Bachelor Course Systems Engineering: Architectural Reasoning; Homework

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Abstract

This is the homework for a course for bachelor students in systems engineering for the part architectural reasoning

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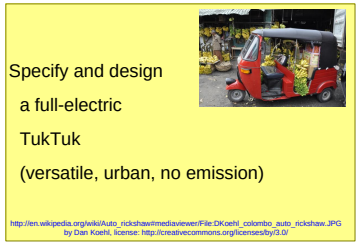


Schedule

Thursday January 14, 10:00 lecture, 11-15 class work

Thursday January 21, 10:00 lecture, 11-15 class work

Tuesday February 2, submit homework 1

Thursday February 4, 10:00 lecture, 11-15 class work

Thursday February 11, 10:00 lecture, 11-15 class work

Tuesday March 2, submit presentation of homework 2

Friday April 2, submit individual reflection report of homework 2

Case during this course

Specify and design

a **Smart Waste System**.

The goal is to achieve sustainability, where resources are fully recycled.

You may determine your own scope, such as type of waste,

e.g., plastic
metals

location, and application

e.g., Kongsberg
Viken
Norway
Europe

e.g., residential
industrial
agricultural

Company: start-up

- Each group is a **start-up company**; you are its **management team**
- You have **investors** that are **funding** you in the first phase
- At the **end of the spring**, the investors will decide on further funding
- You have to build a **presentation** with a **proposal** for the next phase, such that you **convince the investors** to fund the next phase

Allocate your roles

Project Leader

(organization, process)

- planning
- progress control
- resource management
- risk management
- project log

Systems Engineer

(content)

- system specification
- system design
- system integration
- fitness for purpose

Experts

(content, doing)

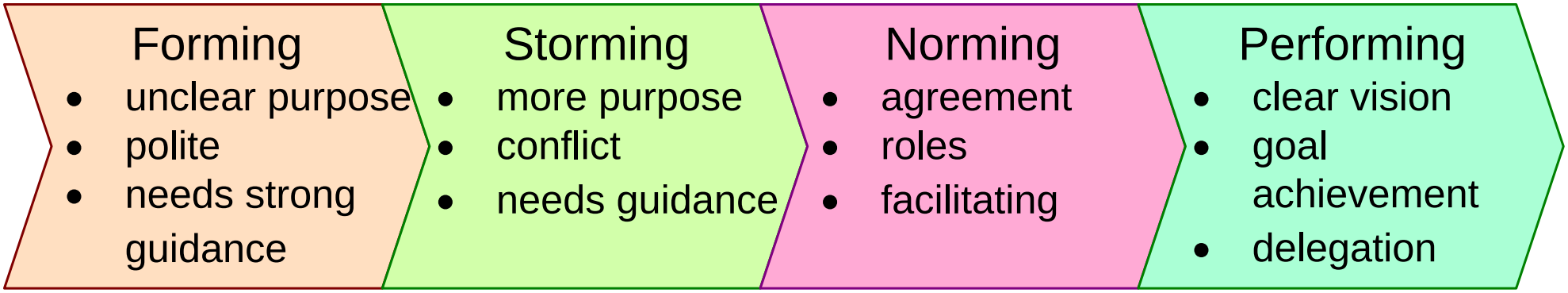
- part & function specs
- part & function design
- analysis
- build
- test

Marketing

(sales, external contacts)

- customer contacts
- pricing
- market positioning
- business model
- options

Be Aware of the Team Dynamics



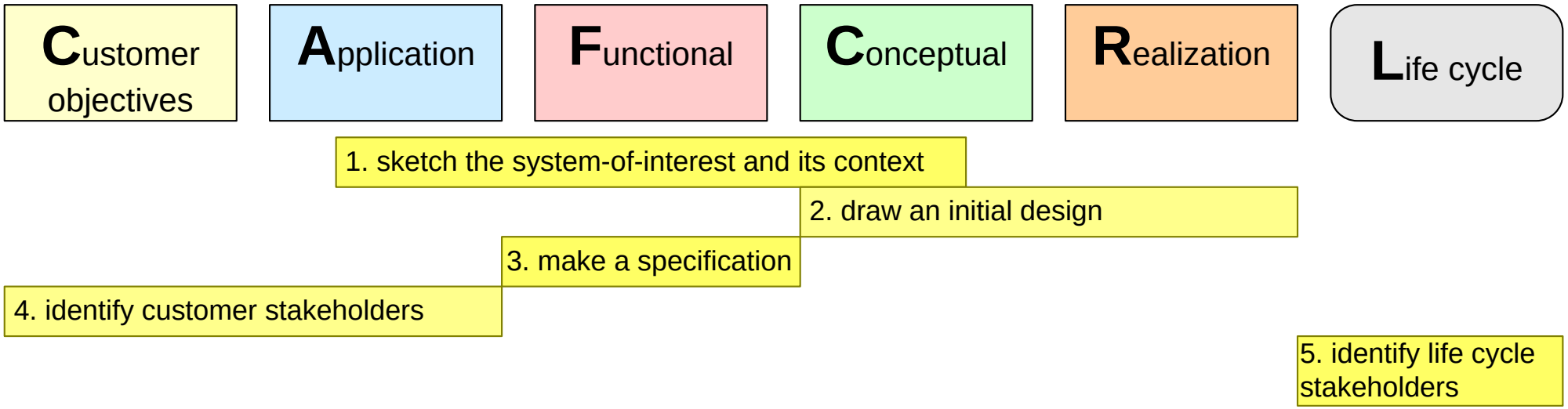
after http://www.mspguide.org/tool/tuckman-forming-norming-storming-performing

Class-work Day 1: Exploration

Use time-boxes of 15 minutes and perform the following steps:

- Sketch the system-of-interest and its immediate context
  - Annotate the sketch (e.g. main components, interfaces, functions, …)
- Draw an initial design
- Make a specification of the system-of-interest (view it as a blackbox)
  - What functionality, performance, interfaces, standards or regulations
- Identify the main customer stakeholders and their concerns
- Identify the main life cycle stakeholders and their concerns
- Review and make a plan to consolidate in a presentation

Class-work Day 1 mapped on CAFCR



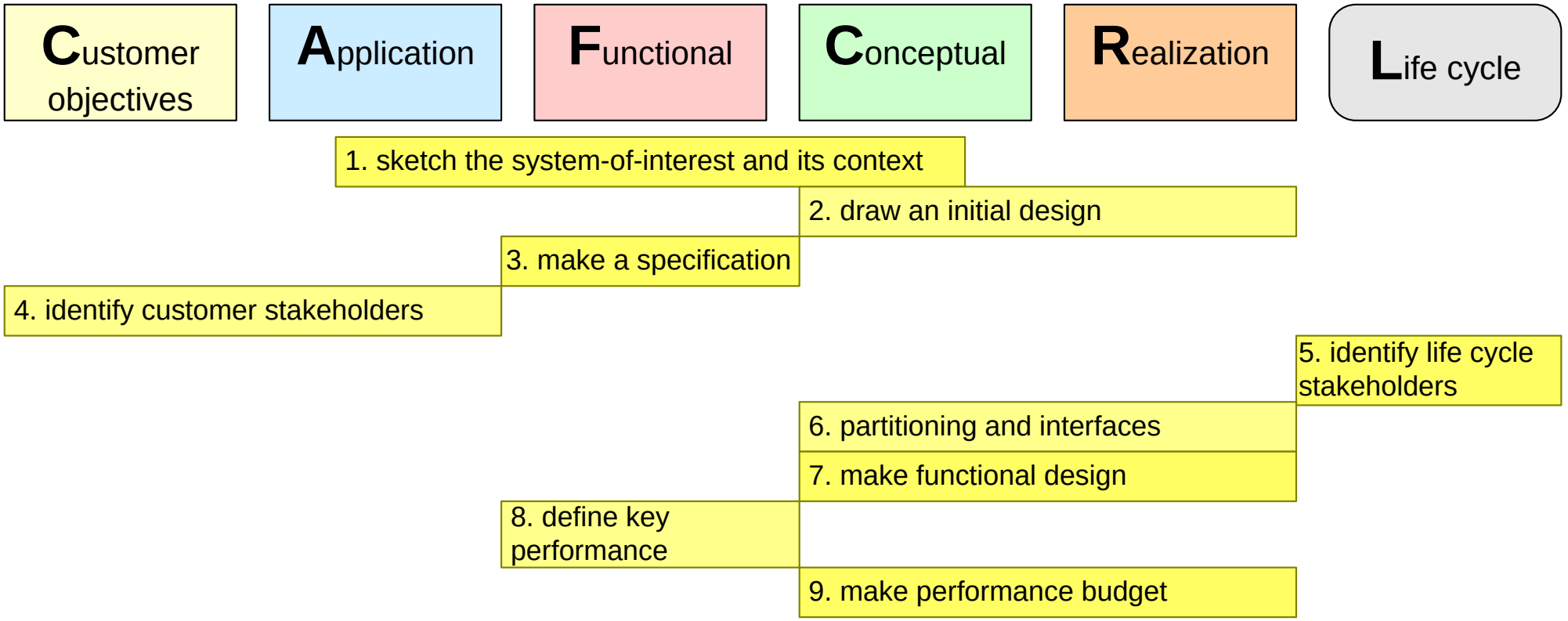
Class-work Day 2: Elaboration

Start second iteration by elaborating FCR views

Use time-boxes of about 30 minutes

- Decompose the system in subsystems, decompose one subsystem in subsubsystems.
  - Show the subsystems and interfaces in a block diagram
- Make a functional model of the internals of the system-of-interest
  - Use one or more diagrams to show the dynamic behavior
- Define 5..10 Key Performance Parameters of the system-of-interest
  - Define a use case to support the definition of KPPs
- Make a technical budget for one of the key performance parameters
- Review and make a plan to consolidate in a presentation

Class-work Day 2 mapped on CAFCR



Homework after Day 2

Transform your results in electronic form (e.g., PowerPoint or Visio)

Develop two alternative solutions/concepts

Compare the three solutions using a Pugh matrix

- define 5..10 criteria for comparison
- score the solutions on a scale from 1 (poor) to 5 (very good)
- recommend a solution with a rationale

Make a list of questions triggered by the first iteration

Search for facts to ease the next class-work

Submit as draft presentation via Canvas

Home work instructions

Homework instructions

presentation

filename: BSEAR team<your teamnumber/name> homework<number>

e.g. BSEAR team1 homework1.ppt

all team members on front page

upload homework to Canvas

Questions email to: <gerrit . muller@usn.no>

from/cc: <all email addresses of team members>

Class-work Day 3: Elaboration CA-views

Continue second iteration by elaborating CA views

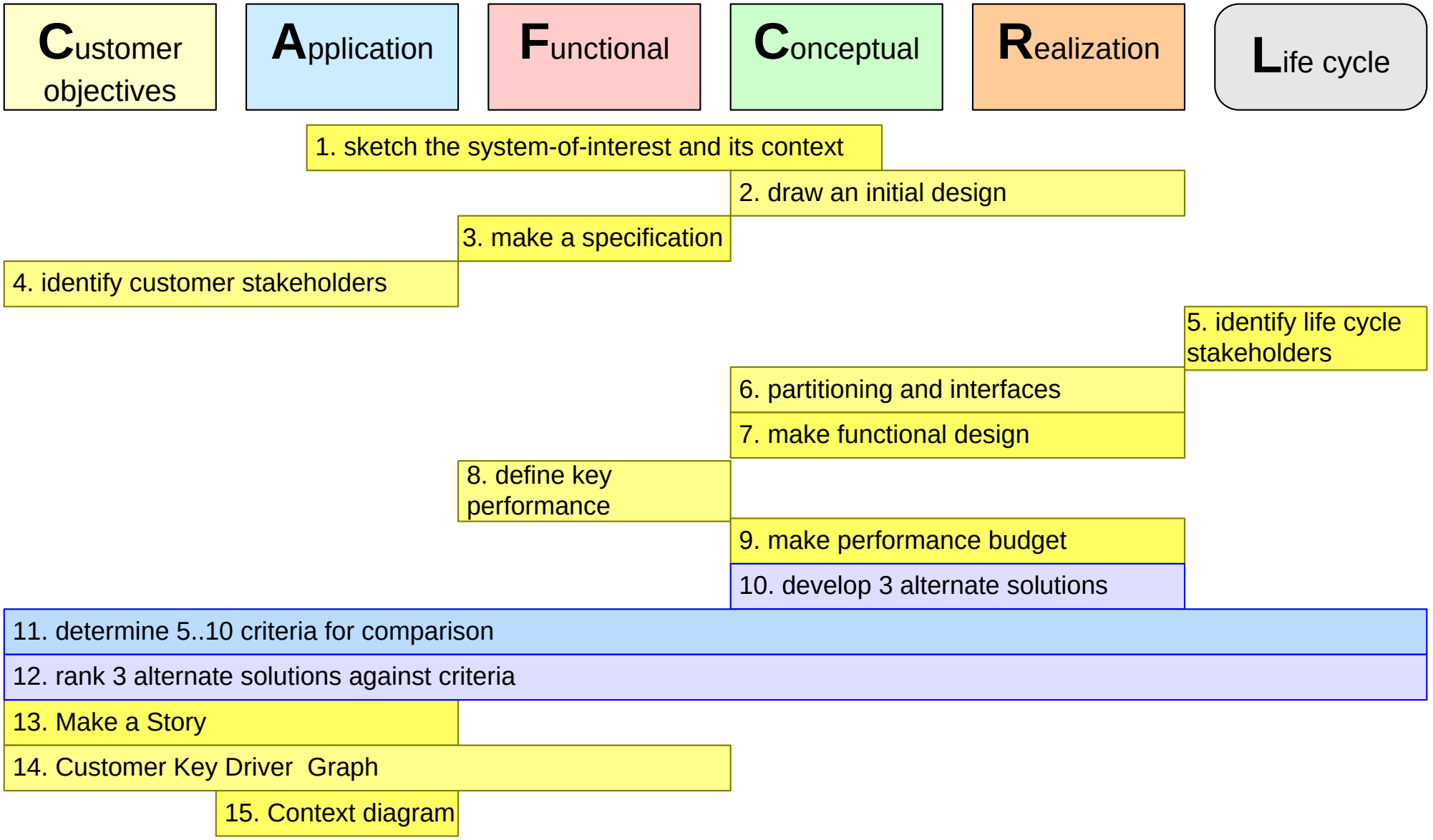
Use time-boxes of about 40 minutes

- Develop a story that helps you to understand the customer better and that facilitates analysis of specification and design
  - Verify your story against the story criteria
- Develop a customer key driver graph
  - Start with Key Performance Parameters and ask “why (is this needed)” repeatedly.

Use time-box of about 20 minutes for the remaining task

- Make a context diagram

Class-work Day 3 mapped on CAFCR



Class-work Day 4: Elaboration Life Cycle

Continue second iteration by elaborating life cycle view

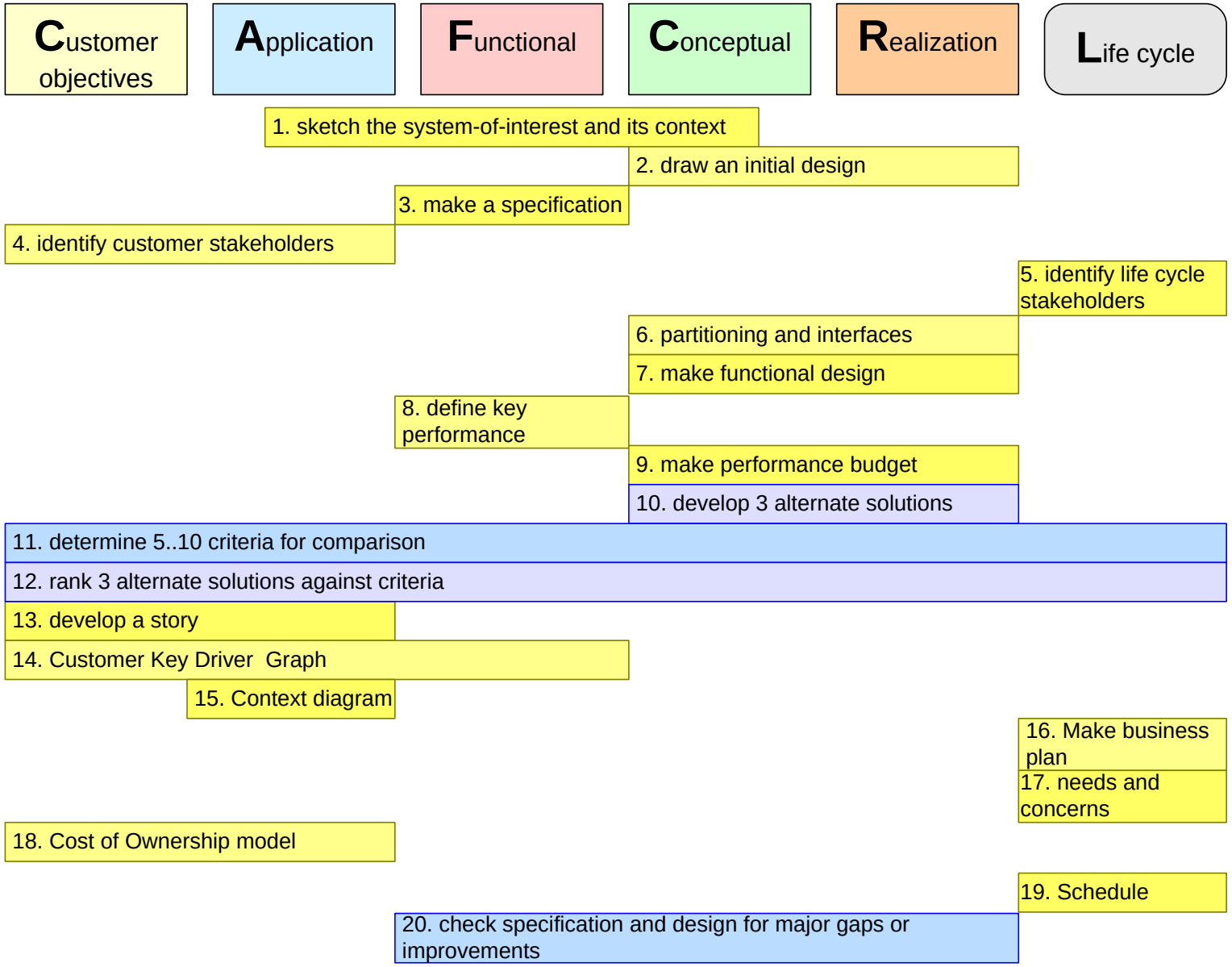
Use time-boxes of about 30 minutes

- Develop a business plan for your company
  - determine your role in the value chain
  - determine income, expenses, and investments
  - estimate cash flow as function of time
- Identify needs and concerns from life cycle stakeholders
  - determine life cycle key drivers and key performance parameters
- Make a Cost of ownership estimate for customers

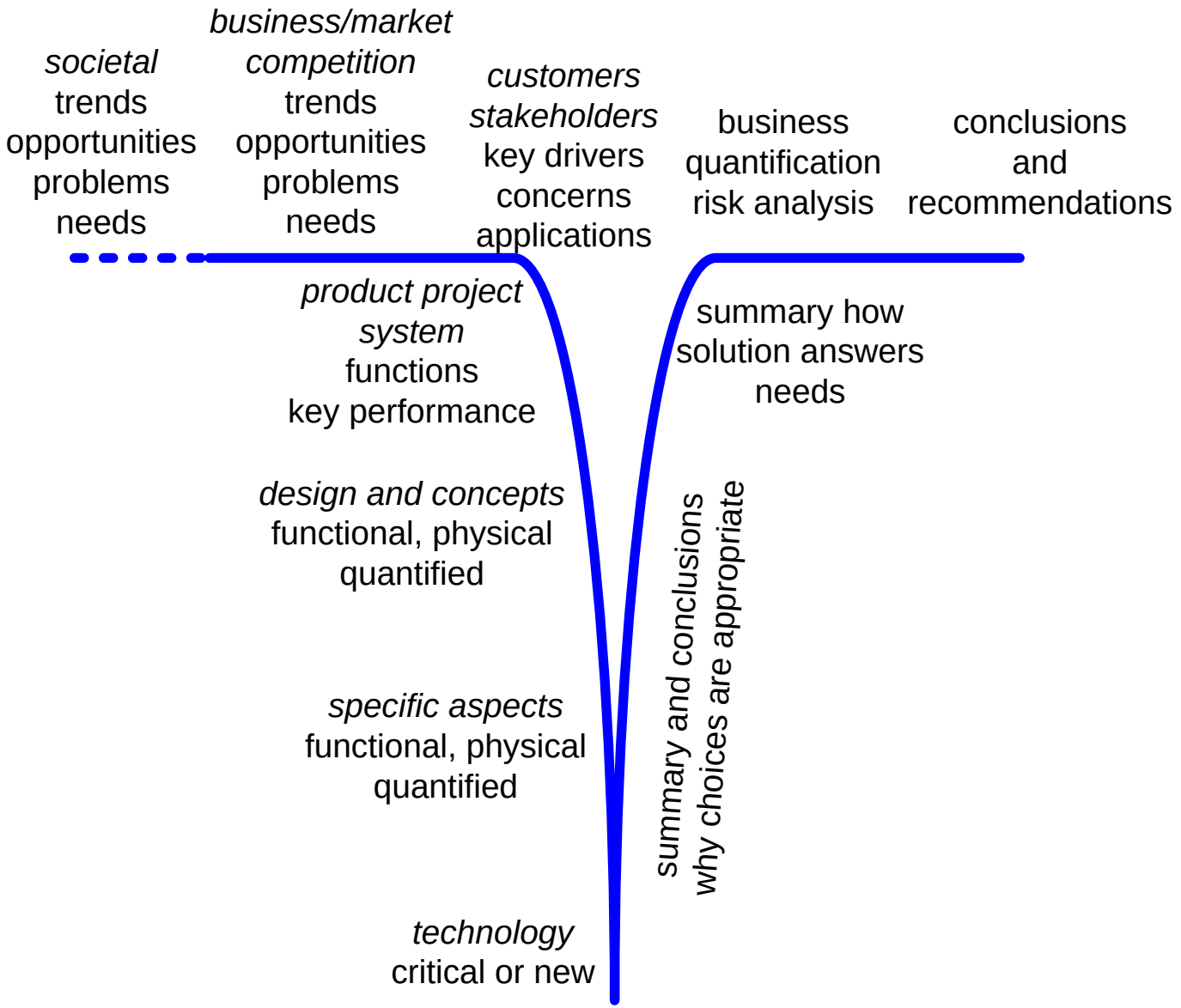
Use time-box of about 20 minutes for the remaining task

- Make a schedule for development and start of deployment

Class-work Day 4 mapped on CAFCR



T-shaped Presentation



Homework after Day 4

Check specification and design for major gaps or improvements

Transform your results in electronic form (e.g., PowerPoint or Visio)

Make a T-shaped presentation for your management; its main purpose is to make a go/no-go decision

Submit this presentation via Canvas

Write an individual reflection report, max 2 A4s:

- What are your main learning points?
- What aspects deserve most attention in next phase of your project? Explain why.

Submit this individual reflection report via Canvas

Case previous course

Specify and design

a Smart and Sustainable, e.g. energy neutral etc., House or Building for Norway,

which will be comfortable, attractive and affordable

Case previous course

Specify and design

an autonomous waste collector.

This collector finds and removes waste from the environment.

Case previous course

Specify and design

an autonomous track/road maintainer for elderly Norwegians.

This robotic vehicle, amongs others, keeps the drive to their home fully operational (in winter).

Case previous course

Specify and design an

Unmanned Humanitarian Response/Support Vehicle,

which will be able to reach locations with

poor, bad, or destroyed access.

Case previous course

Specify and design

a full-electric

TukTuk

(versatile, urban, no emission)

http://en.wikipedia.org/wiki/Auto_rickshaw#mediaviewer/File:DKoehl_colombo_auto_rickshaw.JPG
by Dan Koehl, license: http://creativecommons.org/licenses/by/3.0/

Case previous course

Specify and design

a full-electric

drive-by-wire

race kart

photo http://nl.wikipedia.org/wiki/Bestand:Outdoor-karting.jpg