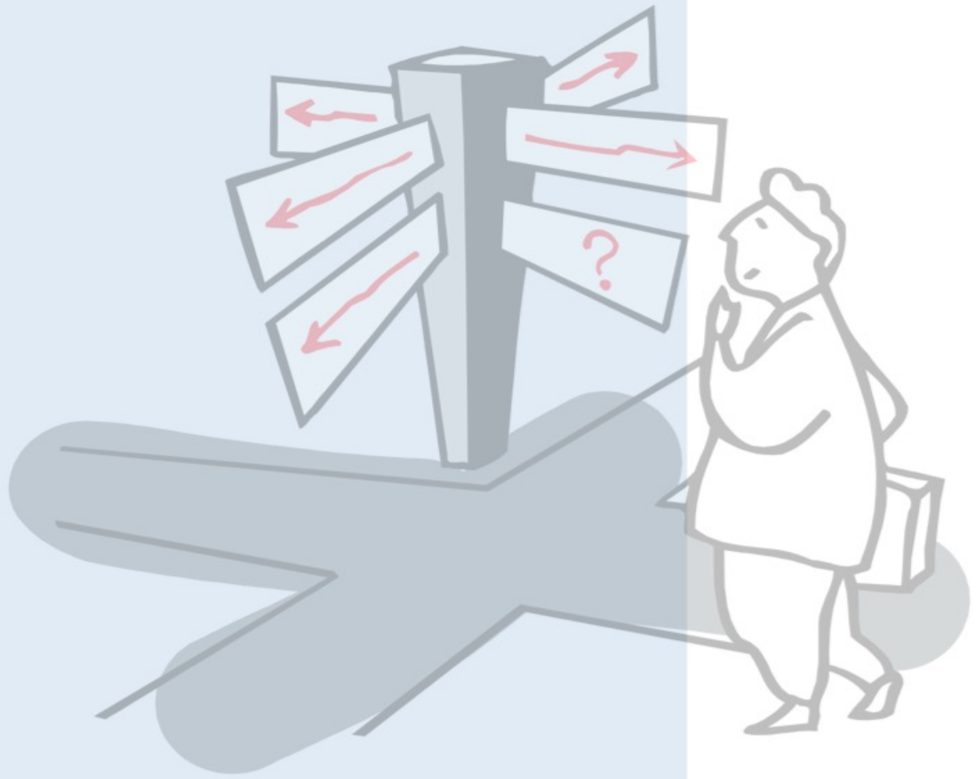
SWE20001
Managing Software Projects

Lecture 2b

Software Design

Roadmap

- Design Principle
- Design Pattern



Design Principle

Pre-OO era

- Strong Cohesion
- Loose Coupling

Design with OO principles

- Encapsulation
- Inheritance
- Polymorphism
- Information hiding

- OO principles “promotes”
  Strong cohesion and Loose coupling

Cohesion (= Intra-dependency)

- Intra-dependencies of the components in a software unit (e.g. class, method, module)
- Want **Strong cohesion**
  - Meaning that "separating" these components into different units will cause issues
- Weak cohesion
  - Those components can be easily separated into different units without causing problems
- Refactoring (weak cohesion → stronger cohesion)

Cohesion – Examples

Weak Cohesion

- PRS_ex1
  - ❌ PRS_AddNewAssessment.java

Strong Cohesion

- PRS_ex2
  - PRS_AddNewAssessment.java
  - AddAssessmentForm.java
  - Assessment.java
- PRS_GUI
  - PRS_AddNewAssessment_GUI.java
  - AddAssessmentForm_GUI.java
  - Assessment.java

Coupling (= Inter-dependency)

- Inter-dependencies of different software units (e.g. class, method, module)
- Want **Loose coupling**
  - Meaning that the units do not depend on others very much
  - So replacing one unit with “a compatible one” will not cause issues
- Strong coupling
  - Those units “depend” on each other so much that replacing one with “a compatible one” will cause troubles due to some dependencies
- Refactoring (strong coupling → loose coupling)

Coupling – Examples

Strong Coupling

- PRS_ex1
  - PRS_AddNewAssessment.java

Loose Coupling

- PRS_GUI
  - PRS_AddNewAssessment_GUI.java
  - AddAssessmentForm_GUI.java
  - Assessment.java
- PRS_GUI2
  - PRS_AddNewAssessment_GUI.java
  - AddAssessmentForm_GUI2.java
  - Assessment.java

OO Principles

- Inheritance
  - Super-class and Sub-class
- Encapsulation
  - Prevent data being accessed / changed by others
- Information hiding
  - Provide flexible design choice
- Polymorphism
  - Provide single interface for different types
  - Examples: operator overloading, [Java] Generic, a superclass with different sub-classes

Design Pattern

- Well known solution for a particular programming situation
- Well known patterns
  - Model View Controller (MVC)
  - Façade pattern

Model-View-Controller

- Model – data model
- View – presentation of the model
- Controller – controls the flow / interactions of the view and model

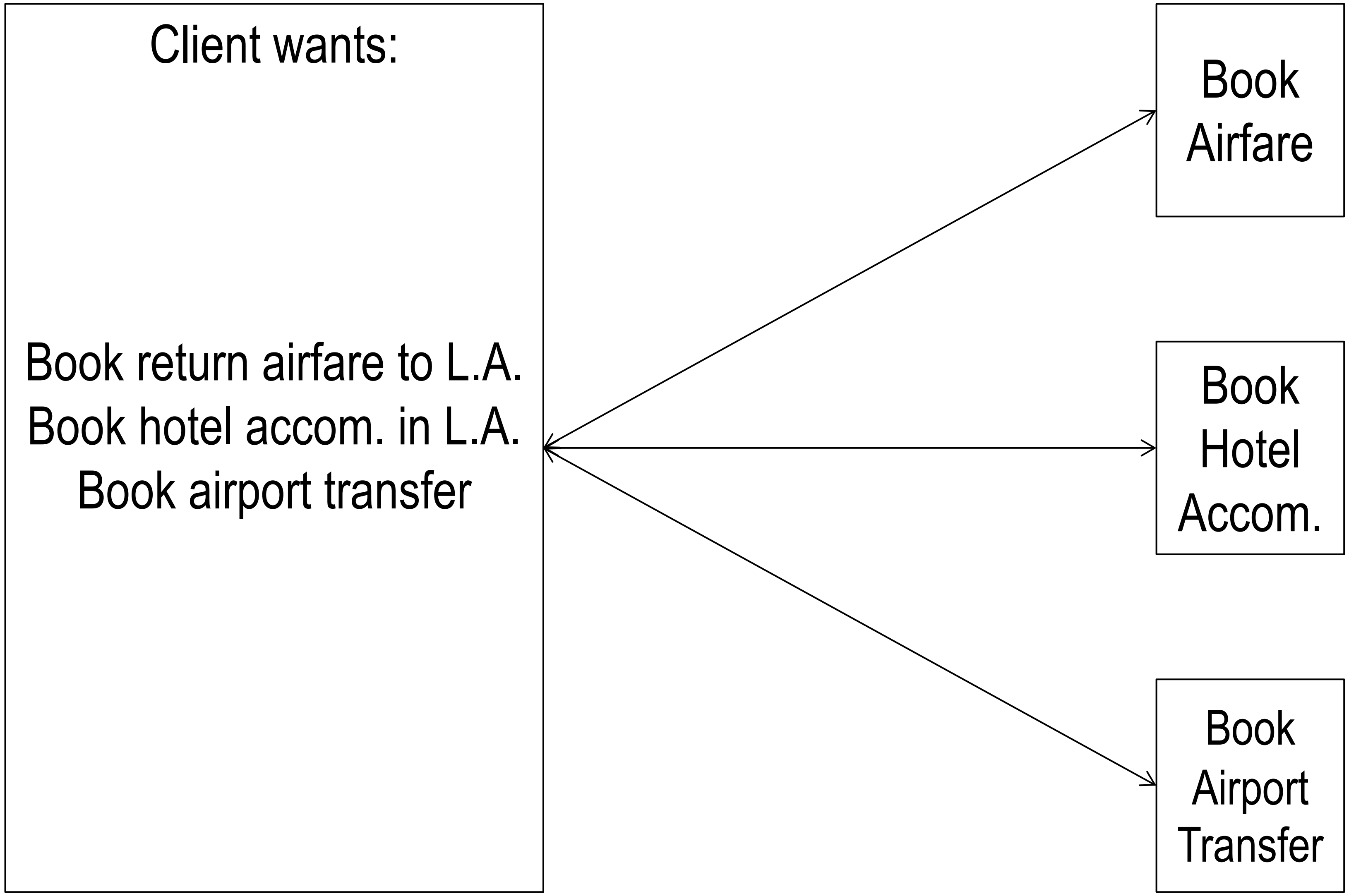
MVC – Example – Balance Transfer

- Model: Bank_Account
- Views: Presentation Form and Result
  - Form to collect the required information
  - Responses with respect to the transfer
- Controller:
  - Check the business logic
    - Enough balance for transfer; transfer amount within daily limit; …
    - Both accounts exist and active
    - …
  - Control the process flow according to the “requirements”

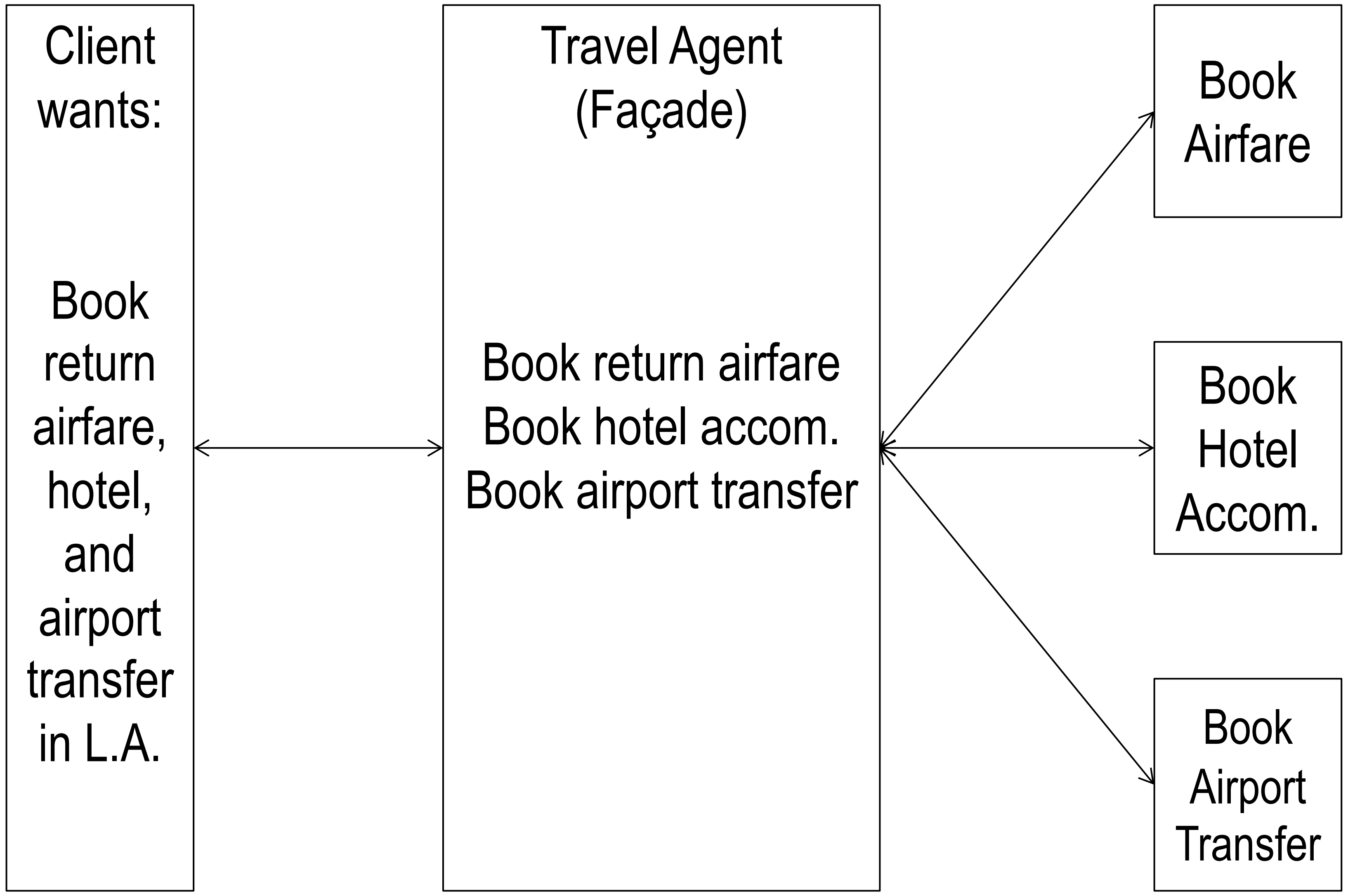
Façade

- A common frontend for several inter-related operations
- Provide a unified interface to a set of interfaces of a subsystem
  - Usually for backend processing
- Usually: provide a higher-level interface that makes the subsystem easier to use
  - … backend processing hidden from other developers

Façade – Example – Travel Booking(Analogy)



Façade – Example – Travel Booking (cont'd)


Client wants:
Book return airfare, hotel, and airport transfer in L.A.
Travel Agent (Façade)
Book return airfare
Book hotel accom.
Book airport transfer
Book Airfare
Book Hotel Accom.
Book Airport Transfer