

MI0A112T - Ingénierie du logiciel avancé

Tableau de bord / Cours / S2 - MI0A112T

Modern Requirements and Business Analysis

1 - Introduction

Jean-Michel Bruel

[UE 1002 – Spécification des exigences](#)

<https://bit.ly/imbruel>



@SmartModelTeam



<https://github.com/smart-researchteam>

OFFICIAL
REFERENCE:

<https://iris.univ-tlse2.fr/course/view.php?id=3645>

HOW TO CITE:

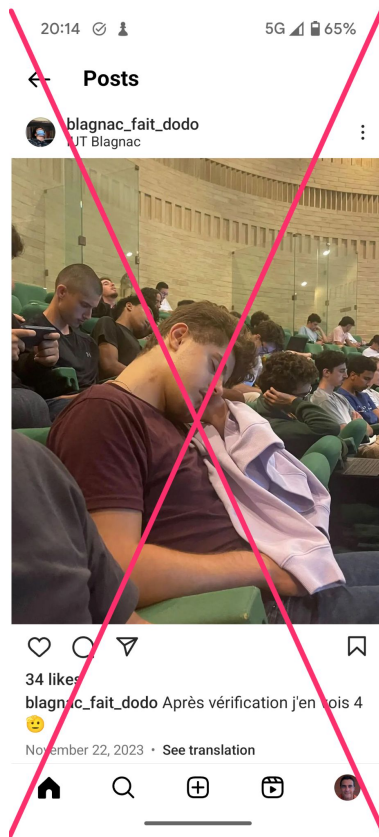
Jean-Michel Bruel, “Cours Ingénierie des Exigences – Master ICE”. Toulouse, 2024.



If you have any content that I did not reference well or that should be removed, please do not hesitate to contact me so that I can correct this presentation.




Get my slides (pdf)
(not yet)



25' of attention



- Today
- During practice
- Any time!

| #P5 | IS Nan Messe | IS/RE Thuy Nguyen | RE JMB  |
|-------------------------|---|---|--|
| Thèmes | Généralités sur l'IS Lien Software Engineering (V vs Agile) SysML | IS assistée par la modélisation & la simulation Stimulus | Ingénierie des exigences en lien avec l'IS Stimulus PEGS |
| 22-26 avril | | | 8h - Généralités - ISO XYZ - GORE (Kaos) - Justifications |
| 29 avril - 3 <u>mai</u> | 4 - Intro Système & IS - Intro Processus | 4 - BASAALT - Iso | 4+6 - Exigences formelles - Initiation à Stimulus (Cranbrook) - Tracabilité - Exigences et SysML ? |
| 6-7 <u>mai</u> | | | 8 - Projet PEGS |
| 13-17 | 4+4 - Lien UML et SysML - Les diagrammes SysML avec Papyrus | 4 - Stimulus sur un cas pratique | (4+2) - Projet PEGS |
| 21-24 | | 4 - Projet Stimulus | |
| Evaluation | 50% d'IS Exam (contrôle dernière heure) | 50% d'IS Projet | Projet 70% de RE Exam/QCM 30% de RE |

Disclaimer (and assumptions)

Désolé pour l'utilisation de l'anglais 😅

C'est la 1ère fois que je donne ce cours!!

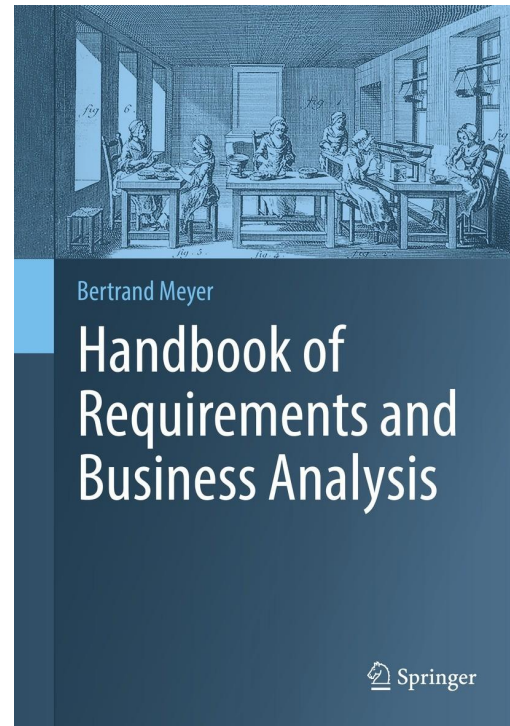
=> vous allez être mis à contribution !



Why me?

- Professor at Toulouse University
 - Teaching **modeling** and **DevOps**
- Member of the CNRS-IRIT Laboratory
 - Model-Based **Systems Engineering**
- **Airbus** MBSE Chair of Toulouse
- Leader of the **companion book** (end of 2024)

<https://bit.ly/jmbruel>



<https://se.inf.ethz.ch/requirements/>

Joint effort...

- Innopolis University



- Alexandr
- Manuel



- Constructor Institute



- Bertrand
- Li



- IRIT/SM@RT team



- Florian
- Sophie
- JMB
- Maria
- Pierre-Jean



- CoCoVaD



CoCoVaD

- Imen
- Thuy




- McMaster University




- Sébastien




Sources for this course



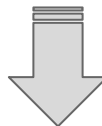
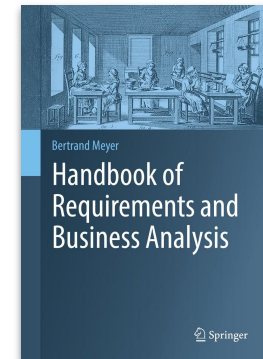

**Requirements
in the software lifecycle**
Bertrand Meyer




Introduction to 3RA3
Dr. Sébastien Mosser
Lecture #01
CS362 3RA3 - Fall 2023



Master 2 ICE
UE MIOA112T
**Ingénierie des exigences :
les phases amonts d'ingénierie
système / logicielle**
Pierre-Jean Charrel
UT2J – IRIT
pierre-jean.charrel@univ-tlse2.fr



<https://bit.ly/jmb-teaching>






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<https://github.com/smart-researchteam>



<https://requirements.university>



**Requirements and Business Analysis
Overview**

v2024.04.19
<https://requirements.university>

DON'T TRUST
THIS!

Outline

OVERVIEW/ TEASING

- (22/04) 4h - Introduction to RE
- (24/04) 4h - PEGS approach / Reqs taxonomy
- (29/04) 4h - Practical aspects
- (02/05) 4h - Introduction to STIMULUS
- (02/05) 2h - Tooling / Practice
- (06/05) 2h - PEGS approach / Reqs taxonomy
- (07/05) 6h - Project #phase1
- (15/05) 4h - Project #phase2
- (17/05) 3h - Project presentation / Feedback

PRACTICE

PRACTICE

PRACTICE

ACTIVE
PARTICIPATION

33H



practice

What about **you**?

What about requirements?

Practice 1: Collaborative experience

1. Open collaborative mind map
2. Express categories you know/expect/manipulate
3. Organize and group
4. Discuss





Get my slides (pdf)

<https://bit.ly/jmb-teaching>

Context: why should you care?

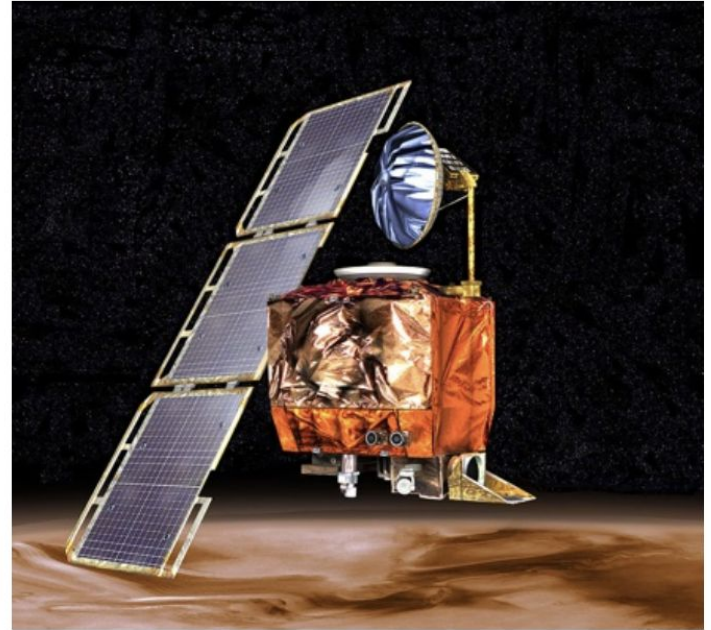
Concrete example of Requirement problem...



https://www.youtube.com/watch?v=_47utWAoupo

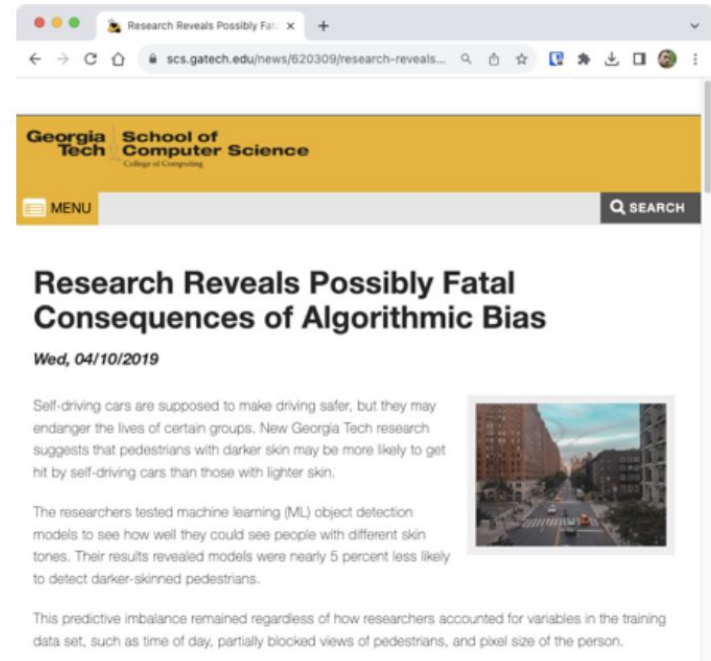
Space Exploration Fiascos

- **Ariane V - Flight v88** (1st flight)
 - Went kaboom after 37s
 - Estimated cost: **\$370M USD**
 - Inflation + exchange: **\$1B CAD**
 - **Bad code reuse, dead code, overflow,...**
- **Mars Climate Orbiter** (lost after 11 months)
 - **\$110M USD** to build and deploy
 - **Unit conversion error** ($\text{lb}\cdot\text{s}^2 \neq \text{N}\cdot\text{s}^2$)



I'm not going to space, I want to do AI!

- **Tesla auto-pilot** anti-collision not able to identify black pedestrians at night
- **Amazon HR** recruitment assistant amplifying Ivy League recruitment biases
- **Google Photo** recognizing black people as gorillas or chimpanzees
- **Contact tracing** application during COVID-19
- **Microsoft navigation** system patented an "avoid ghetto" mode for pedestrian walks



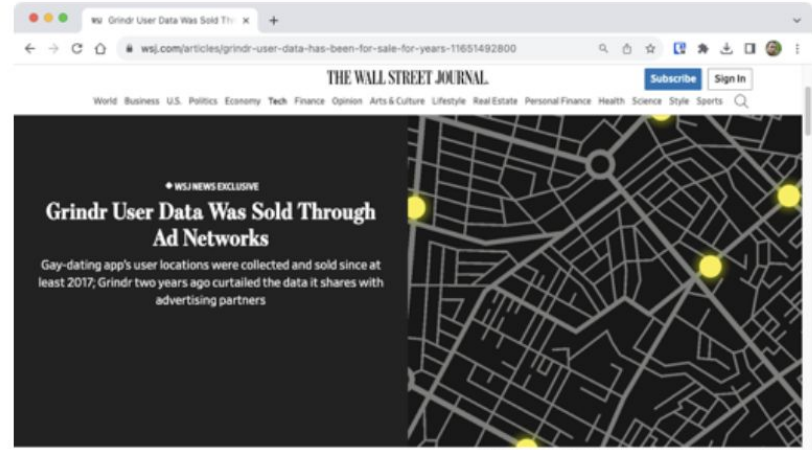
The screenshot shows a web browser window displaying a news article. The browser's address bar shows the URL 'scs.gatech.edu/news/620309/research-reveals...'. The article's header includes the Georgia Tech School of Computer Science logo and a search bar. The main title of the article is 'Research Reveals Possibly Fatal Consequences of Algorithmic Bias', dated 'Wed, 04/10/2019'. The text of the article discusses how self-driving cars may endanger certain groups, specifically mentioning that pedestrians with darker skin may be more likely to be hit by self-driving cars than those with lighter skin. It also notes that machine learning models were nearly 5 percent less likely to detect darker-skinned pedestrians. A small image of a city street with a car is visible on the right side of the article.



I don't care, I want to be a mobile developer!



Waze Drive Now: 151M users — Home Location



Grindr: 2M users — Loc, HIV Status & Sexual orientation

Leaking personal information, sold to external companies.



https://www.linkedin.com/posts/daniel-abrahams_reminder-people-dont-buy-products-they-ugcPost-7010015948820680704-CTJD?utm_source=share&utm_medium=member_android

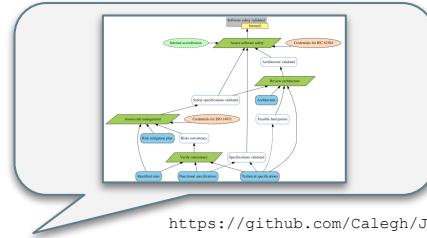


People don't buy **products**
They buy **solutions** to their **problem**

[...] they buy solutions to their problem



- **Play** with the product
 - Not so easy with an airplane...
- Don't need details
 - **Early** V&V
- Validation => **Rational**



<https://github.com/Calegh/JustificationDiagram>

Identifying ambiguities



Validation & Verification (V&V)

Does the right **thing**

- Validation
- « Building the right system »



<https://www.canon.co.nz/software-solutions/iw-sam>

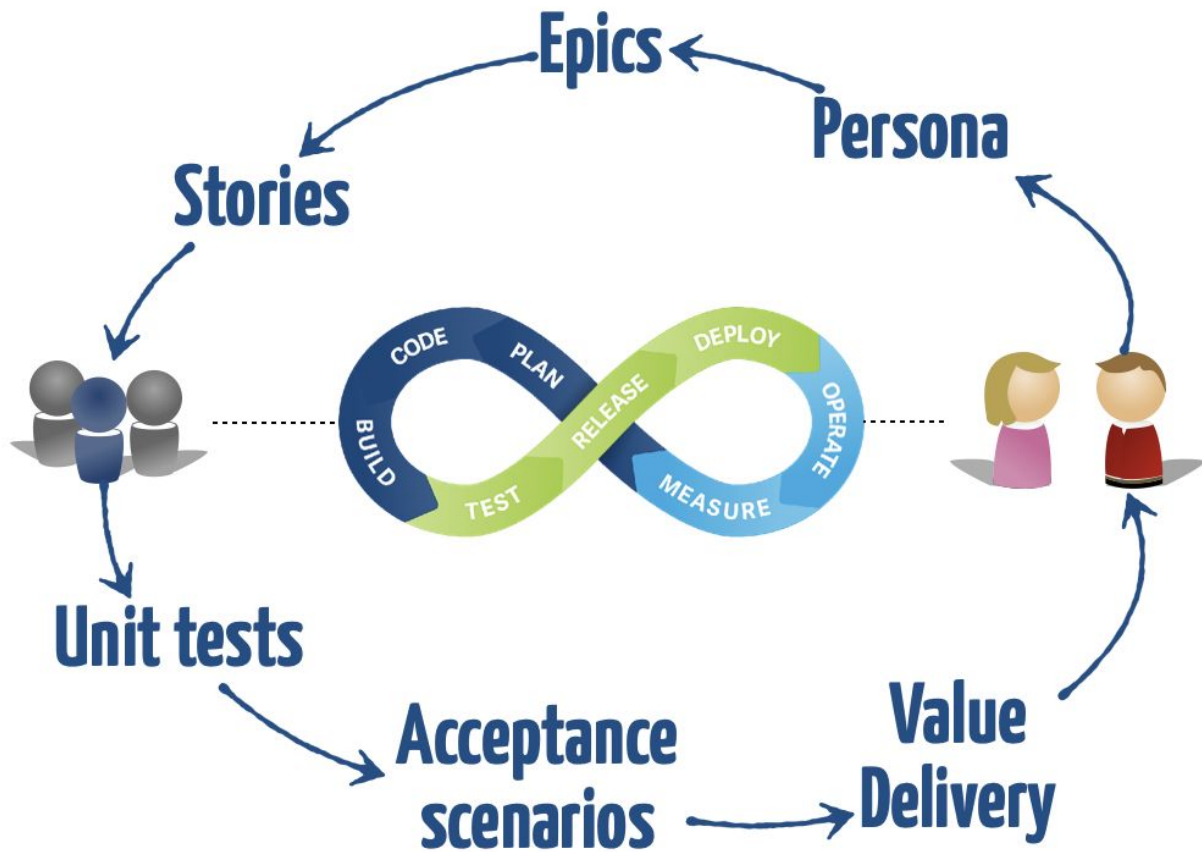
Does them right

- Verification
- « Building the system right »



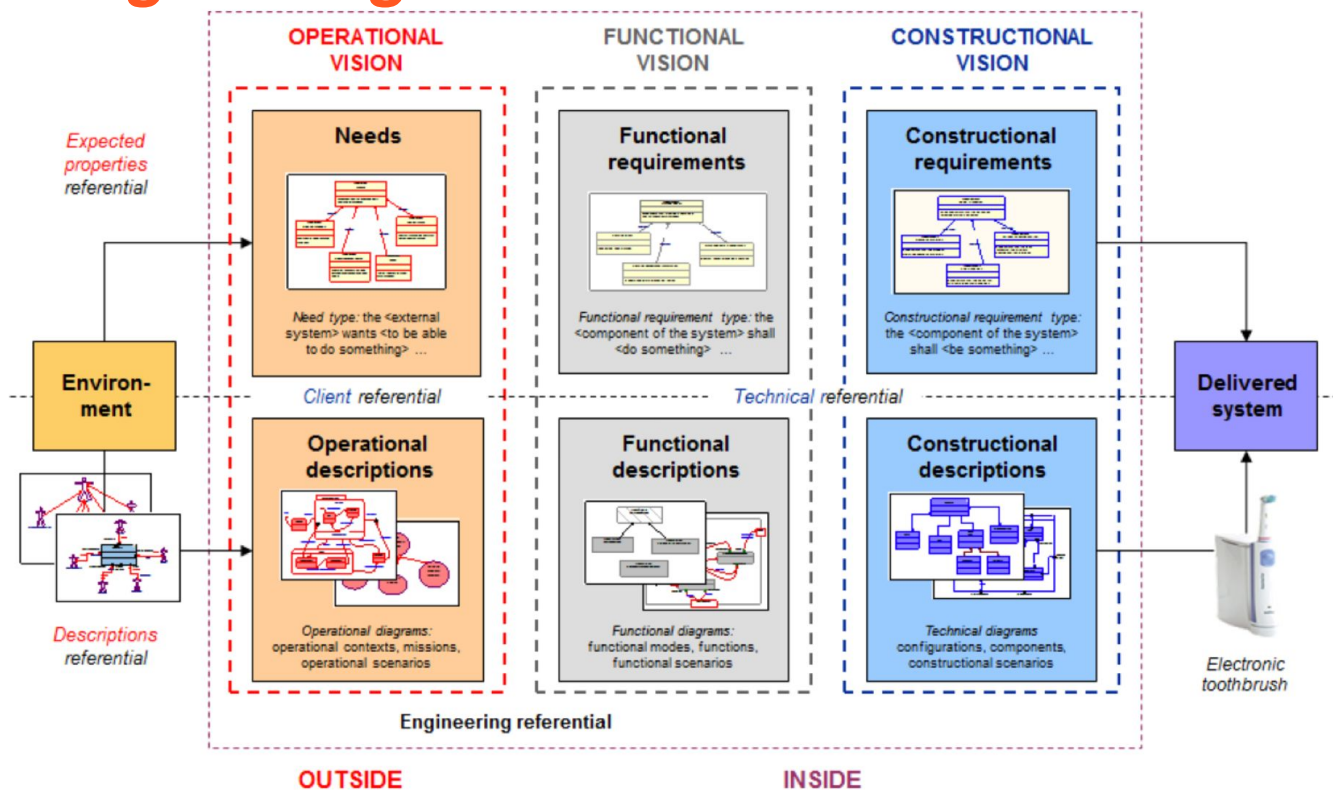
<https://www.techopedia.com>

Lean development

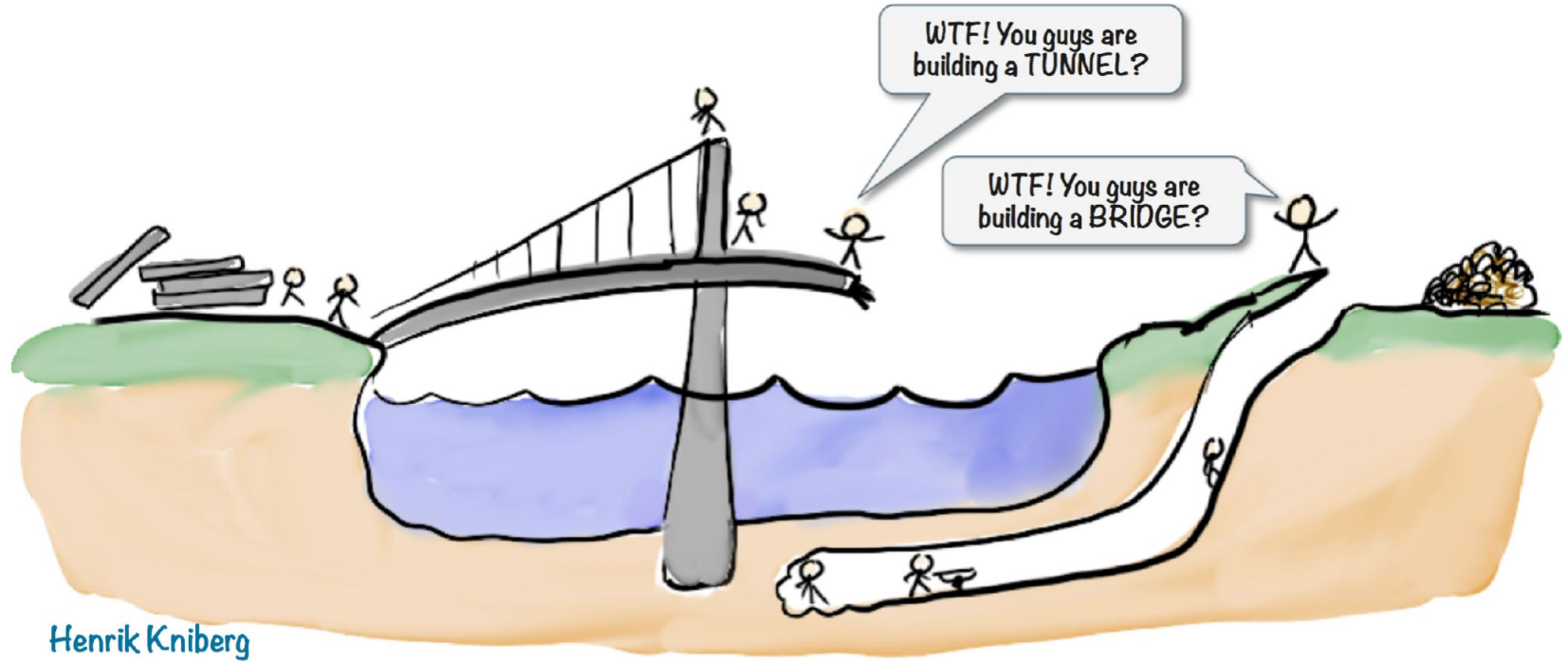


Source: <http://meshfields.de/continuous-integration-testing-delivery-ionic2-hybrid-mobile-apps-buddybuild/>

Systems Engineering

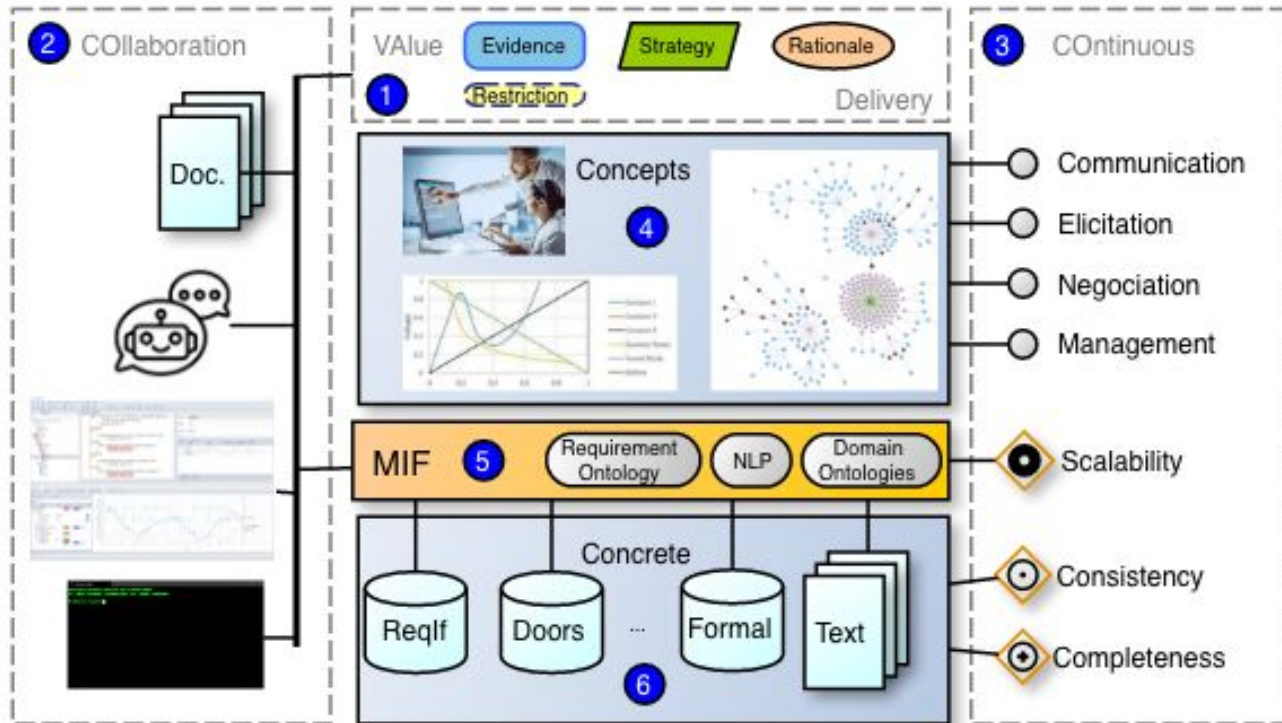


Misalignment



Henrik Kniberg

Requirements as first-class citizens



IEEE/SWEBOK/ISO definition of a Requirement

“A 1.1 Definition of a Software Requirement

At its most basic, a software requirement is a property that must be exhibited by something in order to solve some problem in the real world. It may aim to automate part of a task for someone to support the business processes of an organization, to correct shortcomings of existing software, or to control a device—to name just a few of the many problems for which software solutions are possible. The ways in which users, business processes, and devices function are typically complex. By extension, therefore, the requirements on particular software are typically a complex combination from various people at different levels of an organization, and who are in one way or another involved or connected with this feature from the environment in which the software will operate.

”

http://swebokwiki.org/Chapter_1:_Software_Requirements

Templates (docx, LaTeX, Google Doc, ...)

Goals



Goals are "needs of the target organization, which the system will address". While the development team is the principal user of the other books, the Goals book addresses a wider audience: essentially, all stakeholders (see [Handbook](#)).

It must contain enough information to provide — if read just by itself — a general sketch of the entire project. To this effect, chapter G.3 presents a short overview of the system and G.1 will typically include some key properties of the environment. As it addresses a wide readership, it should be clear and minimize the use of specialized technical terms. Together, G.1, G.2 and G.3 describe the rationale for the project. It is important to state these justifications explicitly. Typically, they are well understood at the start of the project, but management and priorities can change (see [Handbook](#)).

G.1 Context and overall objectives



High-level view of the project: organizational context and reason for building a system (see [Handbook](#)).



This section should not be empty (following the *Minimum Requirements Outcome Principle*, p.27 of the [Handbook](#)).

¹ Example of numbered requirement that can be [referenced](#).

G.2 Current situation



Current state of processes to be addressed by the project and the resulting system (see [Handbook](#)).

1 Goals

Contents

| | | |
|-----|---|---|
| 1.1 | G.1 Context and overall objective | 4 |
| 1.2 | G.2 Current situation | 4 |
| 1.3 | G.3 Expected benefits | 4 |
| 1.4 | G.4 Functionality overview | 5 |
| 1.5 | G.5 High-level usage scenarios | 5 |
| 1.6 | G.6 Limitations and exclusions | 5 |
| 1.7 | G.7 Stakeholders and requirements sources | 5 |

Comment: *Goals are "needs of the target organization, which the system will address". While the development team is the principal user of the other books, the Goals book addresses a wider audience: essentially, all stakeholders.*

1.1 G.1 Context and overall objective

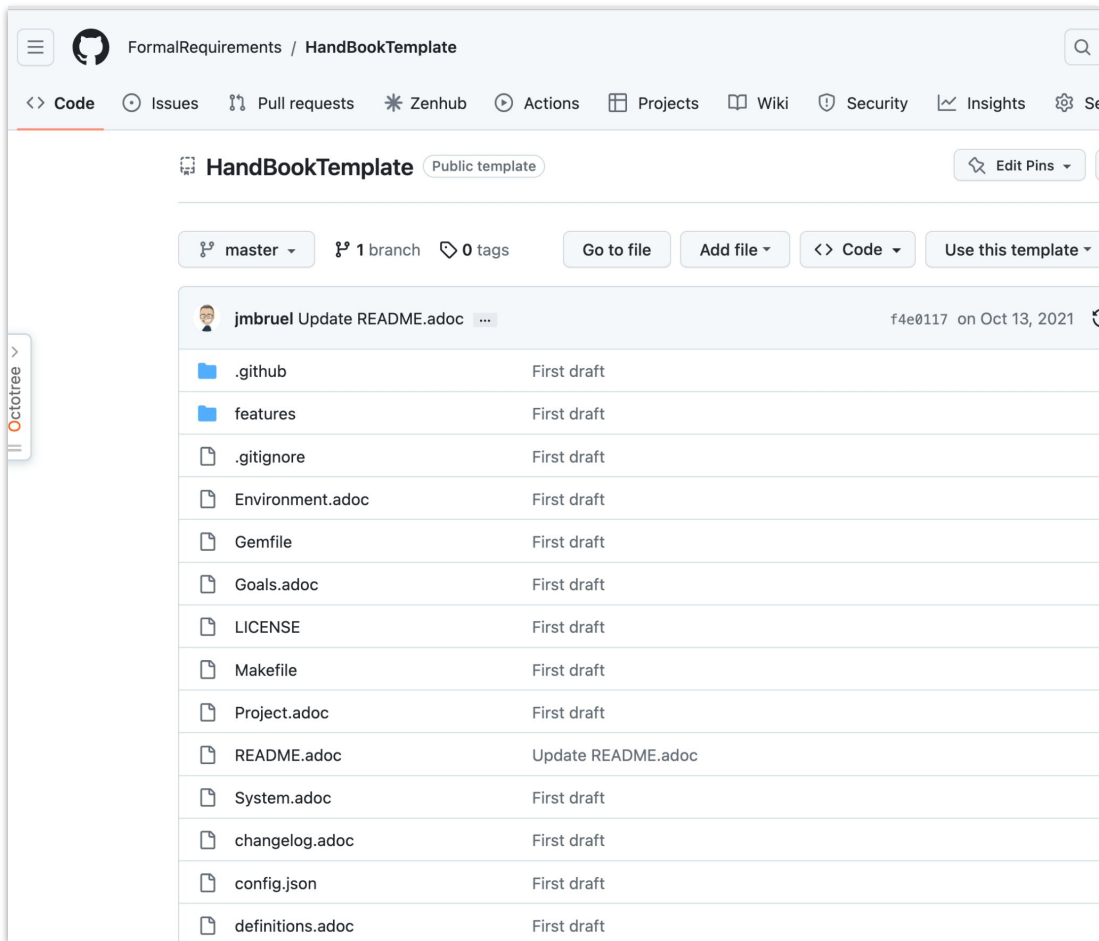
Comment: *High-level view of the project: organizational context and reason for building a system. This chapter should not be empty!*

Goal 1.1.1. This is a goal example. If you need explicit (and automatic) numbering, you can use the definitions in the `.tex` template. It is refined by [1.2.1](#)

More than Word!

- Markdown-like format
- GitHub itself
- Quality metrics & rules **implemented**

Github repo template



The screenshot shows the GitHub interface for a repository named 'HandBookTemplate'. The repository is a public template. The current branch is 'master', with 1 branch and 0 tags. The file tree view shows the following files and folders:

| File/Folder | Status |
|------------------|--------------------|
| .github | First draft |
| features | First draft |
| .gitignore | First draft |
| Environment.adoc | First draft |
| Gemfile | First draft |
| Goals.adoc | First draft |
| LICENSE | First draft |
| Makefile | First draft |
| Project.adoc | First draft |
| README.adoc | Update README.adoc |
| System.adoc | First draft |
| changelog.adoc | First draft |
| config.json | First draft |
| definitions.adoc | First draft |

PEGS chapters to organize requirements writing

The screenshot shows a GitHub project board for "ATCO Eats - Requirements Elicitation" in Kanban view. The board is organized into columns based on task status: "Todo" (22 items), "In Progress" (5 items), "In Review" (3 items), and "Done" (2 items). Below the status columns, tasks are grouped into two milestones: "Milestone #1" (10 items) and "Milestone #2" (11 items). Each task card includes a title, a description, and a progress indicator. A "Sign in now to use Zenhub" button is visible in the bottom right corner.

| Status | Count | Description |
|-------------|-------|--|
| Todo | 22 | This item hasn't been started |
| In Progress | 5 | This is actively being worked on |
| In Review | 3 | Work is done and pending reviewer approval |
| Done | 2 | This has been completed |

| Milestone | Count | Task |
|--------------|-------|--|
| Milestone #1 | 10 | atco-eats #3 (G.7) Stakeholders and requirements sources |
| | | atco-eats #7 (E.1) Glossary |
| | | atco-eats #11 (P.7) Requirements process and report |
| | | atco-eats #1 (G.1) Context and Overall Objectives |
| | | atco-eats #2 (G.2) Current situation |
| | | atco-eats #4 (G.3) Expected Benefits |
| | | atco-eats #10 (P.6) Risk and mitigation analysis |
| | | atco-eats #5 (G.4) Functionality overview |
| | | atco-eats #8 (E.5) Effects |
| | | atco-eats #9 (E.6) Invariants |
| Milestone #2 | 11 | atco-eats #6 (G.6) Limitations and Exclusions |
| | | atco-eats #12 (G.5) High-level usage scenarios |

Thanks to Sébastien Mosser for sharing. More at <https://github.com/ace-lectures/atco-eats/>

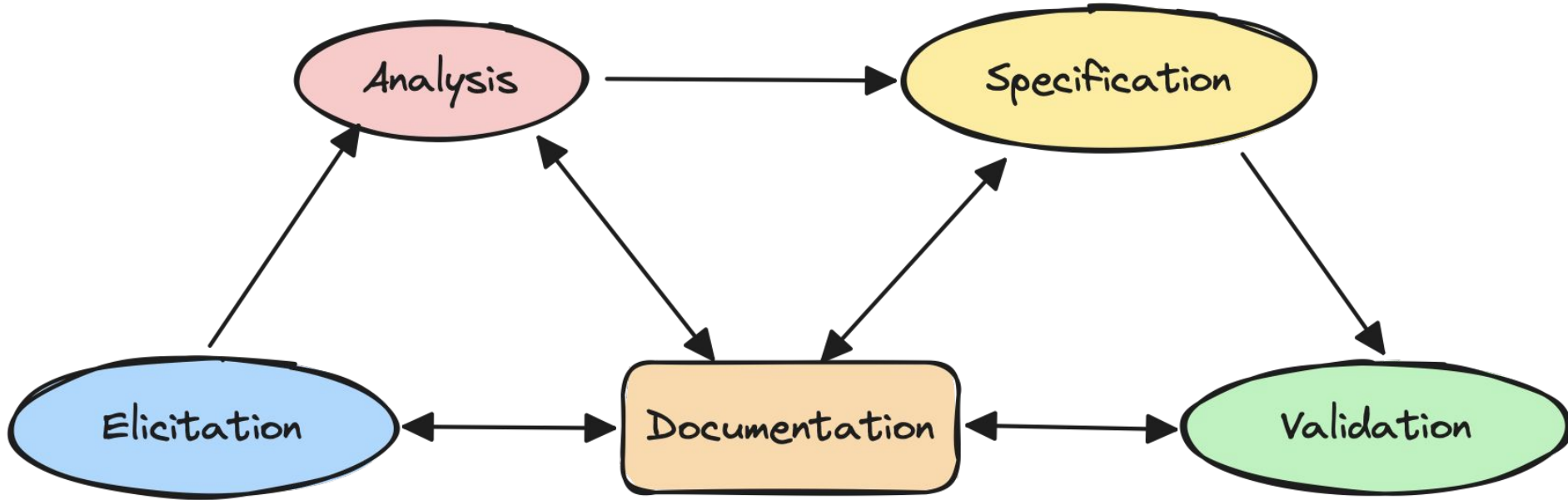
Requirements documents can be tested!

```
#-----  
# language: en  
Feature: Book mutual references  
    The books should follow the mutual references rules.  
  
Scenario: The Environment book must not refer to the Goals and Project books  
    Given The Environment book  
    Then No reference should include the Goals book  
    And No reference should include the Project book  
    And Only E.5 section can refer to the System book  
  
Scenario: The Goals book must not refer to the Project and System books  
    Given The Goals book  
    Then No reference should include the Project book  
    And No reference should include the System book  
  
Scenario: The System book must not refer to the Project book  
    Given The System book  
    Then No reference should include the Project book
```

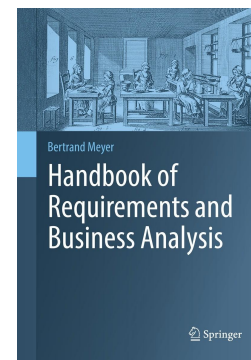
Requirements documents can be tested!

```
4 #-----
5 # language: en
6 Feature: Minimum Requirements Outcome Principle
7 |   The requirements effort must always produce the following elements.
8
9 Scenario: The Project book must have P3 P4 chapters
10 |   Given The Project book
11 |   Then P3 chapter must not be empty
12 |   And P4 chapter must not be empty
13
14 Scenario: The Environment book must have E3 chapter
15 |   Given The Environment book
16 |   Then E3 chapter must not be empty
17
18 Scenario: The Goals book must have G1 G3 G7 chapters
19 |   Given The Goals book
20 |   Then G1 chapter must not be empty
21 |   And G3 chapter must not be empty
22 |   And G7 chapter must not be empty
23
24 Scenario: The System book must have S1 S2 chapters
```

I'll try to cover all the aspects



Chapters from the Handbook



- Covered
- Overview
- Not covered

0. Preface
1. Requirements: Basic concepts and definitions
2. Requirements: General principles
3. Standard plan for requirements
4. Requirements quality and verification
5. How to write requirements
6. How to gather requirements
7. Scenarios: use cases, user stories
8. Object-oriented requirements
9. Benefiting from formal methods
10. Abstract data types
11. Are my requirements complete?
12. Requirements in the software lifecycle

Requirements for this course

Hard skills

- Github account
- Scrum/Agile knowledge
- Formal (maths) skills
- Windows PC (I know, I know, ...)

Soft skills

- Communication skills
- Writing skills
- “Out of the box” thinking



I need your help for this course...

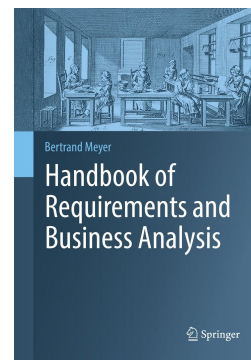
- Design skills (any artist in the audience?)
- Data, reference, evidence (don't use Chat GPT, please ;-)
- Github (hooks, CI/CD)
- BDD (Gherkin/Cucumber)
- ... (be proactive)

Let's move to PEGS Handbook

0. Preface

1. Requirements: Basic concepts and definitions
2. Requirements: General principles
3. Standard plan for requirements
4. Requirements quality and verification
5. How to write requirements
6. How to gather requirements
7. Scenarios: use cases, user stories
8. Object-oriented requirements
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- Covered
- Overview
- Not covered



<https://requirements.university>

Requirements and Business Analysis Overview

v.2024.04.19
<https://requirements.university>



DON'T TRUST
THIS!

Discussions time



Get the slides

 <https://bit.ly/jmbruel>

 @jmbruel