Prototypes and project planning

What are prototypes? How to plan?

Aalto University
School of Electrical
Engineering

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Today’s agenda

10:15 - Lecture (Salu)

- **Project planning**
- **Signing the agreements (continues next week)**

What are prototypes?

Different uses of ‘prototypes’

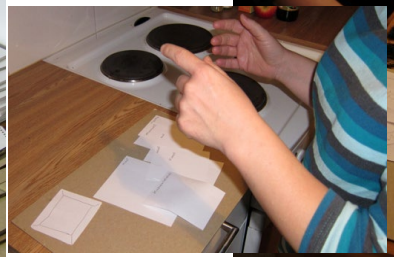
- As learning tool
- As custom device
- As research instrument

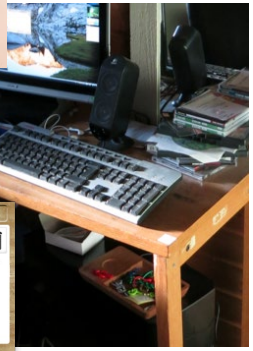
Prototype as Learning Tool

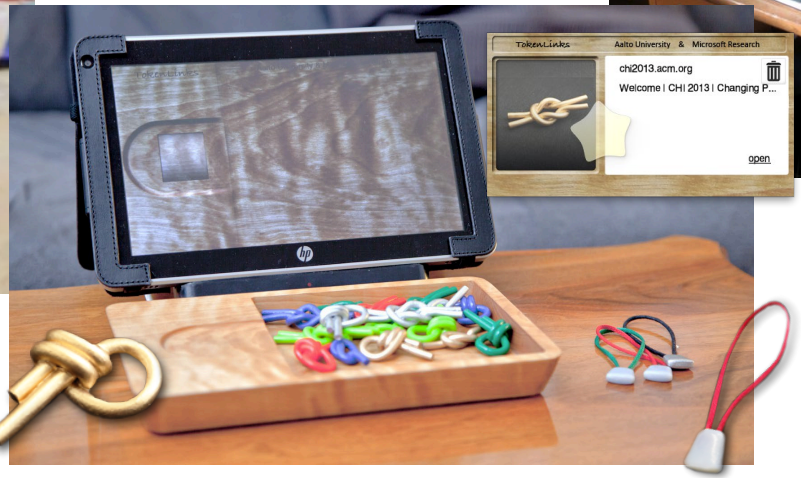
Prototype as a learning tool

- Finding user needs
- Framing the key problem to solve
- Finding novel ways to approach existing problems

- Resembles exploring new territories







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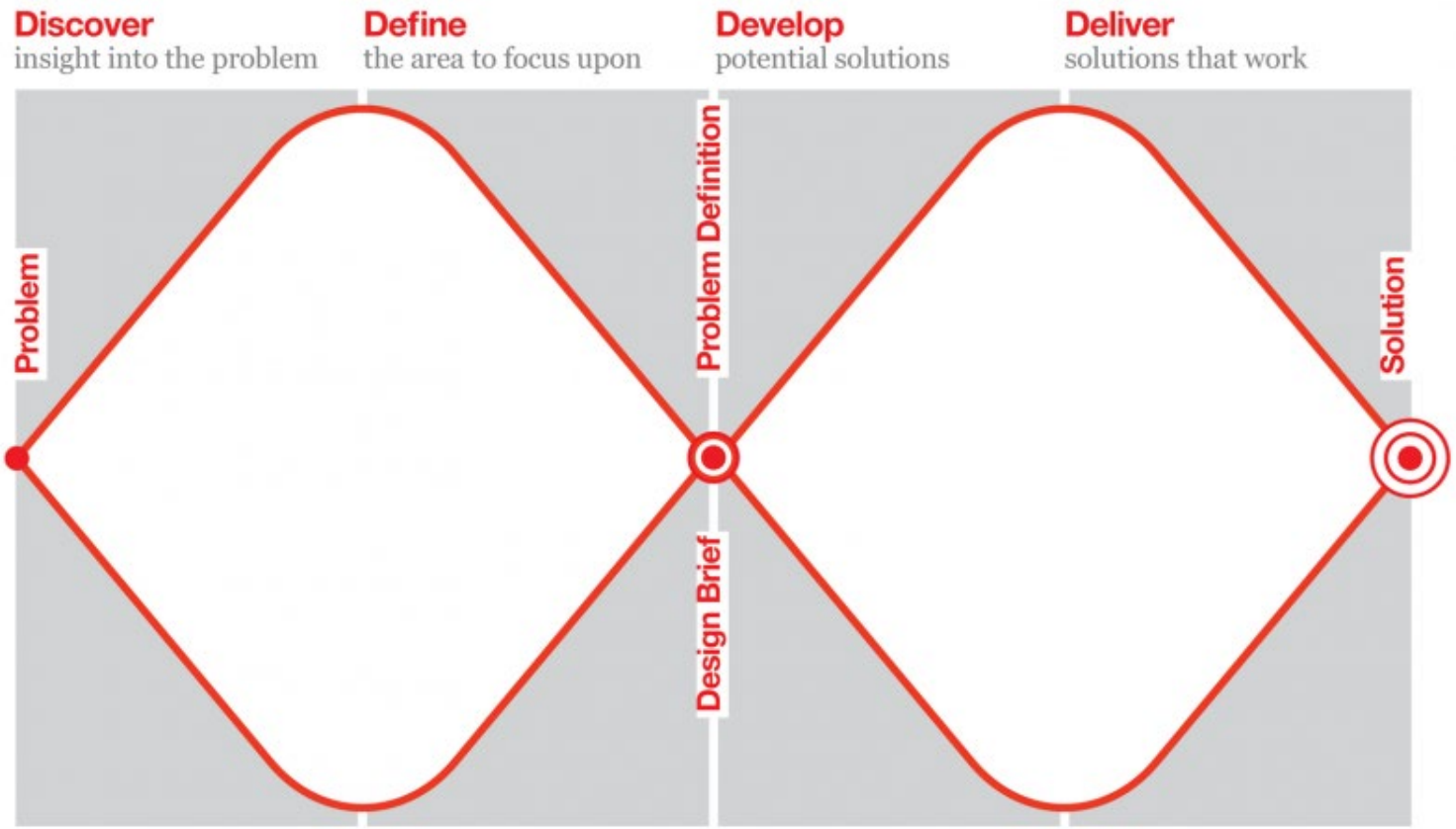
Prototype as a learning tool

1. Set your learning goals
2. Define Requirements for the proto from the goals
3. Build the proto
4. Test it
5. Reflect
6. Iterate (go to step 1)

Double Diamond

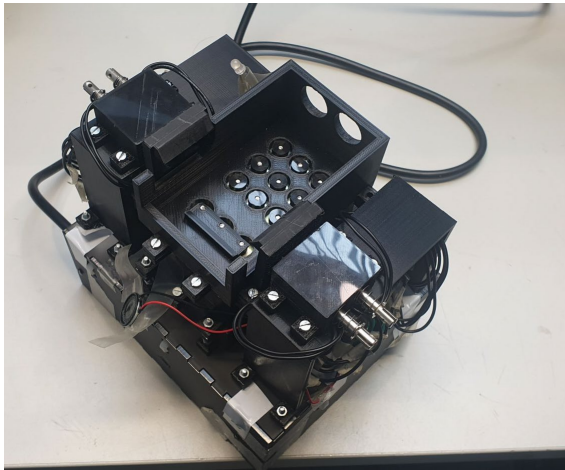
Council, D. (2007). *Eleven lessons: Managing design in eleven global companies. A study of the design process*. British Design Council. Retrieved from www.designcouncil.org.uk



Prototype as Custom Device

Prototype as Custom Device

- **You know exactly what you want**
  - Functions, performance ratings
  - Physical structure, mechanics, and materials
- **Resembles movie production**
  - Key is orchestrating the whole to get done



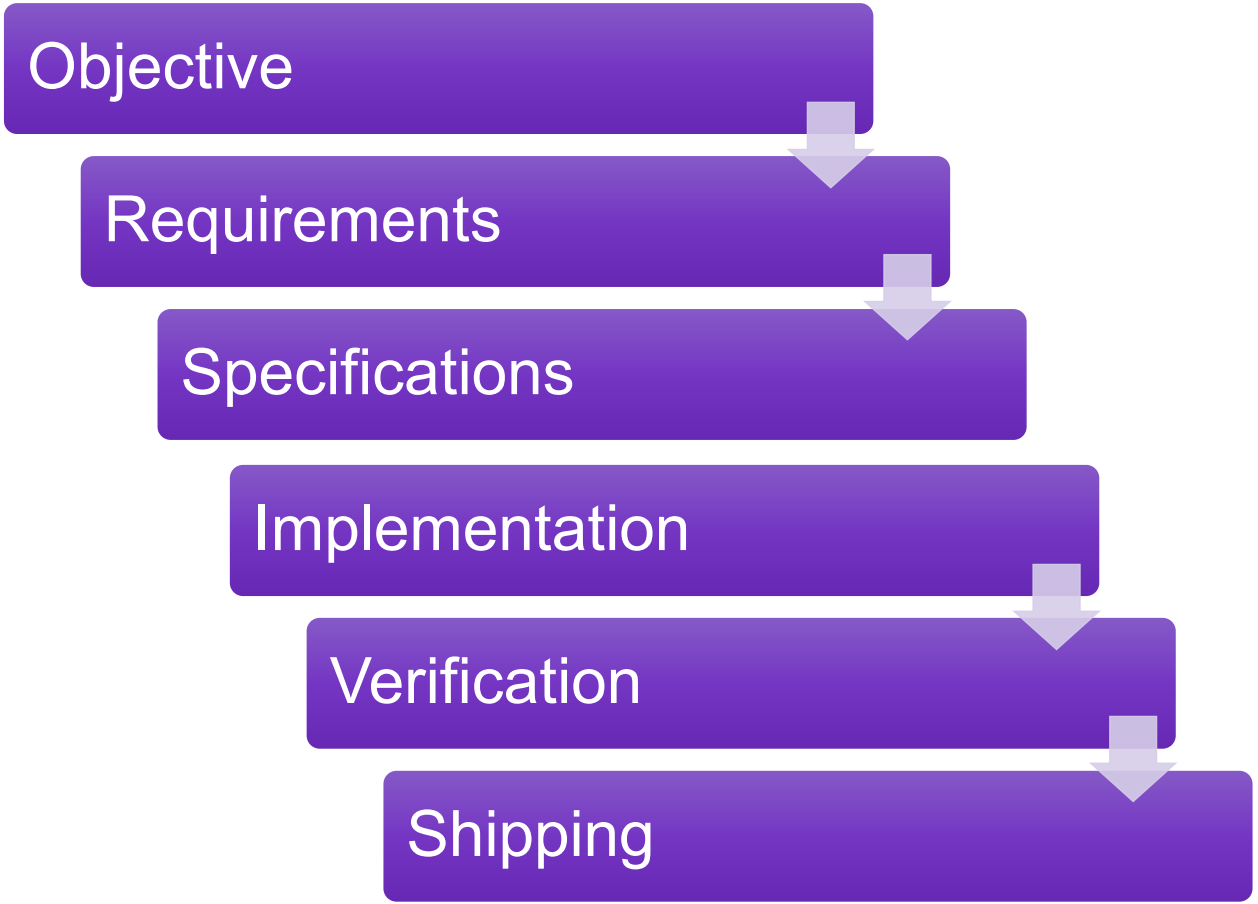
Prototype as a custom device

1. Plan
2. Build
3. Deliver

Prototype as a custom device - Planning

1. Negotiate and define the requirements
2. Define the Work Breakdown Structure (WBS)
3. Define the activities, assign resources
4. Define critical paths and deadlines
5. Define the test procedures
6. Assess the risks

Waterfall process



Prototype as Research Instrument

Prototype as Research Instrument

- **New technology emerges**
  - You want to try out what it is good for
    - Ranges, durability, errors, surprising new phenomena..
  - You want to learn the boundaries of where this new tech can be applied, such as size and power optimization.
- **Resembles scientific work**
  - Make hypothesis, build the setup, take measures, analyse, improve

A combination – A Research Proto

1. **Plan**
2. **Build**
3. **Deliver**
4. **Research (with the tool)**
5. **Reflect**
6. **Iterate**

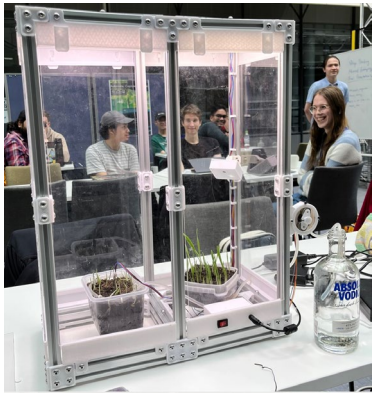
For example:

1. Proto with CoTS components / dev kits
2. Custom proto with more specific capabilities and tailored components

Monolithic vs. Modular Protos

Growing a prototype

- **Monolithic prototype is build once, and is difficult to iterate on**
  - You may need to build a completely new prototype for the next iteration
- **Software projects and modular projects are different**
  - The ‘iterated’ prototype may have most of the parts of the previous prototype



SCRUM

Curcio, K., Navarro, T., Malucelli, A., & Reinehr, S. (2018). Requirements engineering: A systematic mapping study in agile software development. *Journal of Systems and Software*, *139*, 32–50. https://doi.org/10.1016/j.jss.2018.01.036

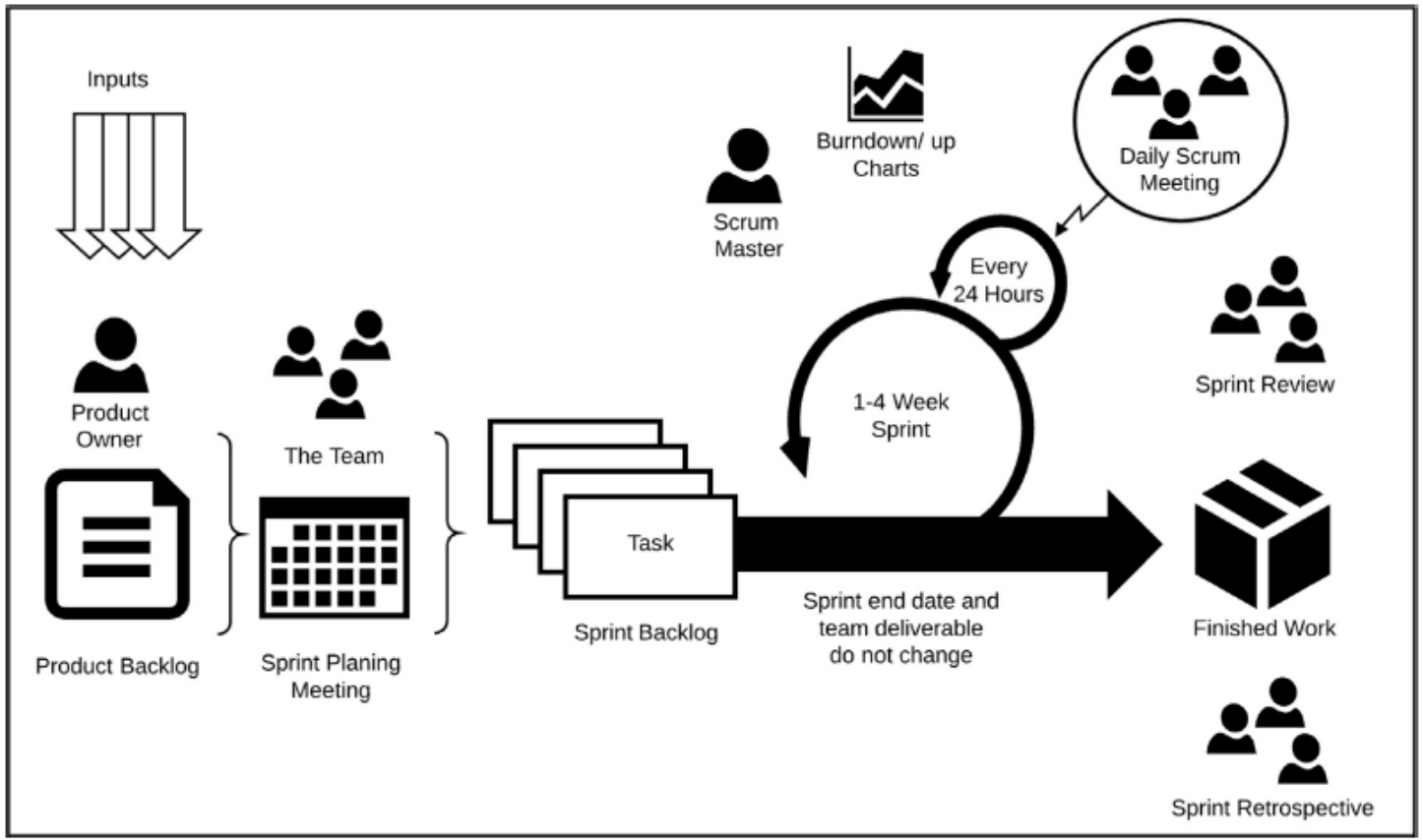


Fig. 2. Scrum Framework based on Schwaber and Sutherland (2018).

Roles for Requirements

Roles for Requirements

- Requirements as negotiation items
- Requirements as a way to prioritize
- Requirements as objective quality measures

Requirements for Negotiation

Requirements for Negotiation

- **When you have the requirements, you can argue for the needed resources**
  - Funding, people, time, facilities…
  - You may need to get in-house and external funding

Requirements specification

- **Understand your prototyping approach**
  - For reflective learning?
  - For specified performance?
  - For scientific research?

Two kinds of requirements

- **Goals**
  - What you need to achieve
- **Constraints**
  - What you need to deal with

Requirements: Constraints

- Time
- Money
- Quality

Costs

Costs

- **People and their time**
  - What do their spend their time on?
  - What is the result of this spending?

Negotiating your plan

Negotiating your plan

- **A project plan is based on the project brief**
- **The plan needs to be agreed**
  - Yes, it is an agreement
  - Deviations must be agreed too
- **Good negotiations**
  - Listen to what the partner wants
  - If you have relevant skills, you can mention these too
  - Adjust the challenge level by both of these!

You aim is to get your plan right

Plan key activities

- Phases
- Milestones
- Work packages
- Tasks

What is a Phase?

A product development project may have phases, such as

1. Specifying the requirements
2. Component design
3. Component integration
4. Testing
5. Reporting

Phases always end with a milestone

What is a Milestone?

Milestones are moments of presenting results/handing out deliverables and making decisions

What is a Work Package?

- **Work package represent one of the key activities in a project**
  - They may overlap different phases, such as ‘project management,’ ‘reporting,’ ‘circuit design’ or ‘interaction design’
- **Tasks within a work package share the overall goal as well as the resources**

What is a Task?

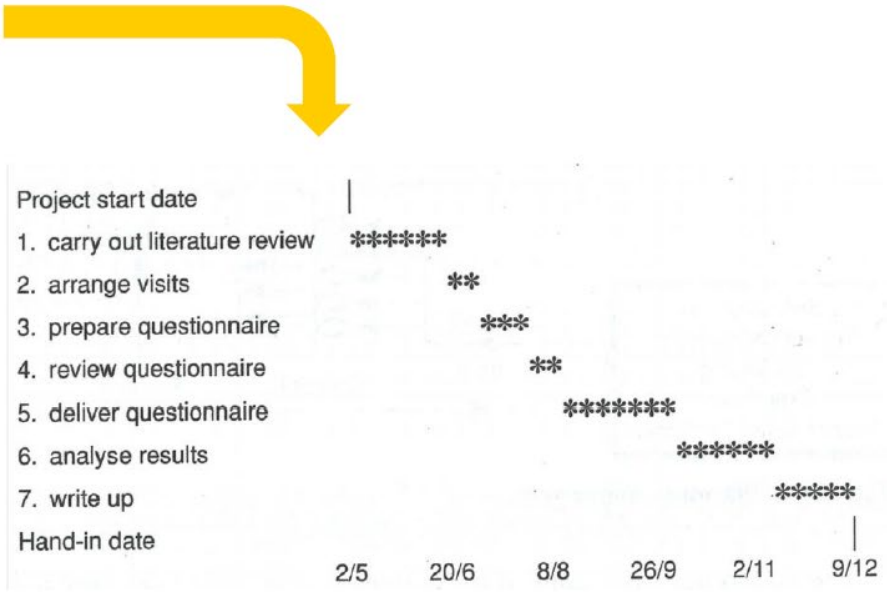
- **A task is the lowest level unit in the plan**
- **It is a single manageable thing to be done**
  - Clear start and end condition
  - Clear resources
  - Clear expectations on results

Scheduling: Activities take time…

- Setting up the development context, installing things
- Learning the tools, software, etc.
- Negotiations / meetings
- Modelling, building, coding, soldering, testing, debugging
- Reading data sheets, purchasing, waiting for stuff to arrive
- Travelling, Writing
- People have different skills, and may be available at different times
- ASK – Don’t assume!

Scheduling

Project start date	2/5
1 carry out literature review	2/5–20/6
2 arrange visits	20/6–4/7
3 prepare questionnaire	4/7–25/7
4 review questionnaire	25/7–8/8
5 deliver questionnaire	8/8–26/9
6 analyse results	26/9–2/11
7 write up	2/11–9/12
Hand-in date	9/12



Multitasking?

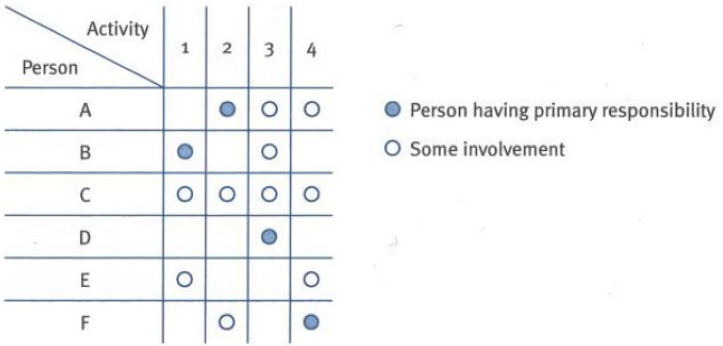
When and how to work in parallel?

Durations

Interfaces

Responsibilities

- 1 responsible / task
- Max 3 persons on a task



Work Breakdown Structure

Work Breakdown Structure (WBS)

- **Imagine your final result**
- **Take it into pieces**
  - Parts
  - Functions
- **Envision what it takes to make each piece**
- **Write it down**

WBS is hierarchical

Start from the top – the overall project outcome

- **What is the final result?**
- **What are the parts (and parts of the parts)?**
- **What are the main functions (and sub-functions)?**

- **The intent is to split the whole into *manageable* chunks**

First actions

- **Before starting with the WBS, take a look at the project brief**
  - There you can find information about the need of your client company
  - The brief is just a starting point for negotiations
  - When communicating with the company, write down notes and confirm your interpretations with the company!
  - Be brave and ask questions (from company representative and your TA)

How to create a WBS?

- **Start with the structure of the product / the whole that you are dealing with?**
- **What parts / functionalities it must have?**

How to create a WBS?

- **Consider ready-made components that you can use**

How to create a WBS?

- **Consider the required deliverables**
  - What must be done in order to meet the deadline?

- **Consider the scheduling order when things depend on each other**
  - Identify critical paths

How to create WBS?

- **Consider the <u>resources</u>**
  - People and their availability (man-hours)
  - Tools
  - Money

Risk management

What are risks?

- **Expected undesirable events that make it more difficult for you to reach the desired goal**
- **Sources**
  - Internal: tech, people, process
  - External: supply, environment
- **Avoiding risks**
  - Expert judgment, informing, planning, negotiating, agreeing
- **Responding to risks**
  - Changing scope, budget, or schedule

Effective meetings

Always have clear goals for each meeting

- **Is it a meeting for decision-making or information gathering?**
  - What do you need to decide in the meeting?
  - What do you want to learn about in the meeting?
- **Information gathering meetings can be about**
  - Substance for the project, i.e. discussing with client
  - Coordinating the project, i.e. checking the situation (task updates, risks)

Each meeting results in a document (or other artefacts)!

Updating the plan

- **When you need to update your project plan, make a new version with a version date**
- **Get agreement for the updated version**
  - With minor changes internal approval is enough, for major changes you need to agree with your client
- **A draft version needs to be handed to the staff through MyCourses on the 8th of June by 8 pm**

Project plan

Project plan

- **Template is provided with the MyCourses assignment.**
  - The given structure and appearance must be used, additions (sub-chapters, appendices) may be done
- **It is MS Word document, but you may use other any text editing tool that you are comfortable with**
  - Agree in the team what tool to use!
- **Document must be submitted as PDF to MyCourses**
- **The plan must have all the requirements and it needs to be agreed by the whole team**
  - So, meet and agree before submitting the final file

Tips for Contacting the company

Things to consider in the negotiations

- **What is the foreseen output by the company?**
  - You need to describe this in the Project plan in your own words as the ‘expected outcome’
- **Are there any project-specific time or resource constraints?**
  - E.g. people on holidays, getting the key components, …
- **Are there any recommended materials, parts, or tools to be used?**
- **Discuss training for specific tools and techniques, if you need such**