Code Smells and Refactoring

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Announcement

- Sprint 4 released Wed
  - We are still waiting for people to finish
  - Spanish Deck
  - Discuss on Thursday
- Thursday
  - Ciera Jaspan, Interview
  - Retrospective Sprints 1-3
  - Discuss Sprint 4

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What are code smells?

"[...] certain structures in the code that suggest (sometimes they scream for) the possibility of refactoring." [Fowler]

They are clear signs that your design is starting to decay.

…Long term decay leads to *"software rot"*

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Refactorings

- The main purpose of refactoring is to fight technical debt. It transforms a mess into clean code and simple design
- Refactorings will change the code but not it's behavior (it still does the same thing!)
- Many modern IDE will provide automatic refactorings

Code Smells

- **Bloaters:** Code, methods and classes that have increased to such gargantuan proportions that they are hard to work with;
- **OO Abusers:** Incomplete or incorrect application of object-oriented programming principles;
- **Change Preventers:** Any change requires you to make many changes in other places too;
- **Dispensables:** Something pointless whose absence would make the code better;
- **Couplers:** Excessive coupling between classes.

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Bloaters

- Long Method
- Long Class
- Long Parameter List

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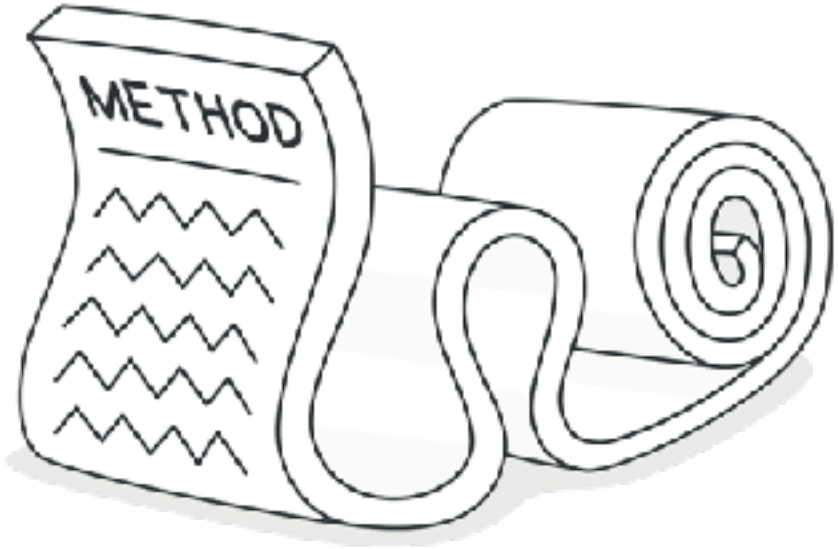
Long Method

- A method containing too many lines of code.
- Any line longer than 10 lines is suspicious.
- If you have to *scroll* to read the whole method, it is definitely too long.
  - Buying a larger display is not the solution



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Long Method

```
98       */
99      public <S extends Sequence> MergeResult<S> merge(
100             SequenceComparator<S> cmp, S base, S ours, S theirs) {
101         List<S> sequences = new ArrayList<S>(3);
102         sequences.add(base);
103         sequences.add(ours);
104         sequences.add(theirs);
105         MergeResult<S> result = new MergeResult<S>(sequences);
106
107         if (ours.size() == 0) {
108             if (theirs.size() != 0) {
109                 EditList theirsEdits = diffAlg.diff(cmp, base, theirs);
110                 if (!theirsEdits.isEmpty()) {
111                     // we deleted, they modified -> let their complete content
112                     // conflict with empty text
113                     result.add(1, 0, 0, ConflictState.FIRST_CONFLICTING_RANGE);
114                     result.add(2, 0, theirs.size(),
115                             ConflictState.NEXT_CONFLICTING_RANGE);
116                 } else
117                     // we deleted, they didn't modify -> Let our deletion win
118                     result.add(1, 0, 0, ConflictState.NO_CONFLICT);
119             } else
...
294                 current = Math.max(oursEdit.getEndA(), theirsEdit.getEndA());
295                 oursEdit = nextOursEdit;
296                 theirsEdit = nextTheirsEdit;
297             }
298         }
299         // maybe we have a common part behind the last edit: copy it to the
300         // result
301         if (current < base.size()) {
302             result.add(0, current, base.size(), ConflictState.NO_CONFLICT);
303         }
304         return result;
305     }
```

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Extract Method:Refactoring

- Extract parts of the code, into a new method
- Use this to split the long method into manageable ones.
- Good opportunities:
  - Code that is preceded by comments.
  - Long blocks in if/else/while/for statements.
  - Long conditions in if/else/while/for statements.

- Always give the new methods a meaningful name. It should express the intent of the method (helper1 is a very very bad name).

```
void printOwing() {
  printBanner();

  //print details
  System.out.println("name: " + name);
  System.out.println("amount: " + getOutstanding());
}
```

```
void printOwing() {
  printBanner();
  printDetails(getOutstanding());
}

void printDetails(double outstanding) {
  System.out.println("name: " + name);
  System.out.println("amount: " + outstanding);
}
```

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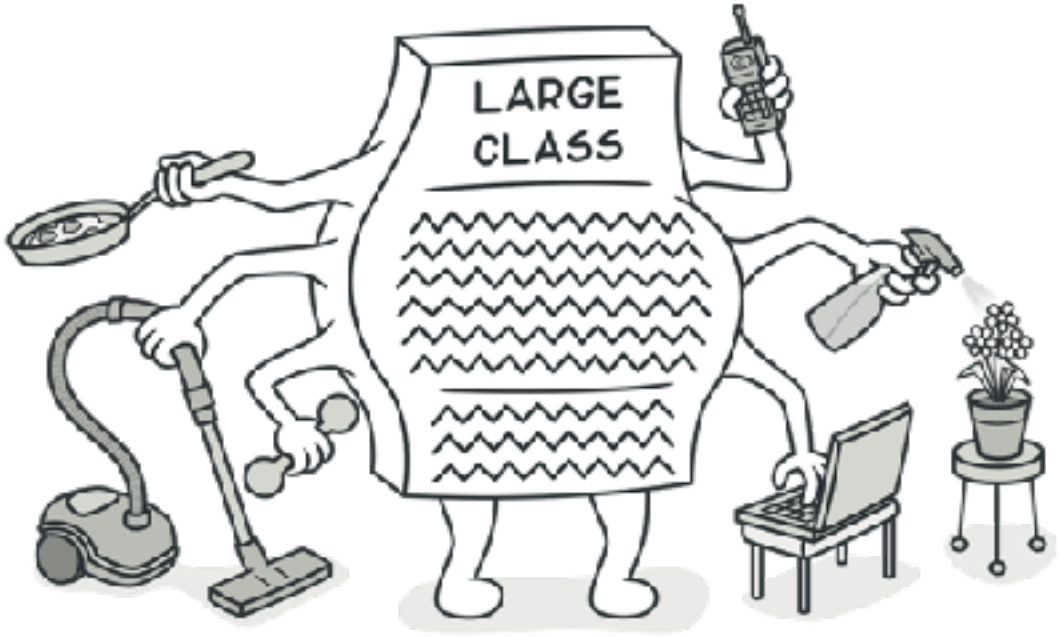
Long Class

- A class contains many fields/methods/lines of code.
- It breaks SRP



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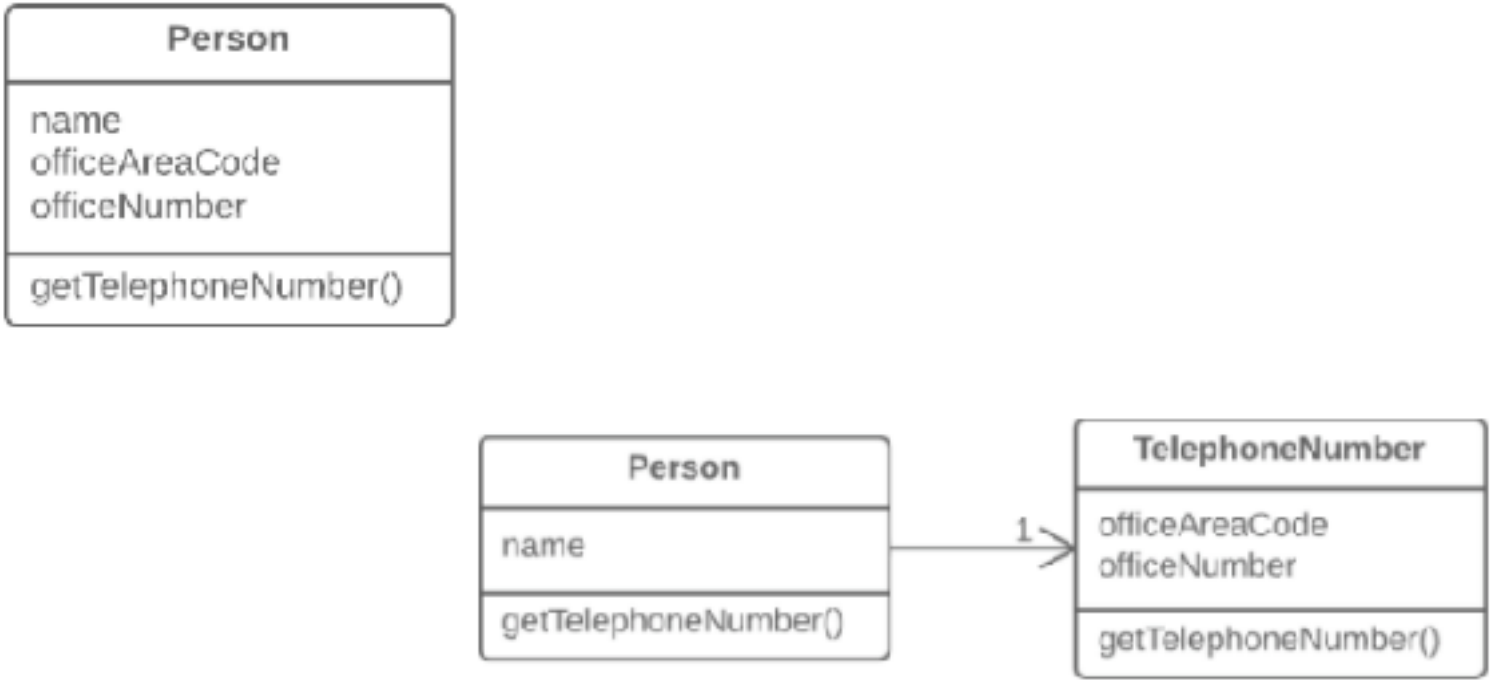
Refactoring

- **Extract Class** to split the class into multiple smaller ones



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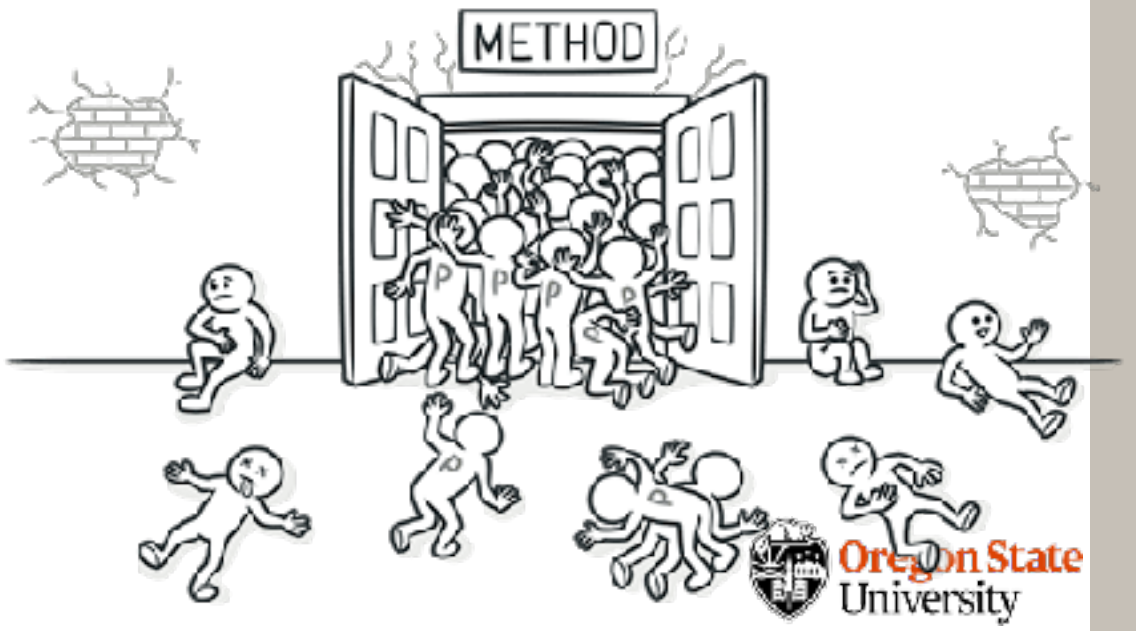
Long Parameter List

- Any method that has more than 4 parameters has too many
- This is an indication of an inadequate abstraction level: too low



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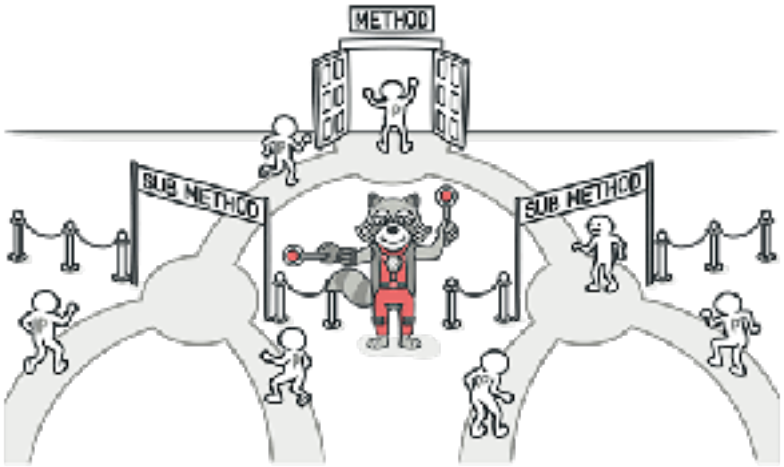
Refactoring

- The parameters can be encapsulated in their own objects, using introduce parameter object
- If a parameter is passed repeatedly to multiple methods, it can be stored a field
- If the parameters are fields that belong to a another object, the whole object can be passed as a parameter



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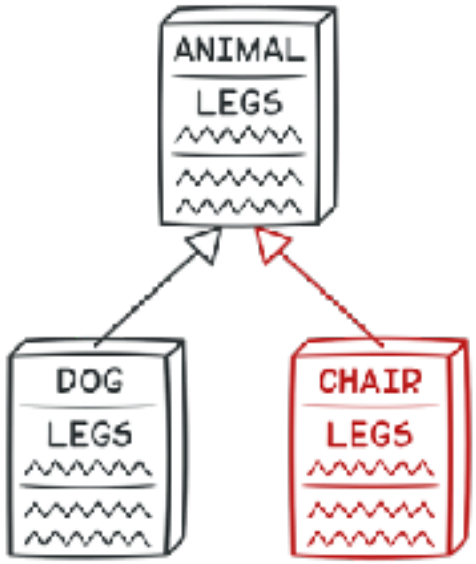
OO Abusers

- Refused Bequest
- Switch Statement

Refused Bequest

- A subclass that uses only some of the inherited fields and method
- The unneeded methods are unused or redefined to do nothing (or throw exceptions)



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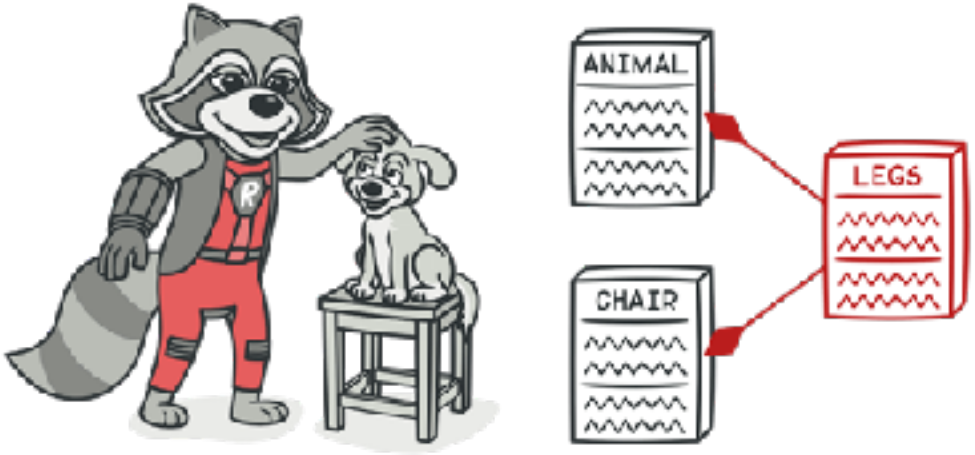
Refactoring

- **Extract Superclass:** Extract the common behavior needed by the subclass into a separate superclass, and extend from that
- **Replace Inheritance with Delegation:** Extract the common behavior in another class, delegate methods to the super class



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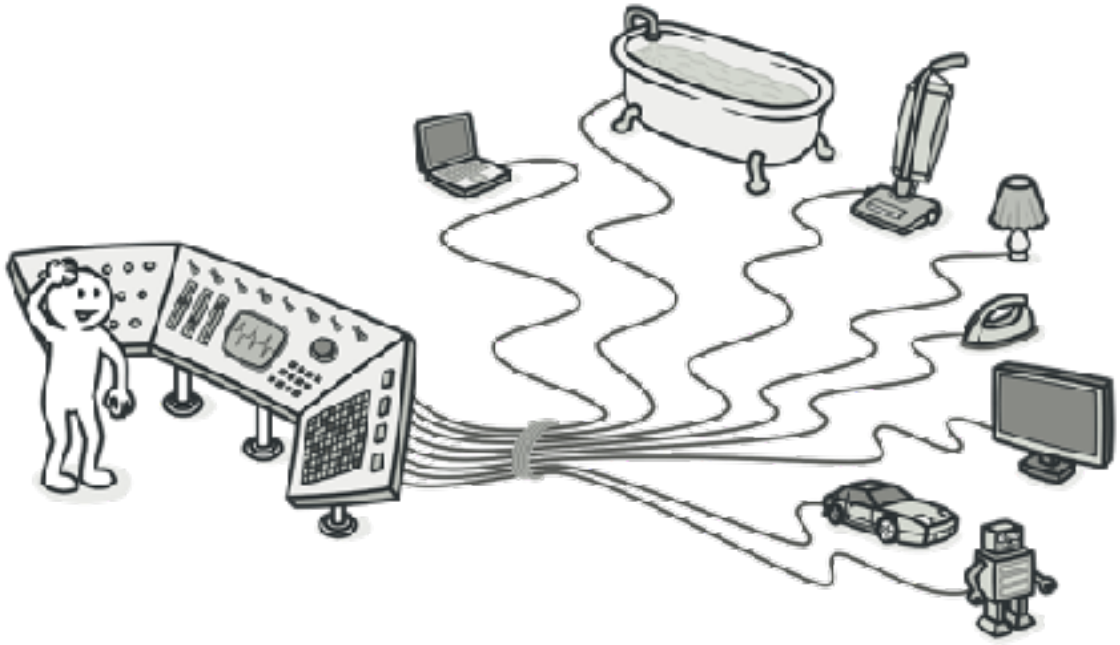
Switch statements

- A complex switch operator or a sequence of if statements.
- It's an indication of a missing class hierarchy.



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Refactoring

- Replace the switch/if statement with an inheritance hierarchy.
- Each branch of the switch/if becomes part of subclass.

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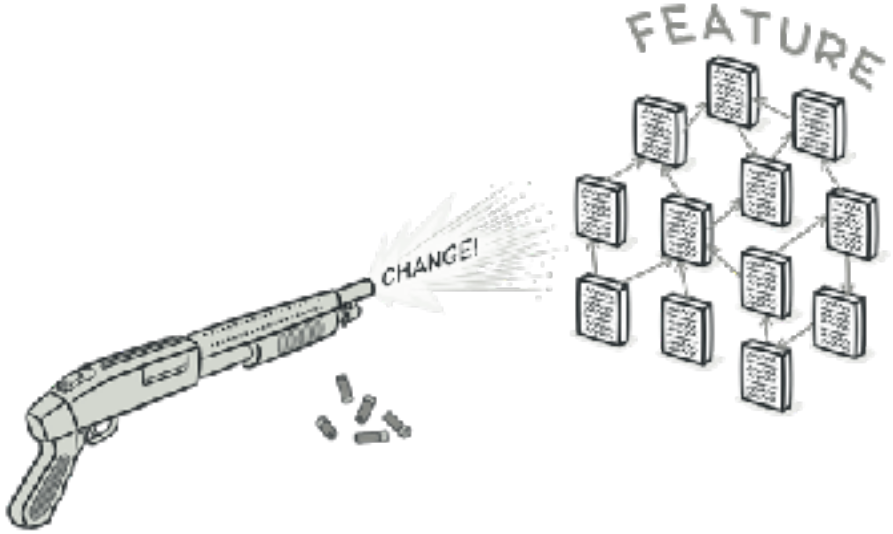
Shotgun Surgery

- Shotgun Surgery is a *change preventer.*
- Making any modifications requires many small changes to many different classes
- A single responsibility has been distributed among different classes.



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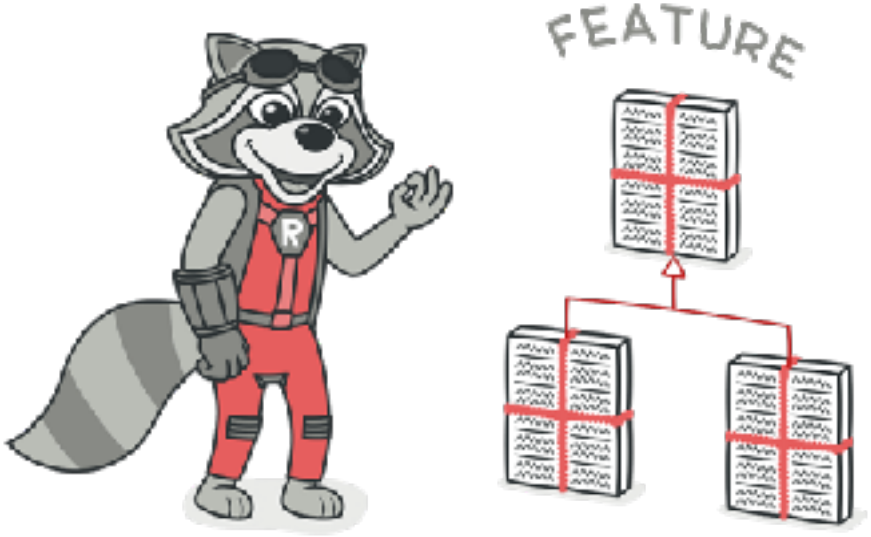
Refactoring

- You want to consolidate that responsibility into a single place.
- Use *Move Method* and *Move Field* to move the existing behavior to the right class.



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Dispensables

- Duplicated Code
- Data Class
- Speculative Generality

Duplicated Code

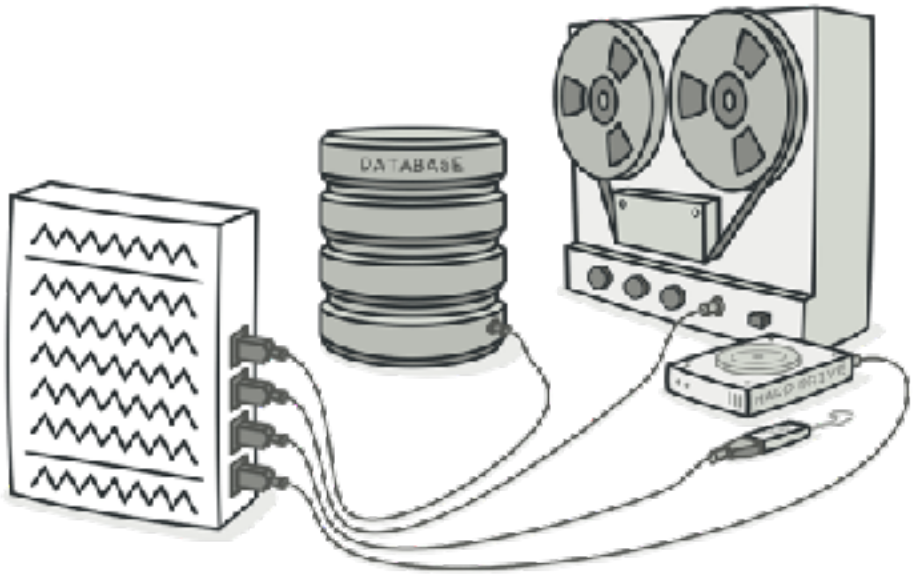
- Two code fragments look almost identical.
- Changes need to be performed to both copies.

Refactoring

- If the duplicated code is in the same class you *Extract Method* and place calls to the new method in both places.
- If the two methods are "independent," use *Extract Superclass* to extract a common superclass.
- If it is on the same level of a class hierarchy, use *Extract Method* for both classes, then *Pull Up Method* to move that method to the superclass.

Data Class

- Contains only fields and crude methods for accessing them (getters and setters).
- They are simply containers for data used by other classes.



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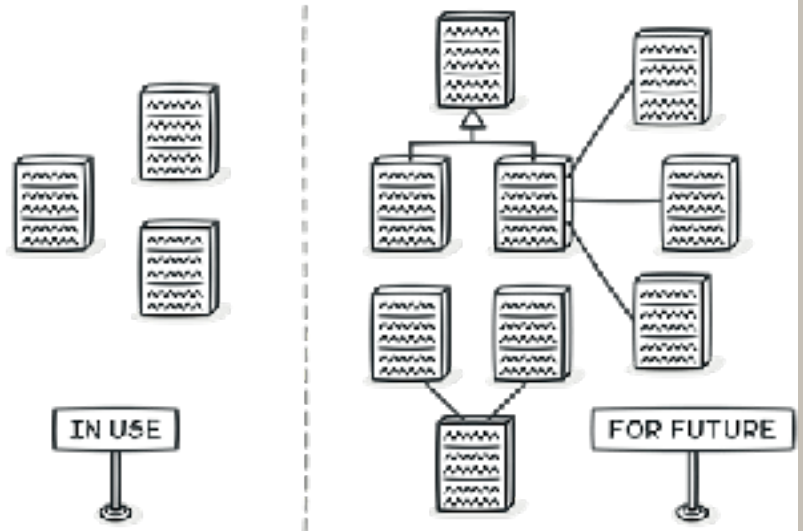
Refactoring

- Look at the client code (consumer). It's very likely that the client has responsibilities that can be moved to the data class.
- *Move Method* and *Extract Method* can be used to move functionality to the data class.

Speculative Generality

- Unused classes, fields or parameters
- Code that is created "just in case" to support anticipated future features that never get implemented.
- e.g. Abstract classes that are only implemented by one subclass



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Refactoring

- Unused abstract classes can be removed using *Collapse Hierarchy*
- Unnecessary classes can be removed via *Inline Class*
- Unused fields and method can be simply removed.

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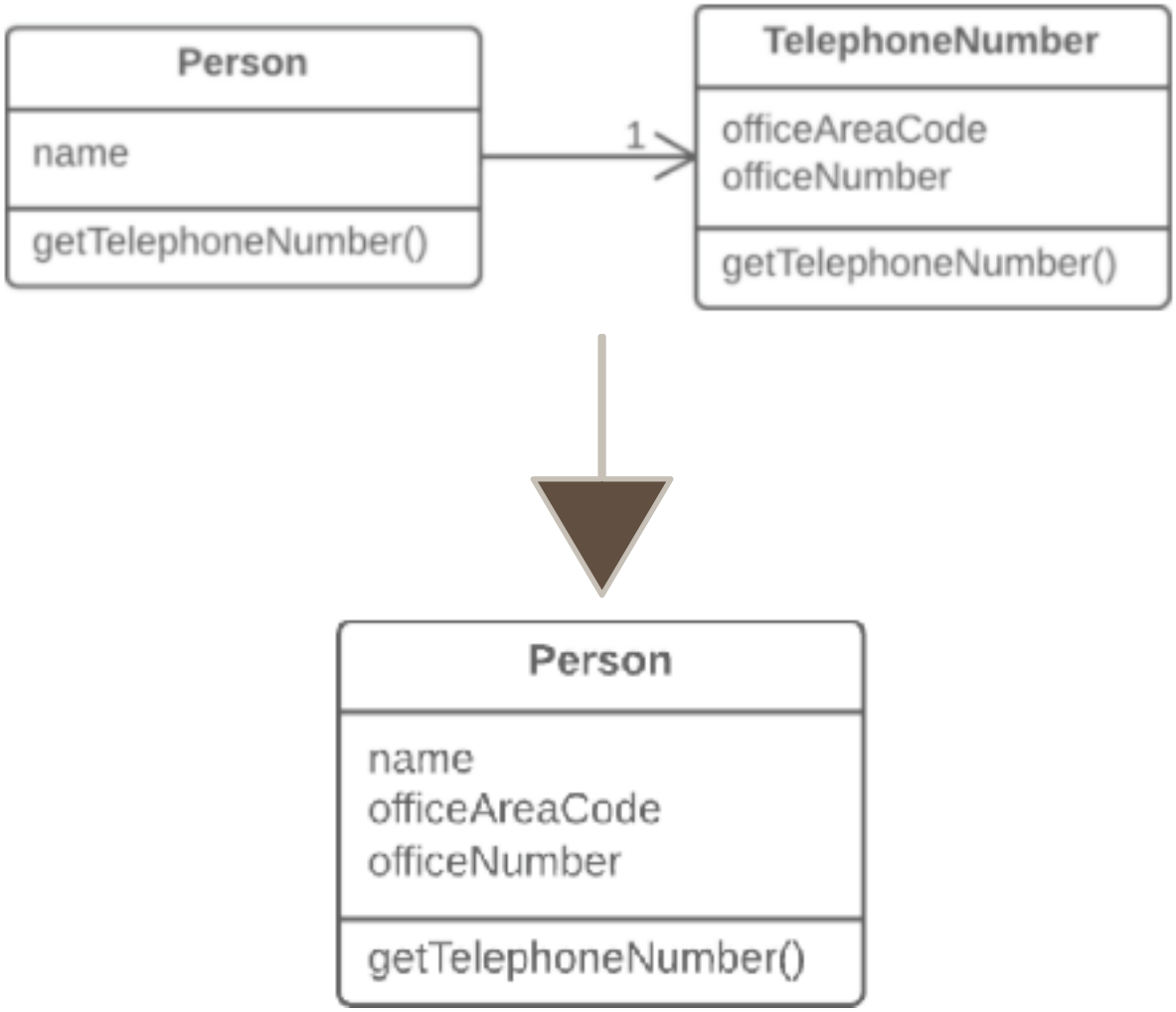
Move to in-line class



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Couplers

- Feature envy
- Inappropriate intimacy

Feature Envy

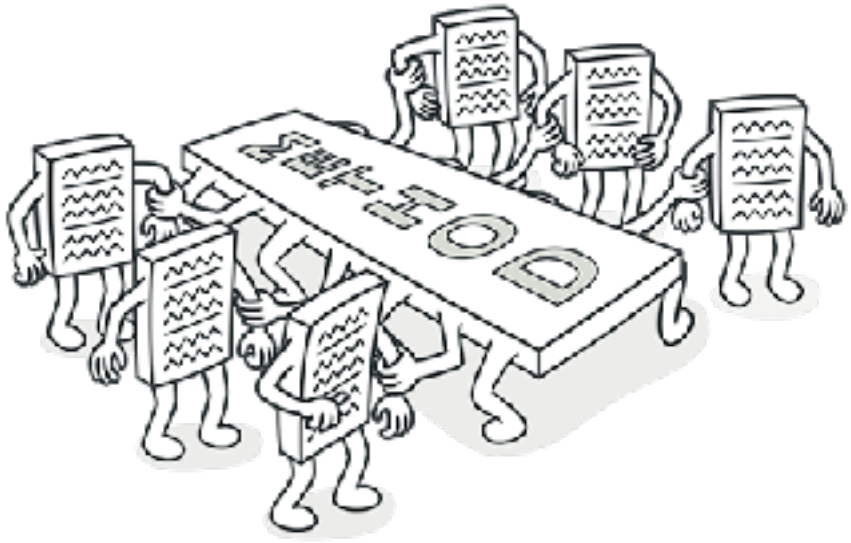
- A **method** accesses the data of another object more than its own data.

Refactoring

- Use *Move Method* to move the methods to another place
- If only part of a method is *envious*, then use *Extract Method*, together with *Move Method*

Inappropriate Intimacy

- One **class** uses the internal fields and methods of another class.
- Good classes should know as little about each other as possible.



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Refactoring

- Use *Move Method* and *Move Fields* to move parts from one class to the other.

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Participation Quiz

Class exercise (in Pairs)

- Look at the code that you downloaded from GitHub https://github.com/cs361fall2017/videostore
- Identify the code smells in the code base

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Class exercise (in Pairs)

- Look at the code that you downloaded from GitHub https://github.com/cs361fall2017/videostore
- Identify the code smells in the code base

- Now what refactoring will you do to clean the code smell