UNIVERSITY OF OSLO

Faculty of Mathematics and Natural Sciences

Exam in INF5120/INF9120 – Model Based System Development

Day of exam: Monday June 1st, 2015

Exam hours: 1430 - 1830 **(4 hours = 240 minutes)**

This examination paper consists of 6 pages.

Appendices: 2 (A and B, included in the 6 pages).

Permitted materials: All printed and handwritten material.

The exam can be answered either in English or in Norwegian.

Make sure that your copy of this examination paper is complete before answering.

Introduction

In this exam you shall in Question 1 create Business Architecture and Requirements models for a practical case of the development of the app “OsloDieselCarAdvice” – described in Appendix A.

In Question 2 you shall create specification models for the "OsloDieselCarAdvice” app, using the approach of IFML for WebRatio Mobile edition.

You shall in Question 3 create a metamodel for a Service Composition Language (SECOL) for EMF and describe how you can create a graphical editor with Sirius - with an additional model transformation for the generation of a web service execution flow.

An overall description of the “OsloDieselCarAdvice” app is given in Appendix A. You can adapt the described scenario as you find suitable to illustrate your models. Appendix B contains two examples showing the use of the main elements of SECOL.

Plan your time with the % and time guidance for each question below, so that you are able to answer all questions.

Question 1) (40% - 100 minutes, Business Architecture and Requirements model for "OsloDieselCarAdvice"- Modelling with some of the INF5120 methodology practices (Business Model (Strategyzer)/ Service Design (Smaply)/Use cases) used in Oblig 1)

a) Make a Business Model Canvas for the "OsloDieselCarAdvice" app. (10% - 30 minutes)

b) Actors – as Personas (5% - 10 minutes) – Specify at least 2 relevant personas derived from the customer segments of the business model canvas from a).

c) Stakeholder Maps (5% - 10 minutes) – Create a stakeholder map showing the relationships between stakeholders from the business model canvas from a)

d) Journey Maps (10% - 20 minutes) – Create a customer journey map for a citizen who is using the "OsloDieselCarAdvice" app to plan for travel today and for the next three days, from a start to a stop place in the area of Oslo.

e) User stories and use case (10% - 30 minutes) - Make a set of user stories for "OsloDieselCarAdvice" for the journey map described in question 1d) , and a corresponding Use Case model for the interaction of a citizen and the "OsloDieselCarAdvice"app. In addition create a use case description (based on the template presented in class/for oblig 1) for the use case starting the app to get advice for the driving today and for the next three days (to be specified in IFML later in Question 2c).

Question 2) (30% - 70 minutes, Domain model, user interface mockup and IFML for "OsloDieselCarAdvice", as used in Oblig 1 and 2

a) Make a Domain model for "OsloDieselCarAdvice"(using UML class diagram or WebRatio ER model syntax), focusing on the information necessary to be handled for the "OsloDieselCarAdvice" app. (10% -20 minutes)

b) Sketch a user interface mockup for some of the main user interface screens for the "OsloDieselCarAdvice" app user interface, similar to what you would do with the Balsamiq tool. (10% -20 minutes)

c) Make an IFML model as supported by the Webratio App version for the "OsloDieselCarAdvice" app based on user interfaces from 2b), in particular showing the IFML model for the main user dialogue related to the user getting recommendations for today and for the next three days, related to provided start/stop addresses, (i.e. the use case from Question 1e) (10% - 30 minutes)

Question 3) (30 % - 70 minutes, Metamodel and editor support for a Service Composition Language (SECOL) - Related to metamodeling and a graphical editor as created in Oblig 3)

Service compositions for service interactions can be supported by a domain specific service composition language, SECOL. This can be used for instance for sequencing and composition of data and processing for air quality pollution information based on weather forecasts and the current traffic situations as input to a service for making predictive forecasts and warnings for future air quality pollution levels. The example in Appendix B shows this for prediction of oil spill drift and water drought warnings, respectively.

a) Create a metamodel for SECOL, described as an EMF compliant UML model, based on the information derived from the examples of SECOL from Appendix B. (15% - 35 minutes)

b) Describe how you can create a graphical editor for SECOL using EMF and the associated tools Sirius. (10% - 25 minutes)

c) Describe how you can create transformation code (i.e. ATL, Java-EMF, MOFScript, or similar) for the generation of web service execution code, like BPEL (Business Process Execution Language) for web service sequencing. You do NOT have to be explicit on the particular code that is being generated, but can instead describe the principle for the generation of the corresponding text. (5% - 10 minutes)

Contact during exam: Arne J. Berre (Phone: 92047452)

Appendix A –"OsloDieselCarAdvice" description

Oslo Kommune decided on May 22, 2015, to try to introduce a ban for diesel car in the Oslo city, from the winter of 2016, during days when the air quality levels are beyond stated thresholds.

The small IT company Concierge has decided to extend its portfolio of systems by developing a new app, “OsloDieselCarAdvice”, that can advise drivers to change their driving behaviour, in order to minimize the number of days when the threshold actually is being passed.

The asssumption is that it is in the best interest of the diesel car drivers to avoid the situation of having days with so high air quality pollution levels that diesel cars will be banned. It is assumed that many diesel car owners can benefit from early warnings about such potential situations, and with some flexibility would be able to either voluntarily not use the car, or travel alternative routes at alternative times. The app should provide warnings about potential problem days in the near future (up to seven days) and encourage drivers to find alternative solutions. The app should be able to register if a driver decides to change his/her driving behaviour, as a a potential reward system for doing driving adaptation could be considered in the future.

The business model idea is to support different markets with the “OsloDieselCarAdvice" app.

Different user groups includes private drivers and transport-company drivers and public authorities. Oslo kommune will allow for transport-company drivers to drive also on polluted days, but might considering an award system for the change of driving behaviour also for such companies.

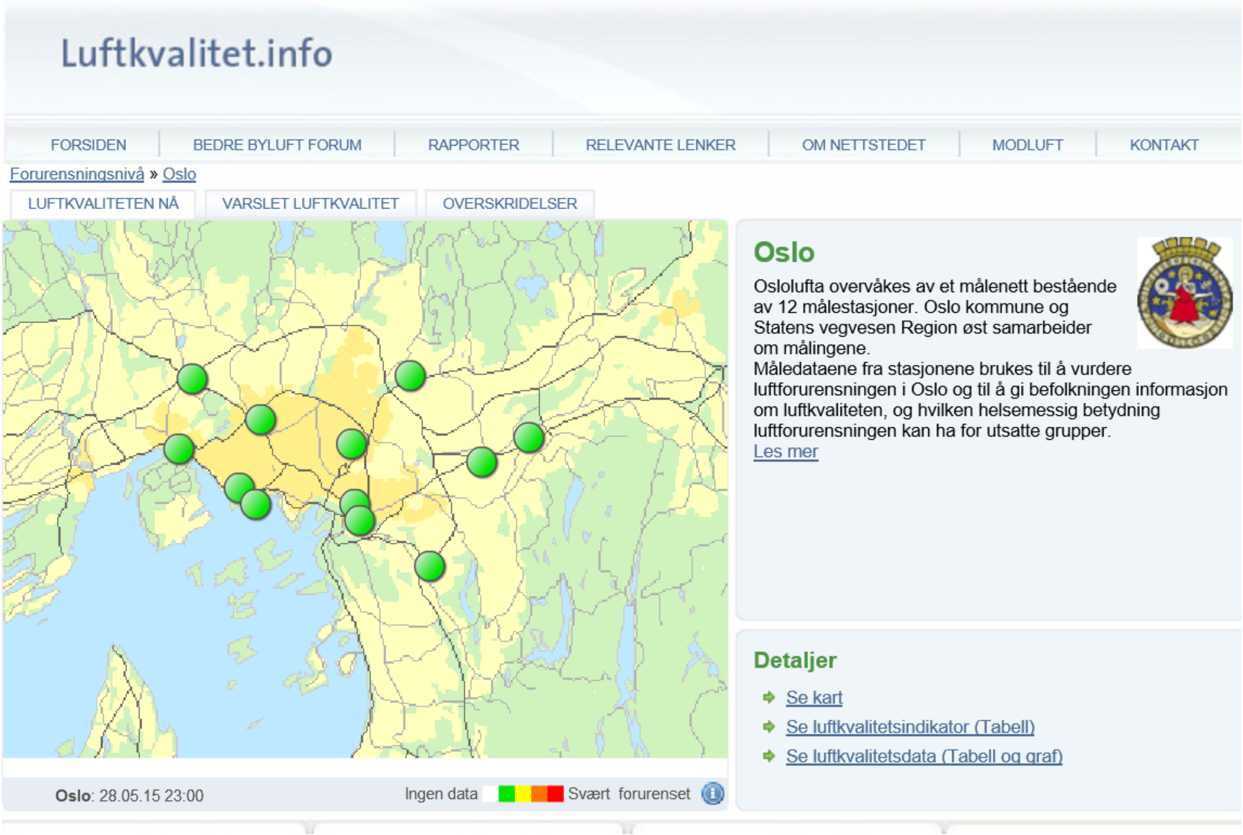
It is planned to have a collaboration with different organisations in the context of providing data and service input for the app. The same functionality could also be made available through a web portal.

Luftkkvalitet.info is a webservice by NILU (Norwegian Institute for Air Quality) which provides air quality data from the 12 air quality stations in Oslo. See figure 1.

Yr.no provides meteorological data and forecasts for today and the next seven days, which can be used as part of the calculation of a new air quality forecast with warnings. See figure 2.

Based on the available web services from these organisations it is assumed that we can produce new web services that can predict air quality pollution for the next seven days – based on a prediction from the current air quality level and the meteorological forecast. The problematic days in Oslo during winter are cold days (typically also clear days) without any wind. The invertion effect means that the air will stay in place and continuously become more polluted. It is assumed that not driving, or driving alternative routes or at alternative times will have a positive effect compared to driving on the more polluted roads in the high traffic periods.

NAF is the Norwegian Automobile Association, which has a large number of members, typcially private drivers, might be interested in promoting the app to their members.



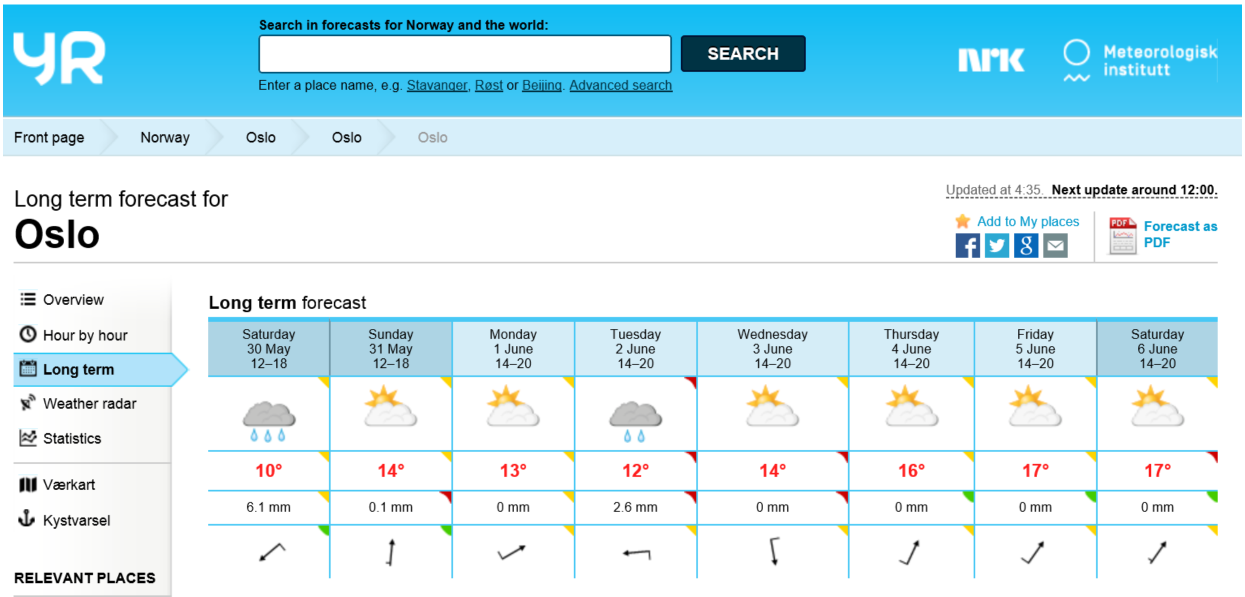
Oslo

Oslolufta overvåkes av et målenett bestående av 12 målestasjoner. Oslo kommune og Statens vegvesen Region øst samarbeider om målingene.
Måledataene fra stasjonene brukes til å vurdere luftforurensningen i Oslo og til å gi befolkningen informasjon om luftkvaliteten, og hvilken helsemessig betydning luftforurensningen kan ha for utsatte grupper.
Les mer

Detaljer

- Se kart
- Se luftkvalitetsindikator (Tabell)
- Se luftkvalitetsdata (Tabell og graf)

Figure 1 Map of the 12 air quality monitoring stations in Oslo.



Long term forecast for

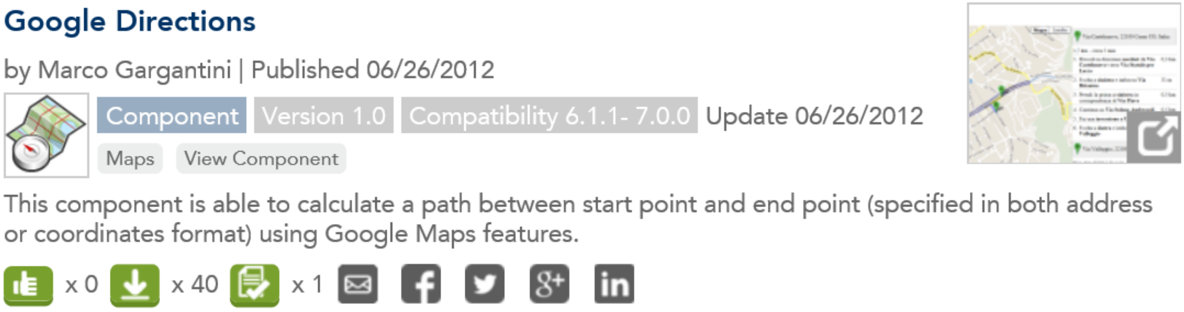
Oslo

Updated at 4:35. Next update around 12:00.

Long term forecast

Saturday 30 May 12–18	Sunday 31 May 12–18	Monday 1 June 14–20	Tuesday 2 June 14–20	Wednesday 3 June 14–20	Thursday 4 June 14–20	Friday 5 June 14–20	Saturday 6 June 14–20
10°	14°	13°	12°	14°	16°	17°	17°
6.1 mm	0.1 mm	0 mm	2.6 mm	0 mm	0 mm	0 mm	0 mm

Figure 2 Weather forecast from Yr.no



Google Directions

by Marco Gargantini | Published 06/26/2012

Update 06/26/2012

This component is able to calculate a path between start point and end point (specified in both address or coordinates format) using Google Maps features.

Figure 3 Google Directions as a WebRatio component

WebRatio supports integration with Google maps, which is one possible map solution to integrate with – and to consider to add specialised components to – for showing air quality forecast for today and the next seven days, as well as for finding the contributed pollution to a route and in finding alternative routes.

Appendix B – Service Composition language (SECOL)

The Service Composition Language (SECOL) is being proposed as a domain-specific modelling language for service composition for execution in particular of sequenced and composed computational services.

The main elements of the language is an ability to chain activities/tasks with input and output data elements into a sequential workflow with execution steps, where each activity/task typically can call on a web service with given input arguments and then present the resulting output as potential input arguments for new steps/services. One activity with its input and output data can be broken down into a new diagram as shown in figure 5.

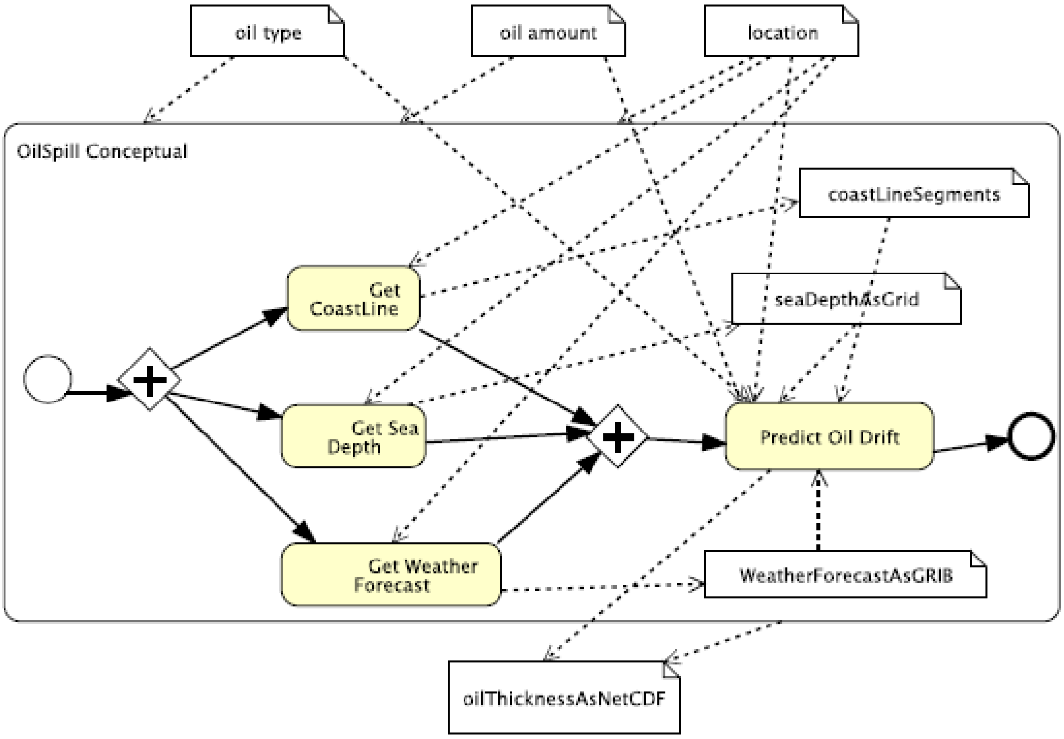


Figure 4 Service Composition Language Diagram (SECOL) – example Oil spill drift

Figure 4 shows an illustrative SECOL diagram that can be used as a reference point for a typical SECOL diagram, as asked for in Question 3, for the example of oil spill drift,

The input and output data elements connected with dotted lines to activities/tasks shows the name of a class in a UML class diagram, which then will have the further details of the data element as properties and possible associated classes. The diamond symbol with a plus sign inside show a gateway as a parallell fork join (AND), other symbols such as O for Or or X for Exclusive Or could also be used inside of this. The circles show start and stop events.

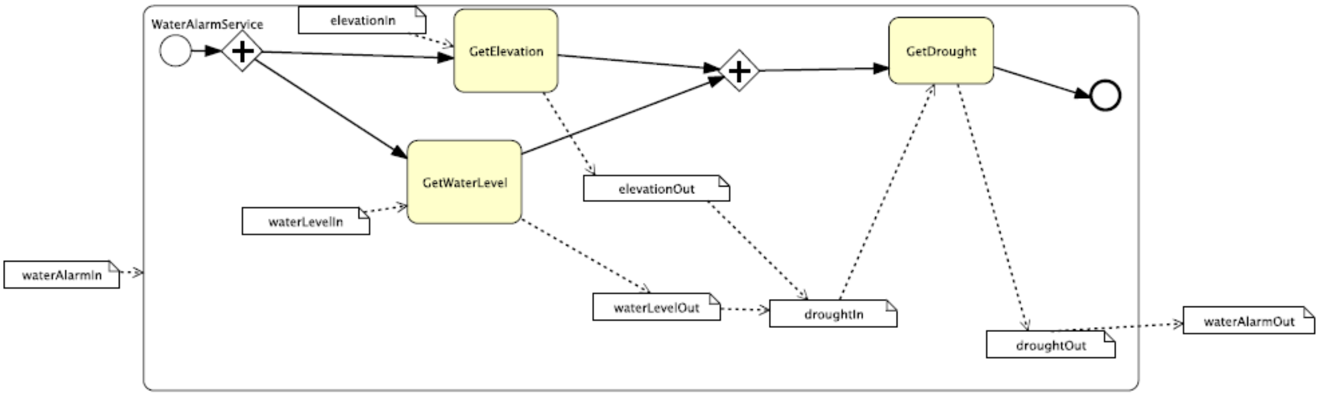


Figure 1 Service Composition Language Diagram (SECOL) – example Drought water alarm