UNIVERSITETET I OSLO

Det matematisk-naturvitenskapelige fakultet

Exam in - INF5150
Day of exam: 5. December 2006
Exam hours: 15.30 – 18.30
This examination paper consists of 5 page(s).
Appendices:
Permitted materials: All written material.

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

NB: This exam text is only given in English since the course has been given in English this year. The candidate may, however, choose to answer in Bokmål or Nynorsk if he or she wants.

Weather service

The business idea behind this service is that people send weather reports from wherever they are, and in return they immediately get weather forecasts for their spot based on all the collected weather reports. The collected weather reports also include data received from weather sensors that periodically send weather reports via SMS to the central database.

The weather forecast is given to the requester by SMS and the collected reports can possibly be viewed on GoogleEarth since the observations are optionally placed in a KML-file.

It is not important for this exam, but we imagine that the weather forecast is done by calculating the routes of the weather and projecting the weather by what is before the requester. For example if the weather seems to flow to Oslo from the west over Drammen we can project that the weather in Oslo will in a few hours be like the weather is now in Drammen. Thus the requester in Oslo takes advantage of the reporters in Drammen.

The exercises may be answered in any order as they should be reasonably independent, but they do refer to the Weather service and Figure 1 for context.

1 Modeling (35%)

In Figure 1 there is a sequence diagram specifying a situation of the Weather Context. Please notice that the uppermost combined fragment has the operator **par**.

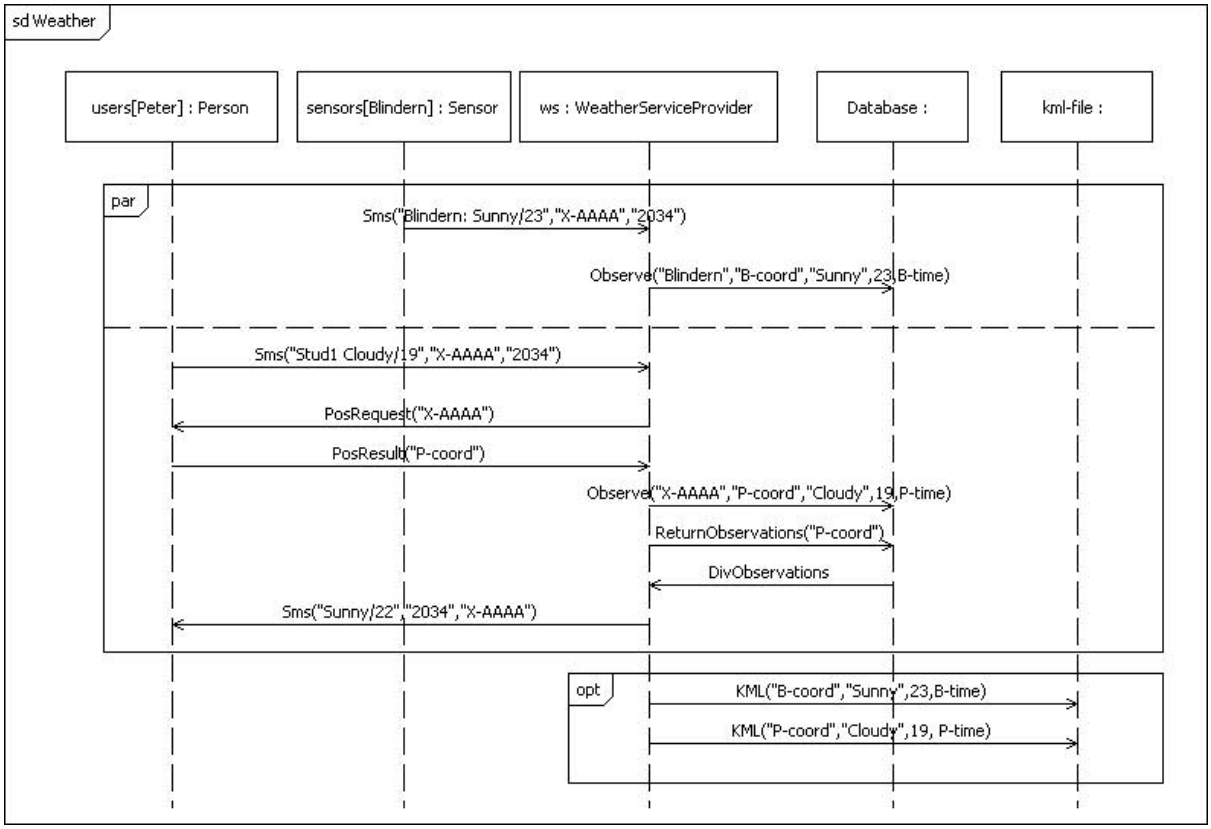

Figure 1Weather reporting and forecasting scenario

The corresponding composite structure of the context is given in Figure 2.

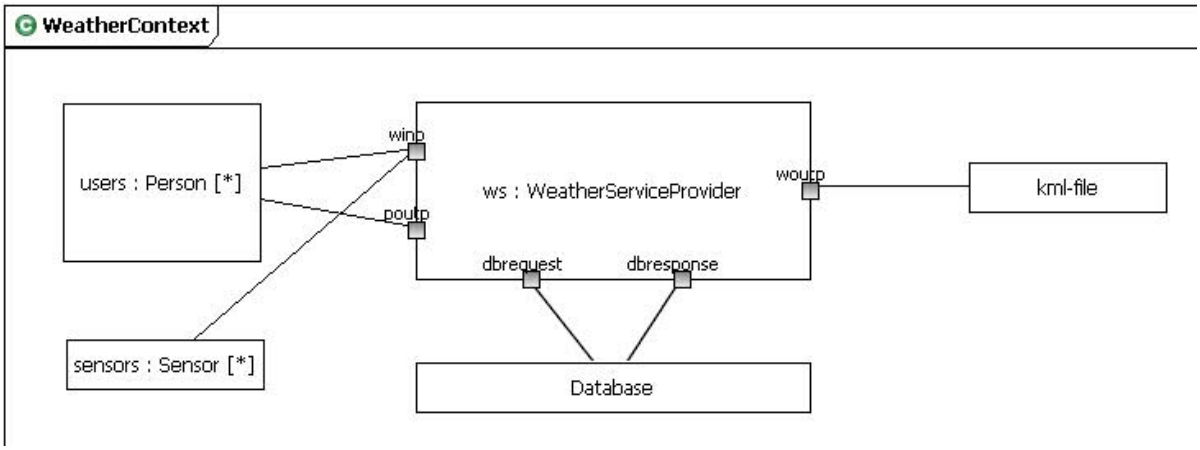

Figure 2Weather context composite structure

1 a) Composite structure

Define a composite structure for WeatherServiceProvider where each sensor is handled by a state machine and there is a session for each weather report sent on SMS from some mobile phone.

1 b) Decomposition

Define a decomposition of lifeline WeatherServiceProvider for sequence diagram Weather.

1 c) State machine

In Figure 3 there is the state machine for the weather sensor corresponding to the sequence diagram in Figure 1. We include this state machine to show some of the vocabulary in the transitions, and how possible variables can be shown.

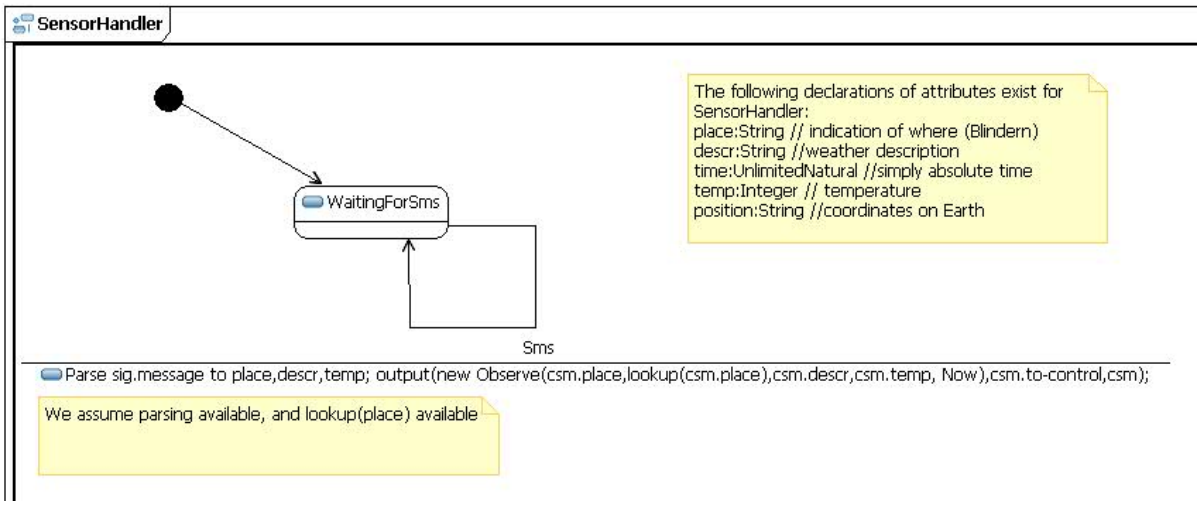

Figure 3State Machine for SensorHandler

Make a state machine for a weather report session.

2 STAIRS (35%)

The exercises below refer to the sequence diagram of Figure 1, but do not depend on what you have answered on exercise 1 above.

2 a) Events

STAIRS Tutorial associates two events with each message, a send event and a reception event.

I. What is the first event(s) of Figure 1. Explain your answer.

II. What is the last event(s)? Again explain your answer.

2 b) Traces

I: How many positive traces are captured by the first operand of the **par**-construct of Figure 1.

II: How many positive traces are captured by the second operand of the **par**-construct of Figure 1.

III: How many traces are negative with respect to the diagram in Figure 1. Explain your answer.

IV: How many traces are inconclusive with respect to the diagram in Figure 1. Explain your answer.

2 c) Refinement

I: Draw a sequence diagram that is a (pure) supplementing of the diagram in Figure 1. Explain your answer.

II: Draw a sequence diagram that is a (pure) narrowing of the diagram in Figure 1.

III: Draw a sequence diagram that fulfils all of the following requirements:

- It **is** a refinement of the diagram in Figure 1,
- It is **not** a (pure) narrowing of the diagram in Figure 1,
- It is **not** a (pure) supplementing of the diagram in Figure 1.
- It has **not** the exact same semantics as the diagram in Figure 1.

2 d) Refinement (continued)

Consider a sequence diagram consisting of an **xalt** where the first operand is the sequence diagram in Figure 1 and the second operand can be selected arbitrarily.
I: Is this diagram a general refinement of the diagram in Figure 1? Explain your answer.

II: Is this diagram a limited refinement of the diagram in Figure 1? Explain your answer.

3. Risk Analysis (30%)

The exercises below refer to the sequence diagram of Figure 1, but do not depend on what you have answered on exercises 1 and 2 above.

Assume that you are hired to conduct a security analysis on behalf of the provider of the weather service.

3 a) Context establishment

I: Select the most natural lifeline in the sequence diagram in Figure 1 to represent the *party (stakeholder)* of the analysis? Explain your answer.

II: Classify the remaining four lifelines according to whether they may be understood as *assets* or *human threats*? Explain your answer.

III: Introduce an additional asset that is indirect with respect to the asset classification above.

3 b) Risk identification

Assume the service provider is particularly concerned about integrity of data. Apply the context that you have established in 3a)
I: Draw a threat diagram capturing a “threat to integrity of data in storage” scenario. Explain your diagram.

II: Draw a sequence diagram that may be understood as a specialisation of the threat diagram.

3 c) Consequences and likelihoods

In this sub-exercise you are not obliged to talk about the weather service, but are free to make other examples and give general answers.
I: Given a threat diagram. Under what conditions does it make sense that an unwanted incident has a higher likelihood than a threat scenario pointing at it (by pointing we mean there is an arrow from the threat scenario icon to the unwanted incident icon).

II: Define a qualitative consequence scale properly (just listing values is not enough)

III: Define two different quantitative likelihood scales.

IV: Why does it make sense to argue that a consequence value is “subjective” while a frequency value is “objective”?