Software Design
Overall Design Process: Structural and Dynamic Modeling

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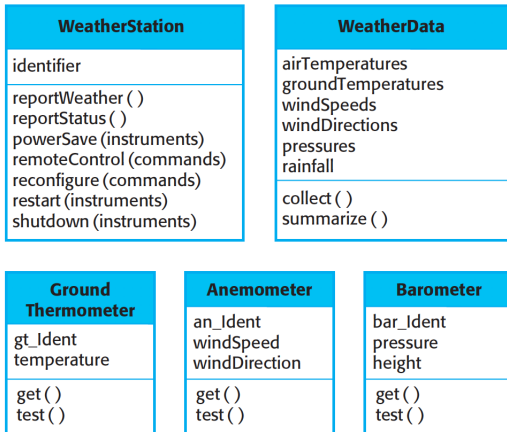Indian Institute of Technology Kanpur

Developing Design Models

- **Structural models:** Describe the static structure of the system using object classes and their relationships

- **Dynamic models:** Describe the dynamic structure of the system and show the interactions between the system objects

Object Class Identification

- Use a grammatical analysis of a natural language description of the system to be constructed
  - Objects and attributes are nouns
  - Operations or services are verbs

- Use tangible entities (things) in the application domain such as aircraft, roles such as manager or doctor, events such as requests, interactions such as meetings, locations such as offices, organizational units such as companies, and so on

- Use a scenario-based analysis where various scenarios of system use are identified and analyzed in turn

WeatherStation

identifier

reportWeather ( )
reportStatus ( )
powerSave (instruments)
remoteControl (commands)
reconfigure (commands)
restart (instruments)
shutdown (instruments)

WeatherData

airTemperatures
groundTemperatures
windSpeeds
windDirections
pressures
rainfall

collect ( )
summarize ( )

Ground Thermometer

gt_Ident
temperature

get ( )
test ( )

Anemometer

an_Ident
windSpeed
windDirection

get ( )
test ( )

Barometer

bar_Ident
pressure
height

get ( )
test ( )

Refining Objects

- Look for common features and then design the inheritance hierarchy for the system

- **Example:** an Instrument superclass, which defines the common features of all instruments, such as an identifier, and get and test operations

- Add new attributes and operations to the superclass, such as an attribute that maintains the frequency of data collection

Dynamic models

- Describe the dynamic structure of the system and show the interactions between the system objects

- Interactions that may be documented include
  - the sequence of service requests made by objects (Sequence models)
  - the state changes that are triggered by these object interactions (state machine models)

Example: Sequence Diagram Describing Data Collection
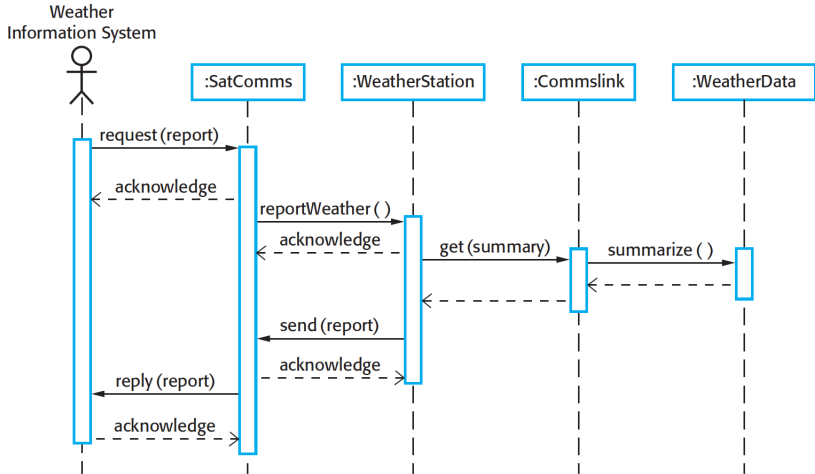
Example: Weather Station State Diagram
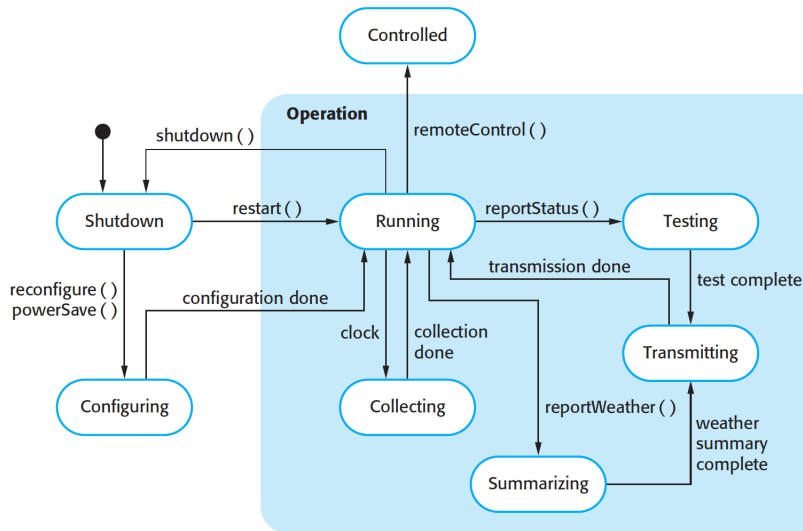
Interface Specification

- An important part of any design process is the specification of the interfaces between the components in the design

- Specify interfaces so that objects and subsystems can be designed in parallel

- Once an interface has been specified, the developers of other objects may assume that interface will be implemented
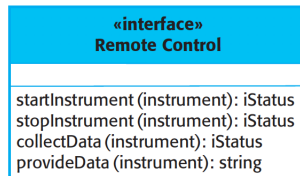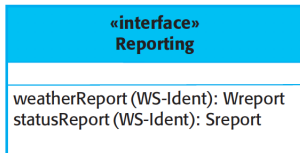
Interface Design

- Attributes are not defined in an interface specification

- Includes operations to access and update data

- As the data representation is hidden, it can be easily changed without affecting the objects that use that data

- This leads to a design that is inherently more maintainable

Interfaces vs. Objects

- There is not a simple 1:1 relationship between objects and interfaces

- The same object may have several interfaces, each of which is a viewpoint on the methods that it provides

- Equally, a group of objects may all be accessed through a single interface

«interface» Reporting
weatherReport (WS-Ident): Wreport statusReport (WS-Ident): Sreport

«interface» Remote Control
startInstrument (instrument): iStatus stopInstrument (instrument): iStatus collectData (instrument): iStatus provideData (instrument): string

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