Software Engineering Primer for the Capstone Project

Carolin Brandt

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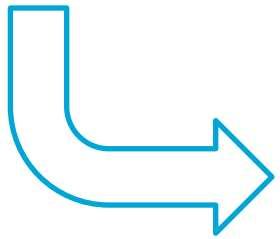
Lecture Goal

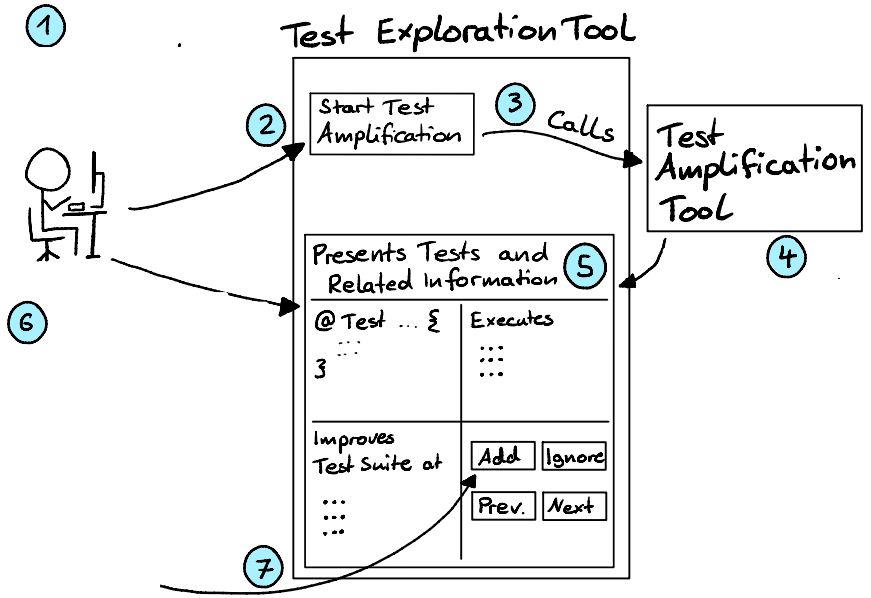
- Help you succeed in the capstone project
- From a team-that-writes-code-together perspective
- Based on scientific insights on **collaborative, large scale software development**



  - Software Engineering
  - Requirements Engineering
  - Project Management

Who am I

- Carolin Brandt
- 3rd year PhD Student, Software Engineering
- Automated testing tools collaborating with software developers
- Passion: Software Quality



- https://carolin-brandt.de
- c.e.brandt@tudelft.nl

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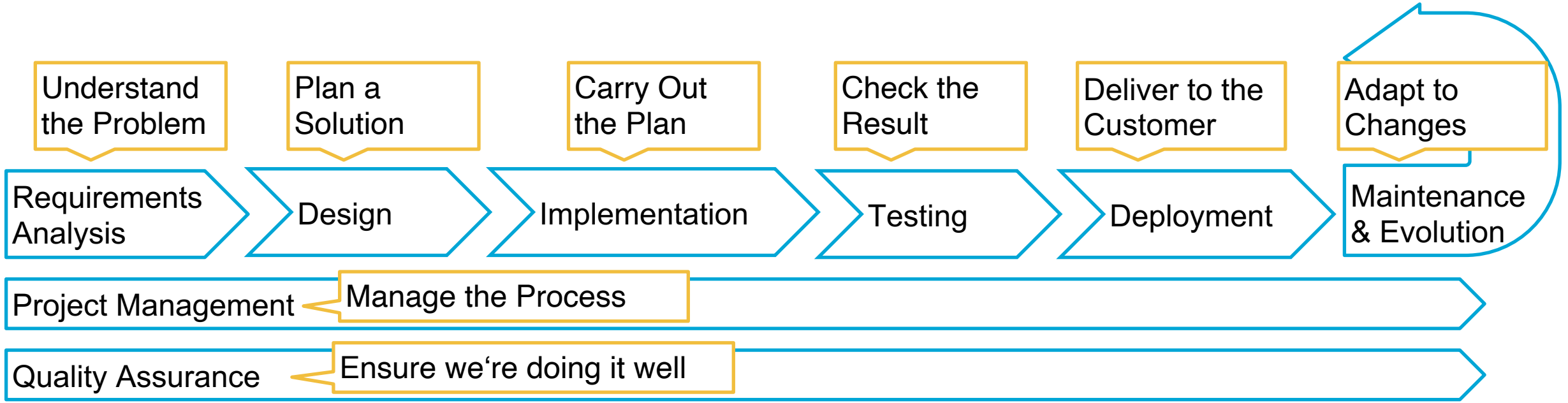
Software Engineering

Simplified

What does Engineering mean for you?

- Build complex software systems in a timely manner and with high quality. [Pre05]



Do your fields have similar processes? What differs?

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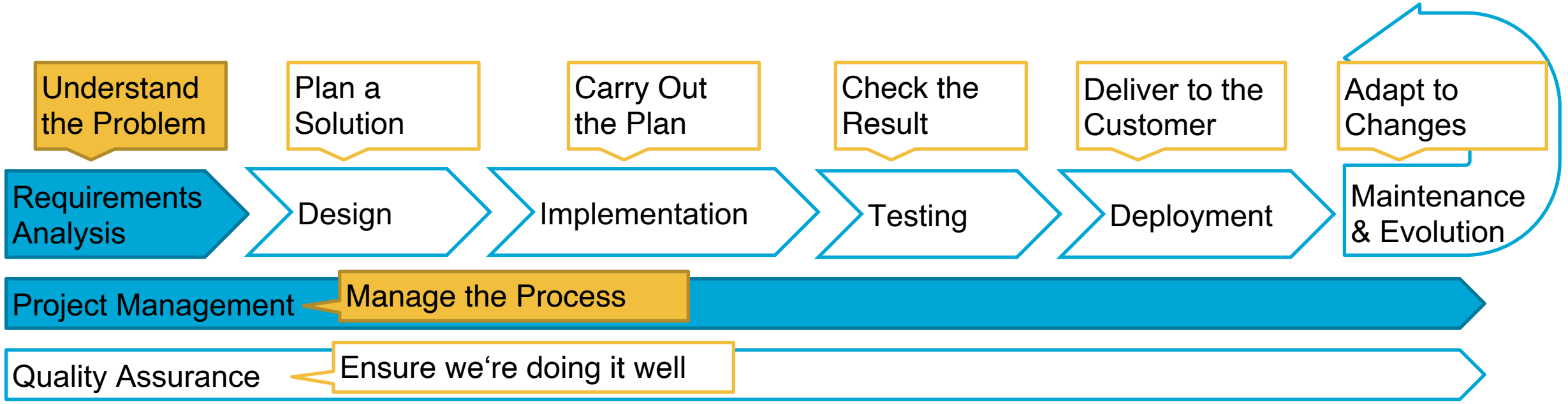
Focus for Today



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Lecture Structure

First Hour

Requirements Engineering

Negotiation
Documentation & Quality

Q&A

Project Management

Scrum
How to have a meeting

Q&A

Second Hour

In Project Groups

Review of Initial Requirements
Preparation for Client Meeting

Q&A

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Requirements Engineering

Make sure you‘re solving the right problem

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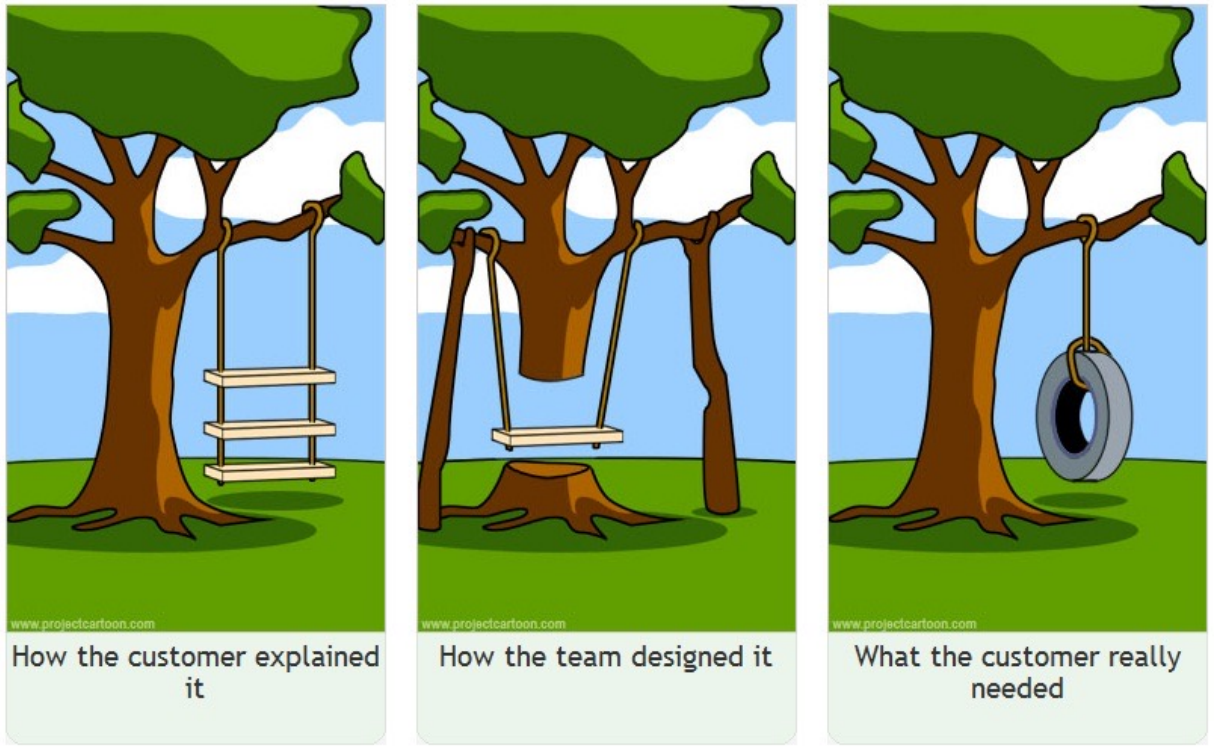
Why do we need requirements (engineering)?

- Agree on what will be done in the project
- Software: 1.000.000 possible solutions
- Create a shared understanding



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Definition: Requirement

- Description on what the system should do:

  the services that it provides, → Functional

  and the constraints on its operation. → Non-Functional Product or Process: Usability, Performance, Ethics, Report

Capstone Examples:

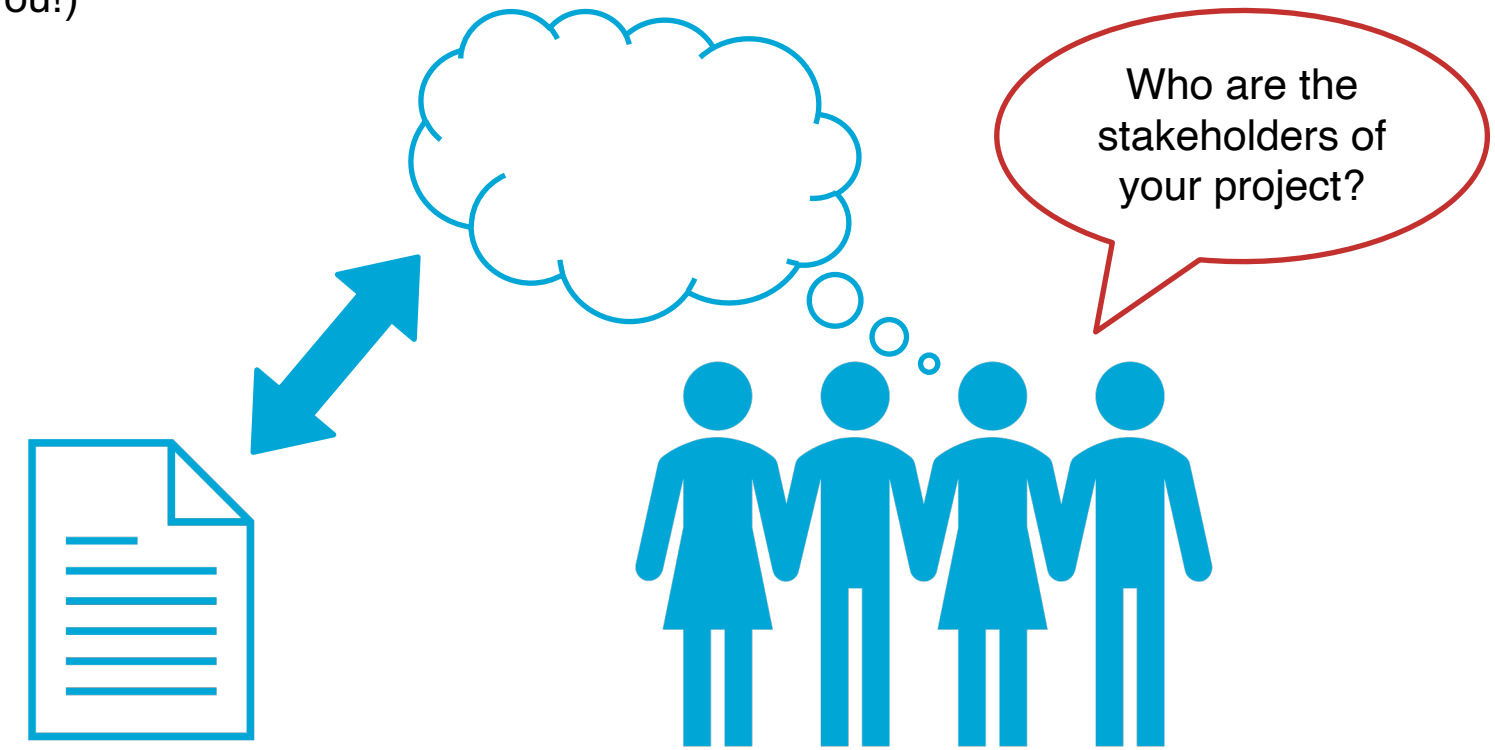
- Extract the social network structure in each city of the set
- Evaluate the performance of the clustering and classification algorithms

- Train the DECODE architecture on the TU Delft HPC cluster
- Get familiar with handling medical data (CT images, 3D dose distributions).

Requirements come from Stakeholders

- Anyone who has a direct interest in or benefits from the system that is developed. [Pre05]
- Client, Users, Supervisors, Developers (you!)

- Talk to / Consider each one
- Be aware of conflicting needs



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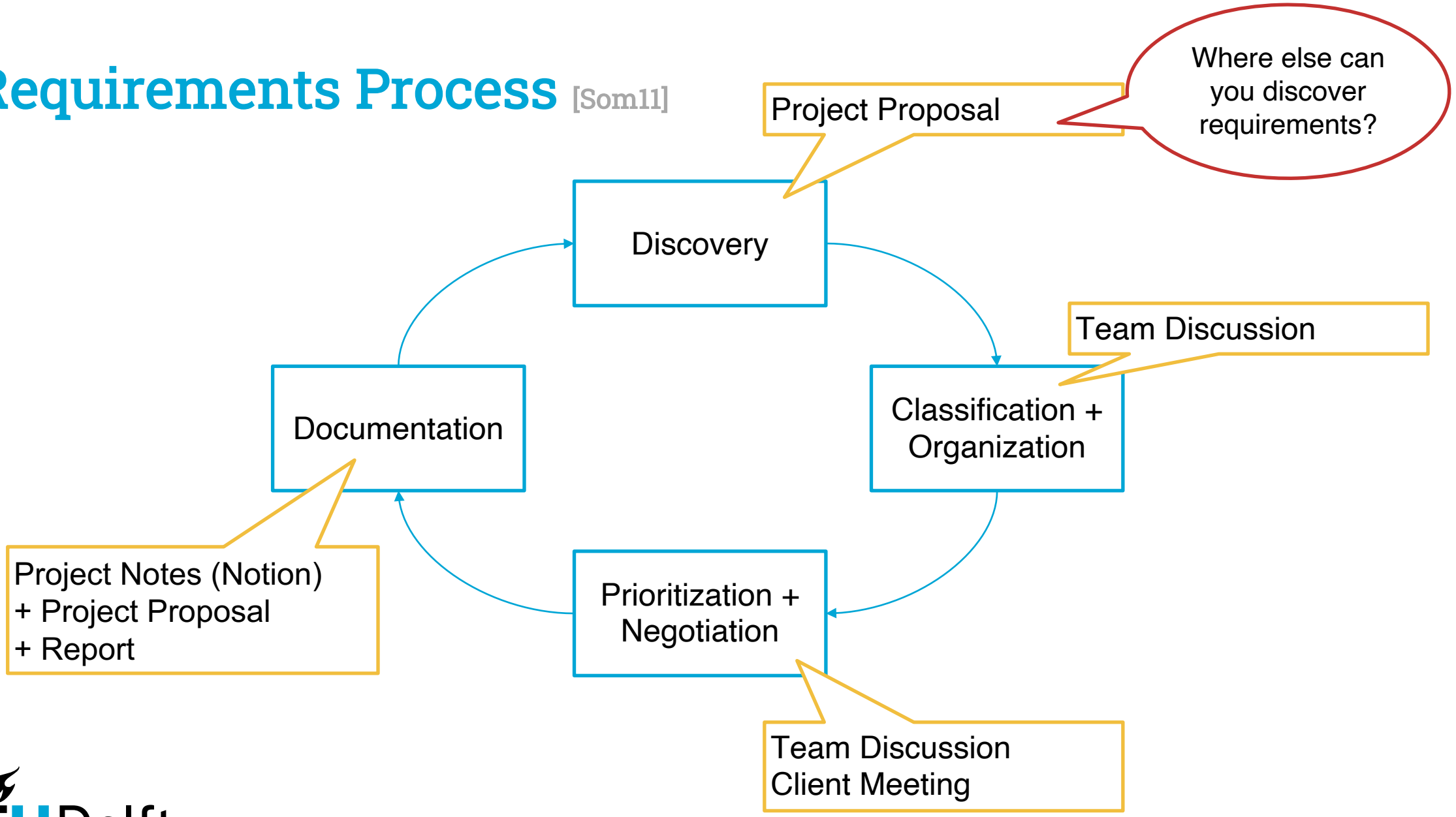
Requirements Process [Som11]



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Documenting Requirements

- Make a template
- Specify the actor: “The system ...“ “The students ...“ “The client ...“

- Don‘t be afraid to write requirements on multiple levels / steps!

  “Evaluate performance...“
  → “Calculate metric x“
  → “Measure time needed for y“
  → “For algorithms a, b and c“

Note down
as much as possible
- for yourself
- as a group

Capstone Examples:

- Extract the social network structure in each city of the set
- Evaluate the performance of the clustering and classification algorithms

What questions
come up when
you read this?

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Prioritizing Requirements

- MoSCoW Model
- **Must** have
  must be satisfied for project to not fail
- **Should** have
  important and valuable, but not essential
- **Could** have
  interesting enhancement, but only to be worked on if others are done
- **Won‘t** have
  explicitly excluded from this project (but might be interesting for the future)

How many % per category should you fulfill?

How do you decide the priority?

Why do we make could and won‘t explicit?

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What is a Good Requirement?

ISO 29148

- Unambiguous
- Feasible
- Verifiable
- Necessary
- Traceable

The requirements should be ideally be SMART:
Specific,
Measureable,
Attainable,
Realistic,
Timely.

- All together:
  - Consistent
  - Complete

What could be improved in these requirements?

Capstone Examples:
- Must take clinical imaging data from various modalities as input (e.g. CT, MRI, echo)

- Must annotate meeting transcripts to create a training dataset

- Must reliably align two complete recordings corresponding to the same written character

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Negoitiation

- Client wishes vs. what you can deliver
- Initial agreement
- Potential re-negotiation

Common Problems

- Missunderstanding: written requirements are the main result
- → **Information exchange and shared understanding**
  between developers and with client are the real value

- What the client says they want vs. what they need

- Stakeholder domain and vocabulary

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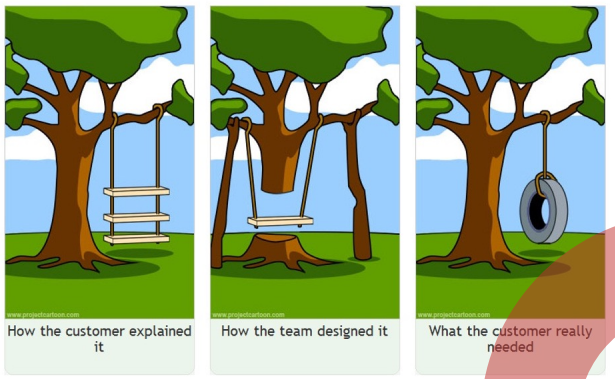

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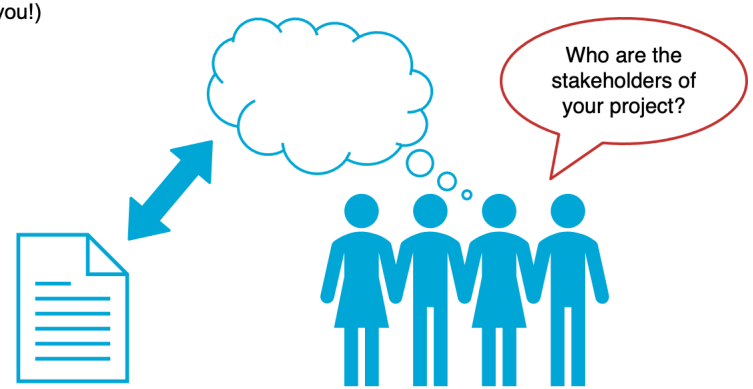

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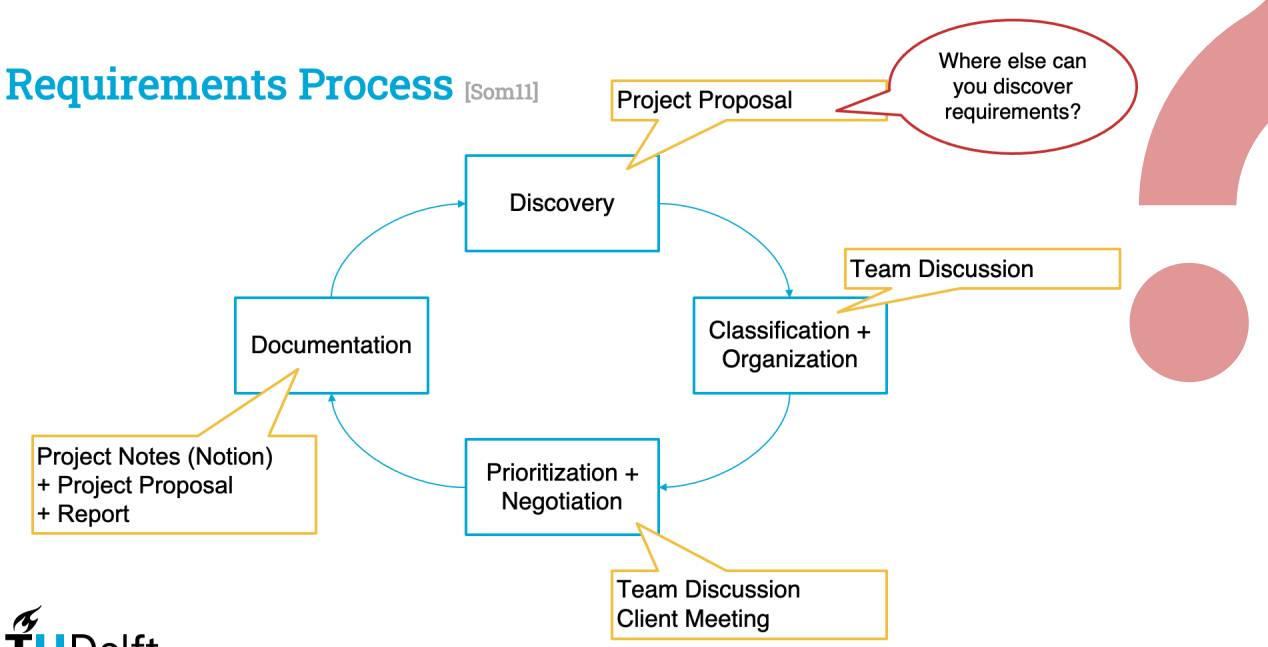

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Project Management

How to organize developing together

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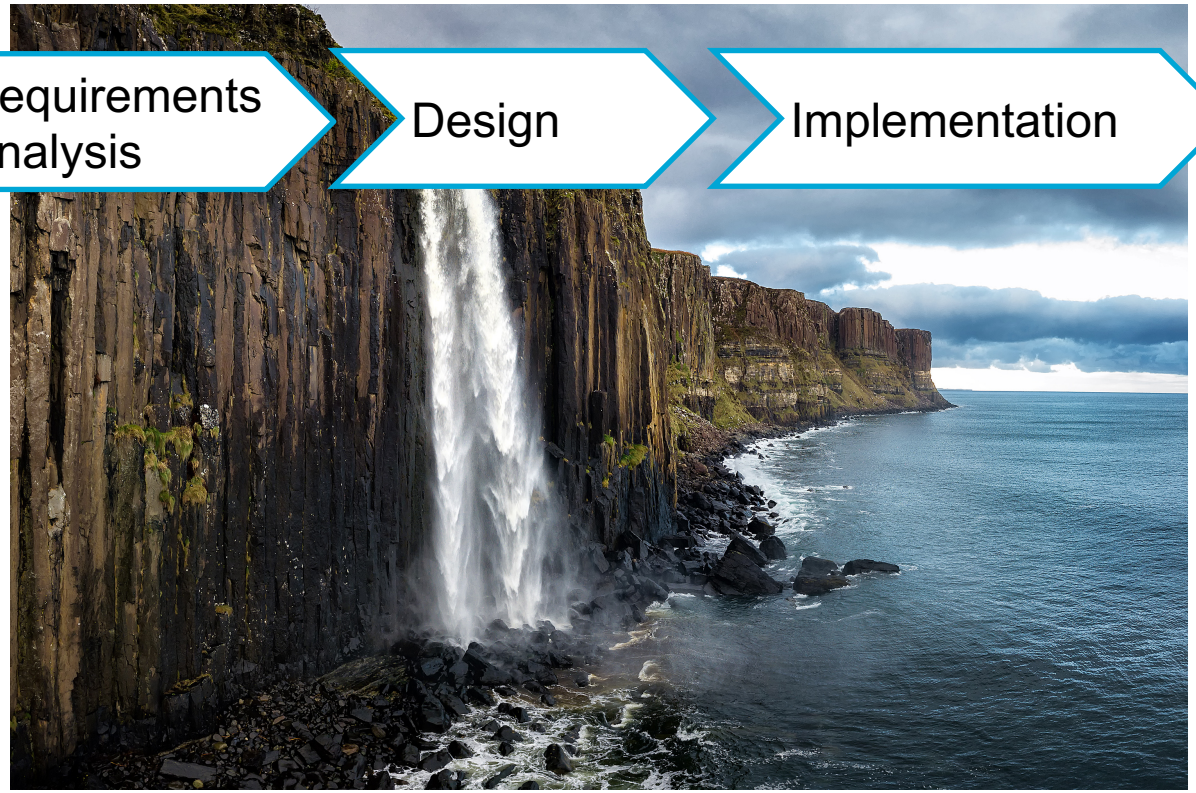
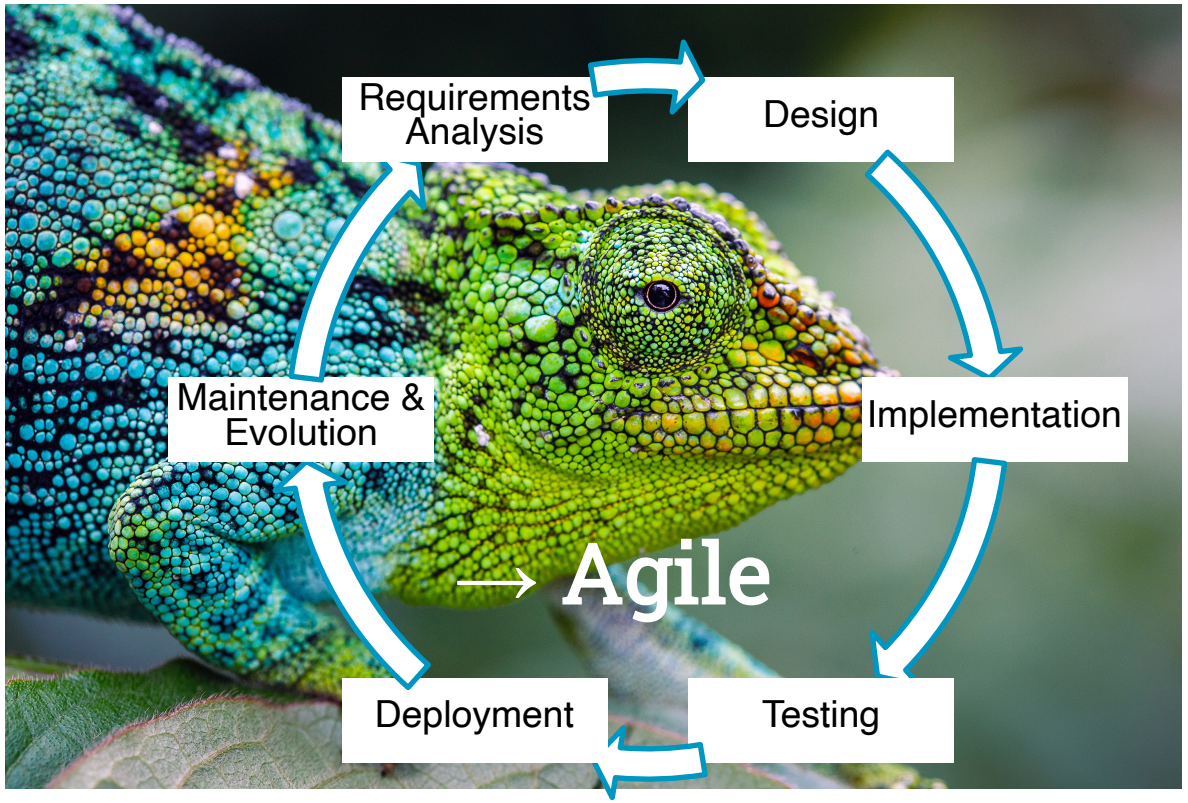
Software Process Model





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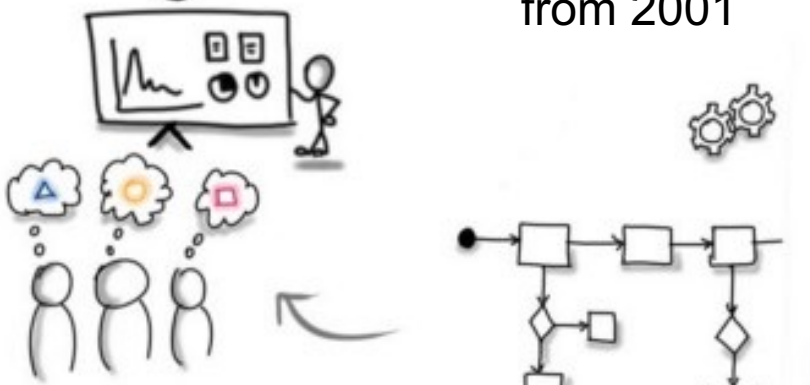
Agile Manifesto

by:
Information Artist

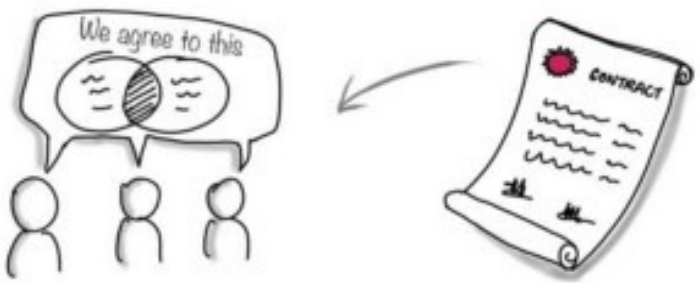
from 2001



People and Interaction

over

Processes & Tools



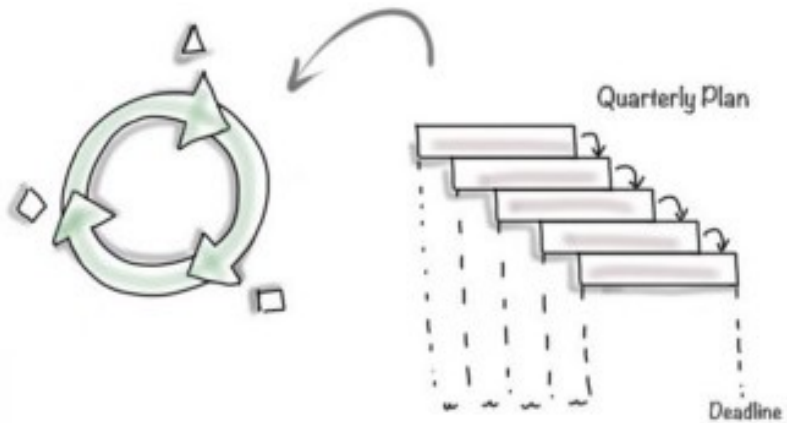
Customer Collaboration

over

Contract Negotiation

Working Software over

Comprehensive Documentation



Responding to Change over

Following a Plan

Scrum: One way of Agile Development

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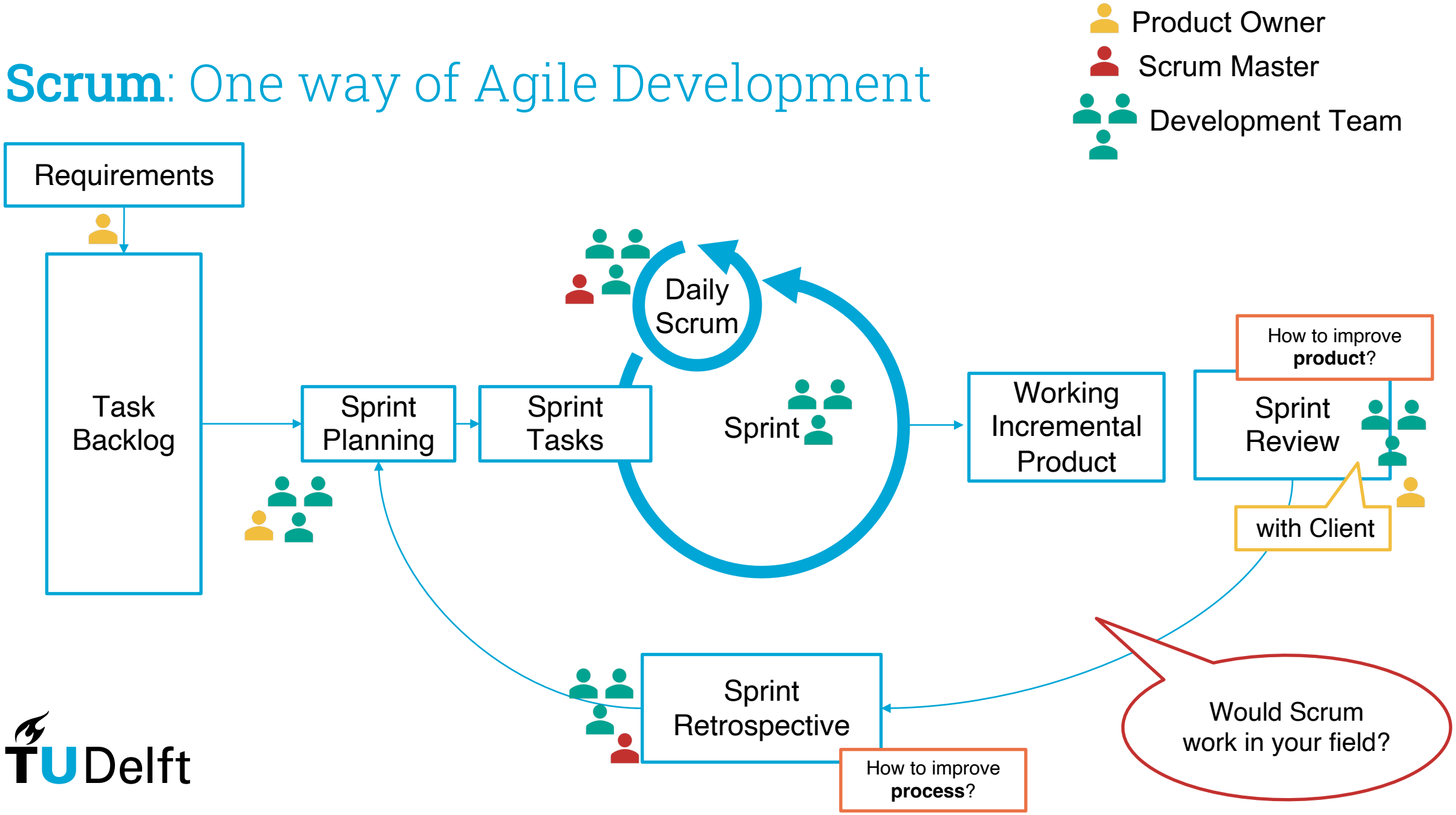

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How to have a (Client) Meeting

- **Pre-Meeting:** Prepare with the whole team beforehand (possibly with TA)
  - Agenda
  - Questions
  - Desired outcome

1-2 Days

- Have **the meeting**
  - Designated note-taker
  - Time keeper / Meeting leader

Team Lead Responsibility vs. Active Roles

30 min

- **Post-Meeting:**
  - What did we learn? → adapt plans
  - Discuss unclear things, surprises

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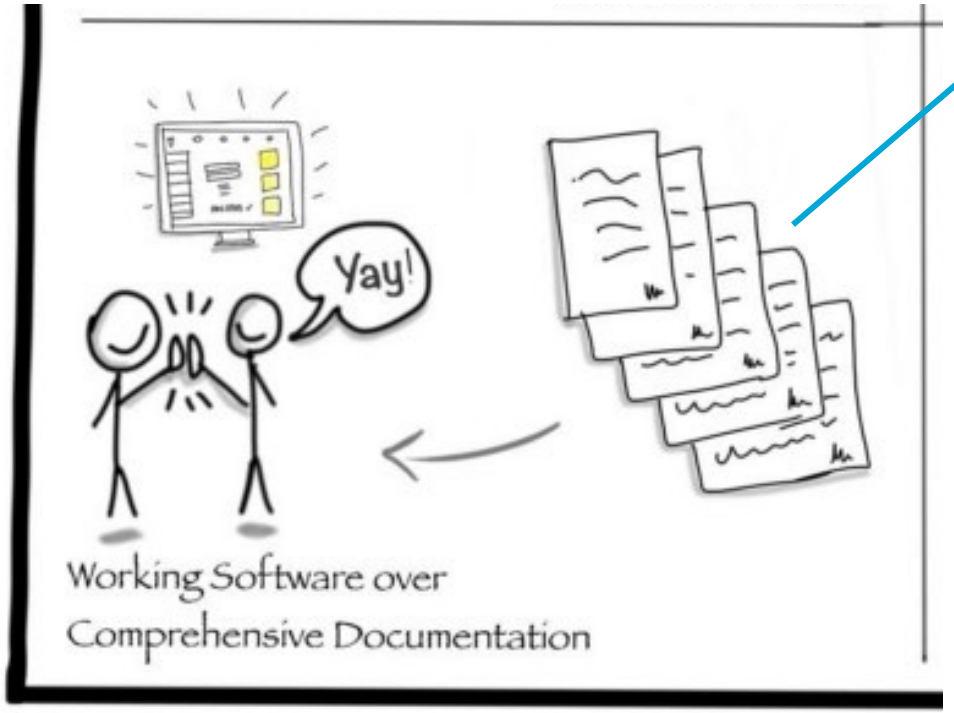
Documentation



complete user documentation ahead of time ≠ keeping track of what the team does

Capstone Progress Document

Where to find everything

Decisions + Rationale

How are decisions documented in your field?

Industry Example: Architecture Decision Record

[short title of solved problem and solution]
Context and Problem Statement
...
Decision Drivers
•…
Considered Options
•…
Decision Outcome
Chosen option: "[option 1]", because ...

Positive Consequen
•…
Negative Consequences
•…
Pros and Cons of the Options
[option 1]
[description]
•Good, because ...
•Bad, because ...

https://github.com/joelparkerhenderson/architecture-decision-record

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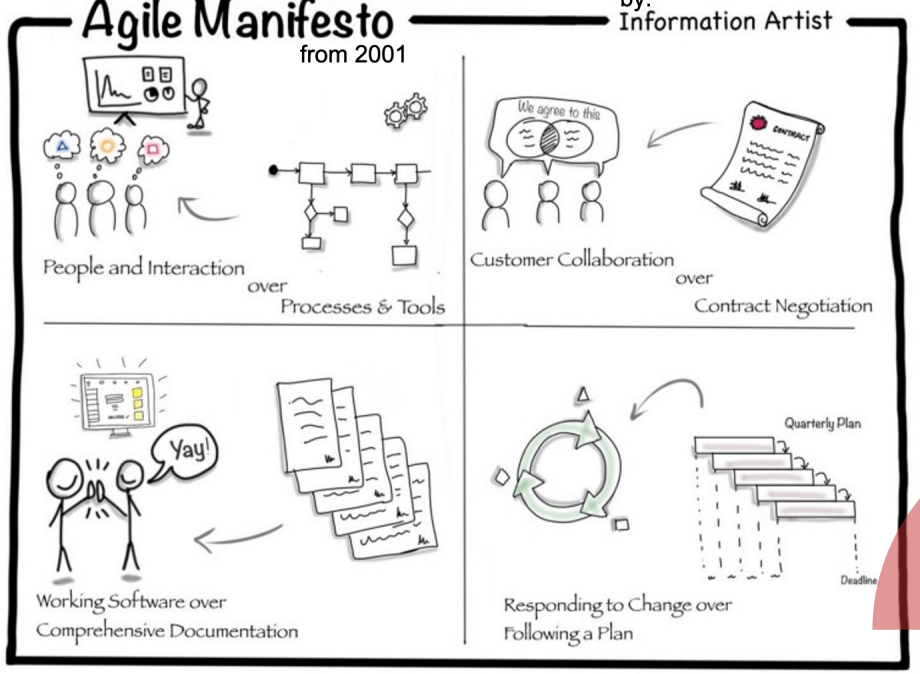
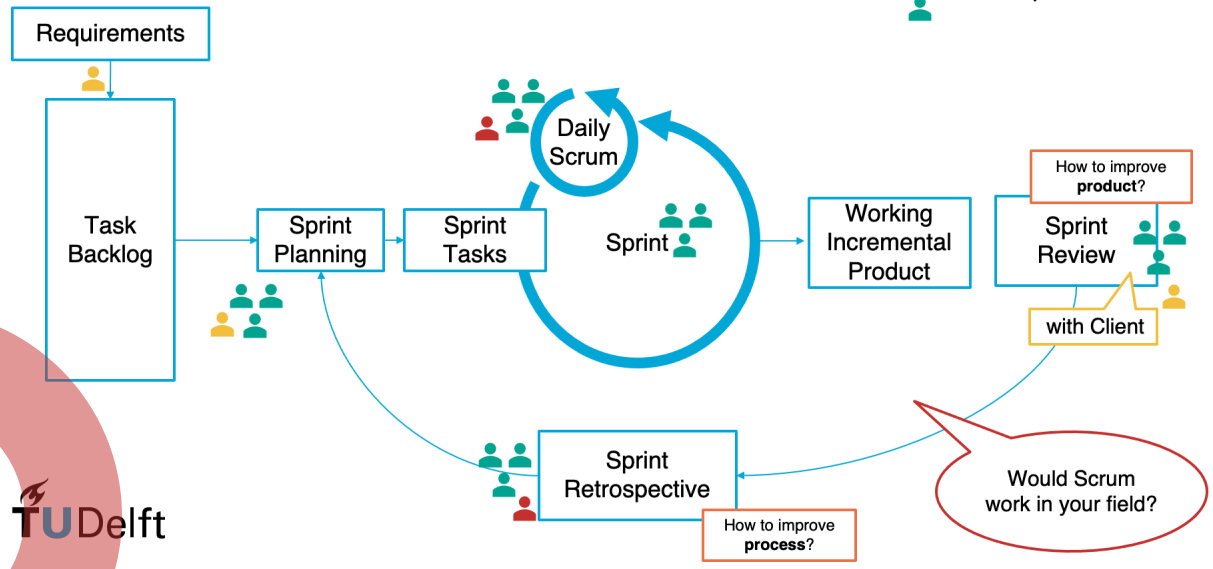


Scrum: One way of Agile Development

Product Owner
Scrum Master
Development Team



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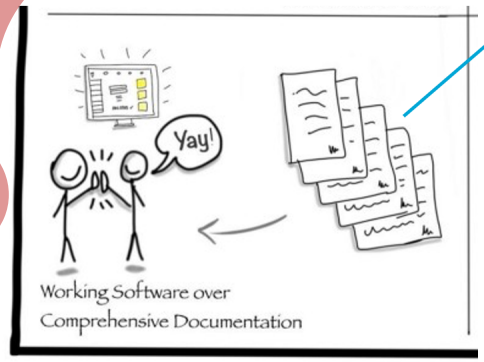

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Let‘s get to work!

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- **Review the initial requirements given by the client**
  - What do you (not) understand?
  - What extra information would you want from the client?
  - What would you look up online / in literature? Where?
  - How would you test that the requirement is fulfilled?
  - Can you see the steps needed to solve this requirement? Is it feasible for this project?
  - What could you offer in a negotiation?
- **Make a process plan**: How will you work together over this course?
  - When and where do you want to work?
  - How will you organize the project time? (Sprint length, meeting dates, deadlines)
  - Assign roles: project lead, project owner, scrum master, ...
  - Where and what will you document? Templates?
- **(Start) preparing your proposed requirements**
  - Should requirements be broken down?
  - Are they functional or non-functional?
  - Where on the MoSCoW scale do you want them?
  - Can you write the requirement better? (Unambiguous, Feasible, Verifiable, Traceable, Necessary; Consistent, Complete)
  - What implementation steps are needed to fullfil this requirement?
- Can you **start setting up your development environment**?

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👆 Ideas on what you can apply right now 👆

Sources

- [Pre05] Pressman, Roger S. *Software engineering: a practitioner's approach*. Palgrave macmillan, 2005.
- [Som11] Sommerville, Ian. *Software Engineering, 9/E*. Pearson Education India, 2011.