# Introduction to Pattern Oriented Analysis and Design (POAD)

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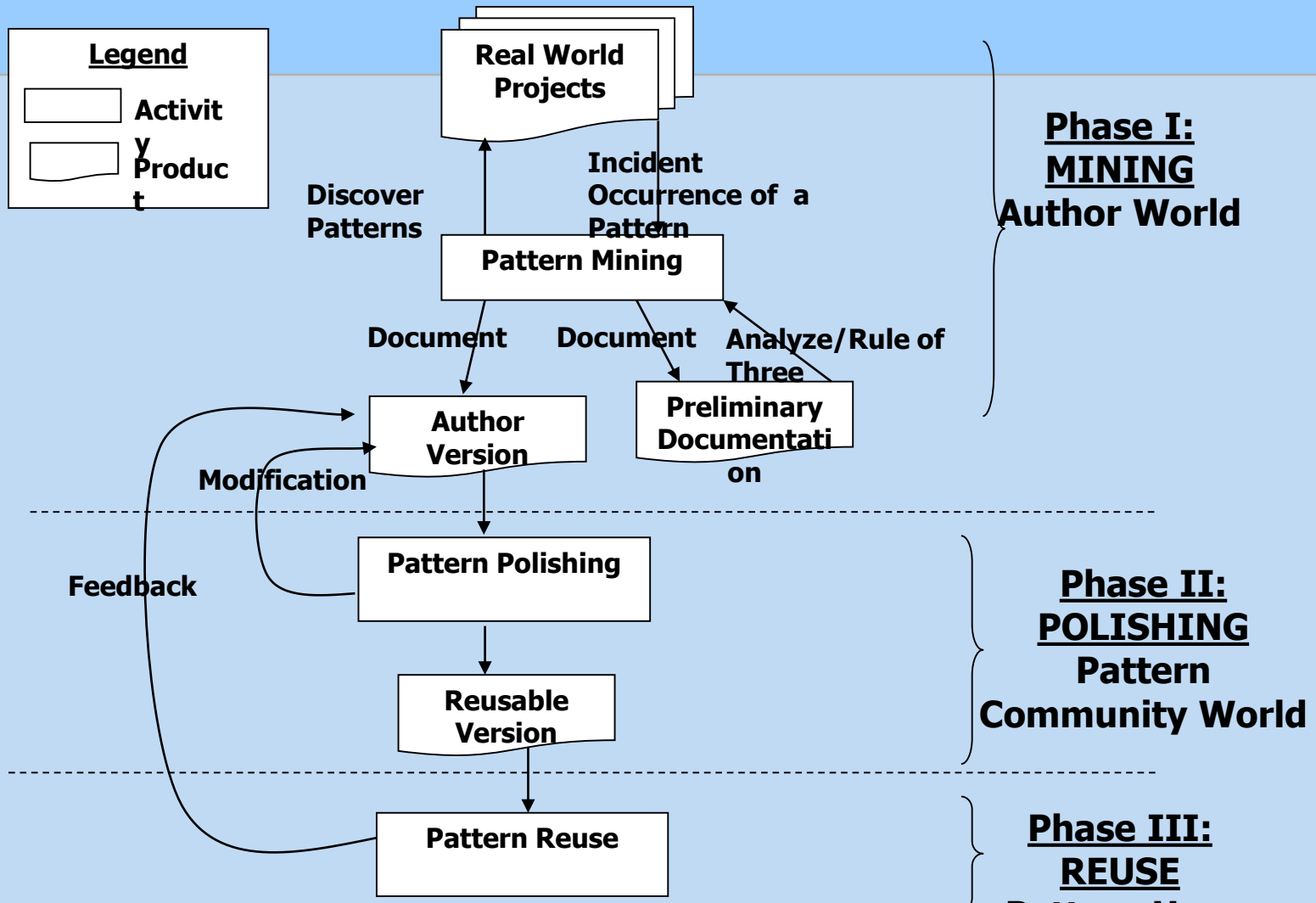
# Outline

- Review of Design Patterns
  - The Lifecycle of a Pattern
  - Examples of Design Patterns
    - The Command Pattern
    - The Observer Pattern
    - The Strategy Pattern
- Pattern Oriented Development
  - The Analysis phase
  - The Design phase
  - The design refinement phase
- The Feedback Control Example

# The Lifecycle of Patterns

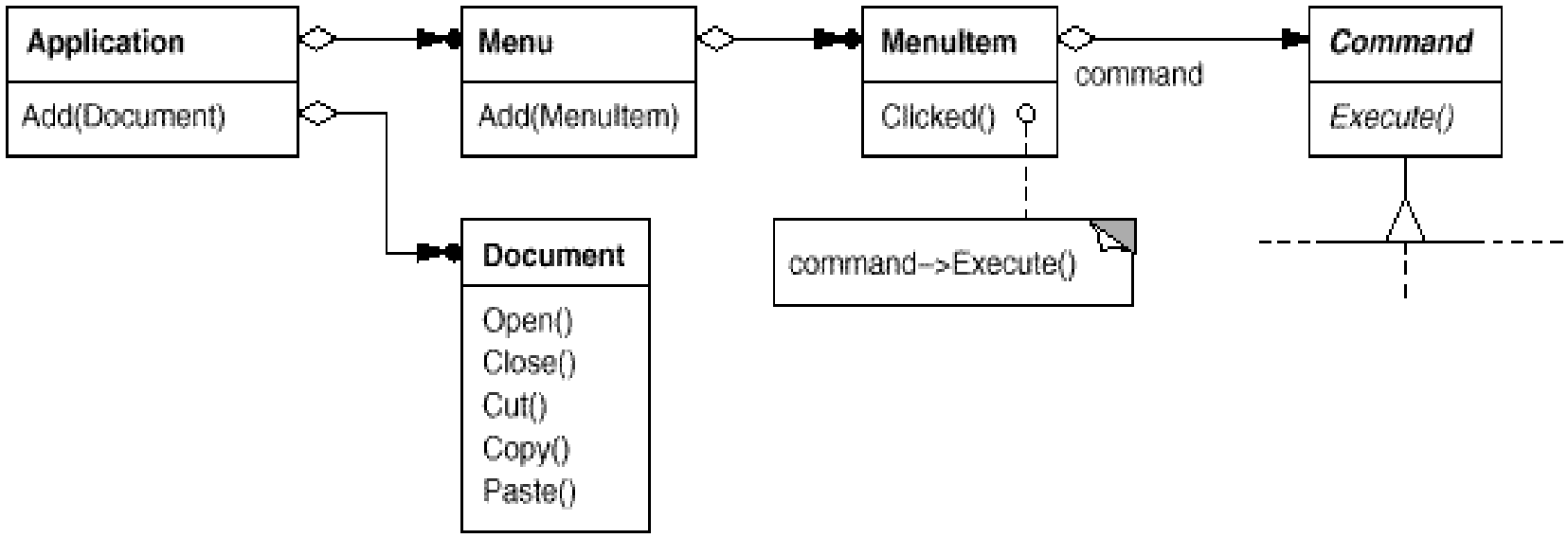
**(From the Reference "Pattern-Oriented Analysis and Design", Sherif M Yacoub and Hany H. Ammar Addison-Wesley Inc., 2004)**



# Review of Design Patterns

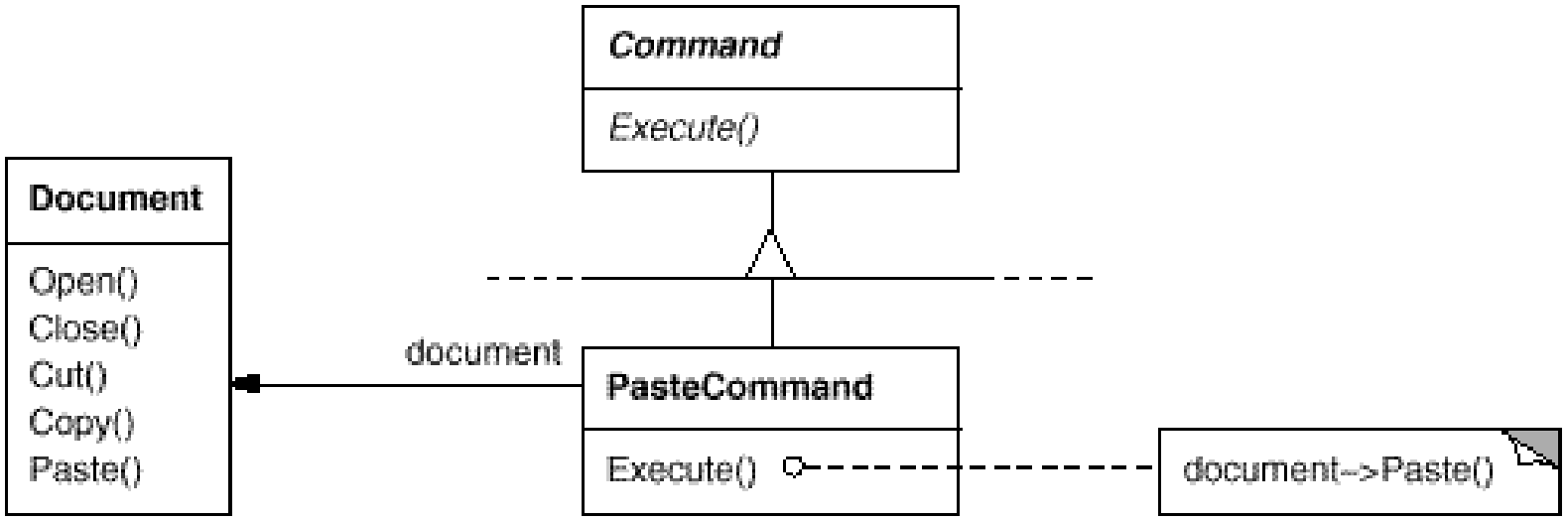
- Examples of Design Patterns (From the Design Patterns CD by Gamma et al, Addison-Wesley Inc., 1998 **)**

The Command Pattern: Encapsulate a request as an object



# Review of Design Patterns

## The Command Pattern



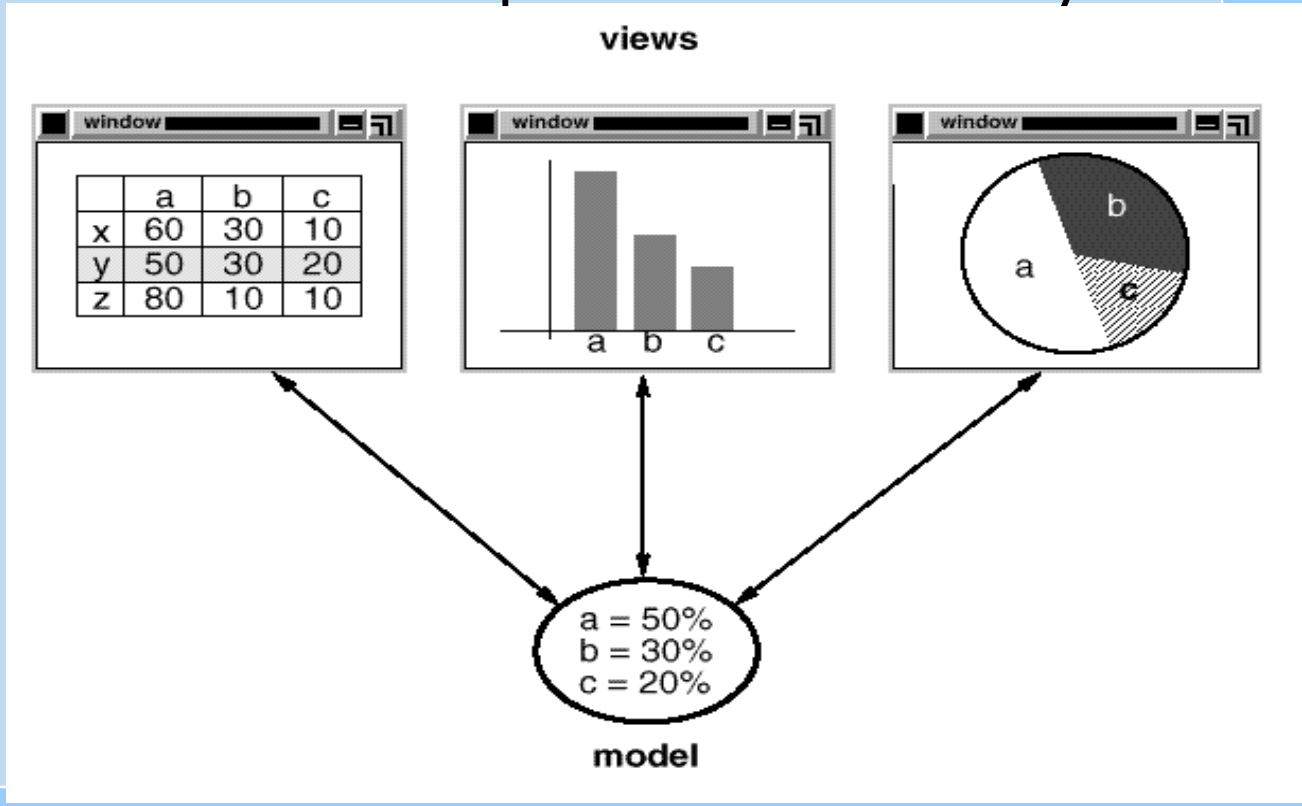

**From the Design Patterns CD by Gamma et al, Addison-Wesley Inc., 1998**

# Review of Design Patterns

## Examples of Design Patterns

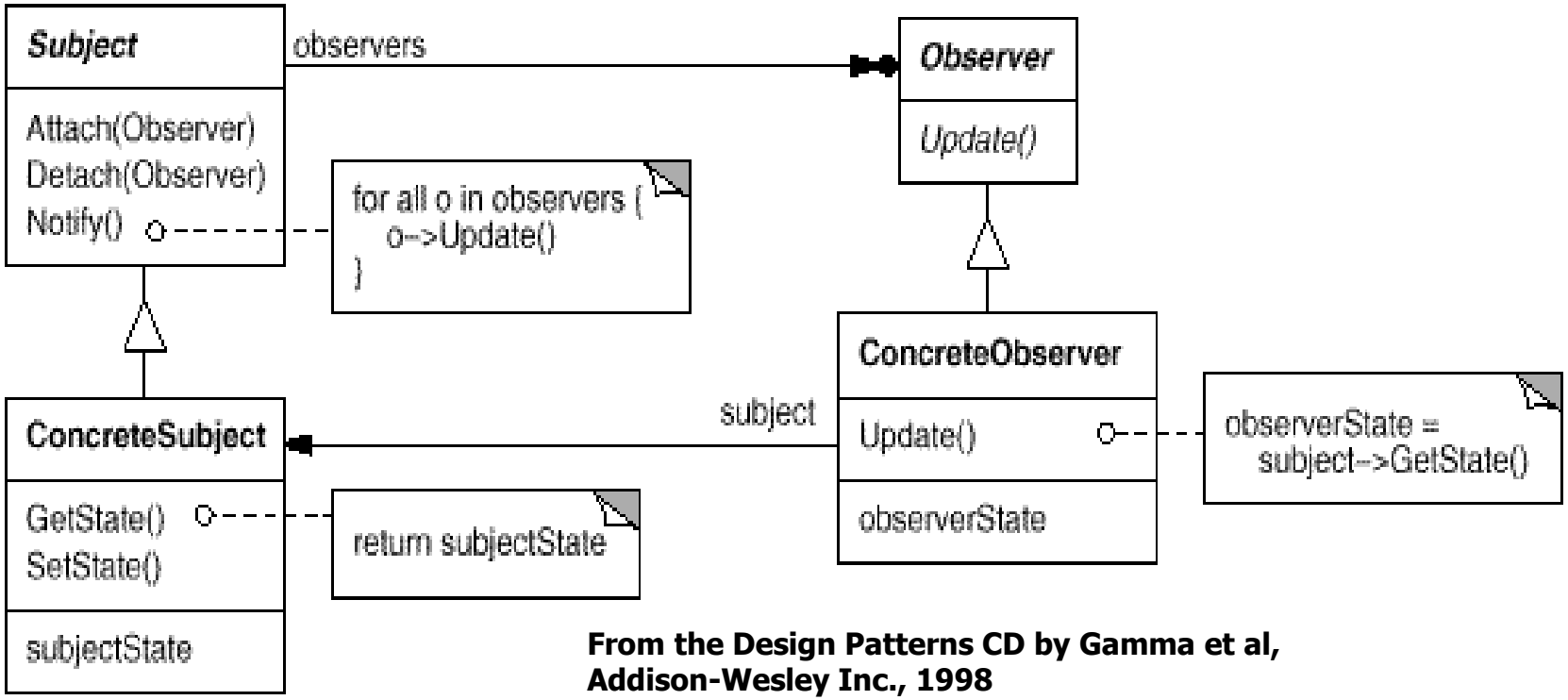
**The Observer Pattern:** when one object changes state, all its dependents are notified and updated automatically

Model View Controller example



# Review of Design Patterns

## Examples of Design Patterns
## The Observer Pattern class diagram

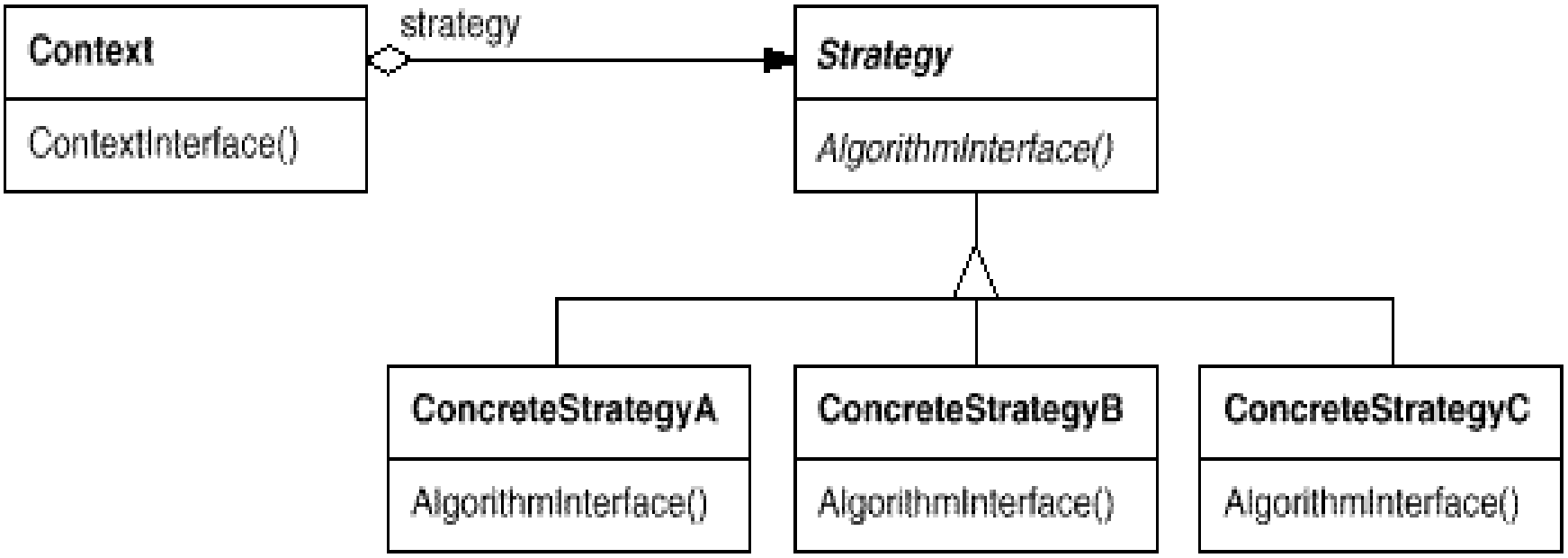



**From the Design Patterns CD by Gamma et al, Addison-Wesley Inc., 1998**

# Review of Design Patterns

Examples of Design Patterns

The Strategy Pattern: lets the algorithm vary independently from clients that use it



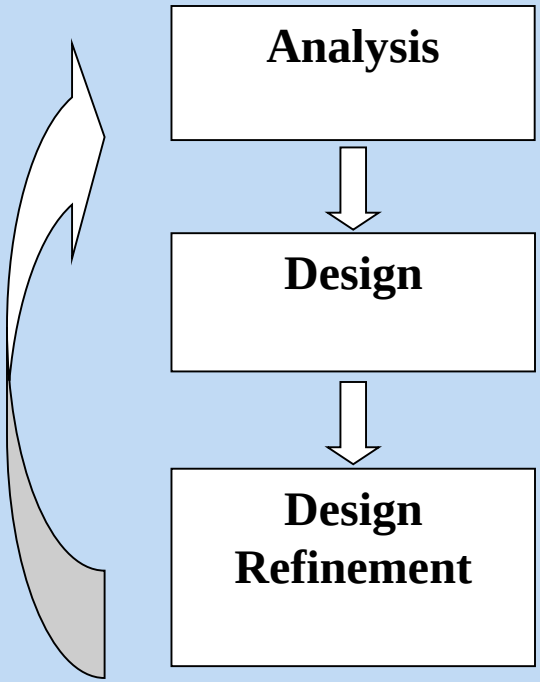
# Pattern Oriented Development

- Design Patterns are used in an ad-hoc strategy for design refinement
- They are also used to address a set of design problems without any guidance of how these patterns can be glued or interface together
- Is there a way to use design patterns as building blocks or as components in the design of systems ?

# Pattern Oriented Development

- Pattern Oriented Analysis and Design (POAD)
  - The process aspects of POAD explains the phases and steps to develop an application design using patterns
  - the POAD process has three phases:
    - Analysis
    - Design
    - Design Refinement

# Pattern Oriented Development



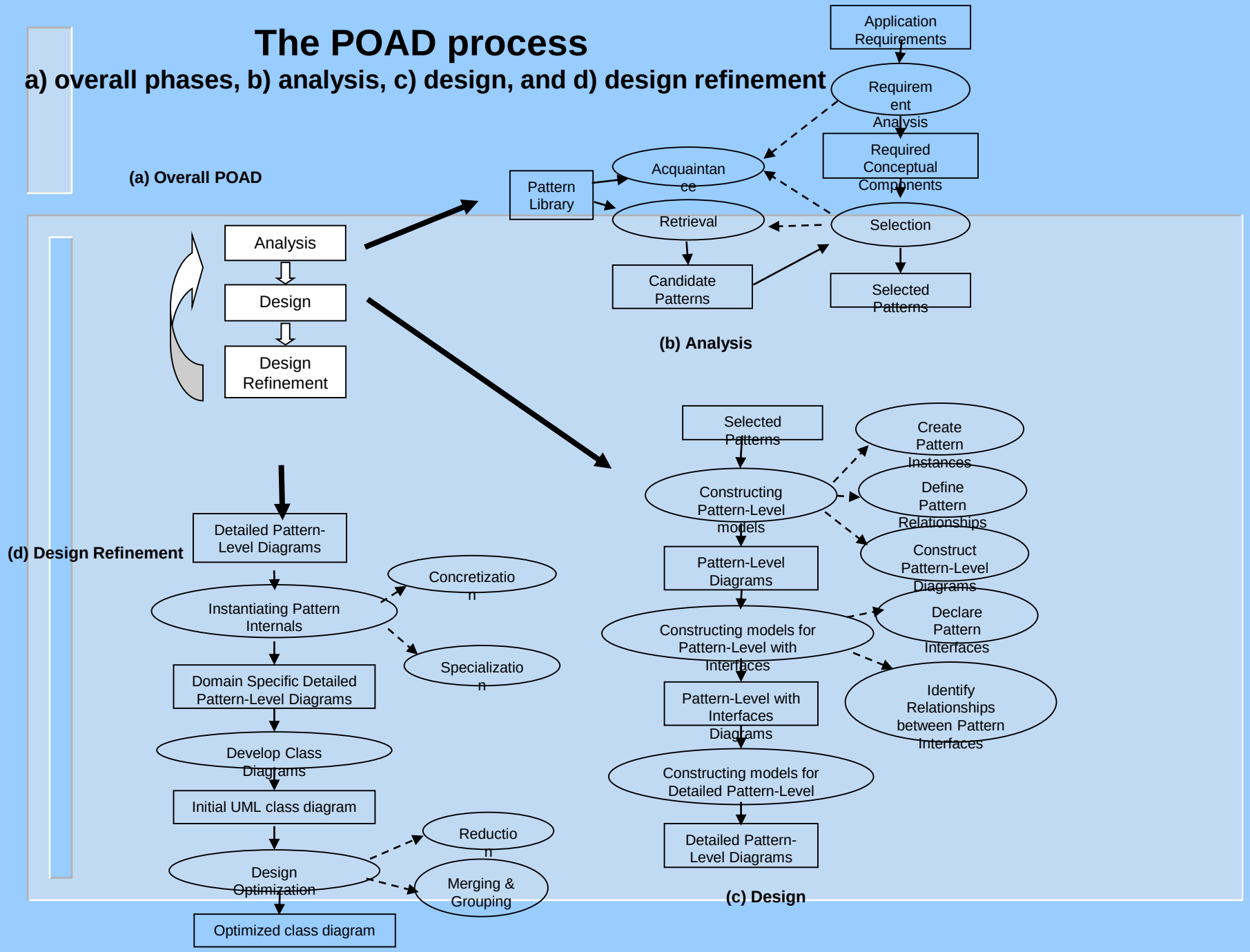

a logical model is developed and patterns are selected

where patterns are glued together to produce a detailed pattern-level diagram

An initial class diagram,
and a more dense and profound class diagram,
and sequence diagrams are developed

# The POAD process

## a) overall phases, b) analysis, c) design, and d) design refinement



# POAD Analysis Phase

- Develop use case diagrams to identify the problems to be solved and the possible breakdown of the application as a set of logical components.
- Acquaintance with relevant pattern databases to get the analyst familiar with existing solutions.
- Retrieval of patterns from the domain specific databases to select a set of candidate patterns in an automated fashion.
- Selection of patterns from a set of candidate patterns for possible inclusion in the design process.

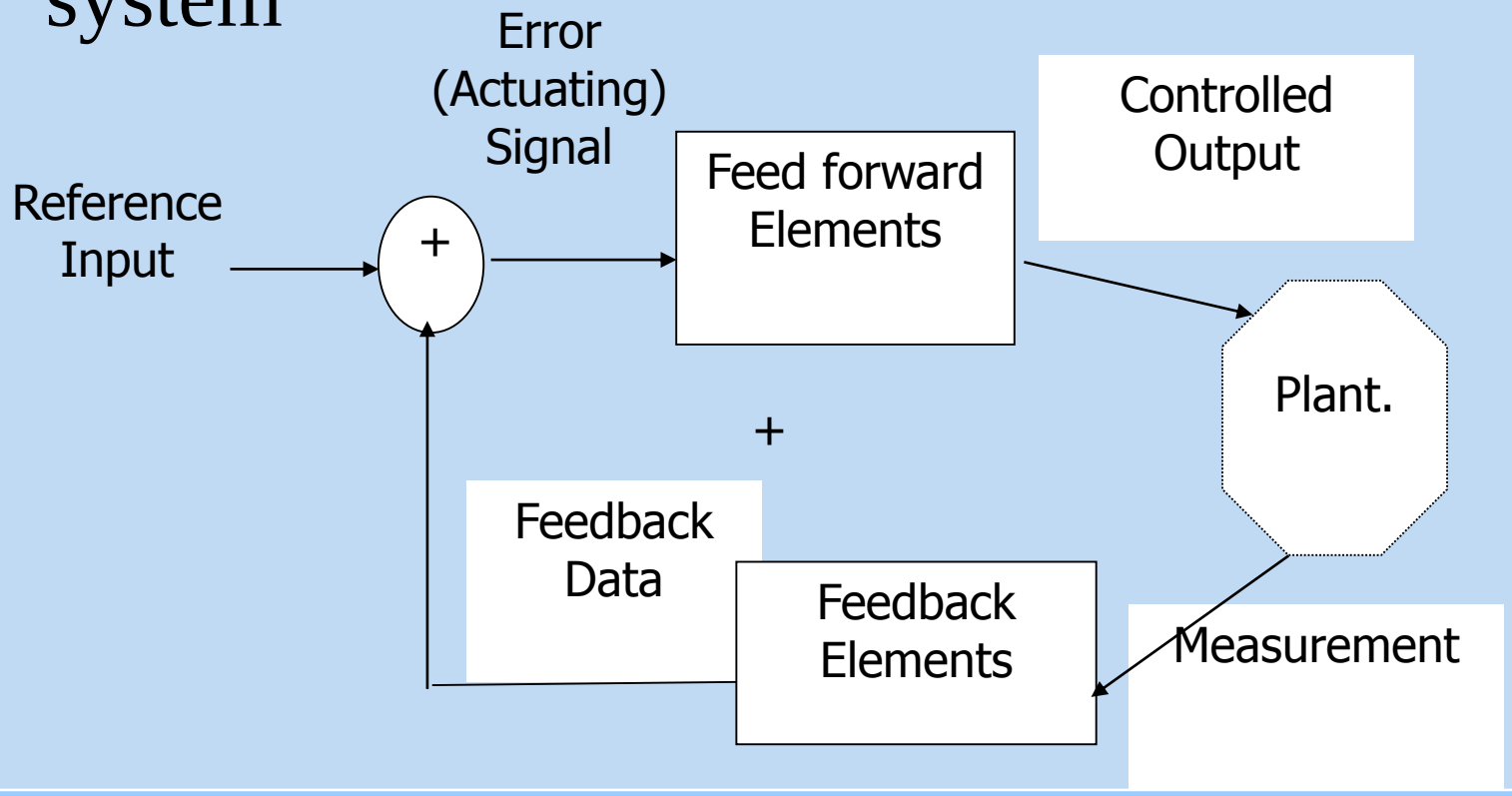
# Construct Pattern-Level Models

- Create an instance for each selected pattern by describing the patterns and their constituents in an application specific context
- Define how these instances are related to each other
- The semantic of a dependency relationship used between patterns has a "*uses*" meaning

# The Feedback Control Example

**From Pattern-Oriented Analysis and Design,**
**Sherif M Yacoub and Hany H. Ammar Addison-Wesley Inc., 2004**

- Block diagram for a feedback control system



# The Feedback Control Example

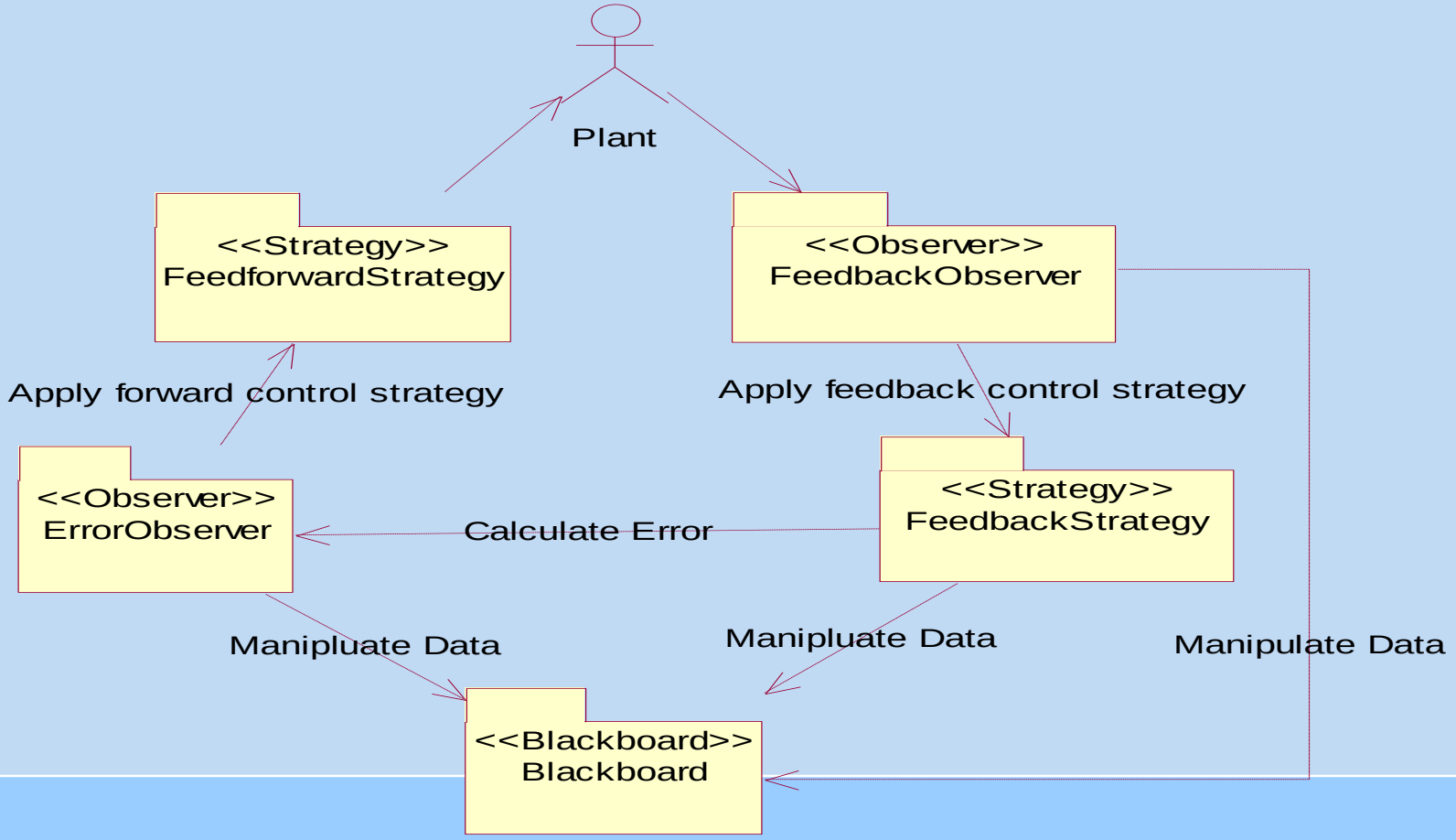
- POAD Analysis Phase (Pattern Selection)
  - The *feedforward* component implements some sort of a control strategy (instance of Strategy pattern)
  - The *feedback* component receives measurements and applies a feedback control strategy
  - In the *error calculation* component, the feedback controller notifies the error calculation unit with the feedback data (instances of the Observer pattern)
  - Data of different types need to be exchanged between the framework components (Measurement,

    Feedback Data, input data , and error data )

# The Feedback Control Example

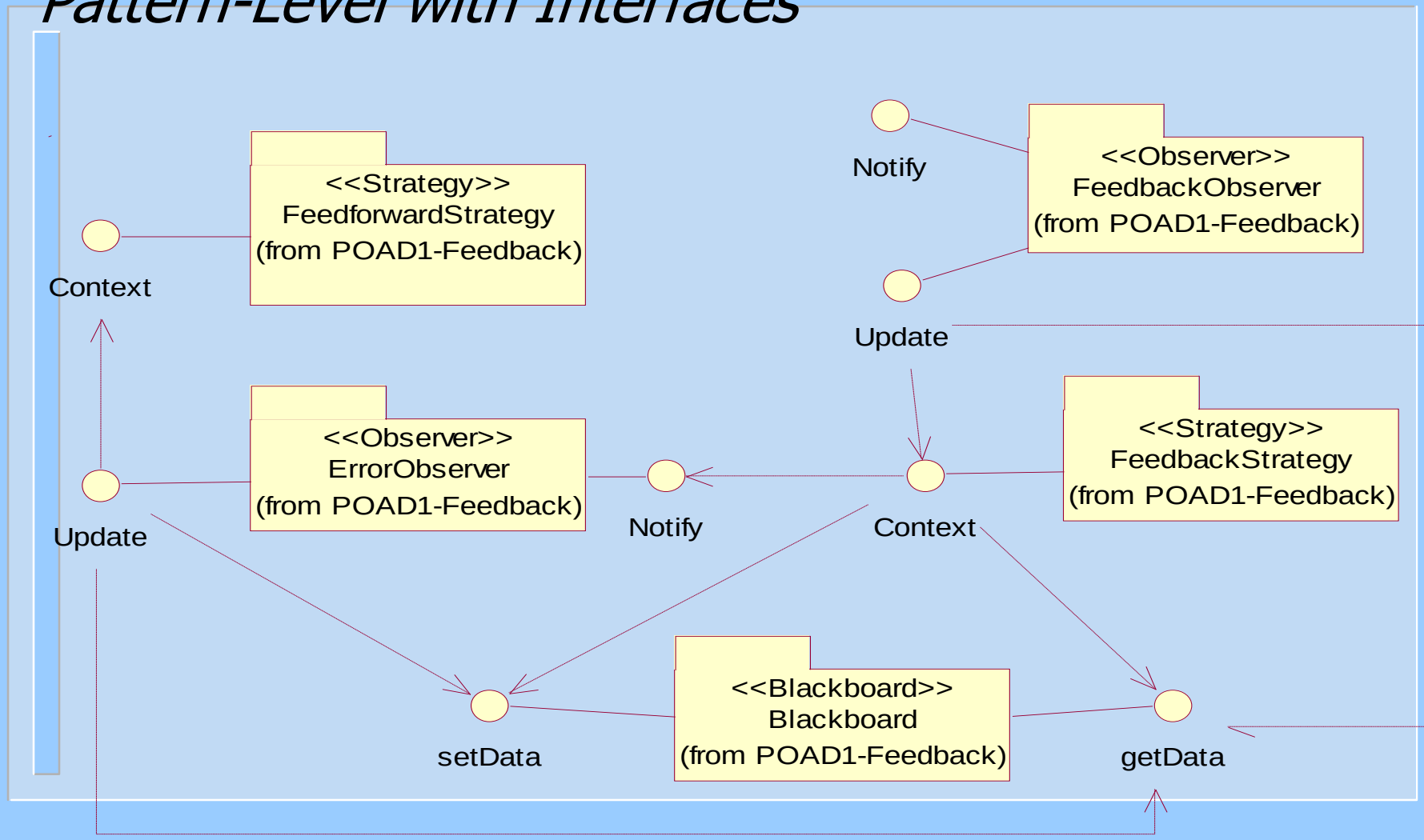
## *Pattern-Level* diagram for feedback control system

*This is an architectural pattern based on the data flow architectural style*



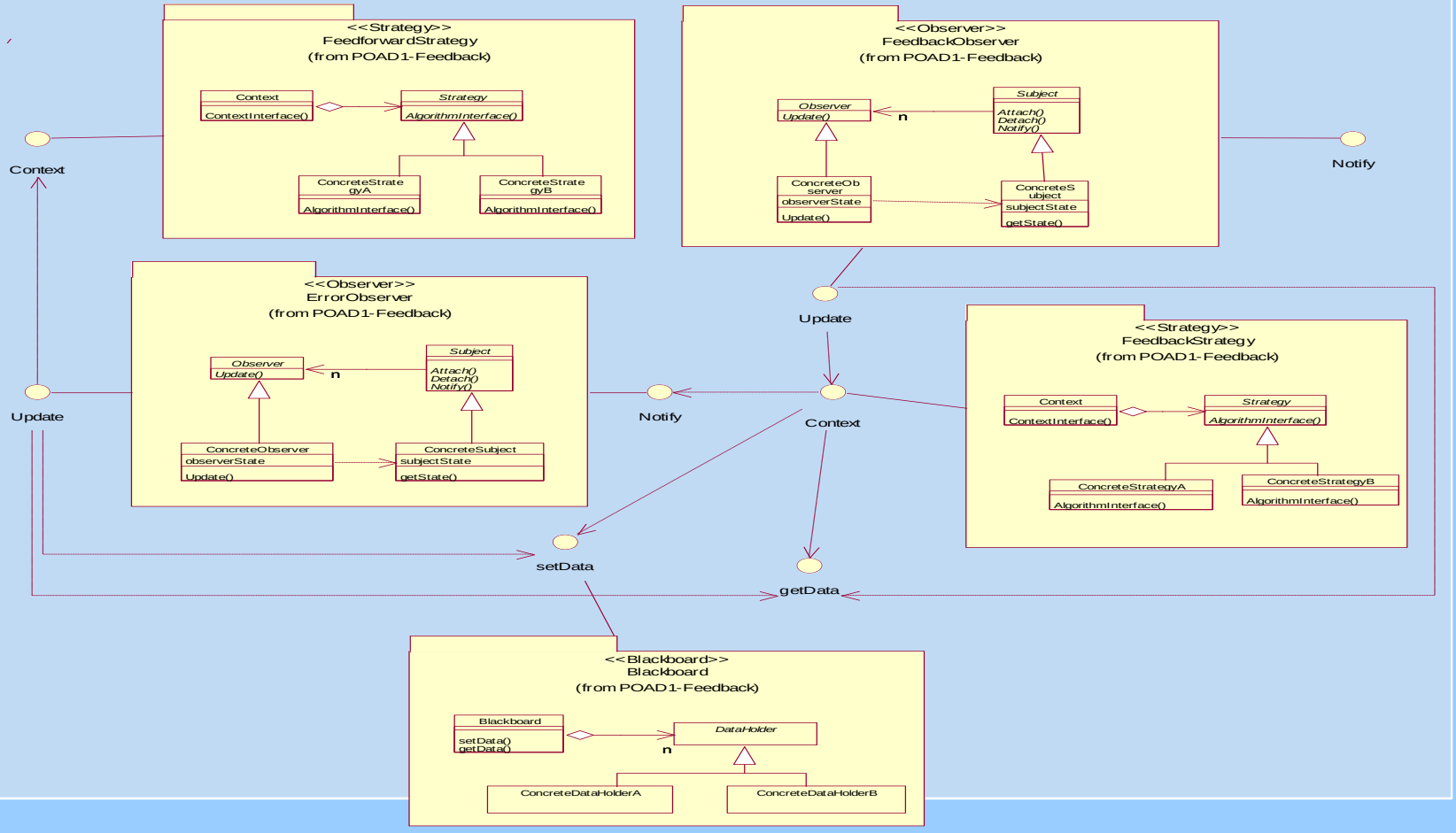
# The Feedback Control Example

*Pattern-Level with Interfaces*



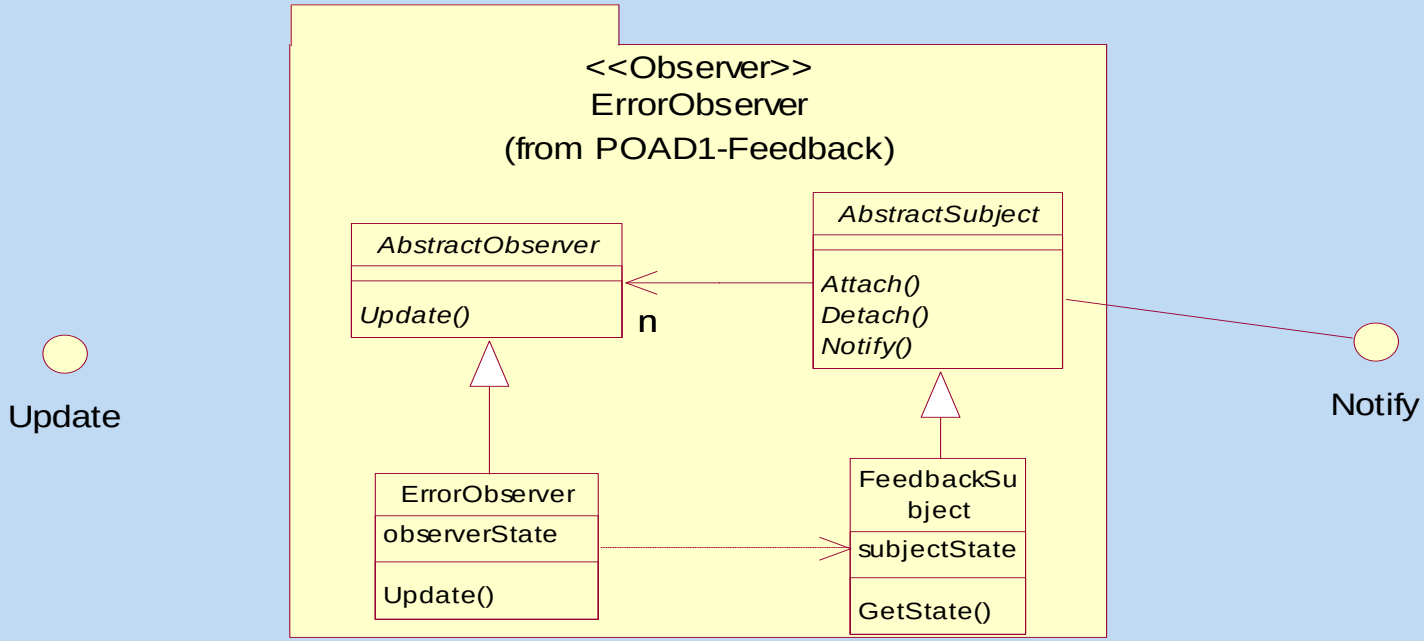
# The Feedback Control Example

## *Detailed Pattern-Level* diagram



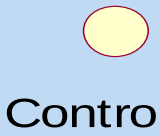
# The Feedback Control Example

## Instantiating the *ErrorObserver* pattern

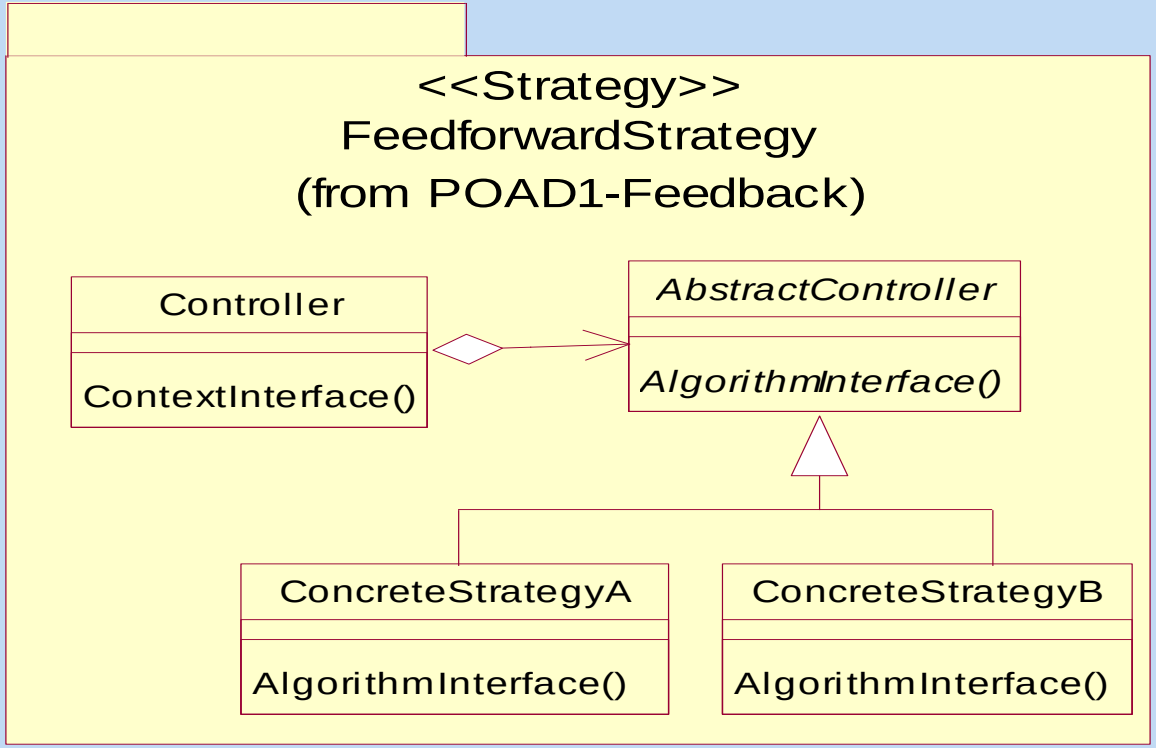


# The Feedback Control Example

## Instantiating the *FeedforwardStrategy* pattern

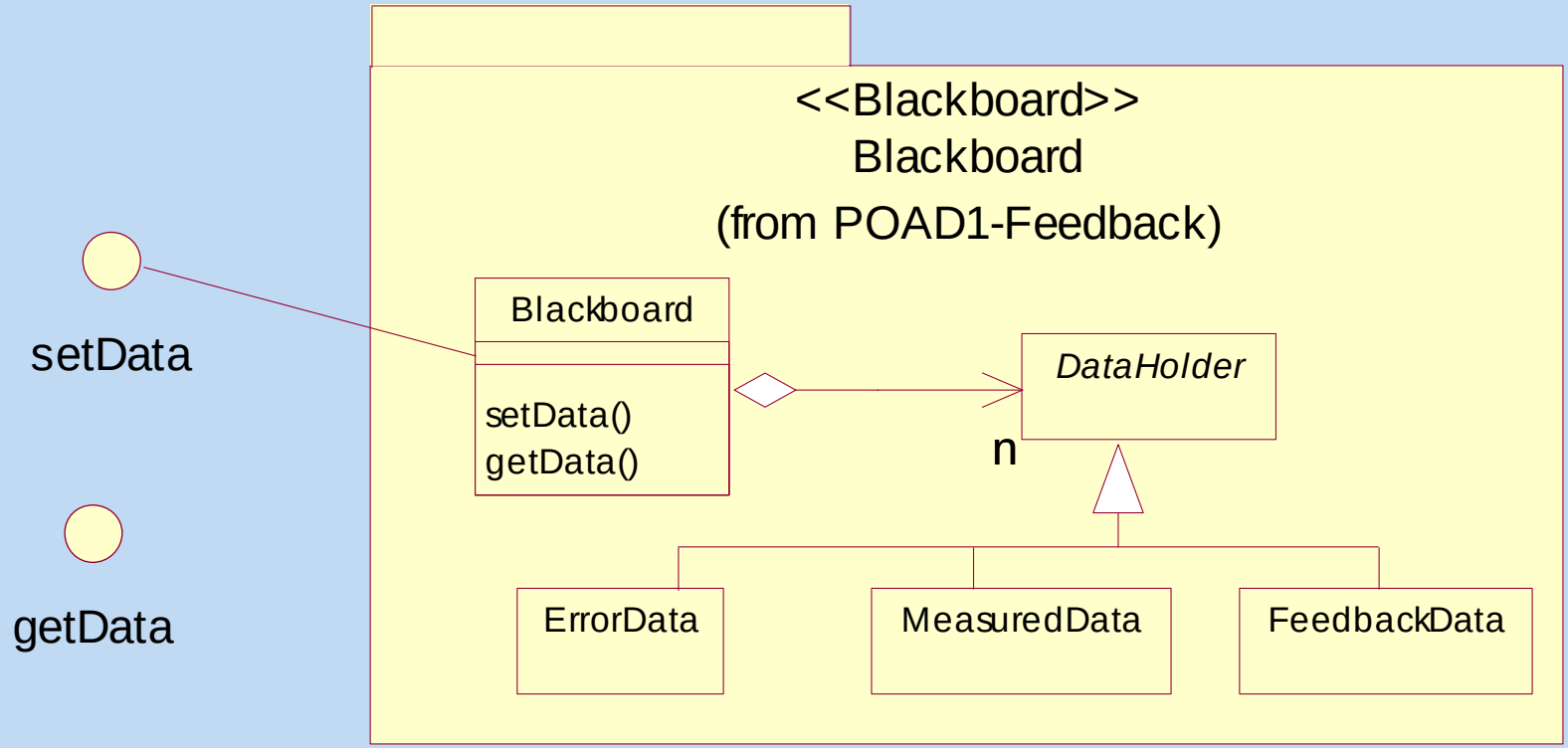


Controller



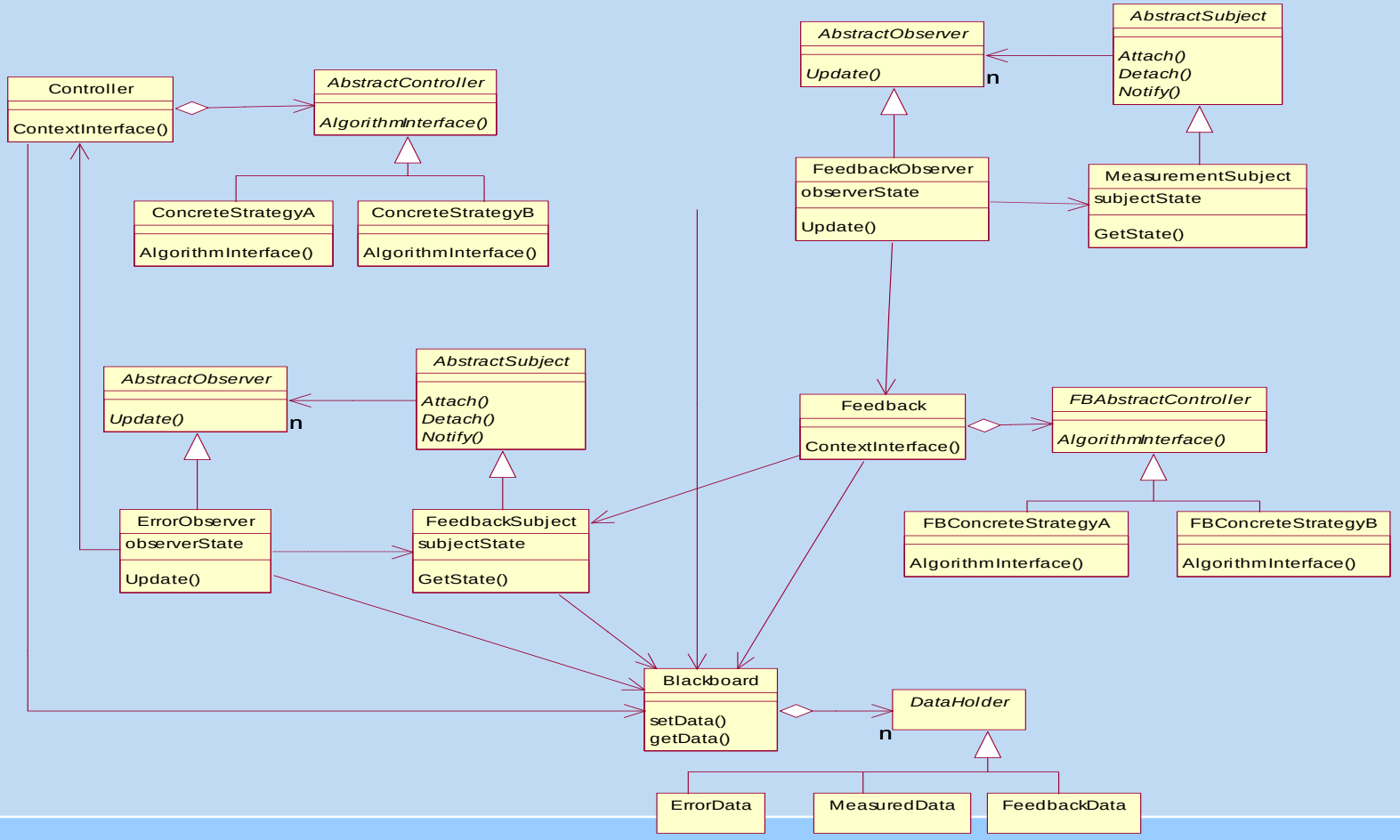
# The Feedback Control Example

## Instantiating the *Blackboard* pattern



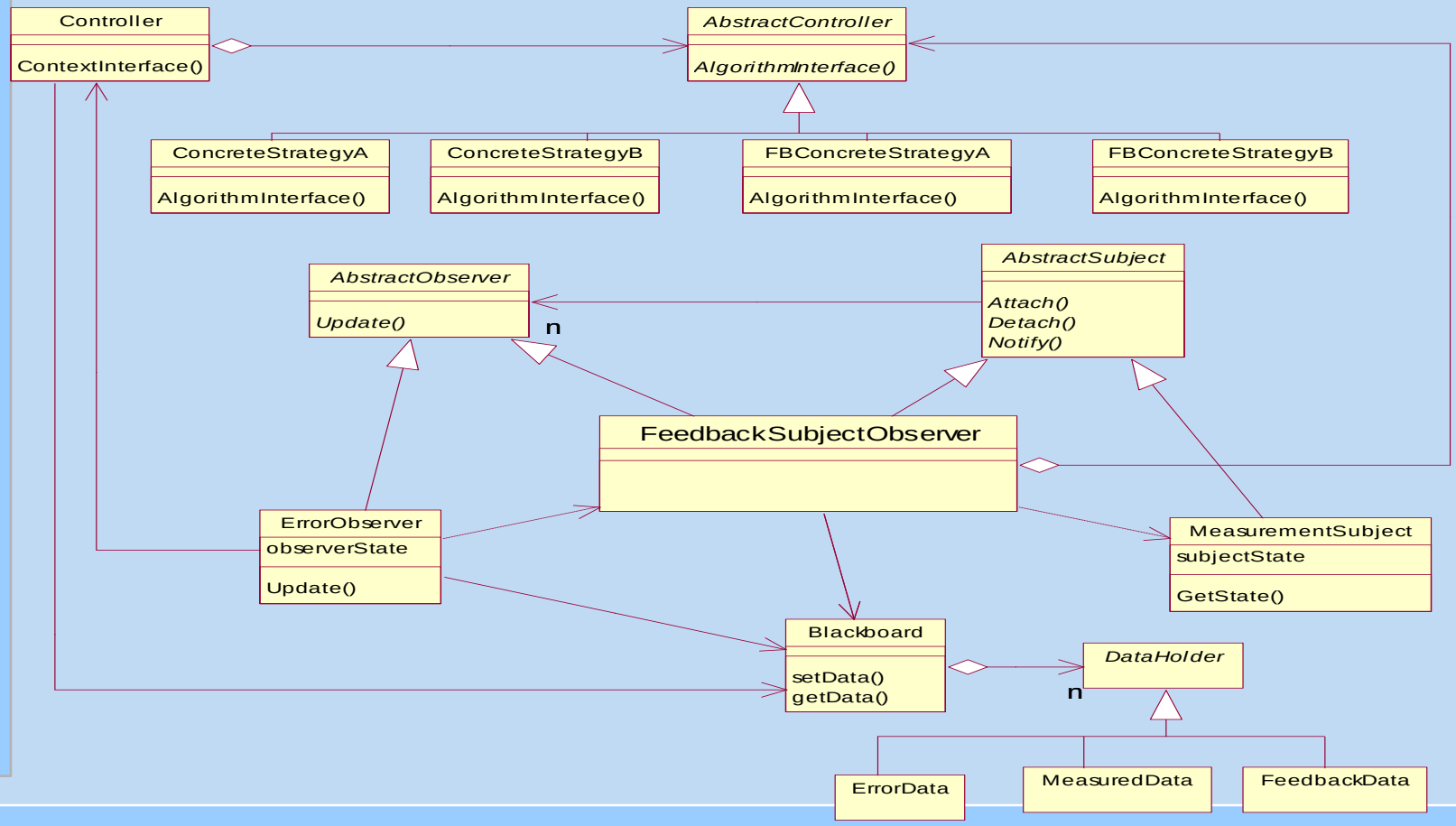
# The Feedback Control Example

## The initial class diagram



# The Feedback Control Example

## The refined class diagram ready for code generation



# The Feedback Control Example

- Object Collaboration Diagram