Examination
Software Architecture 7.5 hp
Course code DIT541

Date:	9 Jan 2018
Time:	14:00-17:00
Place:	Lindholmen
Teacher:	Prof. Dr. M.R.V. Chaudron
Visit to e*xam hall:*	14:00; 1500;
Questions:	5 (frontpage + 4 pages)
Results:	Will be posted by 26[th]of Januari 2018
Grade Limits:	Pass (G) 50%,
	Pass with honors (VG) 75%
Allowed aids:	Ruler

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 (2 + 2 + 2 + 2 + 2 = 10 pts) *General knowledge on software architecture*

(a) Give a definition of 'Software Architecture'.

(b) Describe the concepts of 'stakeholder' and its relevance for software architecture.

(c) Explain why the 'environment' in which a system functions is relevant for the system's architecture design.

(d) Describe the relevance of using 'Software Architecture' in the following events/phases of system development:
    i) system integration
    ii) system maintenance

(e) Explain why Software Architecting is sometimes characterized as 'balancing objectives'.

Question 2 (2 + 2 + 2 + 2 = 8 pts) *Requirements and Quality attributes*

Consider an app (i.e. runs on mobile phone platforms) that does route-planning. You can take a look at an example screenshot of such a system in Fig. 1. In addition to route planning, this app also features real-time traffic (jam) information.

In this question your task is to describe requirements for this app in a SMART way.

(a) Describe one requirement for the main function of the system.

(b) Describe one requirement for the performance of the system.

(c) Describe one requirement for the privacy of the system.

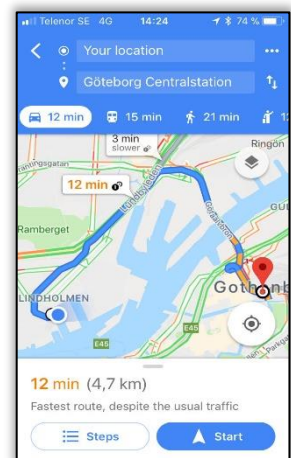(d) Describe one constraint on the interoperability of the system.

Figure 1 Route planning app

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

a) Give a definition of 'Architectural style'.

b) Describe the pipe-and-filter architectural style.

Describe what the most appropriate style for the following systems is and <u>*motivate why*</u> this is the case.

c) Software for an online dating-site: people can become a member, make a profile, this profile describes themselves, their interest and the profile(s) of the people they are interested in meeting. Members can then send each other messages and set up dates.

d) Taxi-firms are often companies with a small number of employees (e.g. 1 or 2) that collaborate in a federative manner. We write sTaxi to denote a small-person Taxi company. Multiple sTaxi-companies often work together in a federative style. Such a federation consist of 1 larger company offering a coordinative-functions for sales and dispatching of jobs. For this the coordinating office hosts some call-center. sTaxi companies can state an interest in particular types of jobs that they want to have (only city center, only to the airport, only outside rush-hours, …) . When a job arrives, the coordination center announces this, and sTaxi companies can then respond by sharing their availability.


Question 4 (6 + 6 = 12 pts)
a) Explain the design principle of 'Separation of Concerns'
b) Consider the route-planning app of question 2 of this exam. The core of that application forms the actual route-planning algorithm. Illustrate the design principle of 'Information Hiding' by giving 2 examples of a method interface for this route planning algorithm. One example should be a good example of information hiding, the other example should violate the information hiding principle – i.e. is a bad example.

Question 5 (4 + 6 + 8 + 4 = 22 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 view
c.   Process view
d.   Deployment view

Motivate your choices and state any assumptions you make.
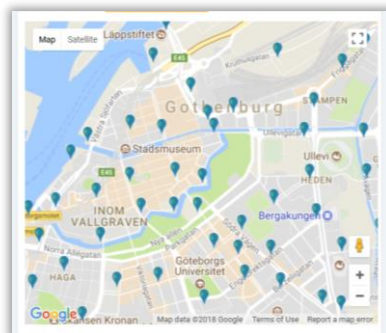
City Bicycle Rental (CBR) System
Like many cities, Gothenburg has a city bicycle rental system. This system is owned and operated by the city council. It works as follows: The city owns 1024 bicycles. When not in use, these bicycles are parked at one of 32 bicycle parking locations across the city – mostly around the city center. At a parking location they are in a locked docking station. A bicycle can be borrowed and used for a particular period of time and then it must be returned (and locked) at one of the parking sites in a docking station. There are several ways for borrowing a bicycle and the number of ways may change in the future. For today, we will only elaborate one method of borrowing. First, a person can become a member by registering on the CBR website. This requires registering a personal number, a mobile telephone number and paying a membership fee. In return, the member gets a QR-code sent to the CBR-app on his mobile telephone. This QR code can be read by the docking station. This reading of the QR code starts the usage period of a bicycle by the associated member. Bicycles have a built in RFID-chip that contains a unique code per bicycle. Via this RFID chip, the bicycle can communicate wirelessly with the docking stations. When a bicycle is entered into a lock in a docking station, the usage period for that bicycle and member is automatically ended. A member can borrow more than one bicycle at a time (so you can cycle together with a friend!). Via the CBR website, members can log in and see which uses of bicycles are registered (it shows place and time of start and termination of a use). When damage is detected to a bicycle, the bicycle is repaired in a

maintenance center. The management of the CBR has a requirement that it can see aggregate statistics, such as how often bicycles are used, for how long they are used, from where to where they move, and how often bicycles go missing.

Elaboration: Your answer must include:
a. Use case view

    For this assignment, consider at least 3 types of users.
    Clearly indicate any external systems that the CBR system is connected to.
b. Logical view
c. Process view

    For this assignment, produce diagrams that for the following features of the system:
    i)   Register as a member on the CBR website
    ii)   Borrow a bicycle
    iii)   Return a bicycle
d. Deployment view