Slides #16

OOD with UML

Section 7.1

CMPT 276

Topics

1) How do we do object-oriented design using UML?
   a) Specifically, what are the steps involved?

Design and Implementation

Design and implementation

- Software design and implementation:
  - stage in software engineering process which..
- Design and implementation are inter-leaved:
  - Software design:
    - a creative activity to identify software components and their relationships
    - based on a customer's requirements
  - Implementation:
    - process of realizing the design as a program.

Build or buy

- Before writing own system...
  - Commercial off-the-shelf systems (COTS) can be adapted to the users' requirements.
  - Ex: buy a medical records system already used.
  - Can be cheaper and faster to buy a COTS.
- Designing an app. from COTS:

  not design and implementation.

"I'm waiting for them to work out the bugs first."

Object-oriented design process

- Common activities in OOD processes:
  - Define the system's...
  - Design the system's...
  - Identify the main...
  - Develop...
  - Specify...
- This process illustrated here using a design for a wilderness weather station.

SE Joke

A programmer was walking along the beach when he found a lamp. Upon rubbing the lamp a genie appeared who stated "I am the most powerful genie in the world. I can grant you any wish you want, but only one wish."

The programmer pulled out a map of the world and said "I'd like there to be a just and last peace among the people of the world."

The genie responded, "Gee, I don't know. People have been fighting since the beginning of time. I can do just about anything, but this is beyond my limits."

The programmer then said, "Well, I am a programmer and my programs have a lot of users. Please make all the users satisfied with my programs, and let them ask sensible changes"

...

Object-oriented design process:

System context and interactions

System context and interactions

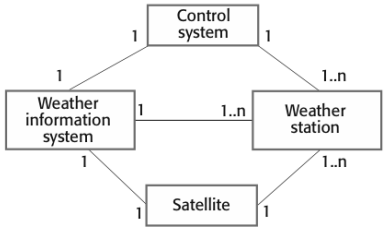
- Understand system context by studying..
- Decide how the system will:
  - satisfy each required function;
  - communicate with external systems;
- This establishes boundaries for what the system must do.

Context and interaction models

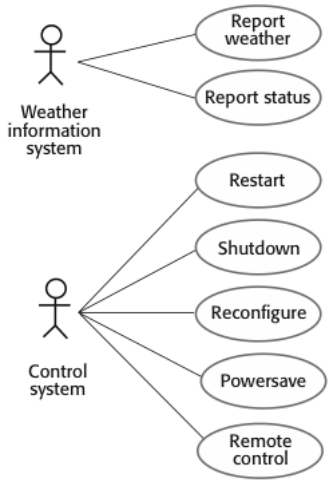
- A system context model:
  - structural model that shows..
- An interaction model:
  - dynamic model that shows..

  with the other systems.

Weather station context & use case



Structure: Context diagram.



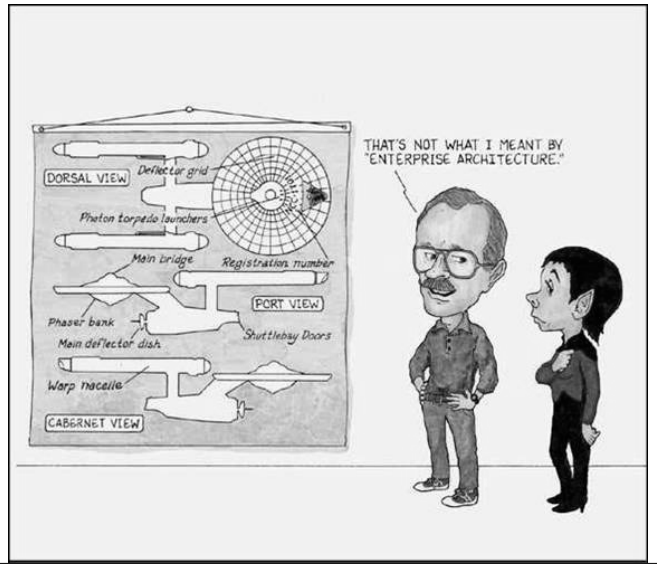
Interaction: Use case diagram.

Use case description - Report weather

System	Weather station
Use case	Report weather
Actors	Weather information system, Weather station
Description	The weather station sends a summary of the weather data that has been collected from the instruments in the collection period to the weather information system. The data sent are the maximum, minimum, and average ground and air temperatures; the maximum, minimum, and average air pressures; the maximum, minimum, and average wind speeds; the total rainfall; and the wind direction as sampled at five-minute intervals.
Stimulus	The weather information system establishes a satellite communication link with the weather station and requests transmission of the data.
Response	The summarized data is sent to the weather information system.
Comments	Weather stations are usually asked to report once per hour but this frequency may differ from one station to another and may be modified in the future.

Object-oriented design process:
Architectural design

Architectural design

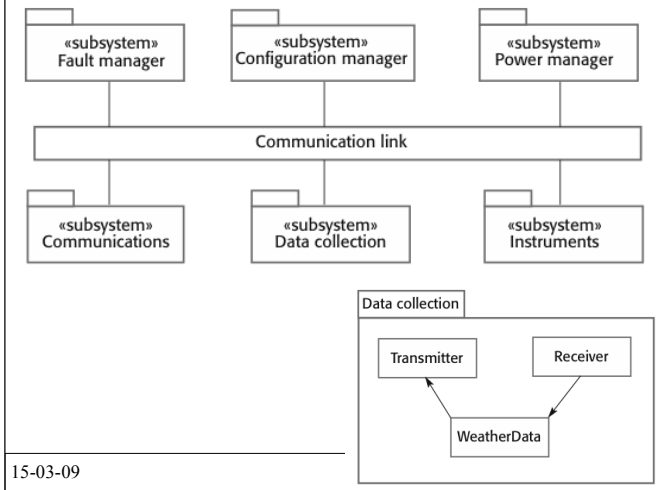


- Process so far:
  1) Understand interactions between system and environment.

     - Identify the system's major components and their interactions.
     - Organize components using an architectural pattern (Ex: layered or client-server model)

High-level architecture of weather station

- Weather station has independent subsystems that...



Architecture of data collection system

Object-oriented design process:
OO Class identification

Object class identification

- Identifying OO classes is difficult.
- No 'magic formula' for object identification.
  - Relies on the skill, experience and domain knowledge of system designers.
-
  - You are unlikely to get it right first time.

Approaches to object identification

-
  - Find the nouns in natural language description of the system.
-
  - Model tangible things from the application domain (aircraft, roles such as manager, events like meetings).
-
  - Identify objects, attributes and methods in each scenario.

Weather station description

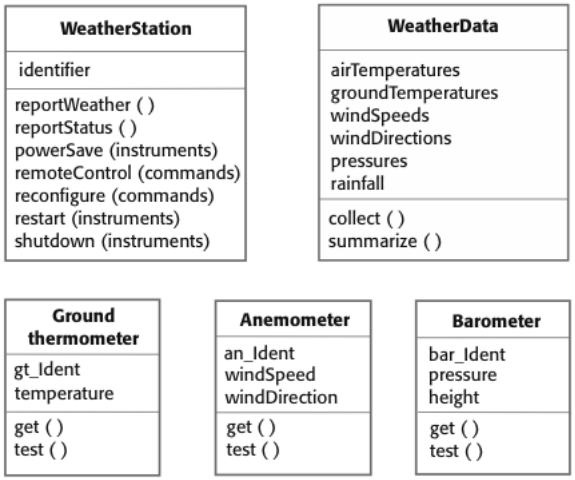
A weather station is a package of software controlled instruments which collects data, performs some data processing and transmits this data for further processing. The instruments include air and ground thermometers, an anemomevane, ter, a wind a barometer and a rain gauge. Data is collected periodically.

When a command is issued to transmit the weather data, the weather station processes and summarises the collected data. The summarised data is transmitted to the mapping computer when a request is received.

Weather station object classes

- Ground thermometer, Anemometer, Barometer
  - (System instruments)
- Weather station
  -
  - Supports interactions listed in use-cases.
- Weather data
  - Encapsulates the data from instruments.

Weather station object classes



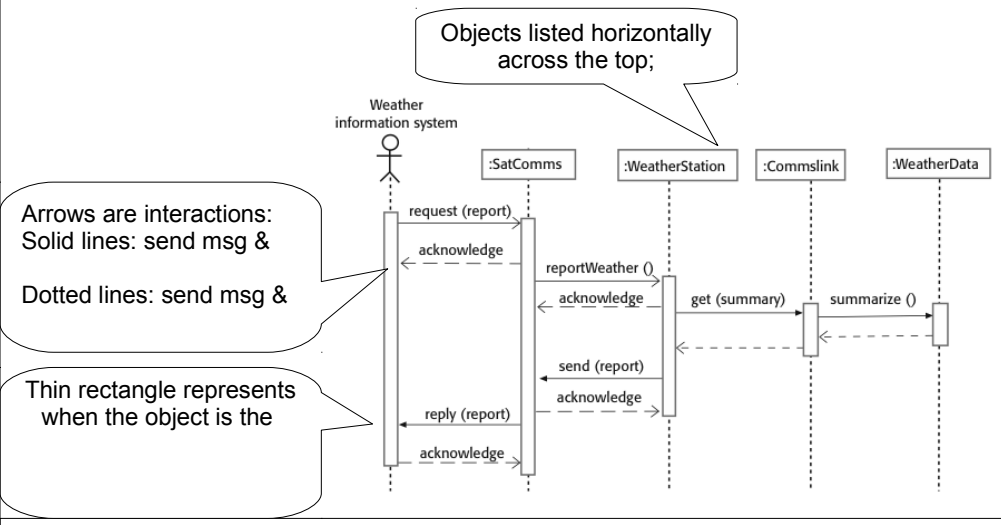
Object-oriented design process:
Dynamic models

Examples of design models

- Sequence models
  - show the sequence of object interactions.
- State machine models
  - show how individual objects...

Sequence models

- Sequence models show the sequence of object interactions.

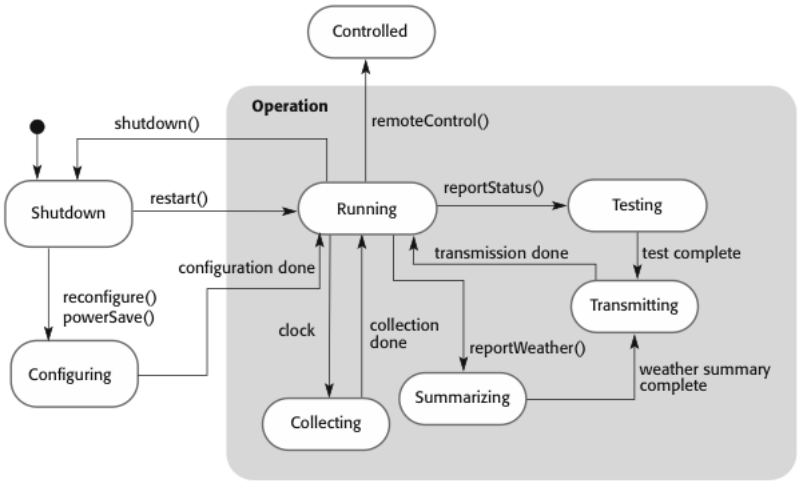


Sequence diagram describing data collection

State diagrams

- State diagrams show how objects:
  - respond to requests, and
  - the state transitions triggered by these requests.
- Useful high-level models of object's...
- What to model
  - You don't usually need a state diagram for all of the objects in the system.
  -

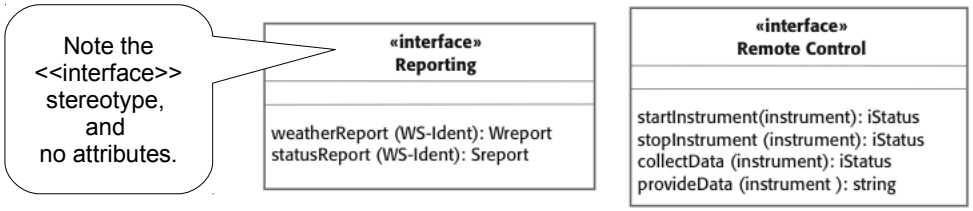
Weather station state diagram



Object-oriented design process:
Interface specification

Interface specification

- Object interfaces:
  - Once specified,
  - Objects may implement several interfaces.
- UML uses class diagrams for interface specification.



Summary

- Software design & implementation: inter-leaved activities.
  - Level of detail depends on the type of system, and plan-driven or agile approach.
- Object-oriented design includes:
  - Designing the system architecture,
  - Identifying objects in the system,
  - Documenting the component interfaces.
- Produce a range of models:
  - static models: class models.
  - dynamic models: sequence models, state machine models.