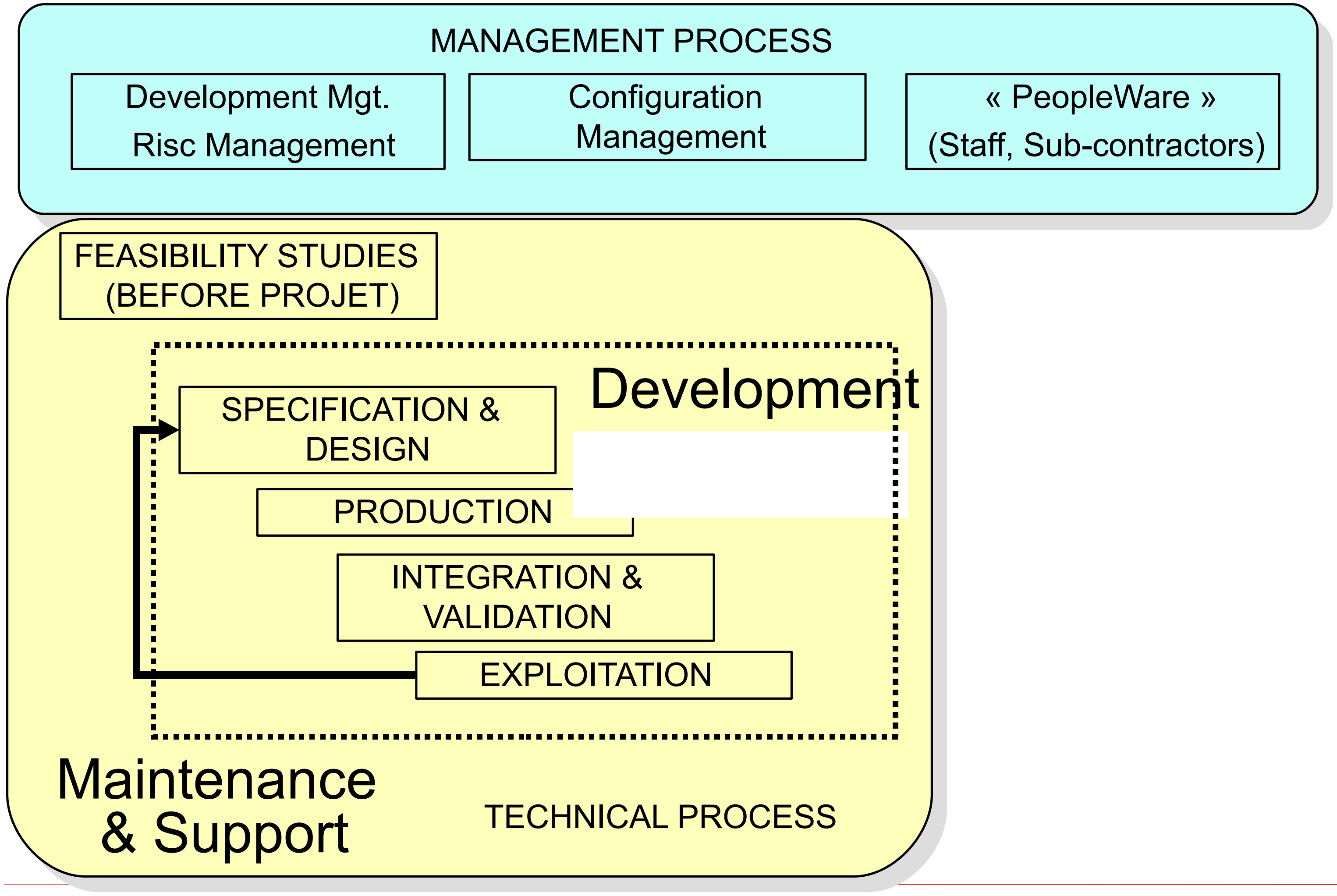

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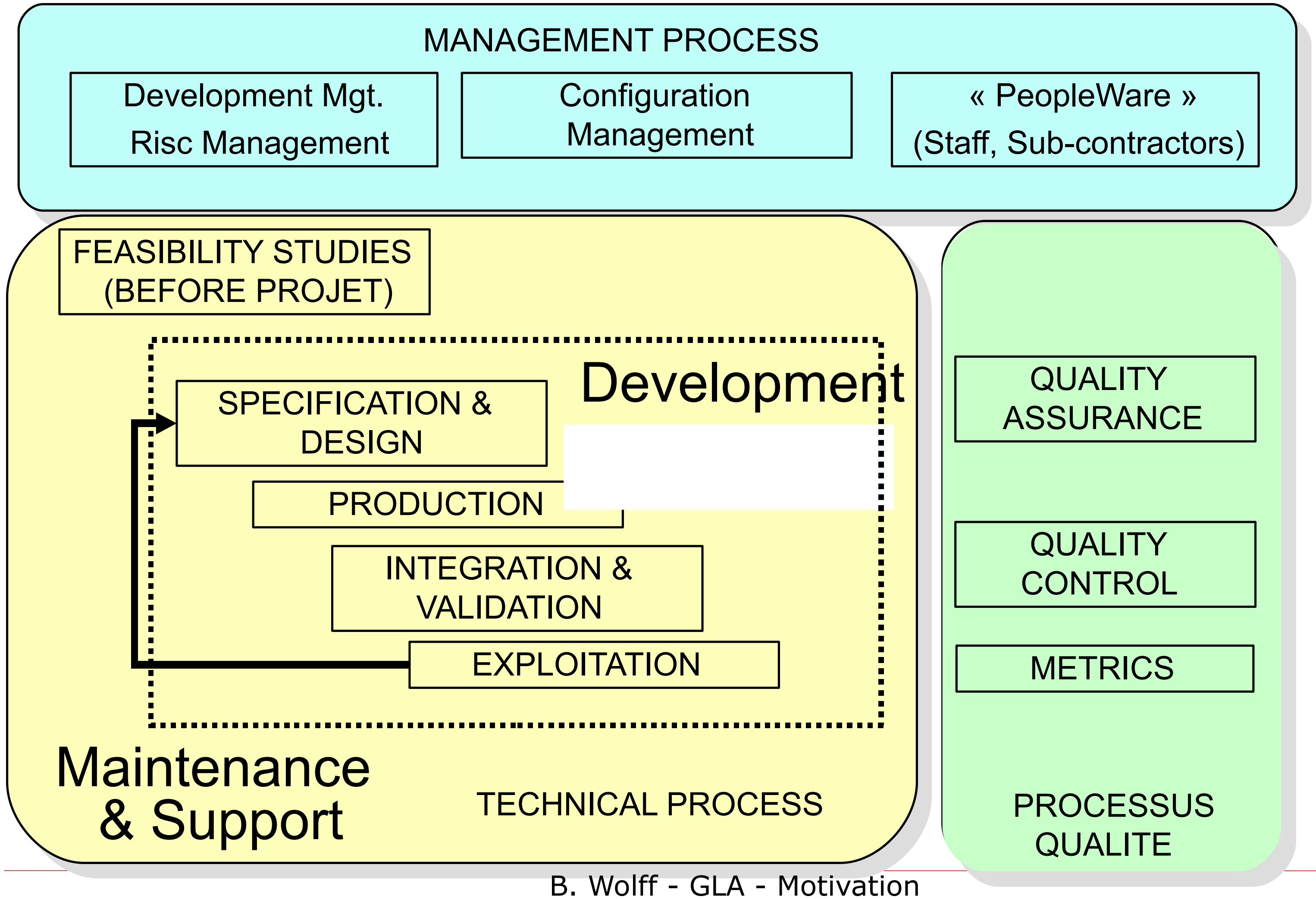

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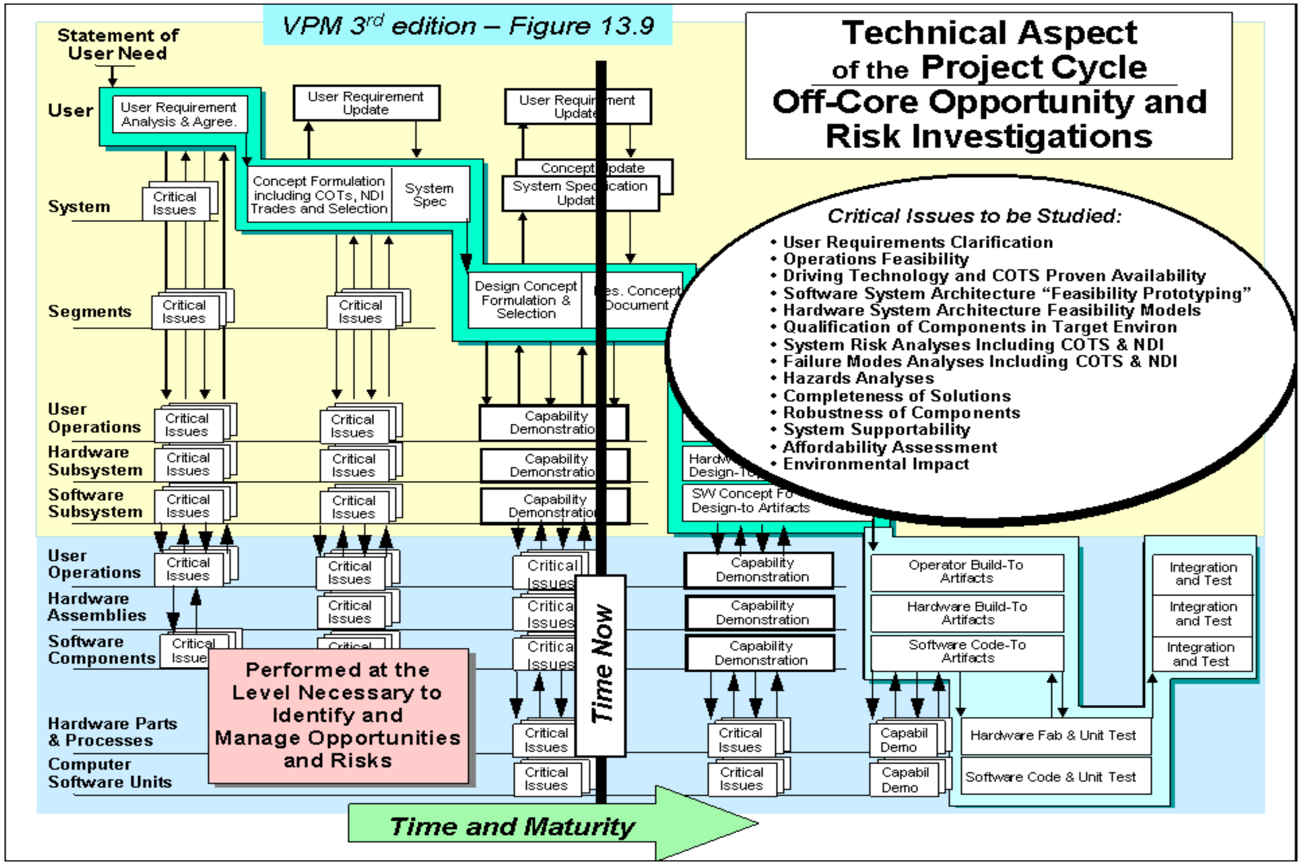
- Another Example: The VPM3-Model (Daimler)


VPM 3rd edition – Figure 13.9
Technical Aspect of the Project Cycle
Off-Core Opportunity and Risk Investigations
Statement of User Need
User
System
Segments
User Operations
Hardware Subsystem
Software Subsystem
User Operations
Hardware Assemblies
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Computer Software Units
User Requirement Analysis & Agree.
User Requirement Update
Concept Formulation including COTs, NDI Trades and Selection
System Spec
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System Specification Update
Design Concept Formulation & Selection
Des. Concept Document
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SW Concept For Design-to Artifacts
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Software Code-To Artifacts
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Capabil Demo
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Time Now
Performed at the Level Necessary to Identify and Manage Opportunities and Risks
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Critical Issues to be Studied:
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• Driving Technology and COTS Proven Availability
• Software System Architecture “Feasibility Prototyping”
• Hardware System Architecture Feasibility Models
• Qualification of Components in Target Environ
• System Risk Analyses Including COTS & NDI
• Failure Modes Analyses Including COTS & NDI
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    IEEE Computer Society an international standard ISO/IEC TR 19759:2005

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- Let's have a closer look into another Example Process-Model: The V-Model. [German Administration 2005]
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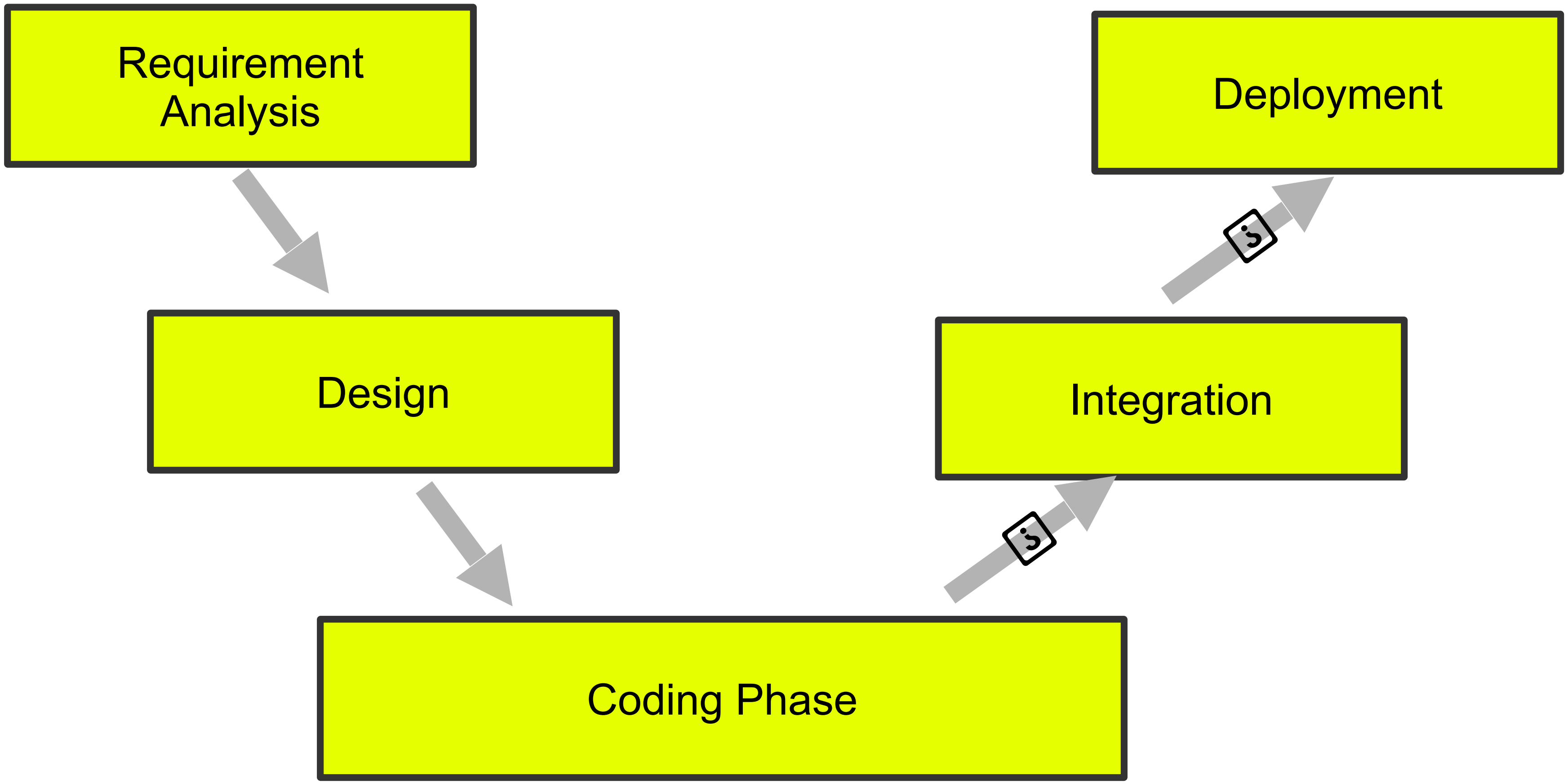
# A Schematic View on the V-Model



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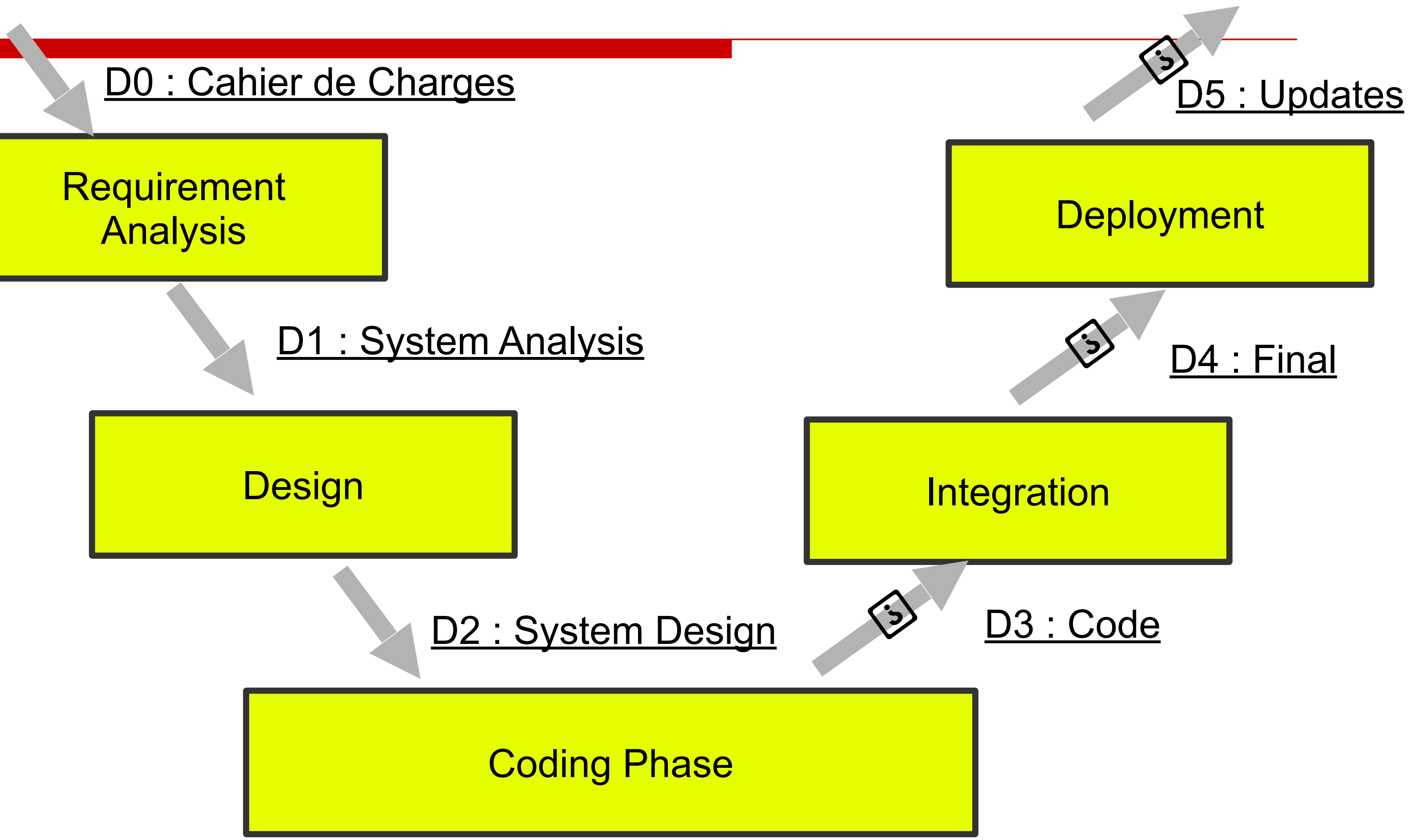

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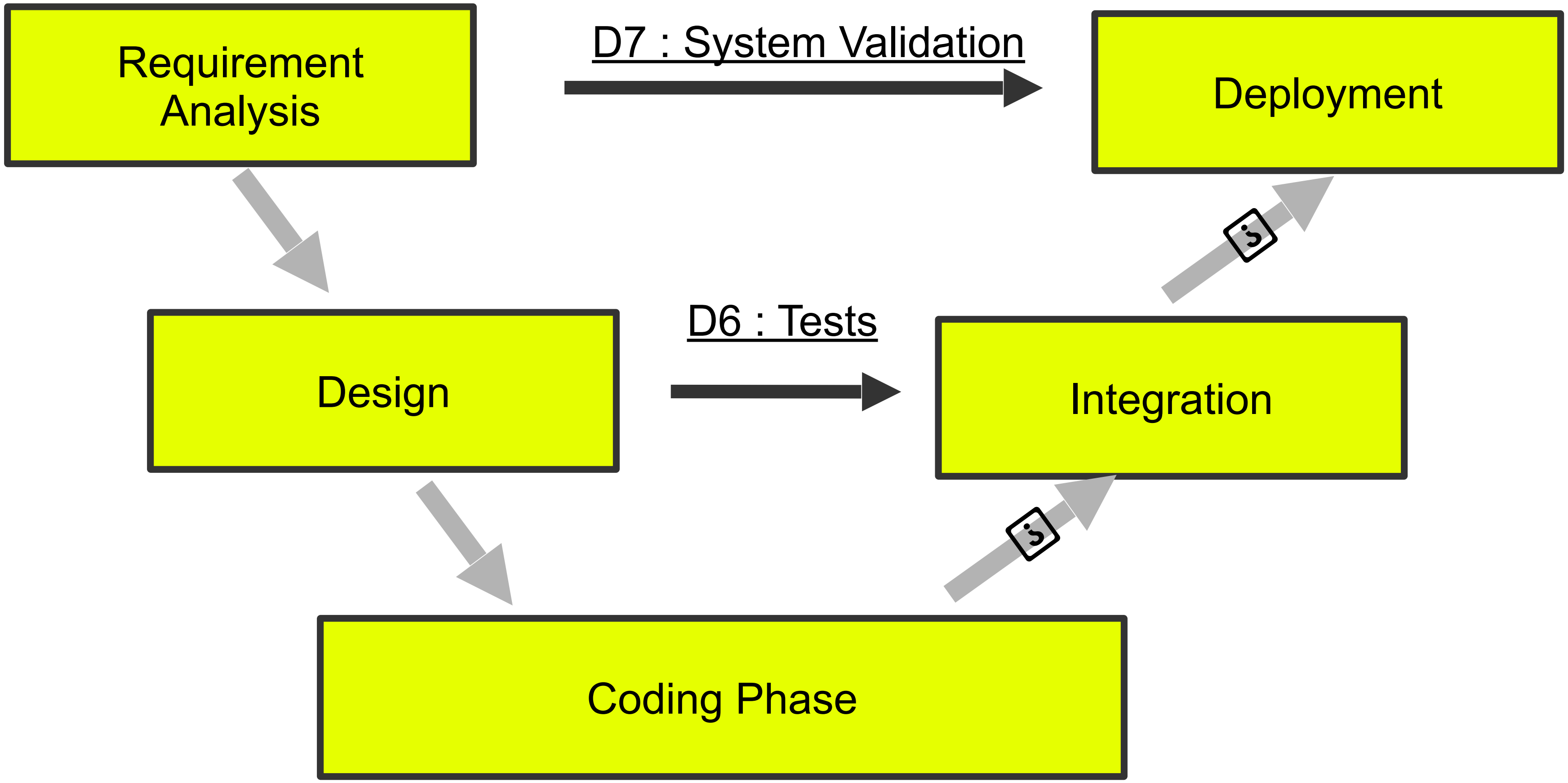


## The V-Model

## The V-Model

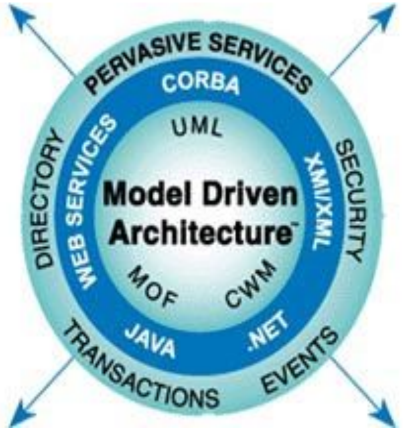
- We will use the V-Model as a kind of "typical classical process-model"

  Many processes are just a variant of it.

- However, there is no such thing like "the process" in industry,

- … et chacun fait ca a sa sauce …

## Alternatives to the V-Model



- IBM Rational Unified Process (RUP)

- Idea : Using UML and OCL integrated into the Deliverables (documents)
- Idea : Allows for semi-formal editing, more precise notation and therefore better communication
- Analysis, Design and Code Documents CONTAIN standardised diagrammatic specification elements (the "model") which can be automatically validated
- Code and Tests can partially be generated from design models (Model-Driven Engineering (MDA))

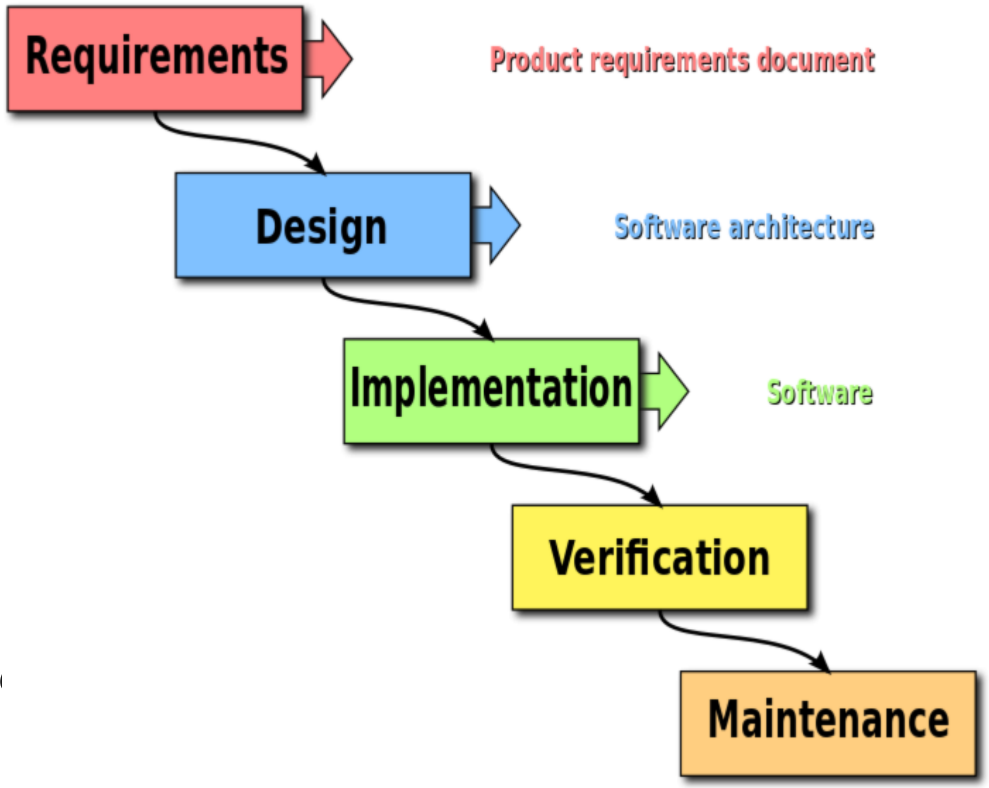
# Alternatives to the V-Model

Waterfall Model

[Benington 56, Royce 70]

Royce presented this model as an example of a flawed, non-working models.

Category: Academic example.
Never works like this in practi

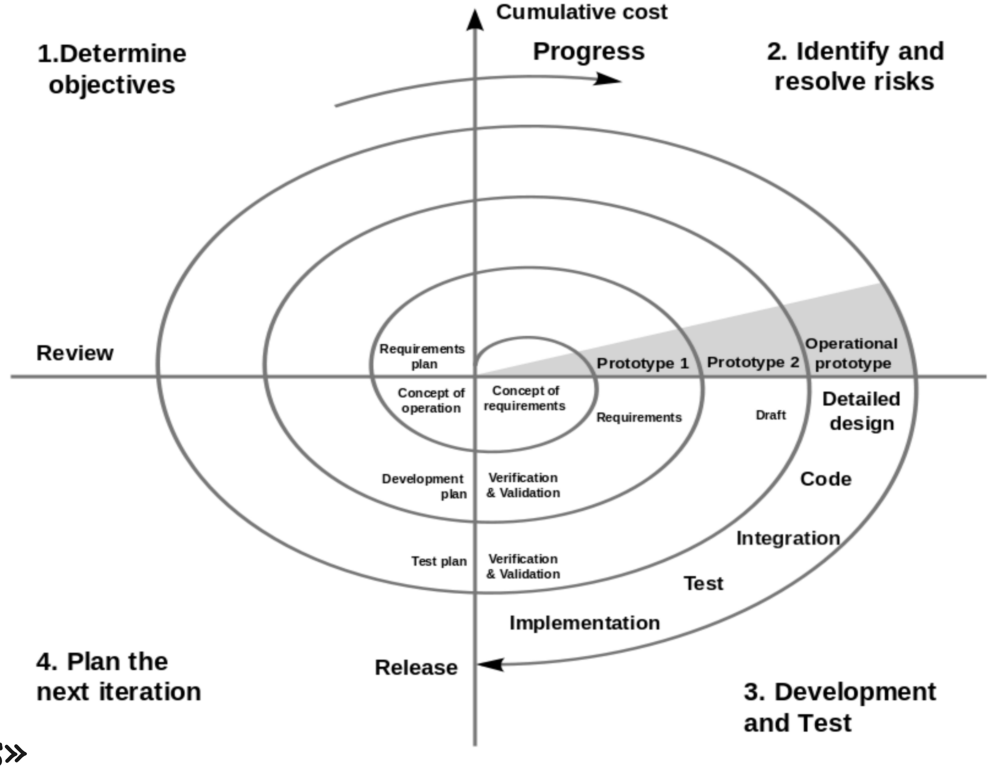


# Alternatives to the V-Model

- ## Spiral Model [Barry Boehm 88]

combines some key aspect of the waterfall model and rapid prototyping methodologies, in an effort to combine advantages of top-down and bottom-up concepts.

Today mostly a conceptual reference; ideas are retaken in « agile development processes»



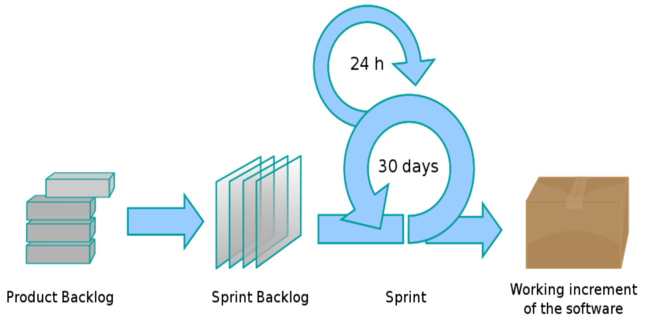
# Alternatives to the V-Model

- Agile Software Development

  [Beck et al 2001, V2: 2010]

  AD advocates:

  - adaptive planning,
  - evolutionary, incremental development,
  - early delivery,
  - continuous improvement,
  - and it encourages rapid and flexible response to change

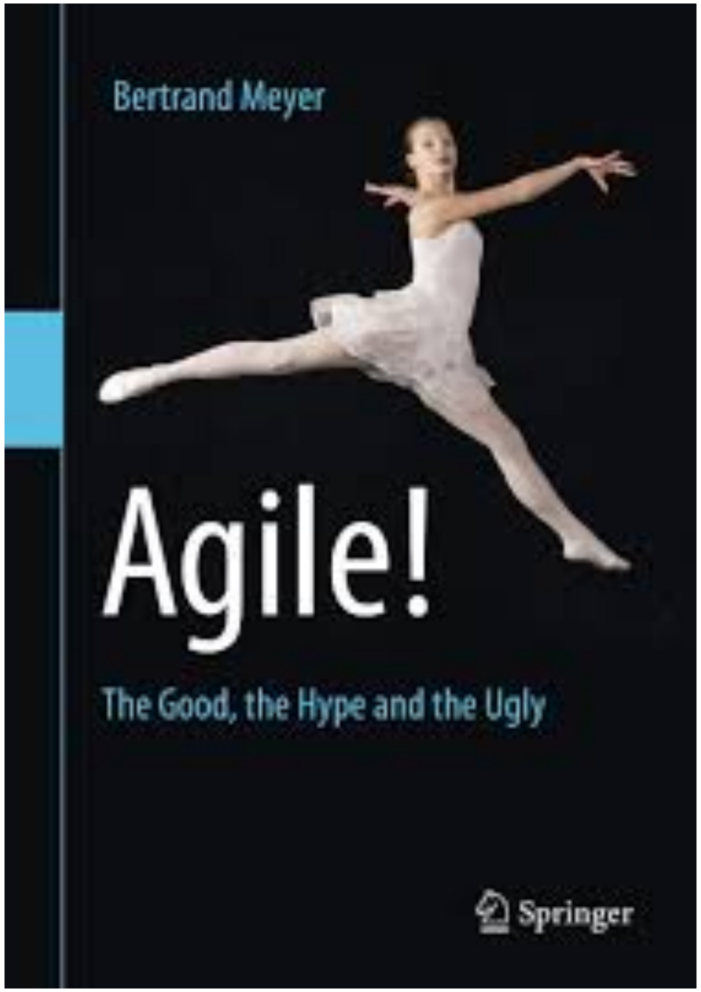


Particular variants are called « Extreme Programming » (with an emphasis on early, handwritten tests)

SCRUM (with emphasis on social organisation and continuous team-reviews)

# Alternatives to the V-Model

- An amusing book analysing and criticising Agile Methods by one of the Peers of Software Engineering is :


Bertrand Meyer
Agile!
The Good, the Hype and the Ugly
Springer