Refactoring

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Refactoring definition

Refactoring is the process of re-organizing and re-writing code so that it becomes cleaner, or fits better into the current conception of the architecture.

Refactoring *does not change functionality*.

Why refactor?

Refactoring was once seen as a kind of maintenance. . .

- You've inherited legacy code that's a mess.
- A new feature is required that necessitates a change in the architecture.

But can also be an integral part of the development process

Agile methodologies (e.g. XP) advocate continual refactoring (XP maxim: "Refactor mercilessly").

What does refactoring do?

A refactoring is a *small* transformation which preserves correctness.

There are many examples.
For a catalogue of over 90 assembled by Martin Fowler, see `http://refactoring.com/catalog/`.

A sample:

- Add Parameter
- Change Bidirectional Association to Unidirectional
- Extract Variable (Introduce Explaining Variable)
- Replace Conditional with Polymorphism

Extract Variable

Change

```
if ( (platform.toUpperCase().indexOf("MAC") > -1) &&
     (browser.toUpperCase().indexOf("IE") > -1) &&
      wasInitialized() && resize > 0 )
{
  // do something
}
```

to

```
final boolean isMacOs     = platform.toUpperCase().indexOf("MAC") > -1;
final boolean isIEBrowser = browser.toUpperCase().indexOf("IE")  > -1;
final boolean wasResized  = resize > 0;

if (isMacOs && isIEBrowser && wasInitialized() && wasResized)
{
  // do something
}
```

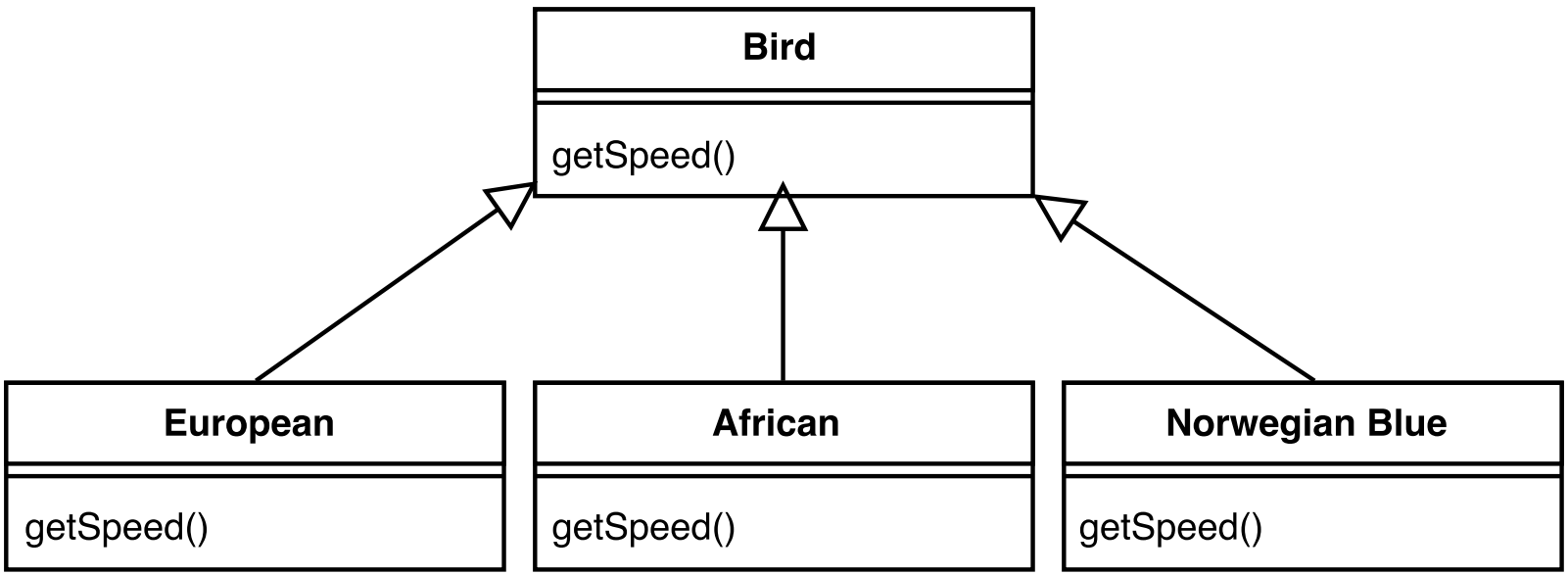
Replace Conditional with Polymorphism I

Change

```
double getSpeed() {
  switch (_type) {
    case EUROPEAN:
      return getBaseSpeed();
    case AFRICAN:
      return getBaseSpeed() - getLoadFactor() * _numberOfCoconuts;
    case NORWEGIAN_BLUE:
      return (_isNailed) ? 0 : getBaseSpeed(_voltage);
  }
  throw new RuntimeException ("Should be unreachable");
}
```

Replace Conditional with Polymorphism II

to



Eclipse Refactoring

Eclipse has a built-in refactoring tool (on the Refactor menu).

Many of its refactoring operation can be grouped in three broad classes . . .

Eclipse Refactoring I: Renaming and physical reorganization

A variety of simple changes.

For example:

- Rename Java elements (classes, fields, methods, local variables)
  - On class rename, `import` directives updated
  - On field rename, getter and setter methods also renamed
- Move classes between packages
- `package` and `import` directives updated

Eclipse applies these changes *semantically*

- Much better than syntactic search-and-replace

Eclipse Refactoring II:
Modifying class relationships

Heavier weight changes. Less used, but seriously useful when they are used. E.g.

- Move methods or fields up and down a class inheritance hierarchy.
- Extract an interface from a class
- Turn an anonymous class into a nested class

Eclipse Refactoring III: Intra-class refactorings

The bread-and-butter of refactoring: rearranging code within a class to improve readability etc. E.g.

- Extract Method: pull method code block into new method.
  - Good for shortening method or making block reusable
  - Also can extract local variables and constants
- Encapsulating fields in accessor methods.
- Change the type of a method parameter or return value

Safe refactoring

How do you know refactoring hasn't changed/broken something?

Perhaps somebody has *proved* that a refactoring operation is safe.

More realistically:

test, refactor, test

This works better the more tests you have: ideally, unit tests for every class.

Reading

Required: The article 'Refactoring for everyone' at `http://www.ibm.com/developerworks/opensource/library/os-ecref/`. Aim to remember: what refactoring is, and a few examples, not the details of the refactorings discussed here.

Suggested: Look at the *Reference - Refactor Actions* section of the Eclipse *Java development user guide* for full information on Eclipse's current capabilities.

Suggested: Browse around Fowler's page at `http://refactoring.com/`. Some of his book *Refactoring* is available on Google Books e.g., details of some of the refactorings in the catalogue.