Applying Some More Gang of Four Design Patterns

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Gang of Four Patterns

Behavioral

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

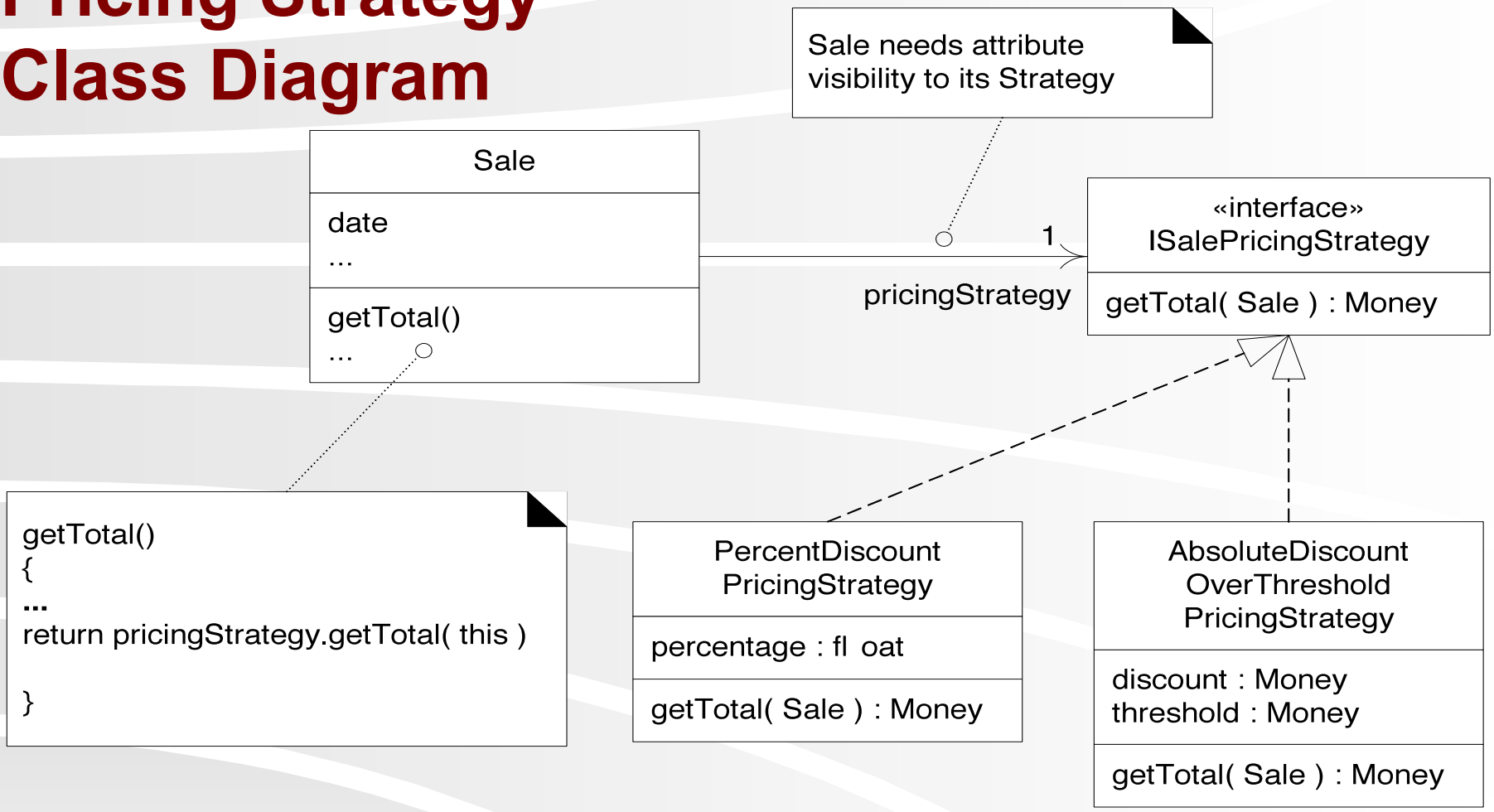
Creational

- *Factory Method*
- ✓ Abstract Factory
- Builder
- Prototype
- ✓ Singleton

Structural

- ✓ *Adapter*
- Bridge
- ✓ Composite
- Decorator
- ✓ Façade
- Flyweight
- Proxy

Pricing Strategy Class Diagram

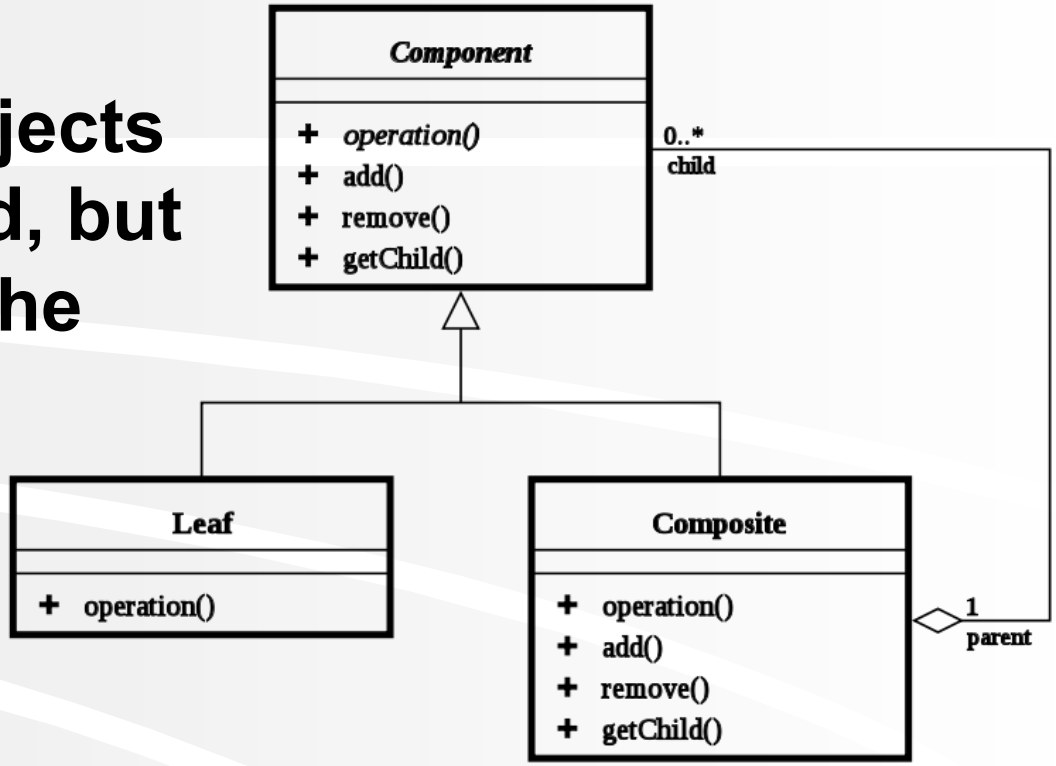


But, how do we handle multiple, conflicting pricing policies?

- **20% senior discount**
- **Preferred customer discount, 15% off sales of $400**
- **Buy 1 case of Darjeeling tea, get 15% off entire order**
- **Manic Monday, $50 off purchases over $500**

Composite

- **Problem**: How do we handle a group of objects that can be combined, but should still support the same polymorphic methods as any individual object in the group?

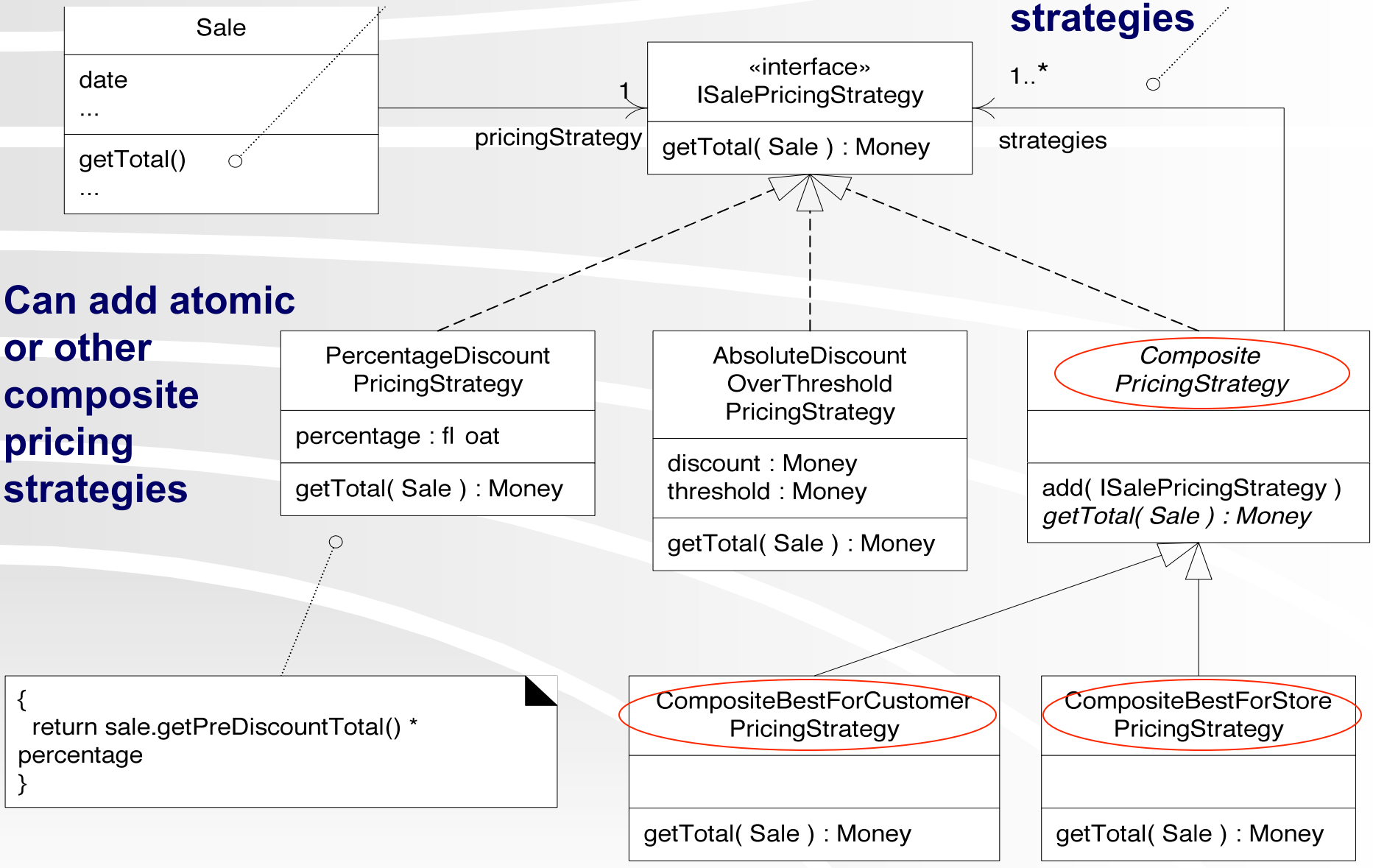


- **Solution**: Define a *composite* object that implements the same interface as the individual objects.

Q1,2

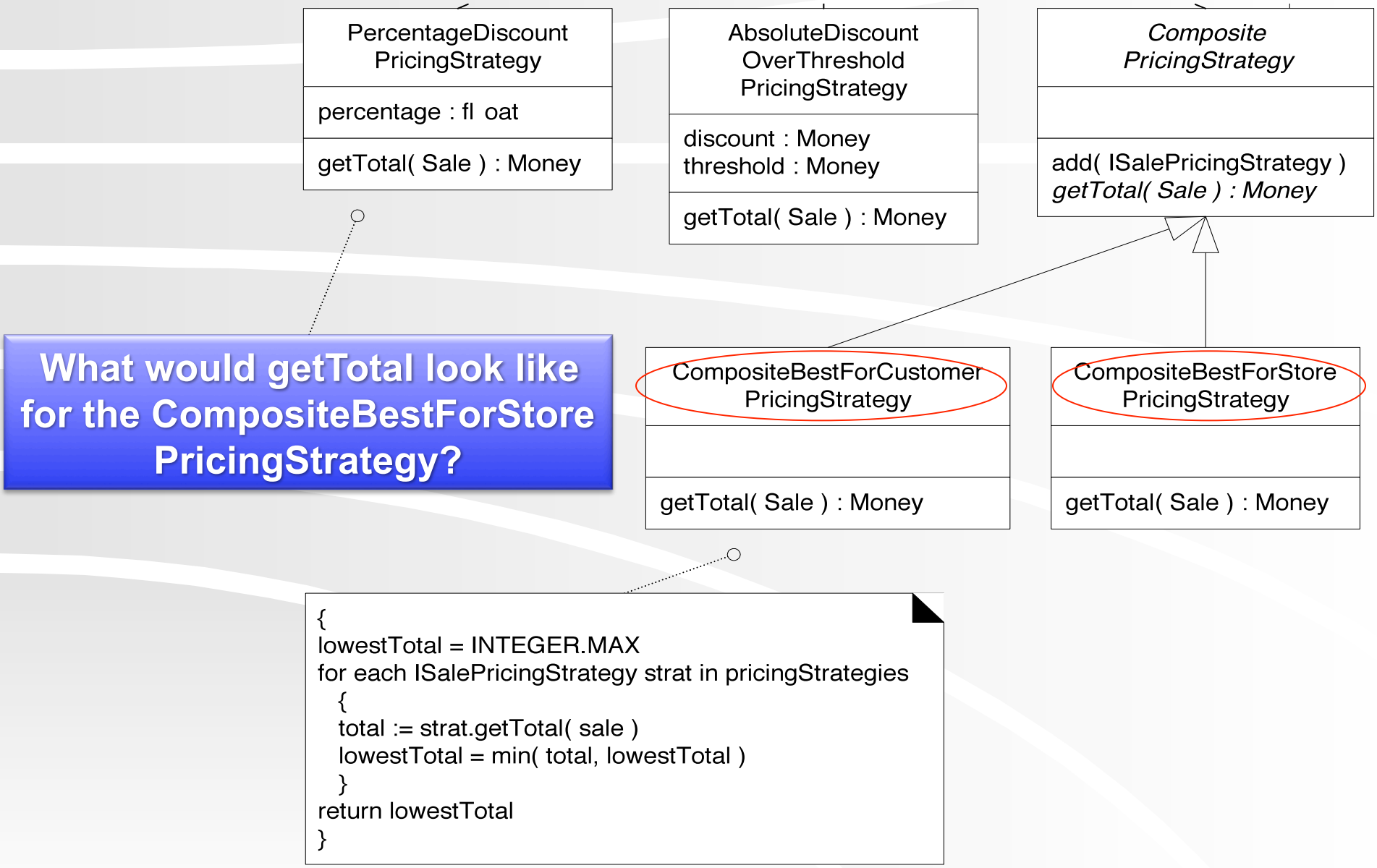
Composite Pricing Strategy

Composites have list of contained strategies

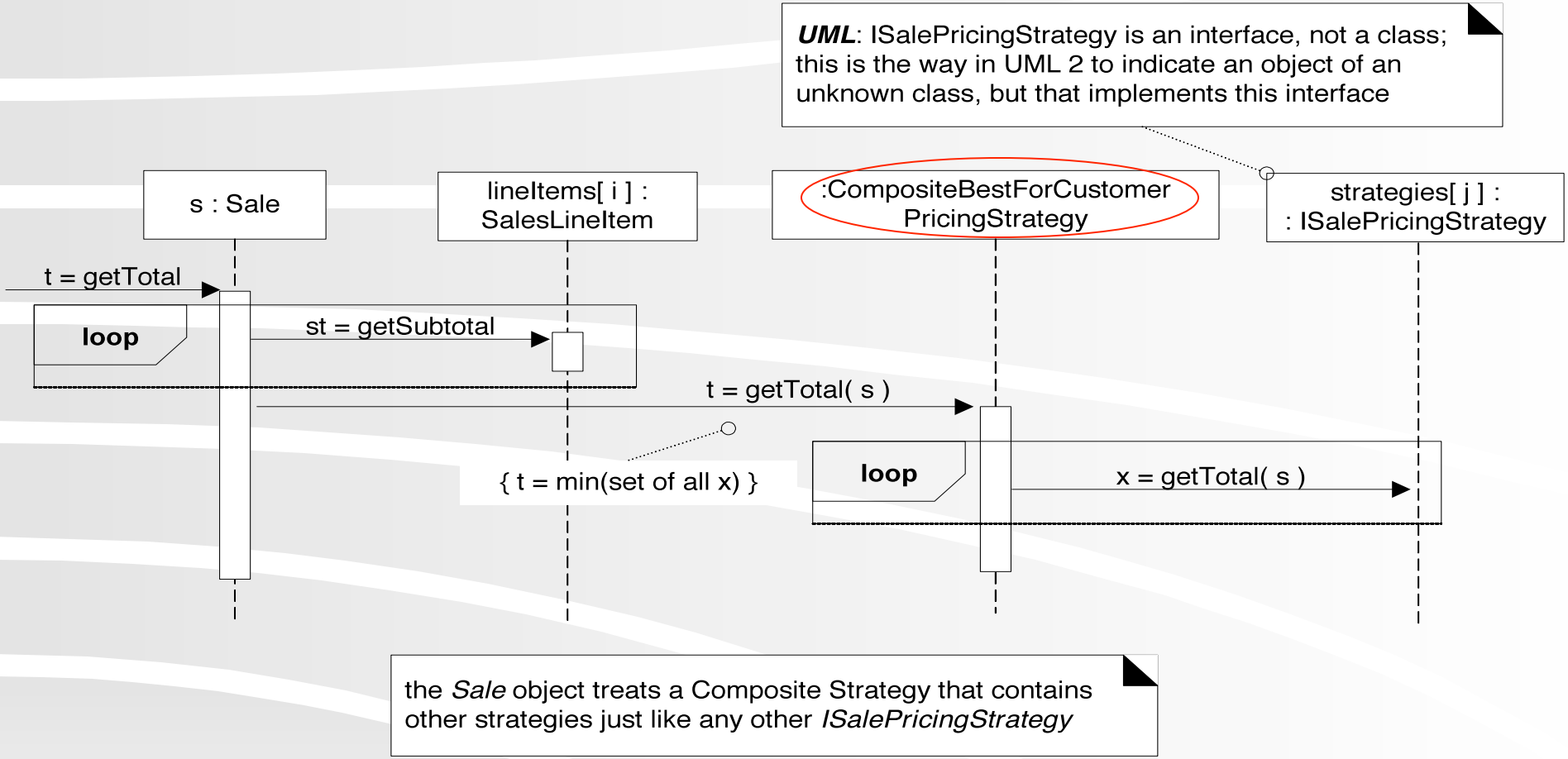


Can add atomic or other composite pricing strategies

Composite Pricing Strategy (continued)



Composite Sequence Diagram



Composite object iterates over its collection of atomic strategy objects

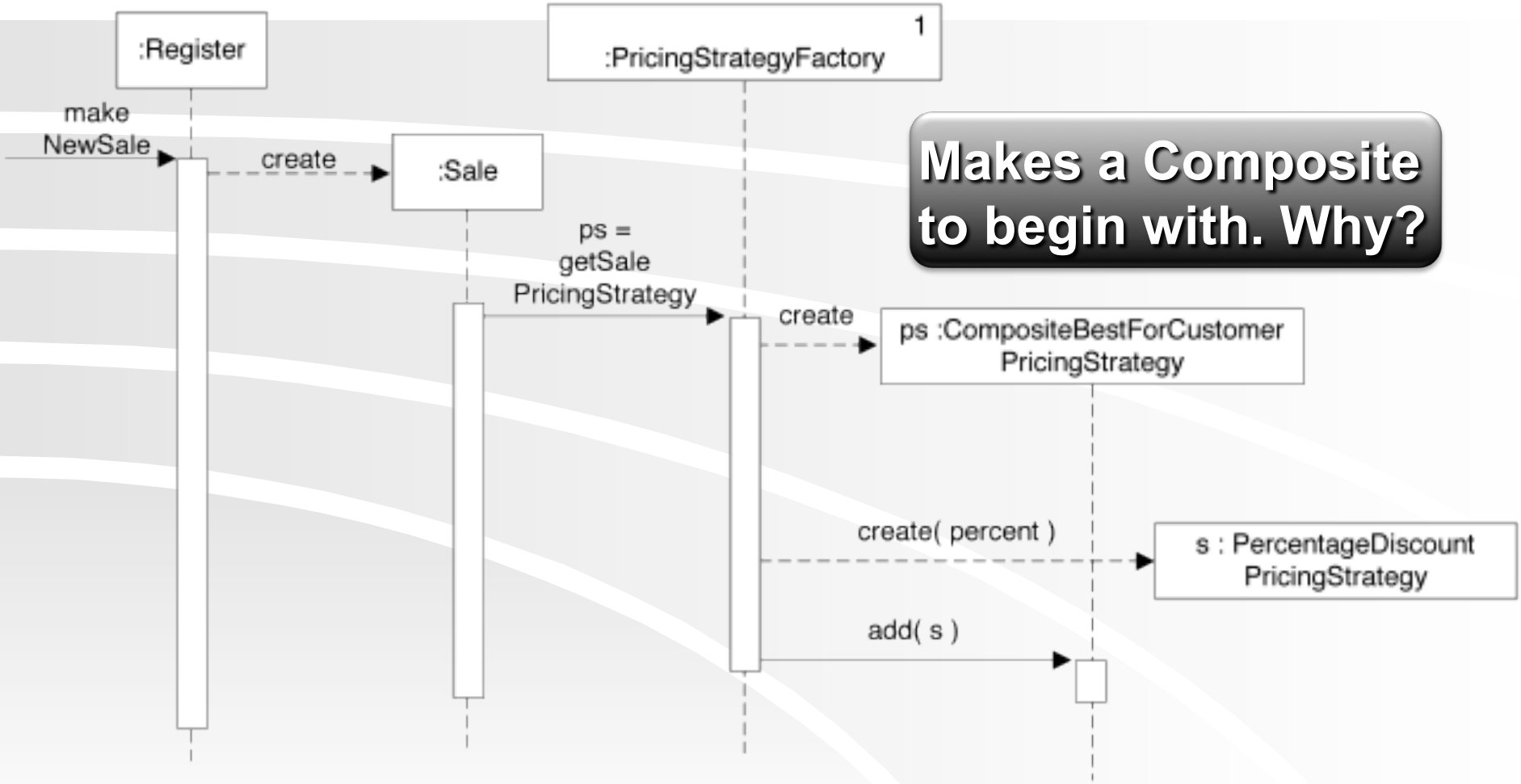
How do we build the Composite Strategy?

- Three places in example where new pricing strategies can be added:

1. When new sale is created, add store discount policy
2. When customer is identified, add customer-specific policy
3. When a product is added to the sale, add product-specific policy

1. Adding Store Discount Policy

Singleton, Factory



Makes a Composite to begin with. Why?

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2. Adding Customer Specific Discount Policy

New system operation from alternative use case flow

Recall: What's a ref frame?

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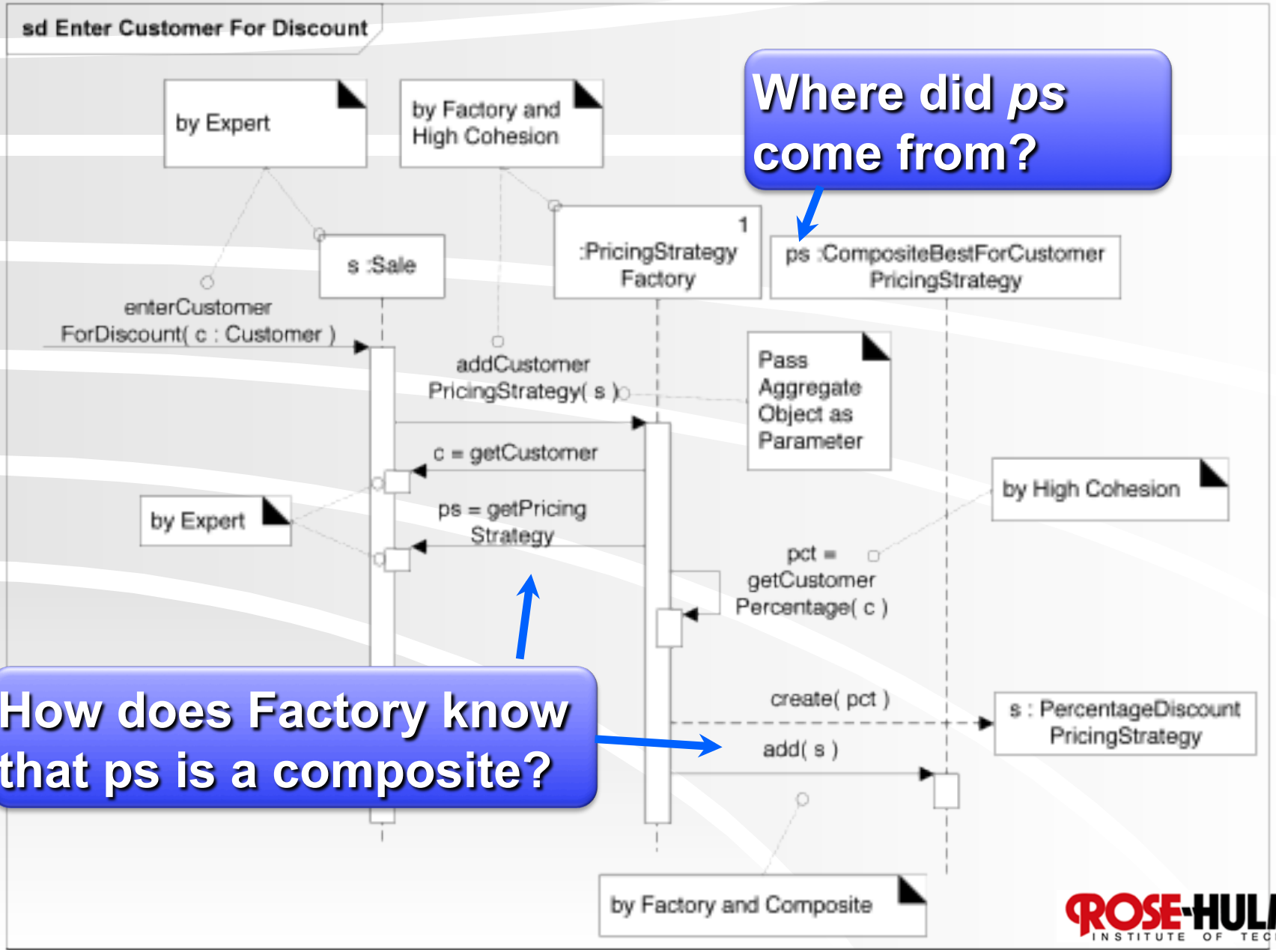
2. Adding Customer Specific Discount Policy (continued)



Applying Composite

Working with your project team, **identify a situation** in your project **where Composite might be applicable**. If no such situation exists, try to come up with an extension to your system that might use Composite.

Façade

More general than just Façade Controllers

- NextGen POS needs *pluggable business rules*
- Assume rules will be able to disallow certain actions, such as…
  - Purchases with gift certificates must include just one item
  - Change returned on gift certificate purchase must be as another gift certificate
  - Allow charitable donation purchases, but max. of $250 and only with manager logged-in

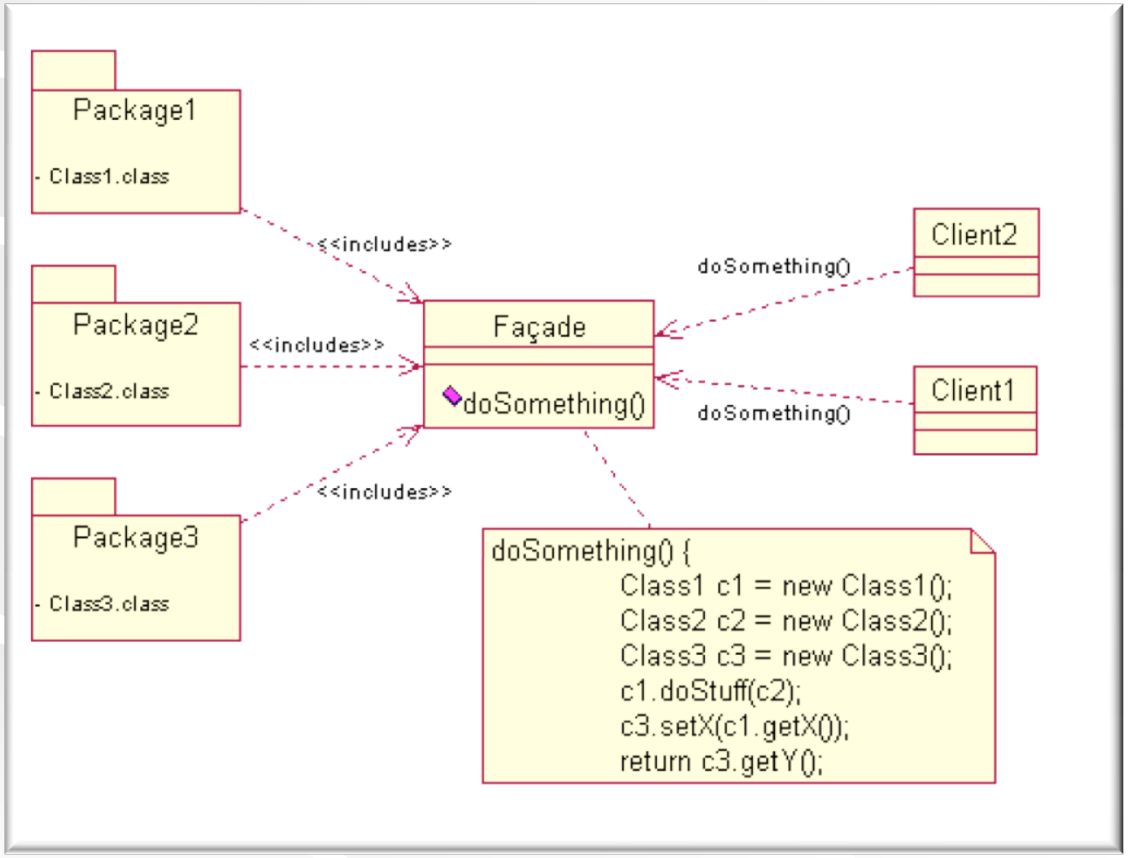
Some Conceivable Implementations

- Strategy pattern
- Open-source rule interpreter
- Commercial business rule engine

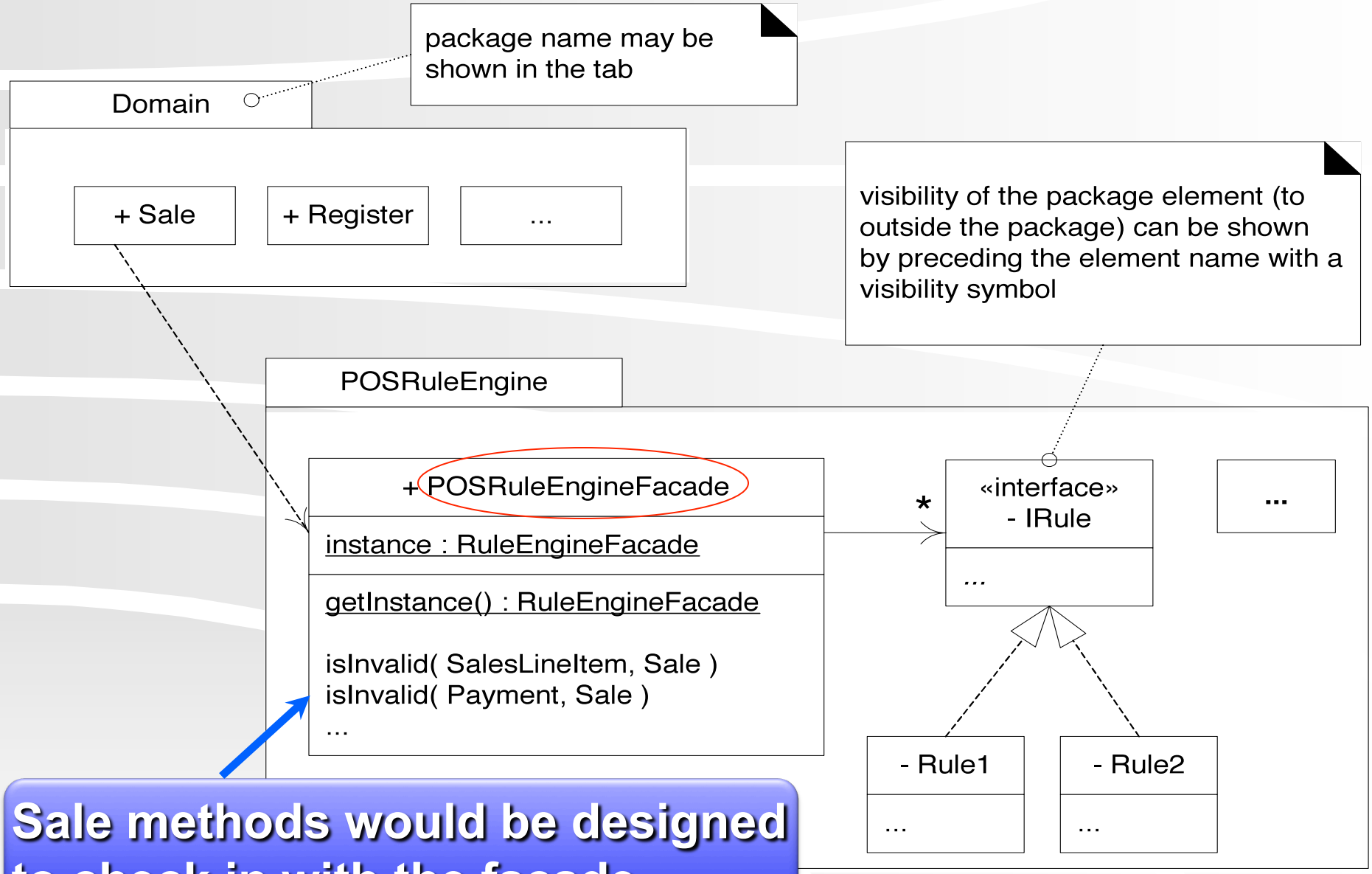
Façade

- **Problem**: How do we avoid coupling to a part of the system whose design is subject to substantial change?

- **Solution**: Define a *single point of contact* to the variable part of the system—a *façade object* that wraps the subsystem.



Façade Example



Sale methods would be designed to check in with the façade

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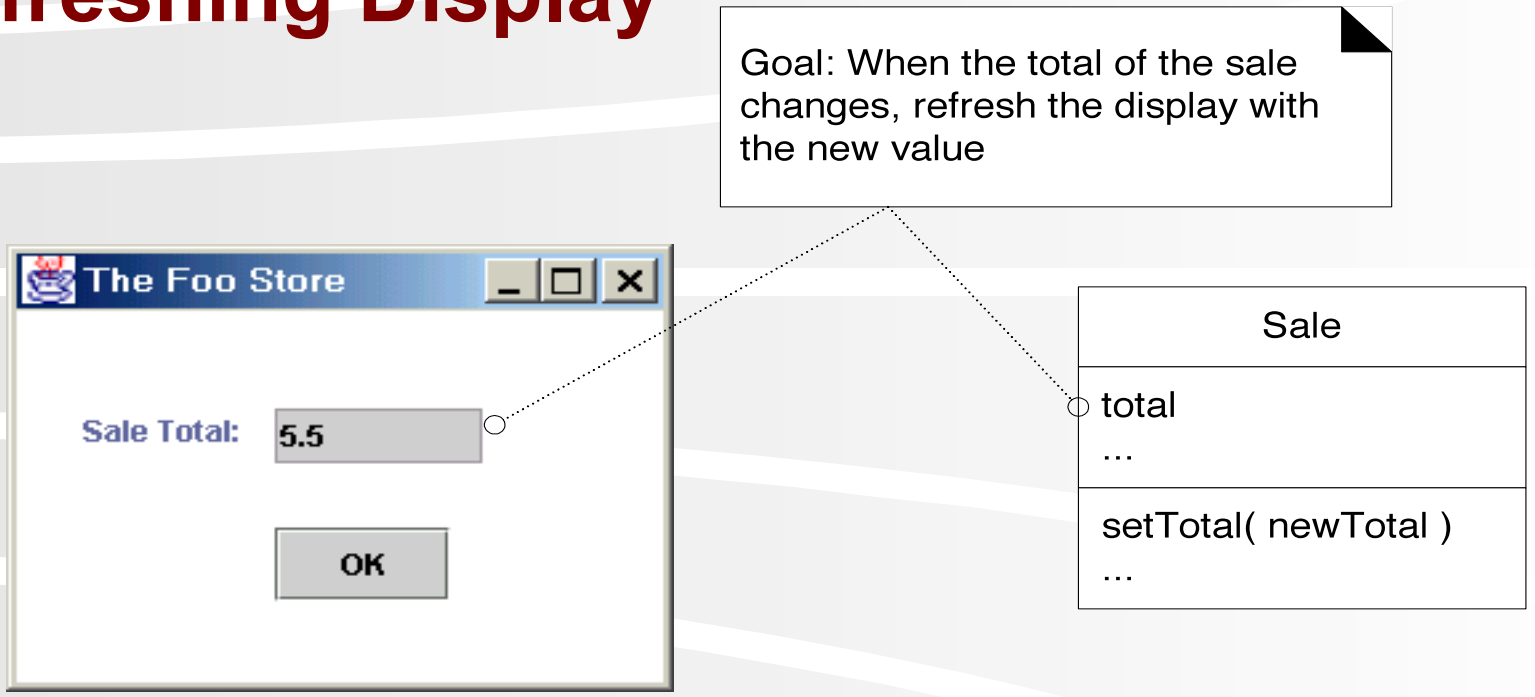
Refreshing Display



How do we refresh the GUI display when the domain layer changes *without coupling the domain layer back to the UI layer*?

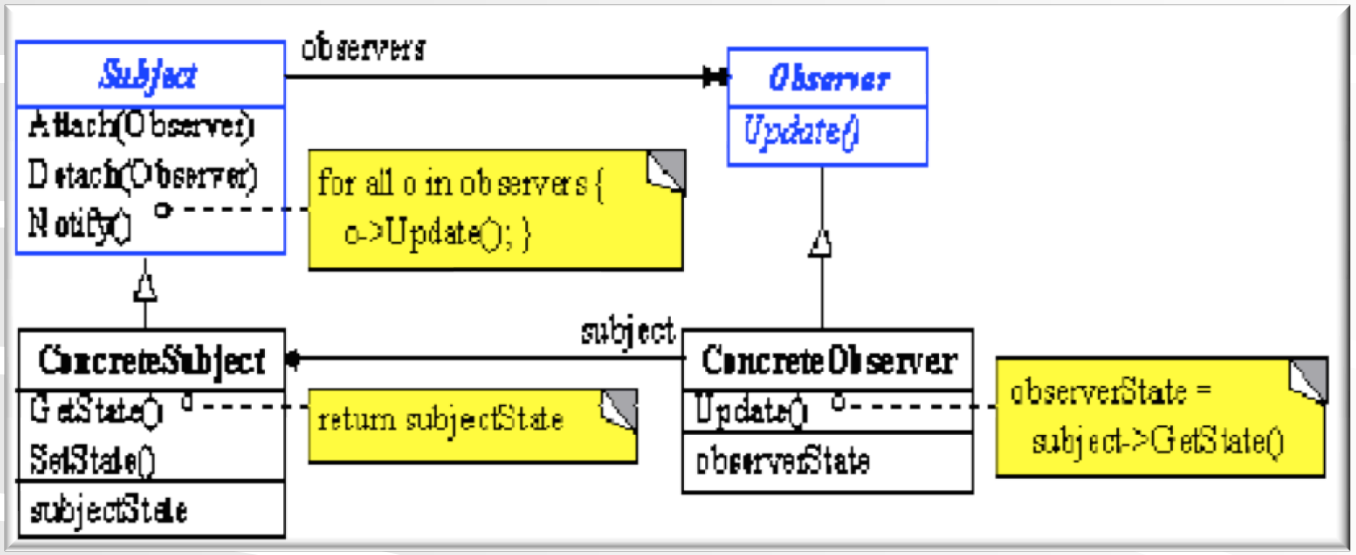
Model-View Separation

Observer (aka Publish-Subscribe/Delegation)

- Problem: *Subscriber* objects want to be informed about events or state changes for some *publisher* object. How do we do this while maintaining low coupling from the publisher to the subscribers?

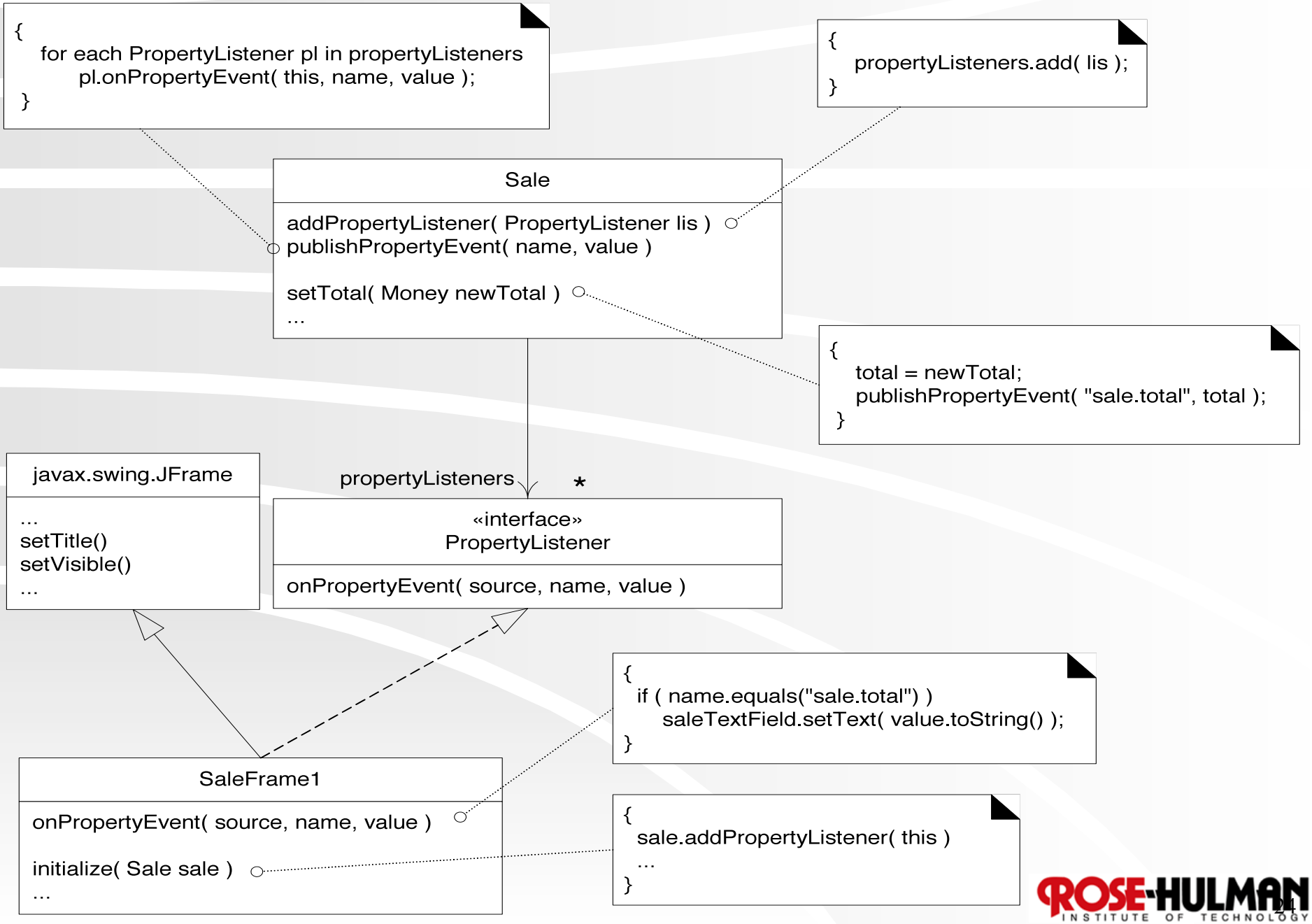
- Solution: Define an subscriber interface that the subscriber objects can implement. Subscribers register with the publisher object. The publisher sends notifications to all its subscribers.

Observer: Behavioral Pattern

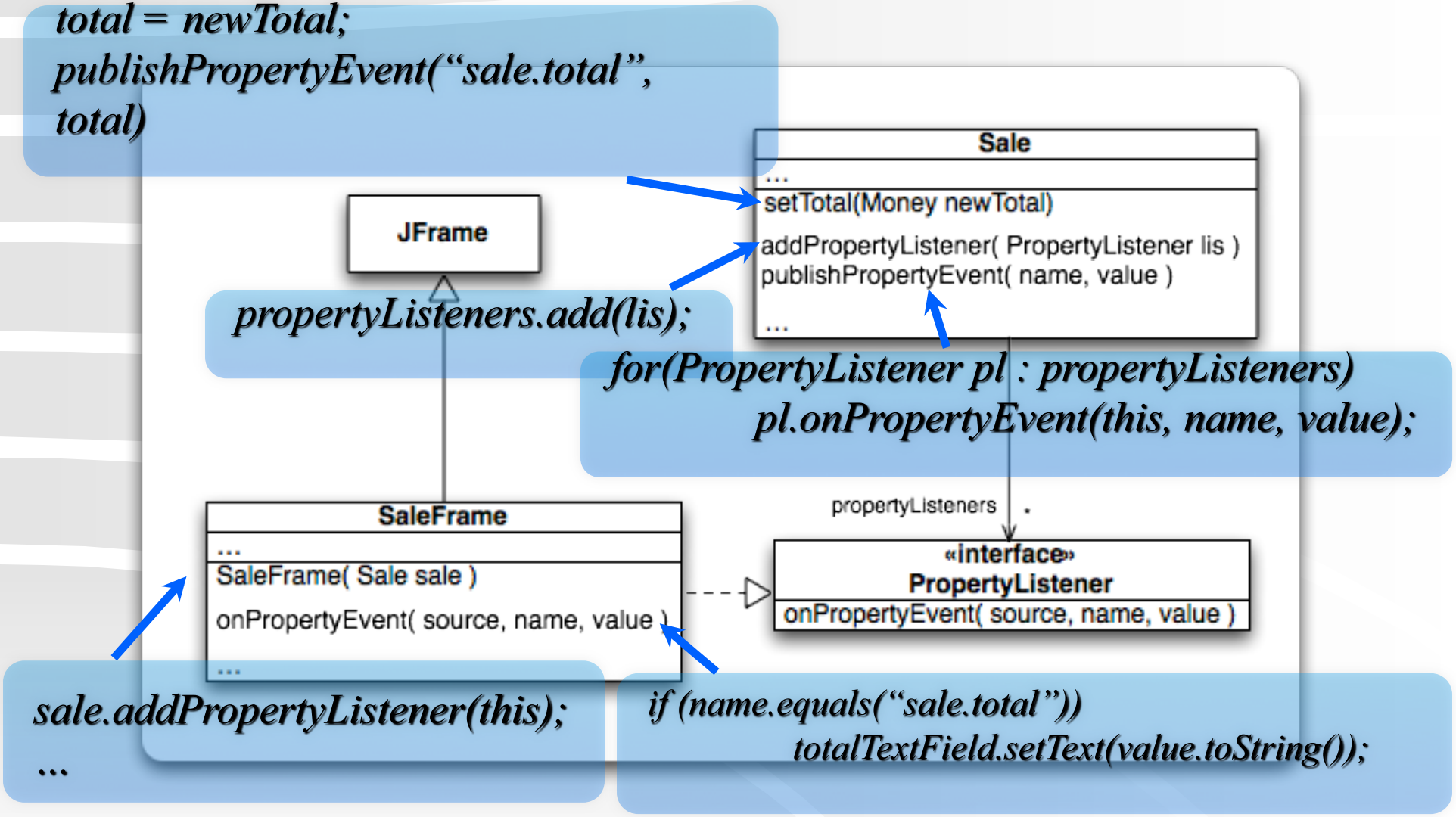


- Observer pattern is a 1:N pattern and is used to notify and update all dependents automatically when one object changes.

Sale has a List of Listeners



Example: Update SaleFrame when Sale's Total Changes



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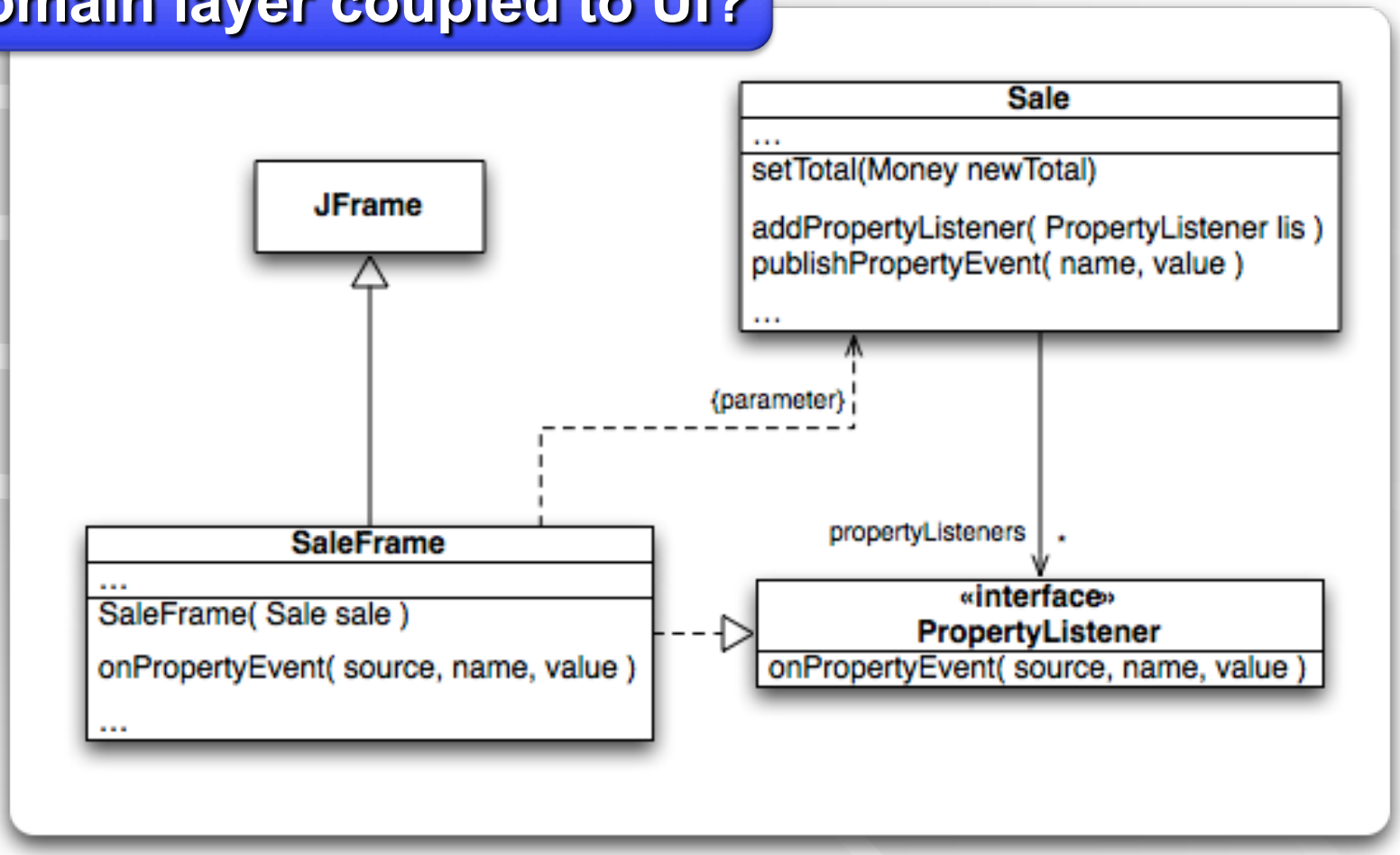
Example: Update SaleFrame when Sale's Total Changes (continued)

Is UI coupled to domain layer?
Is domain layer coupled to UI?



Observer: Not just for GUIs watching domain layer…

- GUI widget event handling
- Example:
  JButton startButton = new JButton("Start");
  startButton.addActionListener(new Starter ());
- Publisher: *startButton*
- Subscriber: *Starter* instance

Homework and Milestone Reminders

- Read Chapters 27 and 28
- Homework 6 – More GRASP on Video Store Design
  - Due by 5:00pm Today (Tuesday, January 26th)
- Milestone 4: Patterns and Detailed Design, with some Iteration 2 on the Side
  - Due by 11:59pm Friday, January 29th, 2010