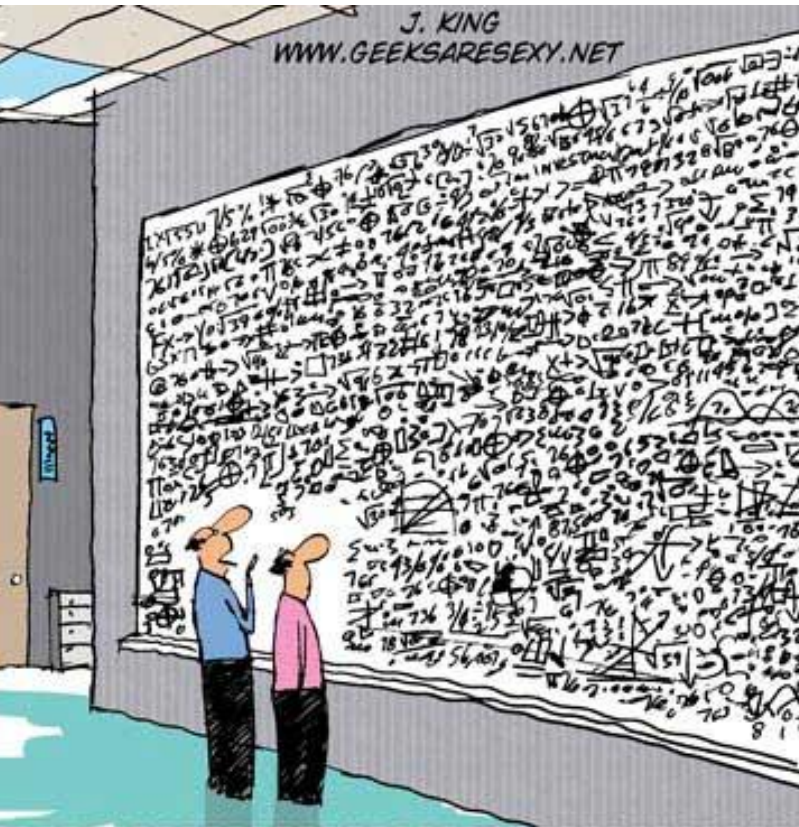


Visualising Crosscutting Concerns

Eduardo Figueiredo

Crosscutting Concerns



Crosscutting concerns are often blamed to hinder...

- design modularity
- program comprehension
- robustness, stability, etc.

Crosscutting concerns manifest themselves in many different ways

“...And that, in simple terms, is what’s wrong with your software design.”

Some Crosscutting Concerns

Crosscutting “shapes”

- Black Sheep and Octopus

Inheritance relationships

- Climbing Plant and Hereditary Disease

Concern-based coupling connections

- Tree Root and Tsunami

Structure of crosscutting code

- Copy Cat and Behavioural Concern



Some Crosscutting Concerns

Crosscutting “shapes”

- **Black Sheep and Octopus**

Inheritance relationships

- Climbing Plant and Hereditary Disease

Concern-based coupling connections

- Tree Root and Tsunami

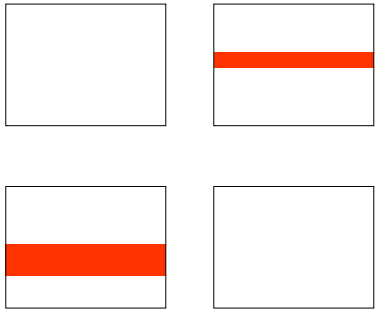
Structure of crosscutting code

- Copy Cat and Behavioural Concern



Flat Crosscutting Shapes

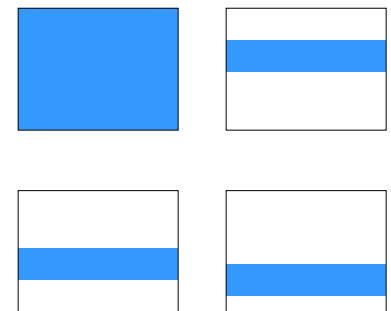
<<Black Sheep>>



Black Sheep touches very few elements in distinct places

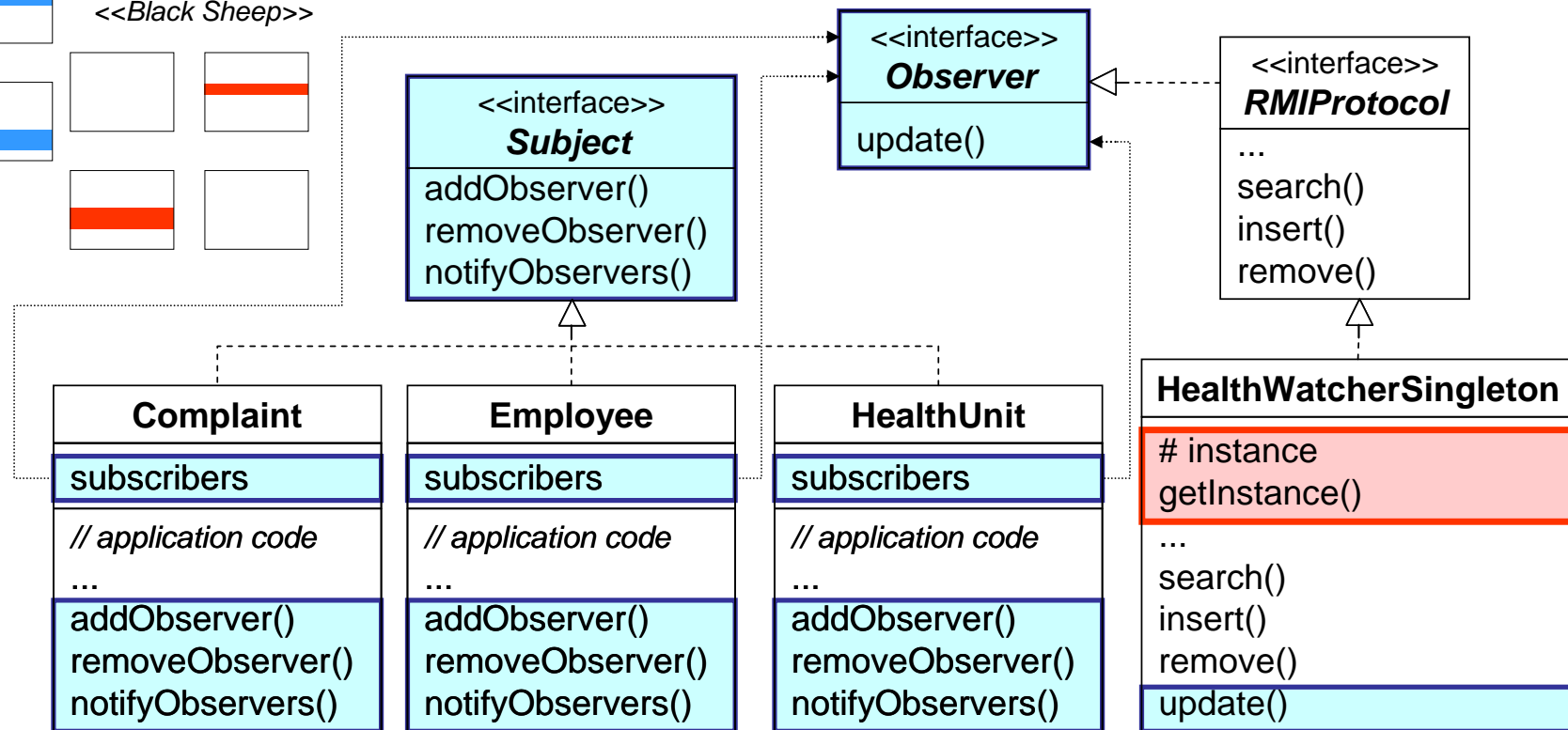
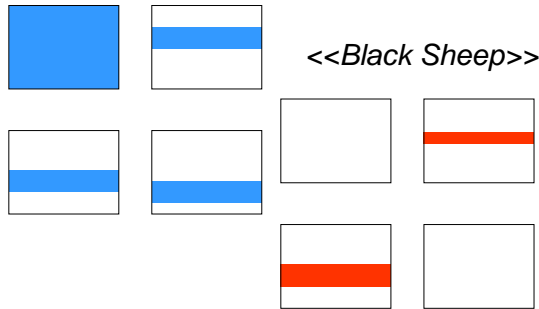
Octopus is partially well modularised, but also spreads across a number of other components

<<Octopus>>



Crosscutting Shapes

<<Octopus>>



 **Observer as Octopus**

 **Singleton as Black Sheep**

Some Crosscutting Concerns

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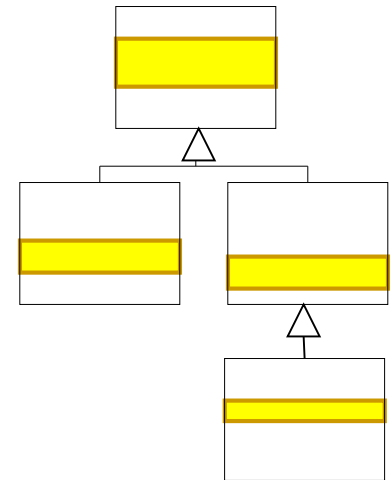
- Copy Cat and Behavioural Concern



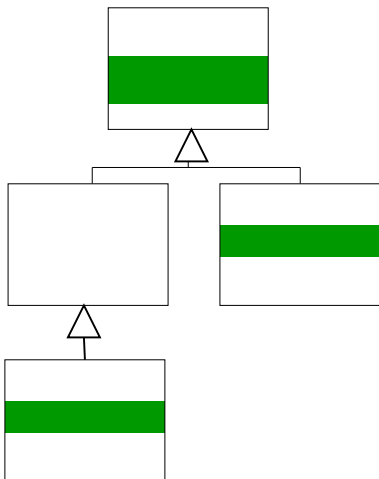
Inheritance-wise Concerns

Climbing Plant affects the root of an inheritance tree and *all* descendents

<<Climbing Plant>>



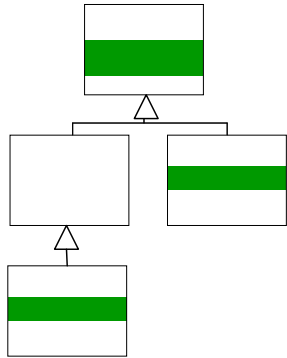
<<Hereditary Disease>>



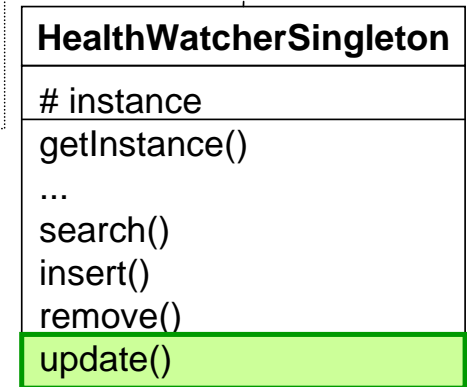
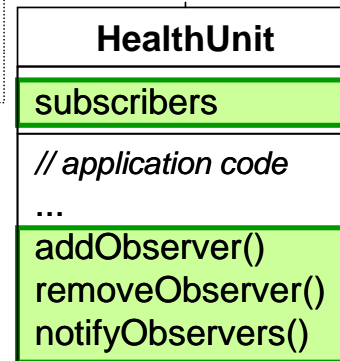
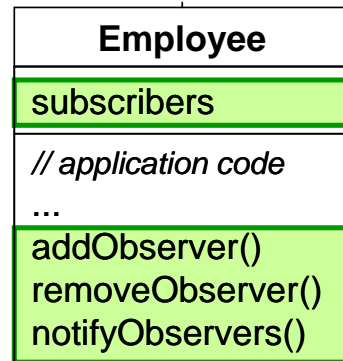
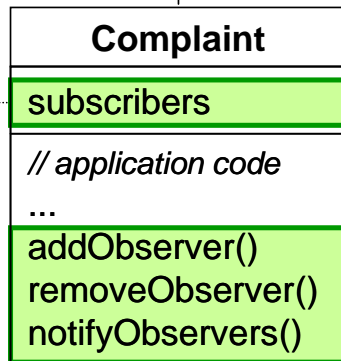
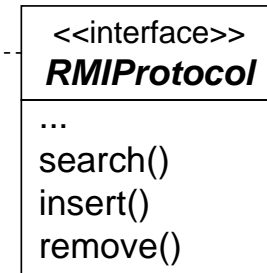
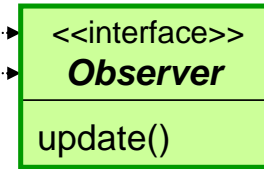
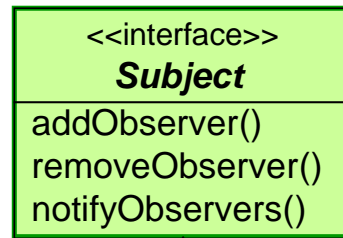
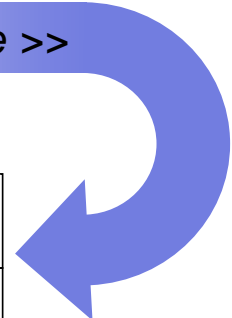
Hereditary Disease affects the root of an inheritance tree and *some* descendents

Hereditary Disease

<<Hereditary Disease>>



>> Disease-free Node >>



Observer as Hereditary Disease

Some Crosscutting Concerns

Crosscutting “shapes”

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Concern-based coupling connections

- Tree Root and Tsunami

Structure of crosscutting code

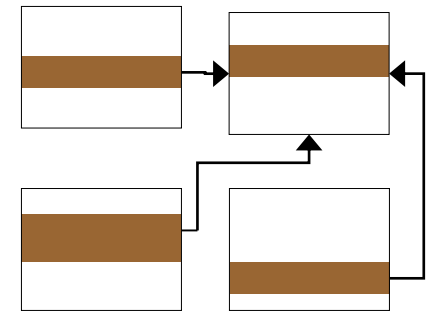
- Copy Cat and Behavioural Concern



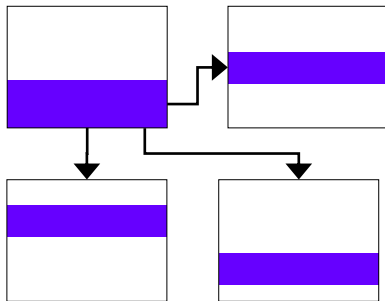
Concern Connections

Tree Root composed of many *feeders* which connect to a *trunk*

<<Tree Root>>

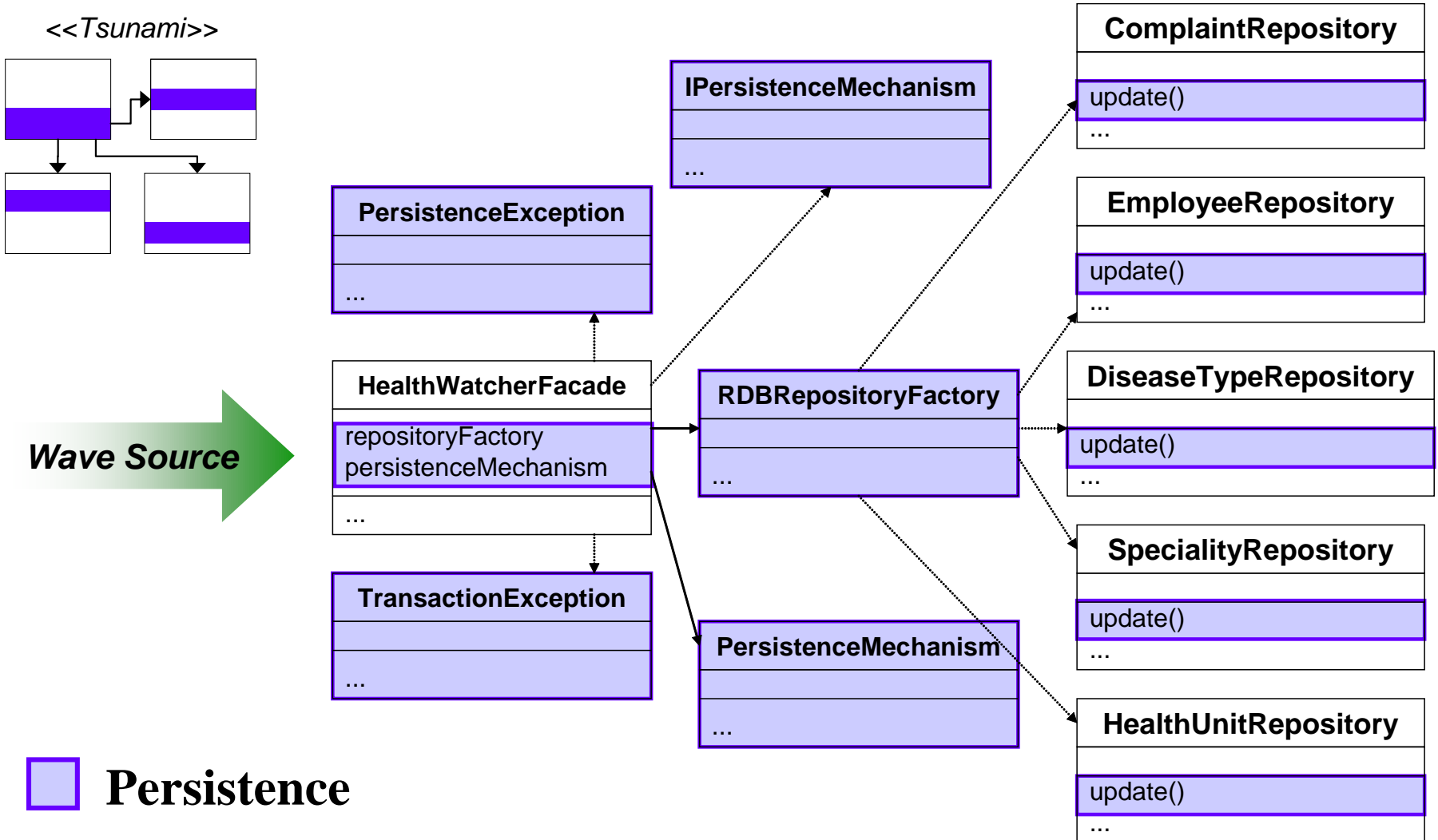


<<Tsunami>>



Tsunami composed of a *wave source* which connects to many *waves*

Tsunami



Some Crosscutting Concerns

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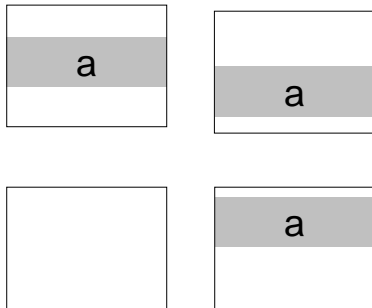
Structure of crosscutting code

- Copy Cat and Behavioural Concern



Structure of Crosscutting Code

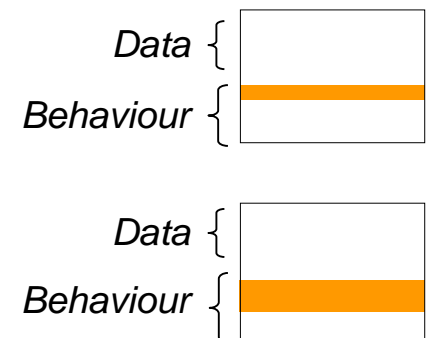
<<Copy Cat>>



Copy Cat is implemented by replicated pieces of code in different places


Behavioural Concern is only composed of methods, i.e., it has no associated attribute

<<Behavioural>>



Structure of Crosscutting Code

```
public class SpecialityRepository {  
    public void update(MedicalSpeciality esp)  
        throws RepositoryException {  
        try {  
            ...  
        } catch (PersistenceMechanismException e) {  
            throw new RepositoryException(...);  
        }  
    }  
    ...  
}  
  
public class SymptomRepositoryRDB {  
    public void update(Symptom symptom)  
        throws RepositoryException {  
        try {  
            ...  
        } catch (PersistenceMechanismException e) {  
            throw new RepositoryException(...);  
        }  
    }  
    ...  
}
```

 **Exception Handling**

Copy Cat

- The same code is replicated in 29 places

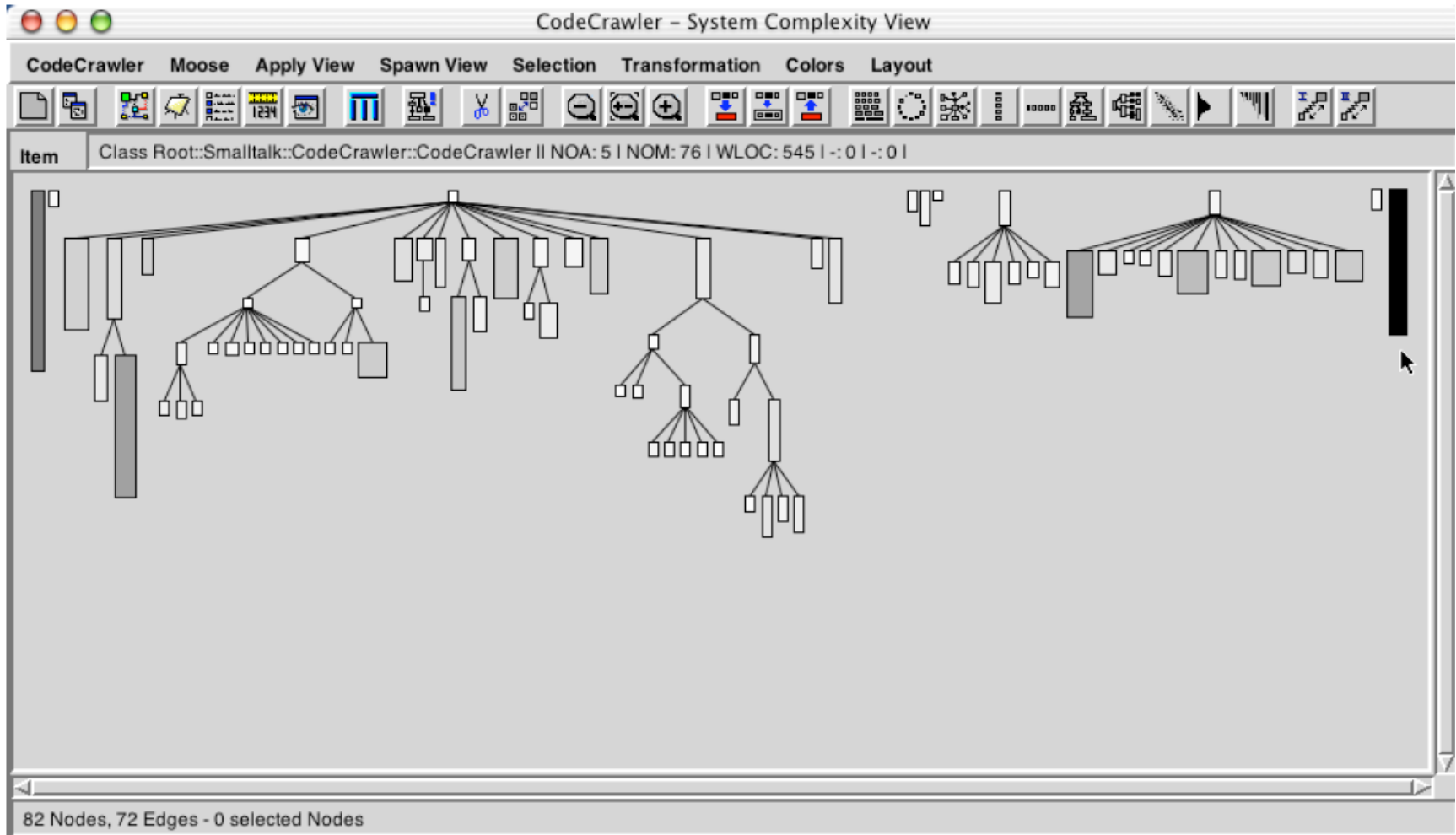
Behavioural Concern

- It is implemented only by (parts of) methods

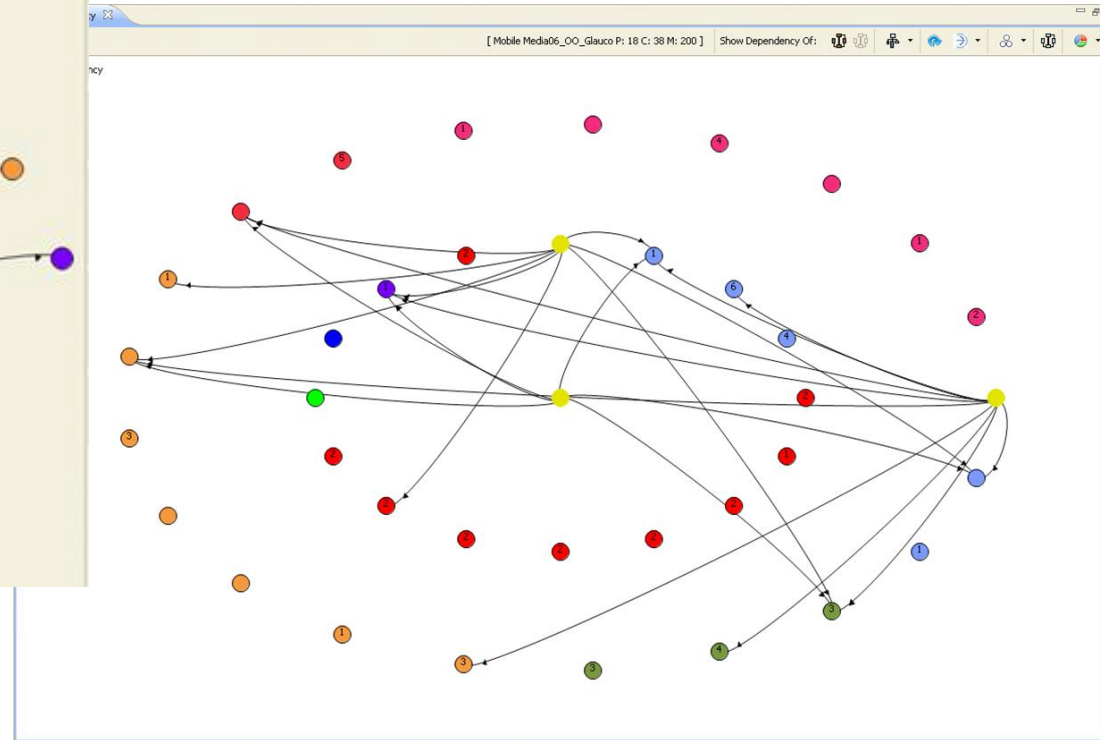
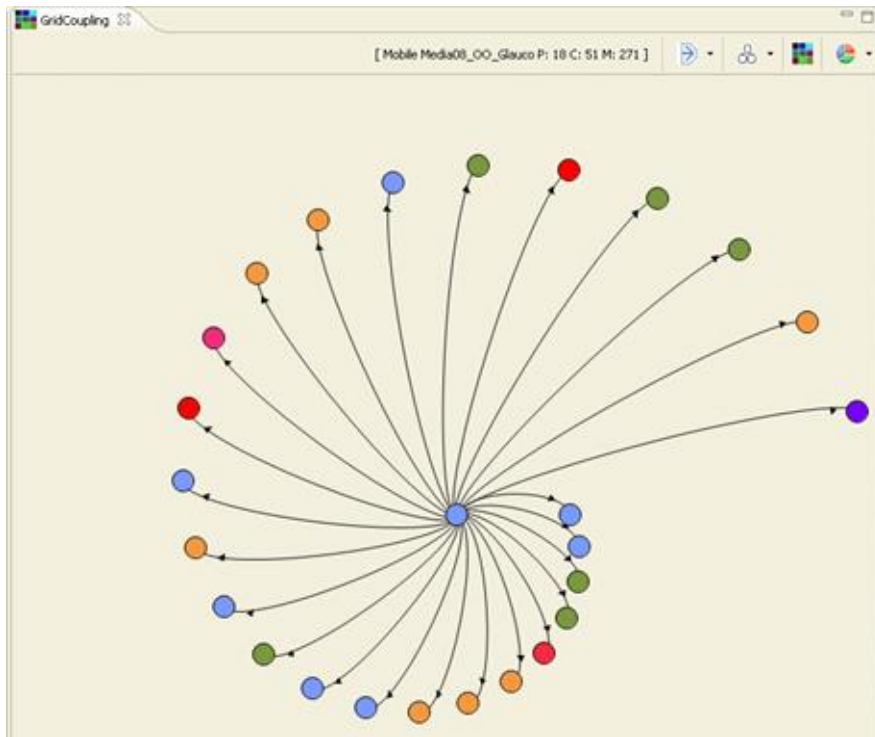
Research Question

How can we identify, visualise, and reason about all the different forms of crosscutting concerns?

Visualising Inheritance



Visualising Coupling



Visualising Shapes

