



Applying the Principles

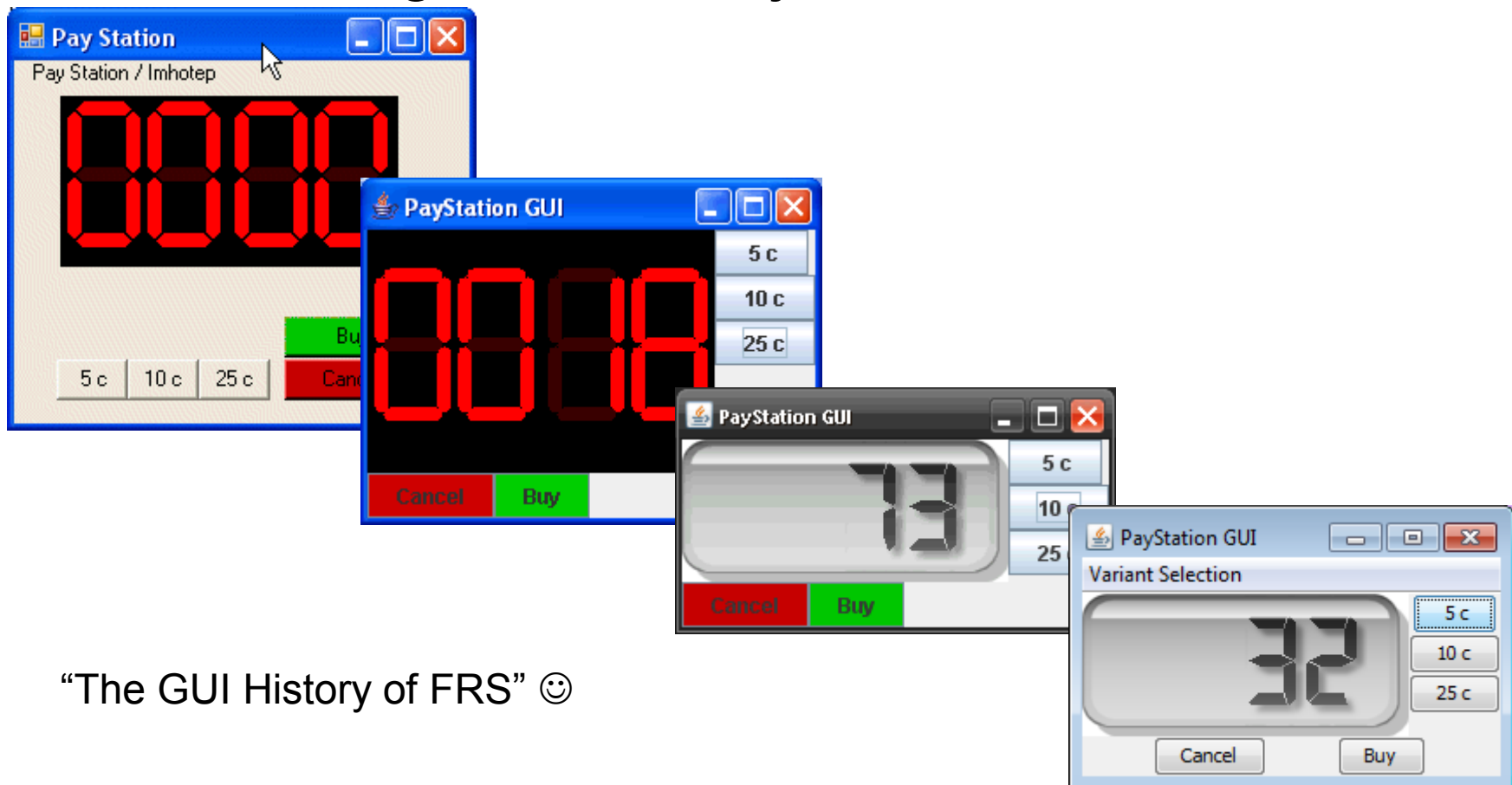
Two Examples



Example 1

New Requirement

It would be nice with a simple GUI “to see something” instead of just xUnit tests...



“The GUI History of FRS” ☺

Run it

– Ant gui

```

/** Create the panel of buttons */
private JComponent createButtonPanel() {
    Box p = new Box( BoxLayout.X_AXIS );
    JButton b;
    b = new JButton("Cancel");
    b.setAlignmentX(Component.CENTER_ALIGNMENT);
    p.add( Box.createHorizontalGlue() );
    p.add( b );
    b.addActionListener( new ActionListener() {
        public void actionPerformed(ActionEvent e) {
            payStation.cancel();
            updateDisplay();
        }
    });

    b = new JButton("Buy");
    b.setAlignmentX(Component.CENTER_ALIGNMENT);
    p.add( Box.createHorizontalGlue() );
    p.add( b );
    p.add( Box.createHorizontalGlue() );
    b.addActionListener( new ActionListener() {
        public void actionPerformed(ActionEvent e) {
            Receipt r = payStation.buy();
            updateDisplay();
            // print the receipt
            showReceiptInWindow(r);
        }
    });

    return p;
}

```

```

/** Update the digital display with whatever the
    pay station domain shows */
private void updateDisplay() {
    String prefixedZeros =
        String.format("%4d", payStation.readDisplay()) ;
    display.set( prefixedZeros );
}

```

```

/** Create the coin input panel */
private JComponent createCoinInputPanel() {
    Box p = new Box( BoxLayout.Y_AXIS );
    p.add( defineButton( " 5 c", "5" ) );
    p.add( defineButton( "10 c", "10" ) );
    p.add( defineButton( "25 c", "25" ) );
    return p;
}

```

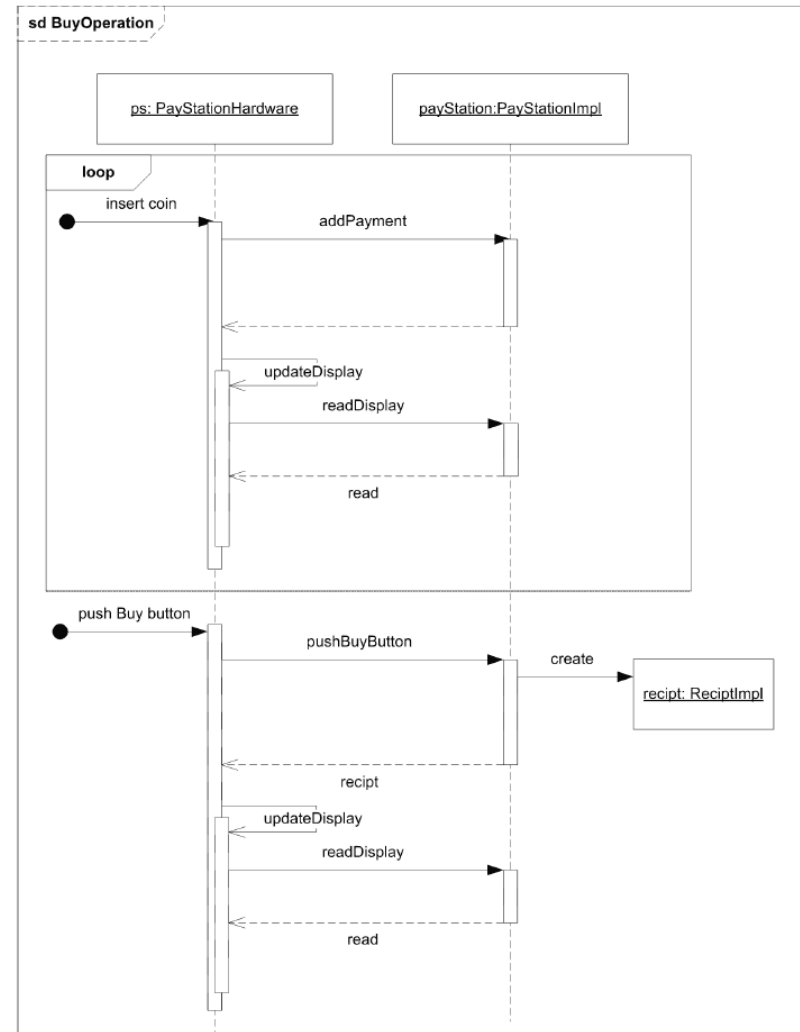
```

/** The button action listener that reacts on clicking the
    coin buttons */
private ActionListener buttonActionListener = new ActionListener() {
    public void actionPerformed(ActionEvent e) {
        String s = e.getActionCommand();
        int coin = Integer.parseInt(s);
        try {
            payStation.addPayment( coin );
        } catch (IllegalCoinException exc) {
            // illegal coins just do nothing.
        }
        updateDisplay();
    }
};

```

Seq Diagram

- No difference in behaviour of a GUI versus real hardware!





Any kind of user interface can operate the
PlayStation!

Wow – Change by addition...

How come we are so lucky?

Design considerations

(3) Behaviour that may vary

- the *same* hardware must operate *varying* pay station implementations: AlphaTown, BetaTown, EpsilonTown...

(1) Variable behaviour behind *interface*

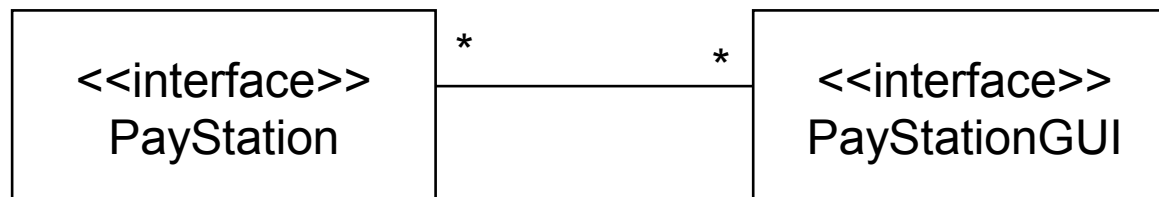
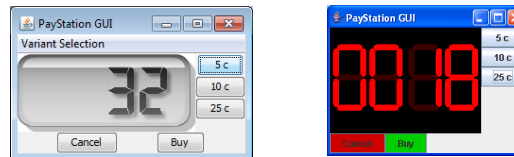
- **PayStation** interface...

(2) Compose behaviour by delegation

- Gui/Hardware does not itself calculate rates, issue receipts, etc., but *lets an instance of PayStation do the dirty job...*

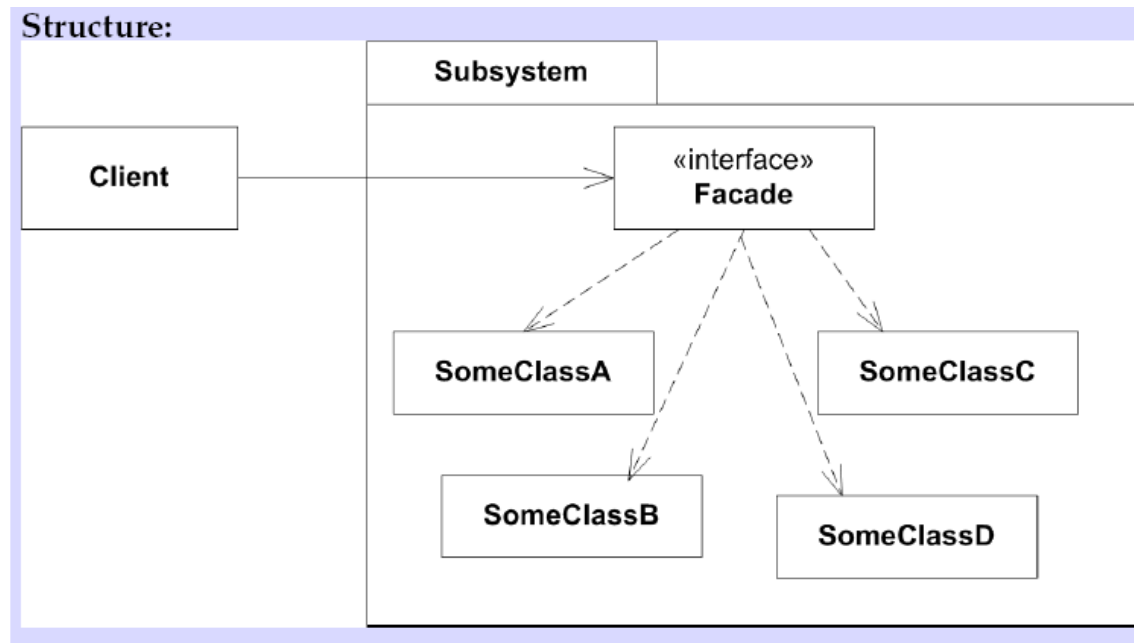
The side effect of this decisions is that *interface decouples both ways!!!*

- *Hardware may operate different kinds of PayStation implementations*
 - *Alpha, Beta, Gamma, ...*
- *Different kinds of user interfaces may operate the same PayStation implementation*



Automagical pattern?

PlayStation is an example of the **Facade** pattern



Consequences

Benefits

- Shields clients from subsystem objects
 - (depends... Consider HotCiv)
- Weak coupling
 - **Many to many** relation between client and façade

Liabilities

- Bloated interface with *lots of methods*
 - Because façade must have the sum of responsibilities of the subsystem
- How to avoid access to the inner objects?
 - Read-only interfaces; no access (require dumb data objects to be passed and parsed over the façade).



Example 2

New Requirement

Alphatown wants to log all coin entries:

- [time] [value]

Example:

- 14:05:12 5 cent
- 14:05:14 25 cent
- 14:55:10 25 cent



The 3-1-2 machinery

Let us look at the machinery:

- ③ Identify the responsibility whose concrete behaviour may vary
- ① Express responsibility as an interface
- ② Let someone else do the job

How does this apply?

What is 3-1-2 here?



③ Identify the responsibility whose concrete behaviour may vary

- It is the “Accept payment” responsibility

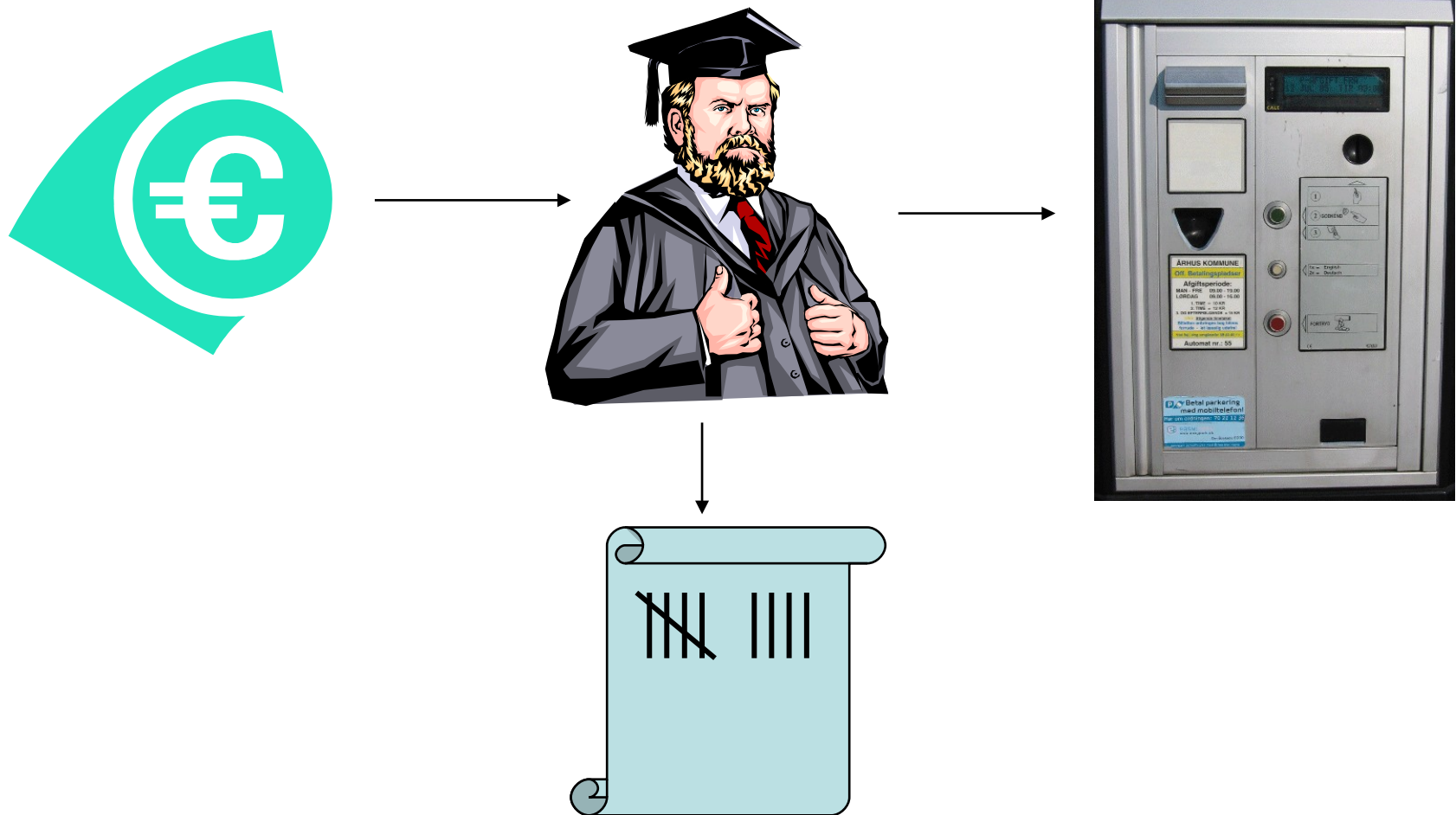
① Express responsibility as an interface

- A) PaymentAcceptor role?
- B) PayStation role? Already in place!

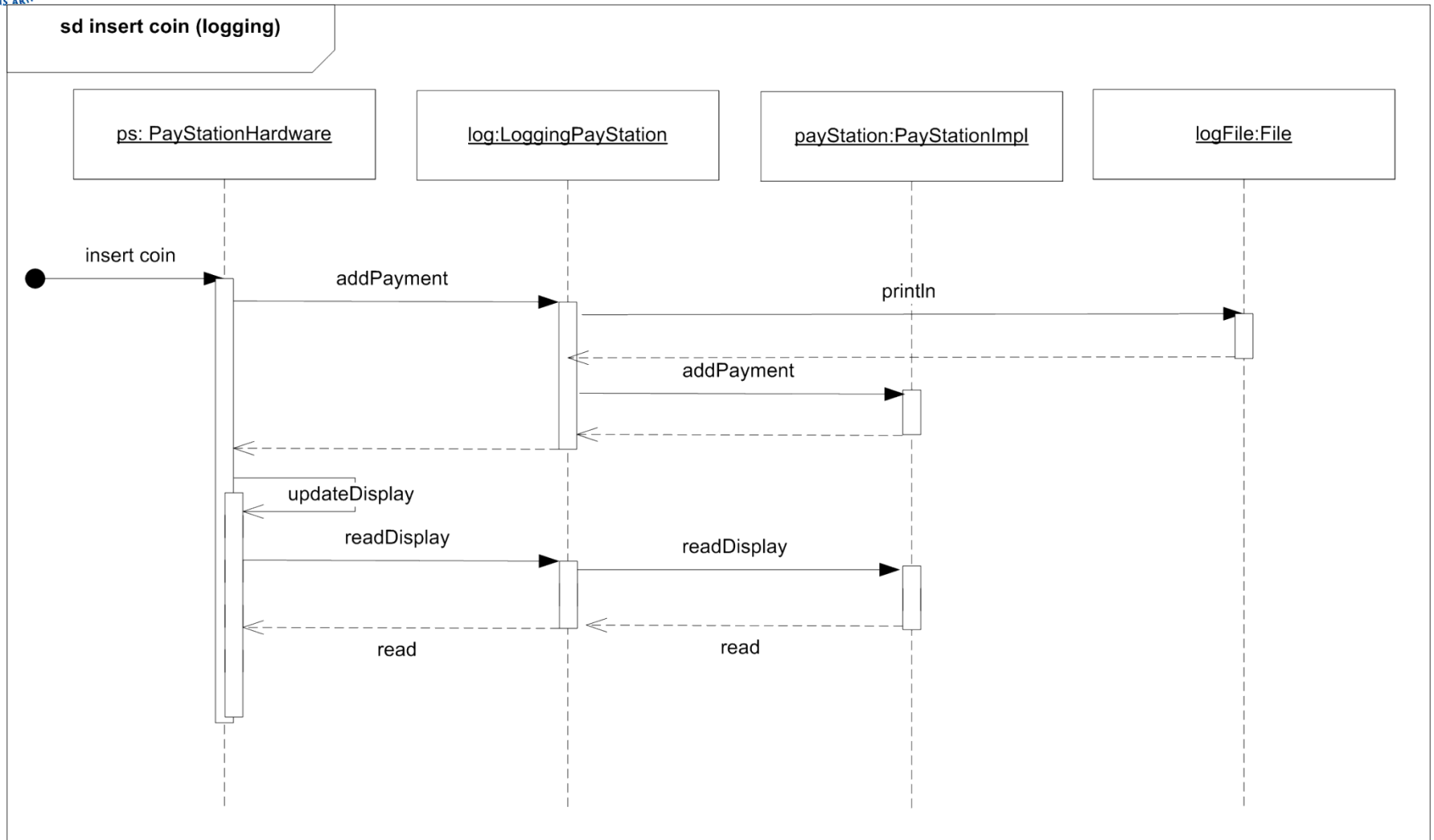
② Let someone else do the job

- Maybe let someone handle the coins *before* the parking machine receives them?

Metaphor: Principle 2



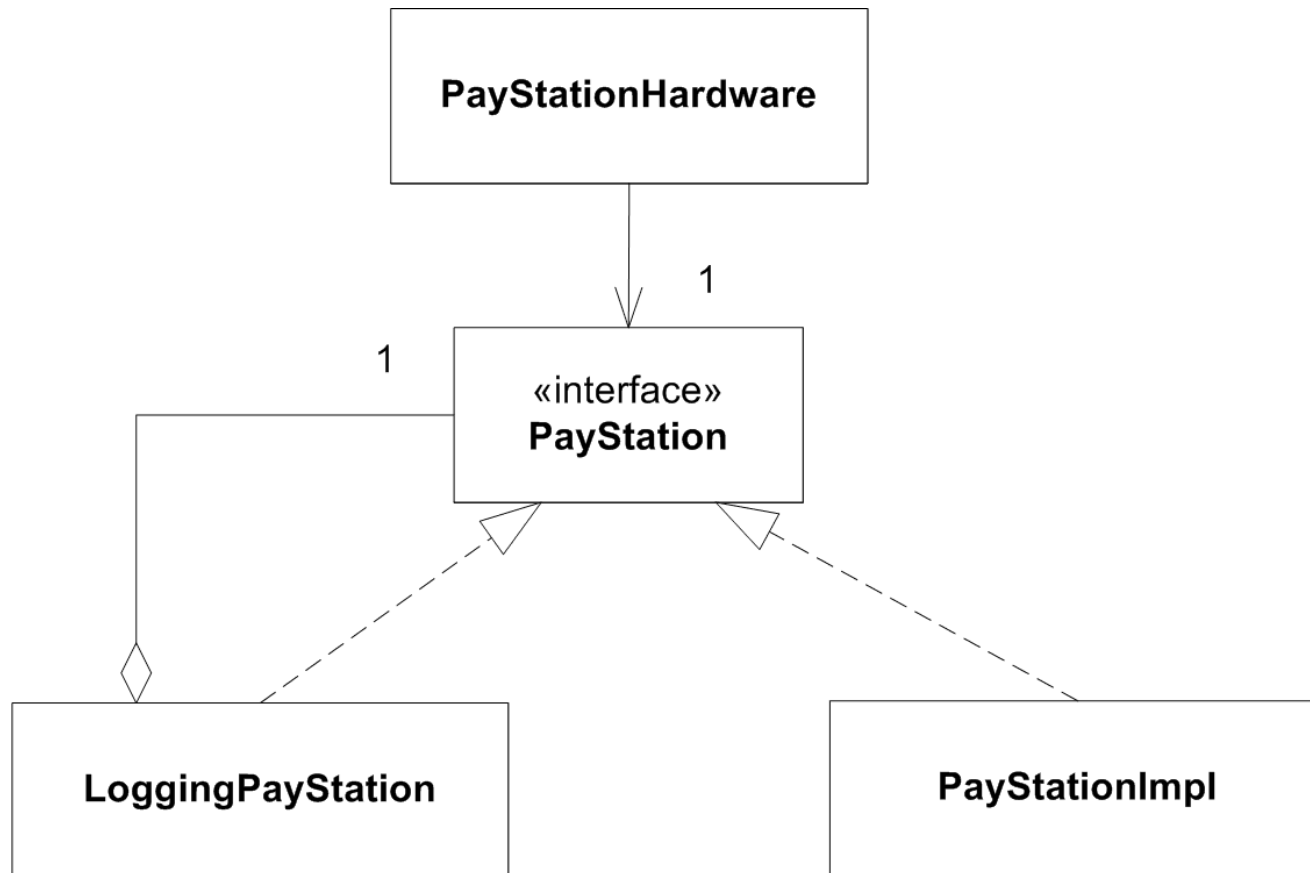
Dynamics





Refactoring process

- Introduce Null Decorator
- Run, see everything pass
- Introduce feature in decorator



Chaining decorators

Decorators can form chains.

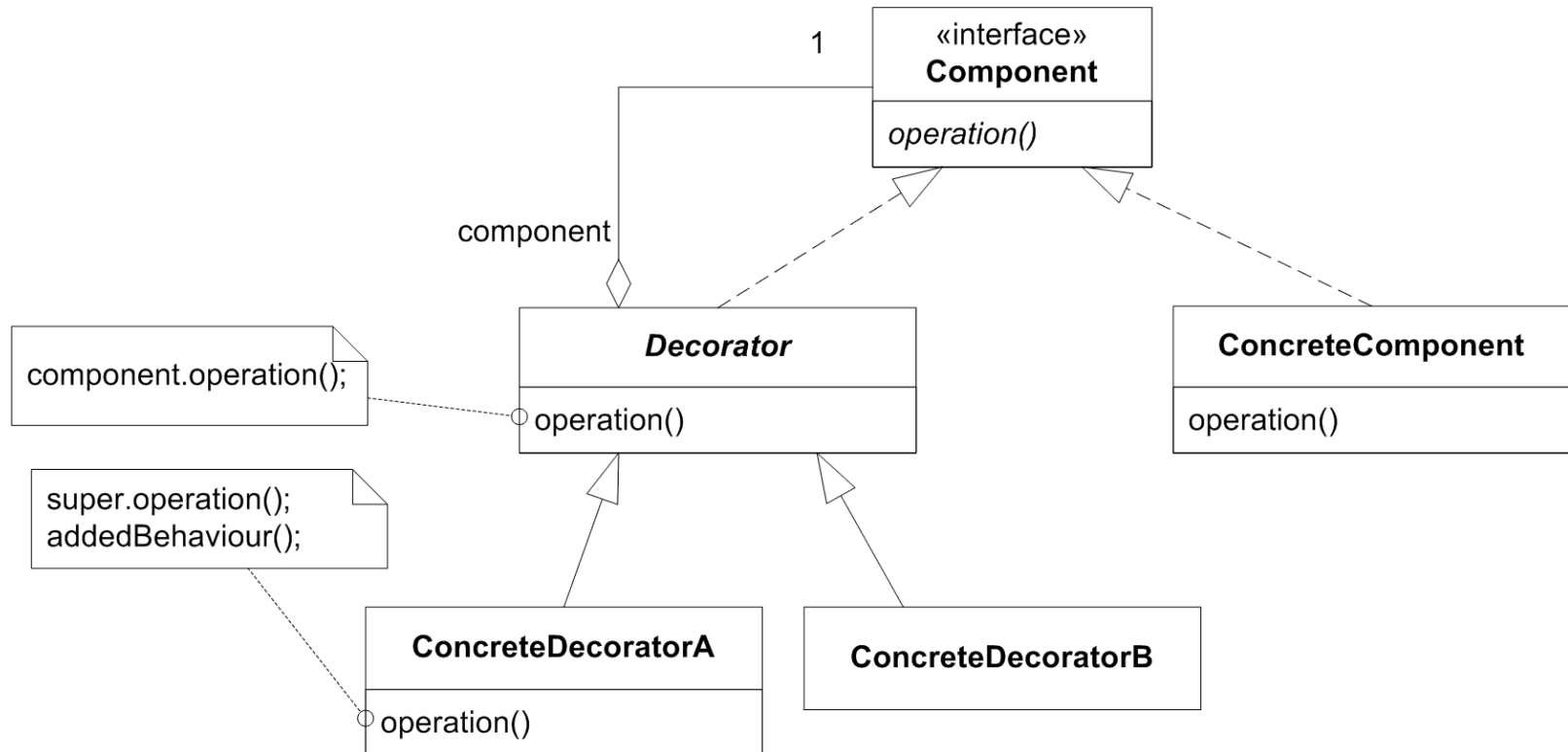
New requirement:

- no payment possible in 19.00 – 07.00 interval



Automagical pattern?

The decorator is yet another application of 3-1-2 and the principles of flexible design!



Consequences

Benefits

- Adding and removing behavior at run-time
- Incrementally add responsibilities
- Complex behavior by chaining decorators

Liabilities

- Analyzability suffers as you end up with lots of little objects
 - Behavior is constructed at run-time instead of being written in the static code
- Delegation code tedious to write
 - Make a 'null decorator' as base class