Design Defects and Restructuring

Lecture 12

Sat, Dec 11, 2021

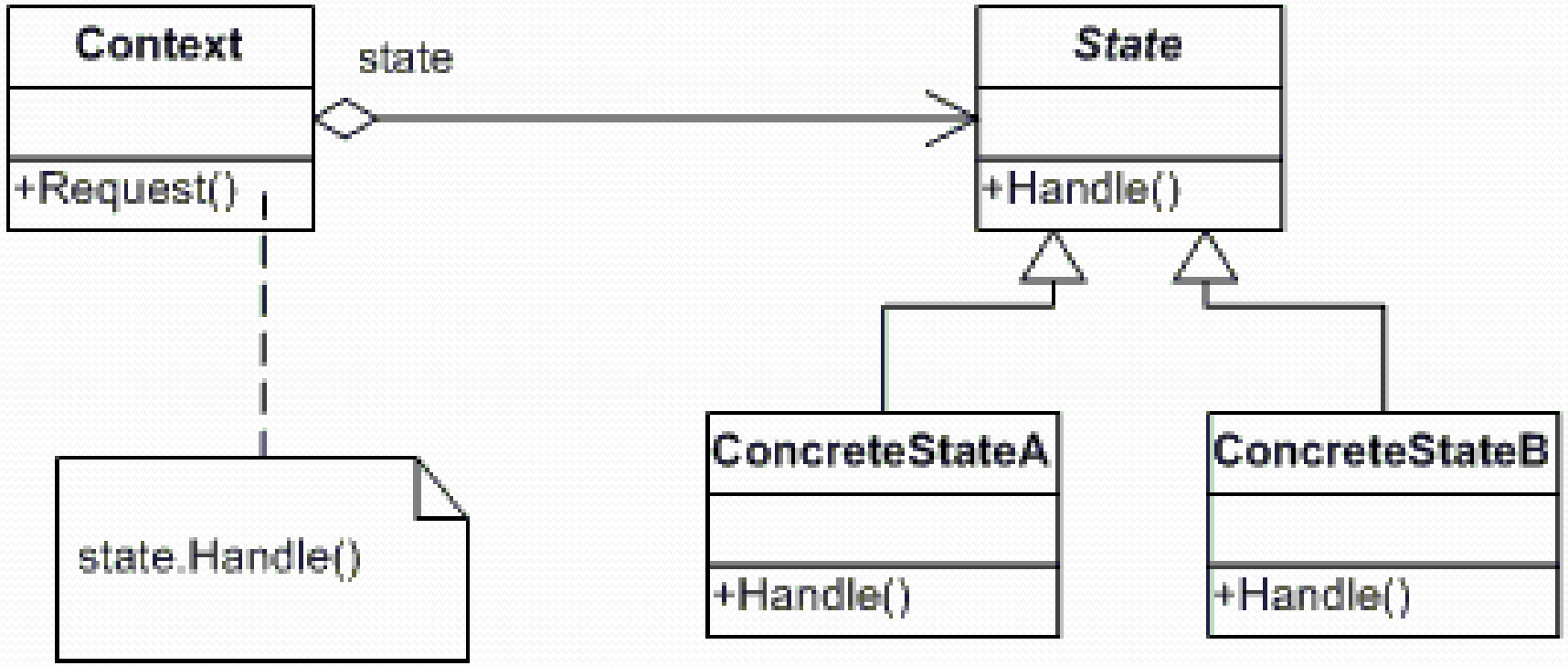
Behavioral Patterns

- Chain of Responsibility
- Command
- Interpreter
- Iterator
- Mediator
- Memento
- Observer
- State
- Strategy
- Template Method
- Visitor

State

- Intent
  - Allow an object to alter its behavior when its internal state changes
  - The object will appear to change its class
- Applicability
  - An object's behavior depends on its state, and it must change its behavior at run-time depending on that state
  - Operations have large, multipart conditional statements that depend on the object's state

State


Context
state
State
+Request()
+Handle()
state.Handle()
ConcreteStateA
+Handle()
ConcreteStateB
+Handle()

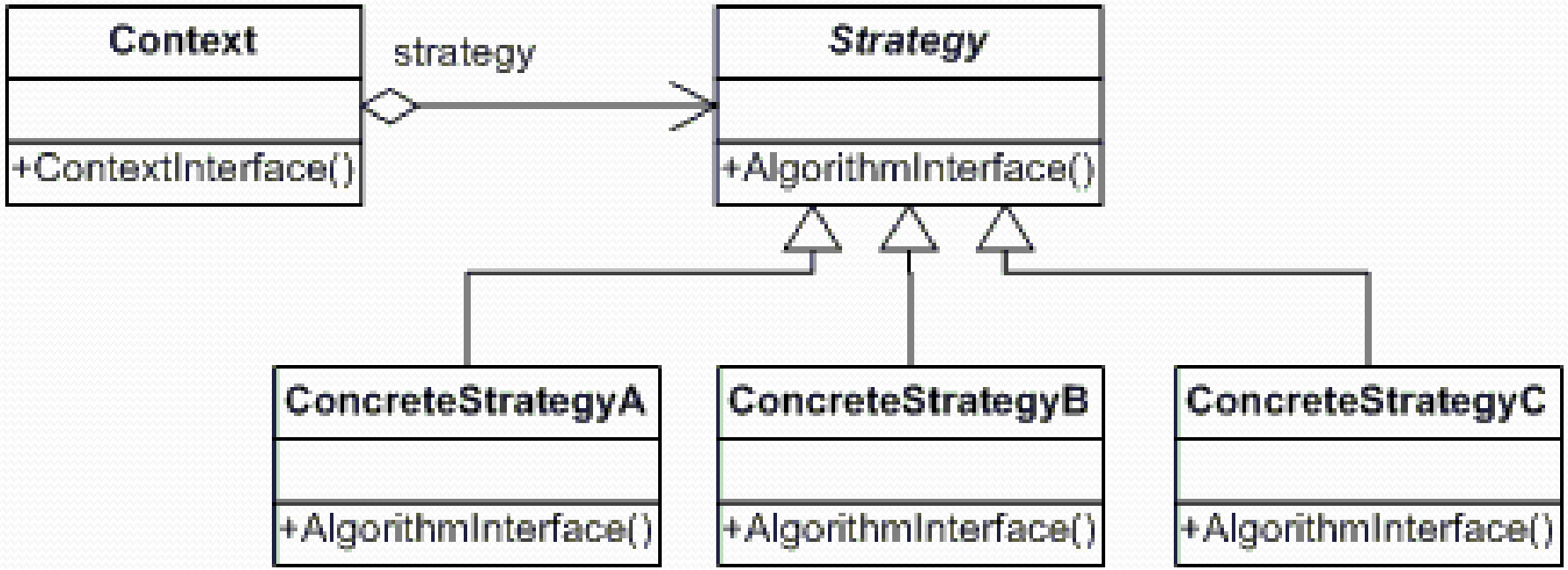
Strategy

- Intent
  - Define a family of algorithms, encapsulate each one, and make them interchangeable
  - Strategy lets the algorithm vary independently from clients that use it

Strategy

- Applicability
  - Many related classes differ only in their behavior
    - Strategies provide a way to configure a class with one of many behaviors
  - You need different variants of an algorithm
  - An algorithm uses data that clients should not know about
    - Use the Strategy pattern to avoid exposing complex, algorithm-specific data structures
  - A class defines many behaviors, and these appear as multiple conditional statements in its operations
    - Instead of many conditionals, move related conditional branches into their own Strategy class

Strategy


Context
strategy
Strategy
+ContextInterface()
+AlgorithmInterface()
ConcreteStrategyA
+AlgorithmInterface()
ConcreteStrategyB
+AlgorithmInterface()
ConcreteStrategyC
+AlgorithmInterface()

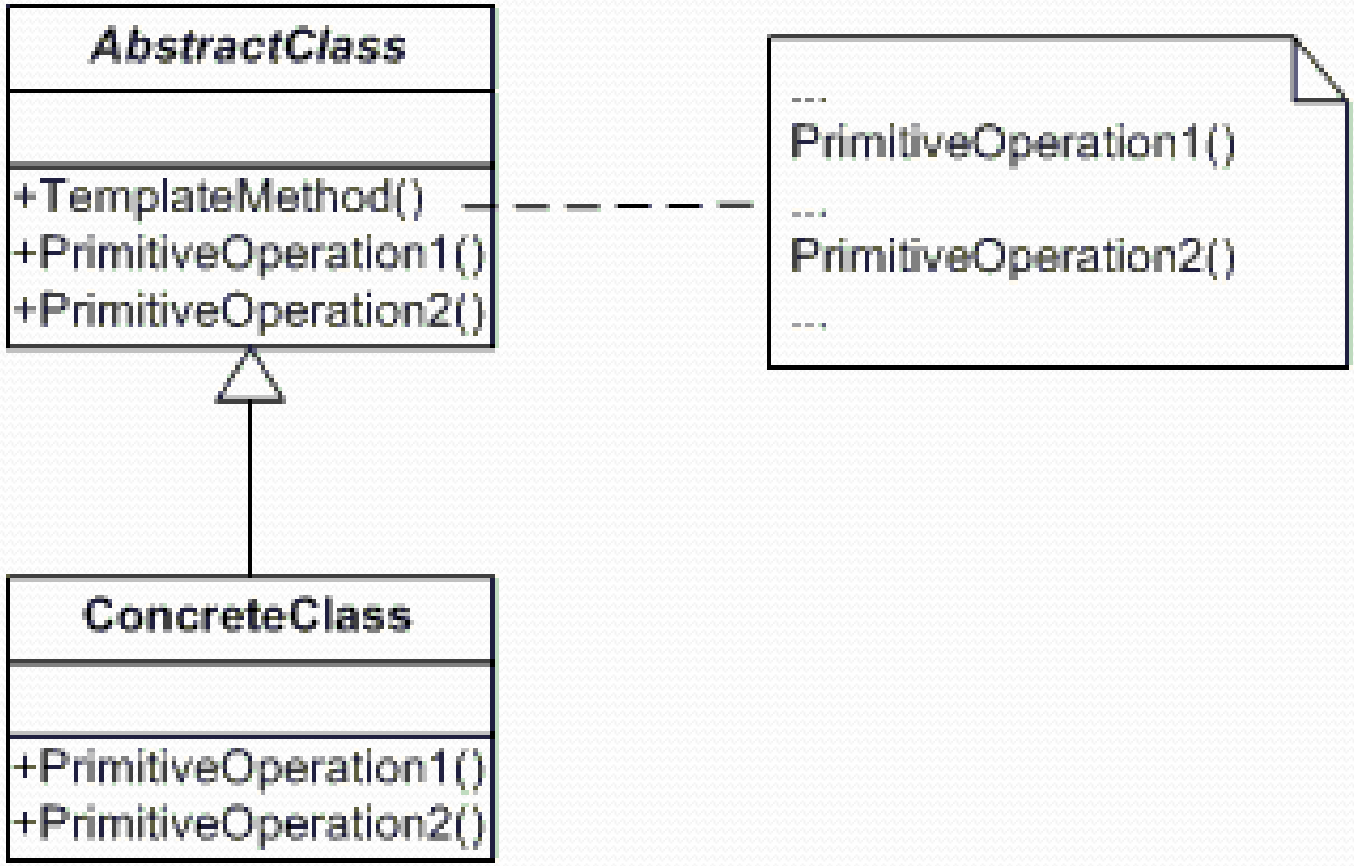
Template Method

- Intent
  - Define the skeleton of an algorithm in an operation, deferring some steps to subclasses
  - Template Method lets subclasses redefine certain steps of an algorithm without changing the algorithm's structure

Template Method

- Applicability
  - To implement the invariant parts of an algorithm once and leave it up to subclasses to implement the behavior that can vary
  - When common behavior among subclasses should be factored and localized in a common class to avoid code duplication
  - To control subclasses extensions
    - You can define a template method that calls “hook” operations at specific points, thereby permitting extensions only at those points

Template Method



Visitor

- Intent
  - Represent an operation to be performed on the elements of an object structure
  - It lets you define a new operation without changing the classes of the elements on which it operates

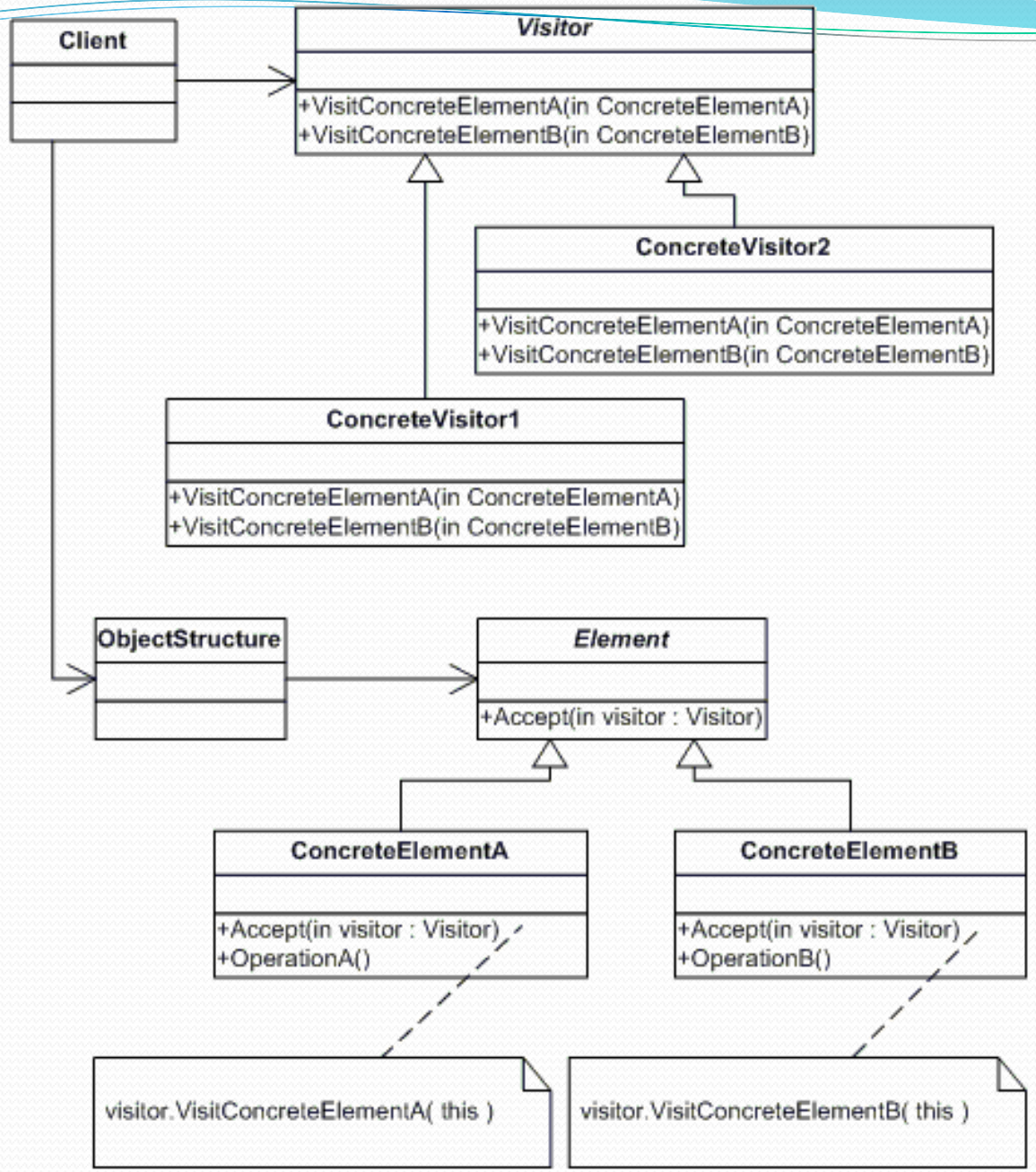
Visitor

- Applicability
  - An object structure contains many classes of objects with differing interfaces, and you want to perform operations on these objects that depend on their concrete classes
  - Many distinct and unrelated operations need to be performed on objects in an object structure, and you want to avoid “polluting” their classes with these operations
    - Visitor lets you keep related operations together by defining them in one class
    - When the object structure is shared by many applications, use Visitor to put operations in just those applications that need them

Visitor

- Applicability
  - The classes defining the object structure rarely change, but you often want to define new operations over the structure
    - Changing the object structure classes requires redefining the interface to all visitors, which is potentially costly
    - If the object structure classes change often, then it's probably better to define the operations in those classes

Visitor


Client
Visitor
+VisitConcreteElementA(in ConcreteElementA)
+VisitConcreteElementB(in ConcreteElementB)
ConcreteVisitor2
+VisitConcreteElementA(in ConcreteElementA)
+VisitConcreteElementB(in ConcreteElementB)
ConcreteVisitor1
+VisitConcreteElementA(in ConcreteElementA)
+VisitConcreteElementB(in ConcreteElementB)
ObjectStructure
Element
+Accept(in visitor : Visitor)
ConcreteElementA
+Accept(in visitor : Visitor)
+OperationA()
ConcreteElementB
+Accept(in visitor : Visitor)
+OperationB()
visitor.VisitConcreteElementA(this)
visitor.VisitConcreteElementB(this)

Design Patterns (Revisited)

- Construction Patterns
  - Abstract Factory
    - Provide for the creation of a family of related or dependent objects
  - Builder
    - Move the construction logic for an object outside the class to instantiate, typically to allow piecemeal construction or to simplify the object
  - Factory Method
    - Define an interface for creating an object while retaining control of which class to instantiate

Design Patterns (Revisited)

- Construction Patterns
  - Prototype
    - Provide new objects by copying an example
  - Memento
    - Provide for the storage and restoration of an object's state

Design Patterns (Revisited)

- Interface Patterns
  - Adapter
    - Provide the interface that a client expects, using the services of a class with a different interface
  - Façade
    - Provide an interface that makes a subsystem easy to use
  - Composite
    - Allow clients to treat individual object and composition of objects uniformly
  - Bridge
    - Decouple a class that relies on abstract operations from the implementation of those abstract operations so that the class and the implementation can vary independently

Design Patterns (Revisited)

- Extension Patterns
  - Decorator
    - Let the developer compose an object's behavior dynamically
  - Iterator
    - Provide a way to access the elements of a collection sequentially
  - Visitor
    - Let the developer define a new operation for a hierarchy without changing the hierarchy classes

Design Patterns (Revisited)

- Responsibility Patterns
  - Singleton
    - Ensure that a class has only one instance, and provide a global point of access to it
  - Observer
    - Define a one to many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically
  - Mediator
    - Define an object that encapsulates the way that a set of objects interact. This keeps the object from referring to each other explicitly and let you vary their interaction independently

Design Patterns (Revisited)

- Responsibility Patterns
  - Proxy
    - Provide a placeholder for another object to control access to it
  - Chain of Responsibility
    - Avoid coupling the sender of request to its receiver, by giving more than one object chance to handle the request
  - Flyweight
    - Use sharing to support large numbers of fine grained objects efficiently

Design Patterns (Revisited)

- Operational Patterns
  - Template Method
    - Implement an algorithm in a method, deferring the definition of some steps of the algorithm so that the other classes can supply them
  - State
    - Distribute state specific logic across classes that represent an object's state
  - Strategy
    - Encapsulate alternative strategies, or approaches, in separate classes that each implement a common operation

Design Patterns (Revisited)

- Operational Patterns
  - Command
    - Encapsulate a request as an object, so that you can parameterize clients with different requests; queue, time or log requests; and allow a client to prepare a special context in which to invoke the request
  - Interpreter
    - Let developers compose executable objects according to set of composition rules that you define