Examination
Fundamentals of Software Architecture 7.5 hp
Course code DIT344 & DIT541

Date:	21 August 2019
Time:	8:00-12:00
Place:	Lindholmen
Teacher:	Prof. Dr. M.R.V. Chaudron
Visit to e*xam hall:*	Around 10:00 and around 11:00
Questions:	6 (frontpage + 4 pages)
Results:	Will be posted by 6[th]of Sept 2019
Grade Limits:	Pass (G) 50%,
	Pass with honors (VG) 75%
Allowed aids:	Ruler, Dictionary

Please observe the following:
- Write in legible English (unreadable means no points!).
- Motivate your answers, and clearly state any assumptions made.
- Start each task on a new sheet!
- Write only on one side of the paper!
- We prefer that you write with a ***pen***, not with a pencil.
  Drawings may be made using a pencil.
- Before handing in your exam, number and sort the sheets in task order!

NOTE:
Not following these instructions may result in the deduction of points!

Question 1 (a(4) +b(6 (2 + 2 + 2)) = 10 pts) *General knowledge on software architecture*

(a) Explain the concept of 'quality attribute' and its relevance for software architecture.

(b) In the context of software development, explain how software architecture can bring benefits to

> i)   Managing complexity of software design
> ii)   Software Maintenance
> iii)   Analysing the performance of the system

Question 2 (a(2 + 2) + 3 + 3 = 10 pts) *Process & Requirements*

a) Explain the relevance of starting any system architecture design by
   i.   Understanding the business drivers of the system
   ii. Understanding the requirements of the system
b) Modern software development processes mostly work according to iterative and incremental stages (such as for example 'sprints' in Agile).
   Such iterative and agile approaches claim to be good at handling new requirements and changes to requirements that are discovered during the development process. Explain how the use of software architecture helps or hinders in dealing with such continuous changes in requirements.
c) Large companies have office across the globe. As a result, it is common that also development teams are located across multiple locations that are geographically far apart. Developer from different locations do not meet each other often. Explain how a shared software architecture design would help such teams in being more effective in their software development.

Question 3 (2 + 2 + 2 + 2 = 8 pts) *Architectural styles*

a) Explain what an 'architectural style' is.

b) Describe the 'publish-subscribe' architectural style. Your explanation must include: which types of components exist, and which types of communication/interaction(s) are part of this style.

Describe what the most appropriate architecture style for the following systems is and *motivate why* this is the case.

c) Software for an electronic-microscope. The driver for the architecture of this system is the continuous (real-time) stream of images that goes a regular process of several subsequent image enhancement steps. There is little user-interaction with this system other than panning and zooming.

d) Supermarket loyalty system: customers of a (chain of) supermarket can register (make an account) to become a 'loyal customer' of the supermarket chain. With this card, the customer can collect points in return for buying groceries in the supermarket. Via a website, the customer can keep track of the points he has collected at any point in time. This system needs to be able to scale to a large number of customers. The frequency of interactions of users with the system is relatively low. Customers should not be able to see the points of other customers.

Question 4 (3 + 3 = 6pts) Design Principles
a) Explain how the architecture design principle of 'information hiding' can be used to make it easy for systems to accommodate changes in software to run.
b) One design principle is to have exactly one responsibility per component.
    How does this relate to the design principle of 'cohesion'?

Question 5 (3 + 3 = 6 pts) Reverse Architecting
a) Briefly describe the process of reverse architecting
b) Describe 2 problems that may be faced during reverse architecting.

Question 6 (4 + 6 + 6 + 4 = 20 pts) Architectural design

Read the description below and make an architectural design. Your answer must include the following. Below the case description follows a detailing and elaboration of which parts of the system to focus on.
a.   Use case view
b.   Logical (a.k.a. Structural) view
c.   Process (a.k.a. Behavioural) view
d.   Deployment view

Motivate your choices and state any assumptions you make.

Digital Visitor Reception System (DVRS)

For this assignment you are asked to design the architecture of a software system that caters for the following: Smart Reception System.

This system is placed at the entrance of the floors of a building. The system displays a screen where visitors can register (type in their name or scan an ID, such as a passport, a driver's licence or a company-badge). The system then displays a graphical inventory of 'business cards' of the people that work on that floor. The visitor can then search for his host on the screen by typing in the name of his host, or by browsing the list through swiping the pages. The visitor can press a button to contact his host. After this press, the system will connect the visitor via a voice-call to the host. The host will then walk over to the entrance of the floor to open the door and welcome the visitor.
In order for this system to work properly, it must be set up such that: all employees of the floor create a record for themselves. This record must contain: their mobile phone number, a recent passport-sized photograph, their room number in the office. If people leave the company, some person from the Human-Resources department of the company ensures that their business-card record is removed from the DVRS.

The system also has the option of recording the departure-time of the visitor. In this case, it keeps a record of the actual visiting times of the visitor. The data in the system are subject to the European privacy regulations GDPR.

Elaboration: Your answer must include:

a. Use case view

For this assignment, represent at least 3 types of users.
Your Use case view should include at least 3 significant use cases.

b. Logical/Structural view

Represent the main structure of the system. For each component, describe its main responsibility in at most 1 sentence.

c. Process/Behaviour view

For this assignment, produce diagrams for the following features of the system:

i)   Register as a host in the system

ii)   A visitor is picked up by a host after registering in the system.

d. Deployment view