Pattern: Iterator

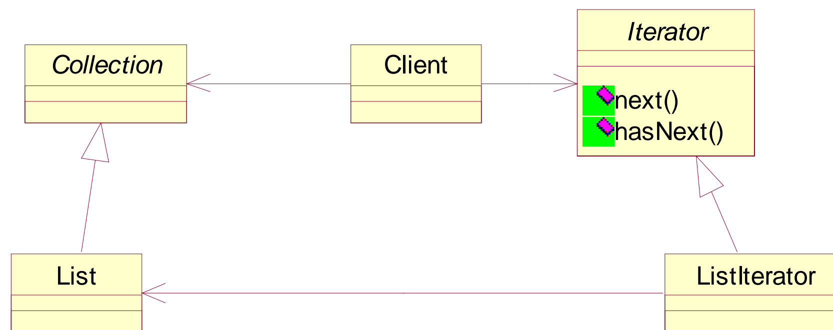
- Purpose:
  - allow sequential access to the elements of a collection
  - do not show internal implementation of the collection
- Example:
  - java.util.Iterator
  - provides access to hashtables, lists, sets…
    - all implement Collection interface
  - typically used in "for" loops

```
for( Iterator i = collection. iterator(); i. hasNext(); ) {
    System. out. println( i. next(). toString() );
}
```

  - new Java 1.5 syntax:

```
for( Object o: collection ) {
    System. out. println( o. toString() );
}
```

Iterator: Sample Class Diagram



Iterator

- Use Iterator when...
  - you have collection classes
  - even though not all of them are sequential (e.g. Set), you want to be able to get the elements sequentially
    - typically, for loops
  - you don't care about the exact type of each collection
  - you don't need random access
- Disadvantages
  - no random access
  - overhead
- Advantages
  - changing the exact type of a collection does not break the code using it
  - writing loops becomes simpler: programmer does not need to know all the details about the collection
- Widely used in class libraries

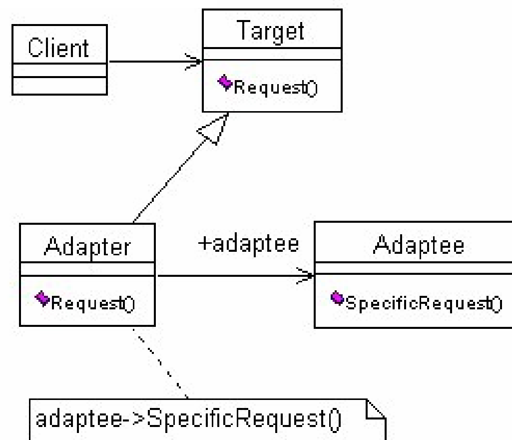
Design Pattern: State

- Goal
  - allow an object to change its behavior when its state changes
- Example
  - class TCPConnection: has one attribute of type TCPState
  - abstract class TCPState: the state of a TCP connection
  - subclasses:
    - TCPEstablished
    - TCPListening
    - TCPClosed
  - operations in all four classes:
    - open()
    - close()
    - acknowledge()

Design Pattern: Adapter / Wrapper

- Convert the interface of one class into another one that is expected by a client
- Structural, object-based pattern
- Useful for adapting
  - legacy code
  - code from libraries
  - classes that are used in different contexts
- Advantage
  - allows reuse of existing class without changing it
- Disadvantage
  - one more class

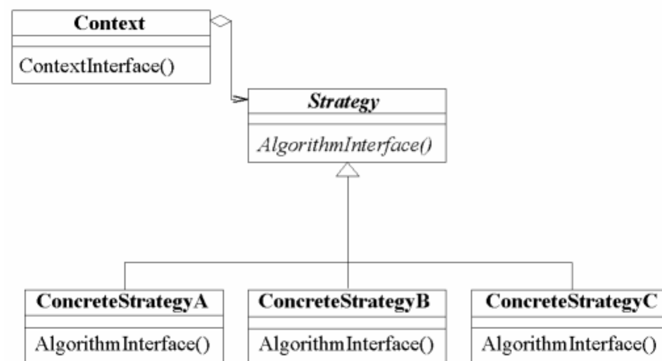
Adapter: Structure



Strategy Pattern

- Intent:
  - Define a family of algorithms
  - make them exchangeable
- It often depends on the situation, which algorithm is best
  - algorithm a: better for sorting numbers
  - algorithm b: better for sorting addresses
- Usable
  - when you need several algorithms
  - that all fulfill the same task

Strategy Pattern



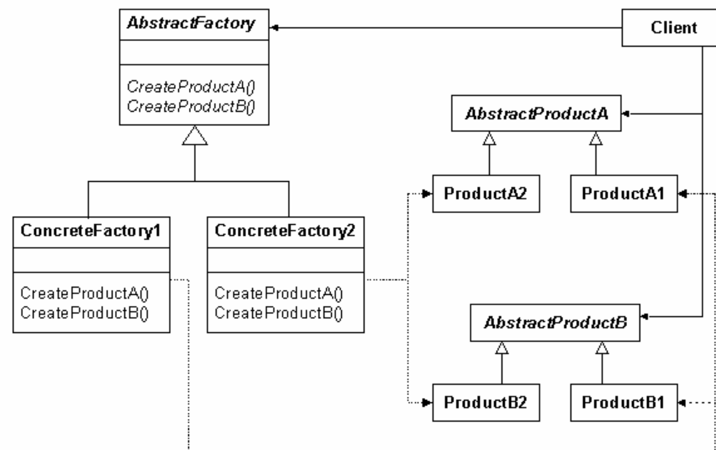
Strategy Pattern

- Advantages:
  - Better than subclassing the Context class itself
    - algorithms can be used by other Contexts too
    - Context may already have other subclasses
  - Reusability
  - Active choice between algorithms
    - clients can decide which they prefer
- Disadvantages:
  - clients need to understand tradeoffs between algorithms
  - increased number of objects
    - may be reduced by making Strategy objects stateless
    - can be shared

Abstract Factory Pattern

- Intent:
  - enables creation of a family of similar objects
  - without giving out their concrete classes
- Motivating example:
  - Gui library
  - runs on MS Windows, Motif, and Mac OS
  - how to create widgets?
  - bad solution:
    - have "new MacOSButton()", "new MacOSScrollBar" all over the code
    - most of the code should be independent from OS!

Abstract Factory Pattern



Abstract Factory Pattern

- Advantages:
  - concrete classes are encapsulated
    - clients do not need to know them
  - object families can be easily exchanged
    - change from MS Windows 98 to MS Windows XP
  - objects are guaranteed to be consistent
    - can't happen that clients accidentally mix MS and Mac widgets
- Disadvantage:
  - if a new class is added to the family of objects, all AbstractFactory subclasses must be updated