17.3 Subject and Observer Aspects

Description

In this section, we introduce two related aspects, *subject* and *observer*, which have to be used in tandem. Objects of classes with a subject aspect may be observed by a set of objects with an observer aspect. An observer object subscribes to certain events in the subject object, events that typically change the state of the subject object. In a case of such an event, the observer will be notified.

As a first example, we use a a fire alarm in a shopping center with a number of shops. The fire alarm may be considered a subject to be observed by a number of stakeholders that include the fire department, the owner of the shopping center and the shops in the center. As a second example, we show how to add subject and observer aspects to the bank system to monitor suspicious transactions on the accounts of the bank.

Måske en ***illustration*** der viser subject/alarm og observers/FireDept, …? Og som en almindelig illustration – ikke et objekt-diagram.

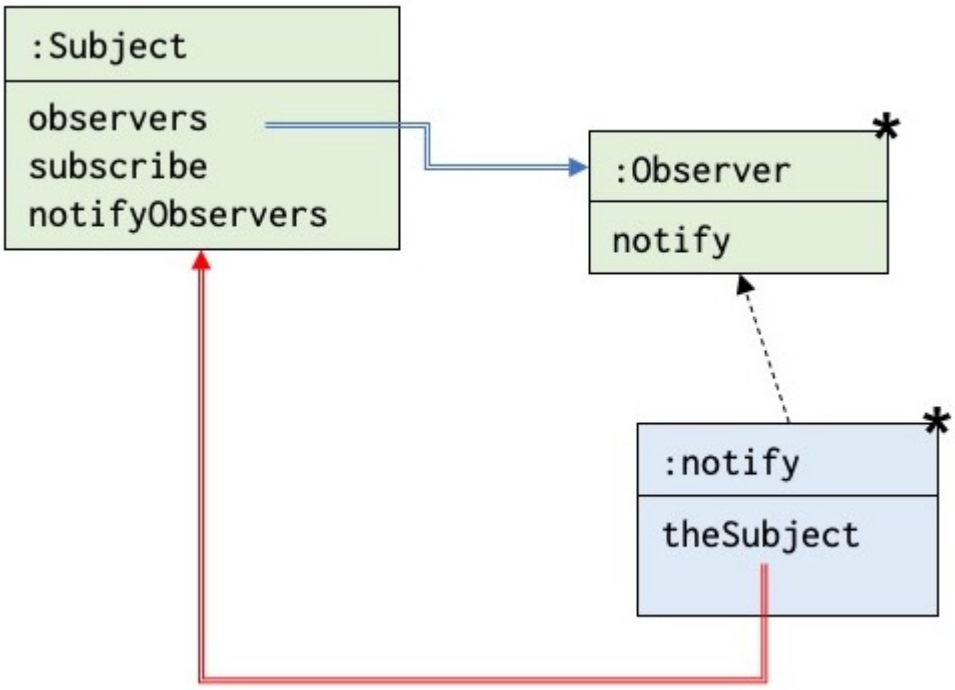
In programming a *design pattern* describes a well-defined functionality of a program in terms of how to structure a program fragment implementing the functionality. Observer is an example of a design pattern.

Before we show how to represent the examples, we introduce some general classes for representing subjects and observers represented by `Subject` and `Observer`. Objects being subject to observation shall have the properties of `Subject`, and observer objects shall have the properties of `Observer`. The structure and behaviour of class `Observer` and class `Subject` is known as the *Observer Design Pattern* – we thus place the two classes in a module called `ObserverPattern`:

```
ObserverPattern: obj
   class Subject:
      observers: obj Set(#Observer)
      subscribe(obs: ref Observer):
         observers.insert(obs)
      notifyObservers:
         observers.scan
            current.notify(this(Subject))
      inner(Subject)
   class Observer:
      class ObservedSubject:< Subject
      notify(theSubject: ref ObservedSubject):<
         inner(notify)
```

- A `Subject` have a `Set` `observers` containing `Observer` objects.
- It has a method `subscribe` that makes an `Observer` object an element of `observers`;
- It has a method `notifyObservers` that is called in case the observeres should be notified about changes, so it will for each `observer` in `observers` invoke its `notify`.
- An `Observer` has a local virtual class `ObservedSubject` that can be extended with further attributes in subclasses of the observed `Subject`.
- It has a method `notify`, which has a parameter, `theSubject` of type `ObservedSubject`, which is a reference to the `Subject` that invokes `notify`.

The figure below illustrates that a `Subject` has a set (`observers`) of references to a number of `Observer` objects; this is illustrated with the '*' in rightmost top of the `Observer` object. The figure also illustrate that when `notify` is invoked on these `Observer` objects, the parameter `theSubject` of each `notify` method object is set to denote the `Subject` object that invoked `notify`:



SubjectObserver

The dashed line indicates that each notify method object is an instance of the method notify of a given Observer object.

The classes `Subject` and `Observer` are rather abstract so in the next section we will show how the above example of a fire alarm in a shopping center may be modeled using the `ObserverPattern`. We show how to add subject and observer aspects to the bank system in the section following the next section.