COMP 401 – Recitation 8

Observer Pattern

Agenda

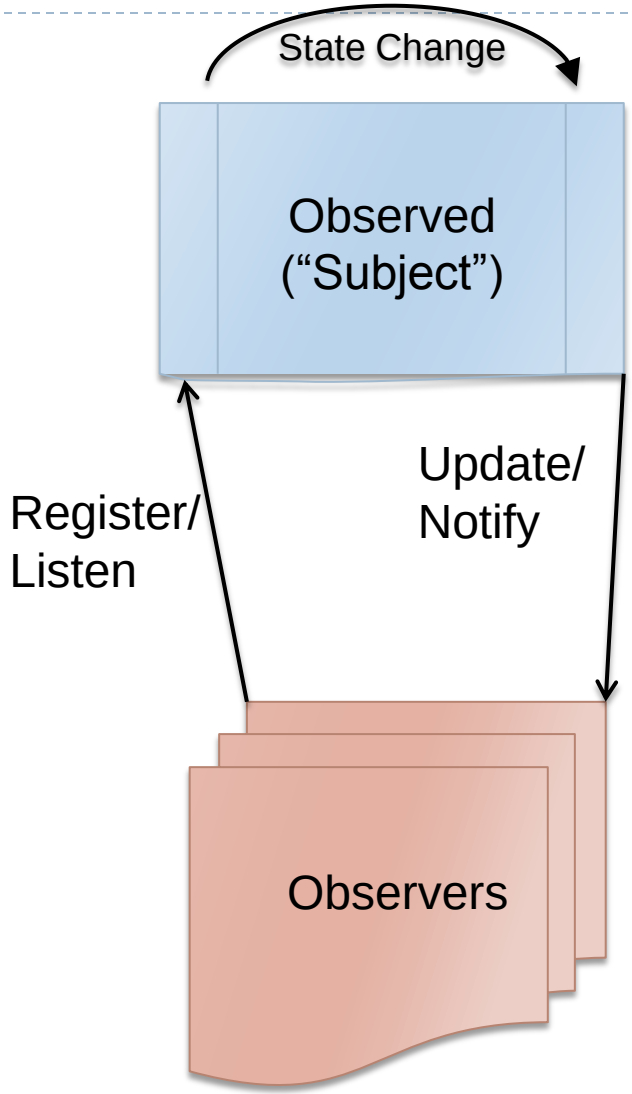
- Quick review of the Observer pattern
- Worked example
- Exam review (~30 minutes)
- Quiz (on your own time)

Observer Pattern – Problem Statement

- I have some object A whose state (properties) changes from time to time.
- I have some other objects {B} which care about the state of A and may wish to take actions when A changes state, e.g.:
  - Update some user interface element
  - Record the change event
  - Notify some other component about the change
  - Etc.

Observer pattern -- Abstraction

- The Observed object (a.k.a. “Subject”) implements some interface (or extends some class) allowing other classes to “register” their desire to receive events from the Observed class
- The Observing objects (Observers) implement a call-back and register themselves with the Observed object
- At runtime, the Observed object will notify the Observers of state changes or other events



Same pattern, different nouns and verbs

- In Java:
  - `Observer/Observable`
  - `PropertyChangeListener/firePropertyChange`
  - `Action/ActionListener`
  - Other eventing interfaces
- In web applications
  - Subscribe/Notify pattern
  - (related) Publish/Subscribe/Notify
- Most user interface SDKs use a similar model

Callbacks

- A callback, in general, is a method in one object that is registered with and invoked by some other object(s)
- In the present context, these are generally of the form `of update(…), onXXXAction(…), propertyChange(…),` etc.
- The callback is passed one or more parameters informing it of, e.g.:
  - The source of the event
  - Metadata about the event, e.g.:
    - The type of event
    - Values related to the event (e.g., old value/new value, which key was pressed, etc.)

Example (from the exercise)

```
public interface Listenable {
 public void addPropertyChangeListener(PropertyChangeListener listener);
 public void removePropertyChangeListener(PropertyChangeListener listener);
}
public class AnObservableStrokedLine extends AStrokedLine implements Listenable {
        protected PropertyChangeSupportpropertyListenerSupport;
        @Override
        public void addPropertyChangeListener(PropertyChangeListener listener) {
                propertyListenerSupport.addPropertyChangeListener(listener);
        } @Override
        public void setX(int newX) {
                int old = getX();
                super.setX(newX);
                if (null != propertyListenerSupport) {
                        propertyListenerSupport.
                                firePropertyChange(PROPERTY_X, old, getX());
        }
}
//Elsewhere…
someLine.addPropertyChangeListener(this);
```

Another Example (from the exercise)

```
//In some code…
JButton leftButton = new JButton("Left");
leftButton.addActionListener(
        new LineMoverAction(line, MoveDirection.LEFT, MOVE_INCR));

public class LineMoverAction implements ActionListener {

    protected Line line, MoveDirection direction, int increment;

    public LineMoverAction(Line line, MoveDirection direction, int increment) {}

    @Override
    public void actionPerformed(ActionEvent e) {

        switch (direction) {
            case LEFT:
            line.setX(line.getX()-increment);
            break;
            case RIGHT:
            line.setX(line.getX()+increment);
            break;
            ….
        }
    }
}
```

Exercise

- Run `Driver.java`; the main application code is in `AppDemo1.java`
- OE shows two lines, but nothing else happens. The buttons don't do anything either. Hmmph.
- Find POI #1 and #2 around line 49 of `AppDemo1.java` and swap the comments so that we use `AnObservableStrokedLine`.
- What happens?
- Find POI #8 around line 67 (*idem*) and uncomment the subsequent line.
- What do happens now?
- Try adding buttons to do other things, e.g.:
  - Move the line up and down
  - Move `line2`
- Check out `LineMoverAction.actionPerformed()` (line 30)
  - Print the output from some of the getters on the `ActionEvent` passed to this callback.
  - Could we figure out whether the event was generated by a mouse click of the button or a keyboard event (space) on the button?