Testing the Undesirable

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About me

Independent Consultant,
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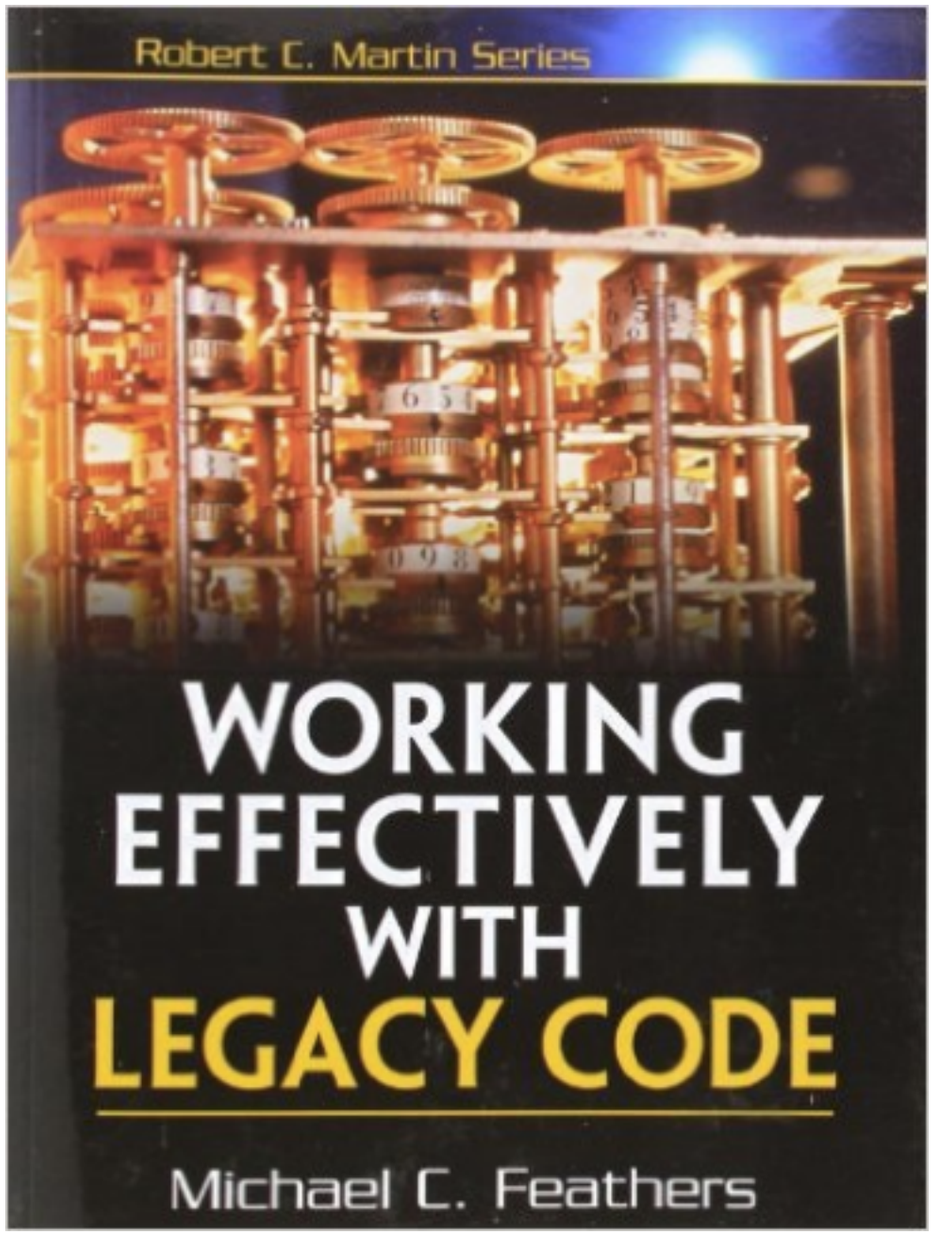
Just loves doing this kind of stuff.

(Sometimes comes with beard, sometimes not)

Agenda

Discuss some of the techniques to get tests around some of this undesirable code all while *preserving signatures*.


Java™ centric


Robert C. Martin Series
WORKING
EFFECTIVELY
WITH
LEGACY CODE
Michael C. Feathers

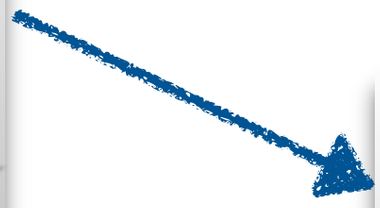
http://misko.hevery.com/code-reviewers-guide/

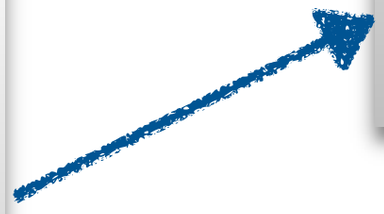
Miško Hevery

The Testability Explorer Blog

```
class Service1 {
  def bar(int i) {
    foo.bar(i + 9)
  }
}
```

```
class Service2 {
  def bar(int i) {
    foo.bar(i + 3)
  }
}
```





```
class Foo {
  def bar(String i) {
    ...
  }
}
```

```
def bar(int i) {
  ...
}
```

Before we Begin...

Test Driven Development

We will be using Test Driven Development, although this time.....after the fact.

TDD, a gentle reminder

1. Quickly add a test.
2. Run all tests and see the new one fail.
3. Make a little change.
4. Run all tests and see them all succeed.
5. Refactor to remove duplication.

What do we want to work towards?

Single Responsibility Principle (SRP)

Every class should have a single responsibility: It should have a single purpose in the system, and there should be only one reason to change it.

Liskov Substitution Principle

Objects of subclasses should be substitutable for objects of their superclasses throughout our code.

or

“Functions that use pointers or references to base classes must be able to use objects of derived classes without knowing it.”

Bob Martin

Demo Liskov Substitution Principle

Command/Query Separation

"A method should be a **command** or a **query**, but not both"

What is a Command?

A **command** is a method that can modify the state of the object but that doesn't return a value.

What is a Query?

A **query** is a method that returns a value but that does not modify the object.

Why can’t we violate it?

A method should be responsible for one thing, without us have to question to what it does or look to see if it has some side effect.

What should I test first?

Effect Sketching

Effect Sketching

Effect Sketching draws out what affects a change would happen on your code.

Interception Point

A point in your program where can detect the effects of a particular change

Effect Sketching

Start with the method that will be affected. This is called the *change point.*

Which Points to Choose?

Find *interception points* that are closer to your *change points*.

Which Points to Choose?

Given multiple *change points* find the *interception point* where the effects meet.

change point

State.calcTax()

PO.generate()

interception point

Quote.generate()

interception point

change point

change point

change point

Stops.getReport()

GasPriceWS.find()

GasHistory.locate()

GasSpeculator.create()

pinch point

Techniques

Seam Model

Seams Defined

A Seam is a place where you can alter behavior in your program without editing in that place.

Michael Feathers - Working Effectively with Legacy Code

Seam Enabling Points

Every seam has an enabling point, a place where you can make the decision to use one behavior or another.

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Java Seam Enabling Points

That point (In Java) can be at the classpath.

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Using 

Patterns

Extract Interface

Extract Interface

```
public interface IAccount {

}
```

Step 1: Create a new interface with the name you'd like to use. Don't add any methods to it yet.

Extract Interface

```
public interface IAccount {

}
```

```
public class Account implements IAccount {

}
```

Step 2: Make the class that you are extracting from implement the interface. This can't break anything because the interface doesn't have any methods. But it is good to compile and run your test just to verify that.

Extract Interface

```
public Account merge(Account account1, Account account2)
```

```
public IAccount merge(IAccount account1, IAccount account2)
```

Step 3: Change the place where you want to use the object so that it uses the interface rather than the original class.

Extract Interface

```
public interface IAccount {
  public void deposit(float amt);
  public void withdrawal(float amt);
}
```

Compile the system and introduce a new method declaration on the interface for each method use that the compiler reports as an error.

Not too exciting…

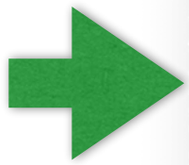
Couple of notes about it…

- Great way to try a new implementation
- Important when someone wants a “change”

Extract Interface is a great to try a new implementation

Parameterize Method

Parameterize Method



```
public class Foo {
    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }
}
```

Step 1: Identify the method that you want to replace

Parameterize Method

```
public class Foo {
    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }

    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }
}
```

Step 1.1: Make a copy of the method

Parameterize Method

```
public class Foo {
    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }

    public void bar(Bar b) {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }
}
```

Step 2.1: Add a parameter to the method for the object whose creation you are going to replace.

Parameterize Method

```
public class Foo {
    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }

    public void bar(Bar b) {
        Bar bar =
        bar.baz();
        bar.qux();
    }
}
```

Step 2.2: Remove the object creation

Parameterize Method

```
public class Foo {
    public void bar() {
        Bar bar = new Bar();
        bar.baz();
        bar.qux();
    }

    public void bar(Bar b) {
        Bar bar = b;
        bar.baz();
        bar.qux();
    }
}
```

Step 2.3: Add an assignment from the parameter to the variable that holds the object

Parameterize Method

```
public class Foo {
    public void bar() {

    }

    public void bar(Bar b) {
        Bar bar = b;
        bar.baz();
        bar.qux();
    }
}
```

Step 3.1: Delete the body of the original method

Parameterize Method

```
public class Foo {
    public void bar() {
        bar(new Bar());
    }

    public void bar(Bar b) {
        Bar bar = b;
        bar.baz();
        bar.qux();
    }
}
```

Step 3.1: Make a call to the parameterized method, using the object creation expression for the original object.

Parameterize Method

```
public class Foo {
    public void bar() {
        bar(new Bar());
    }

    public void bar(Bar b) {
        Bar bar = b;
        bar.baz();
        bar.qux();
    }
}
```

Addendum: The new method is now testable

Parameterize Method

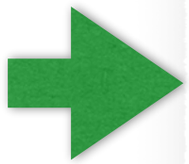
```
public class Foo {
    public void bar() {
        bar(new Bar());
    }

    public void bar(Bar bar) {
        bar.baz();
        bar.qux();
    }
}
```

Addendum: After your test, perform refactoring

Parameterize Method to Overcome Static Calls

Parameterize Method to Overcome Static Calls

Parameterize Method



```
public class Foo {
    public void bar(int a, int b) {
        Resource r = Server.getResource(“account”)
        r.send(r.process(a, b) * 10);
    }
}
```

Step 1: Identify the method that you want to replace

Parameterize Method

```
public class Foo {
    public void bar(int a, int b) {
        Resource r = Server.getResource(“account”)
        r.send(r.process(a, b) * 10);
    }

    public void bar(int a, int b) {
        Resource r = Server.getResource(“account”)
        r.send(r.process(a, b) * 10);
    }
}
```

Step 1.1: Make a copy of the method

Parameterize Method

```
public class Foo {
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }

    public void bar(int a, int b,
                    Function<String, Resource> f){
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 2.1: Add a functional interface to the method for the static you are going to replace.

Parameterize Method

```
public class Foo {
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }

    public void bar(int a, int b,
                    Function<String, Resource> f){
      Resource r = f.apply(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 2.3: Add an assignment from the parameter to the variable that holds what the function will return, including the static's former parameters.

Parameterize Method

```
public class Foo {
    public void bar(int a, int b) {

    }
```

```
    public void bar(int a, int b,
                    Function<String, Resource> f){
      Resource r = f.apply(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 3.1: Delete the body of the original method

Parameterize Method

```
public class Foo {
    public void bar(int a, int b) {
        bar(a, b,
            s -> Server.getResource(s))
    }

    public void bar(int a, int b,
                    Function<String, Resource> f){
      Resource r = f.apply(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 3.2: Make a call to the parameterized method, using the object creation expression for the original object.

Caveat

If the function is something where you don't expect much of a different behavior to change you may opt for a *"Parameterize Constructor"* with the function instead.

Parameterize Constructor

Parameterize Constructor

- **Constructors are not a part of the interface!**
- **It is false to think that a change in the constructor will change your interface.**

Parameterize Constructor

```
public class Foo {
    public Foo() {
        Bar bar = new Bar();
        bar.init();
    }

    public baz() {
        bar.qux();
    }
}
```

Step 1: Identify the constructor that you want
to parameterize

Parameterize Constructor

```
public class Foo {
    public Foo() {
        Bar bar = new Bar();
        bar.init();
    }

    public Foo() {
        Bar bar = new Bar();
        bar.init();
    }

    public baz() {
        bar.qux();
    }
}
```

Step 1.1: Make a copy of it.

Parameterize Constructor

```
public class Foo {
    public Foo() {
        Bar bar = new Bar();
        bar.init();
    }

    public Foo(Bar b) {
        Bar bar = new Bar();
        bar.init();
    }

    public baz() {
         bar.qux();
    }
}
```

Step 2.1: Add a parameter to the constructor for the object whose creation you are going to replace

Parameterize Constructor

```
public class Foo {
    public Foo() {
        Bar bar = new Bar();
        bar.init();
    }

    public Foo(Bar b) {
        Bar bar = b
        bar.init();
    }

    public baz() {
         bar.qux();
    }
}
```

Step 2.2: Remove the object creation and add an assignment from the parameter to the instance variable for the object.

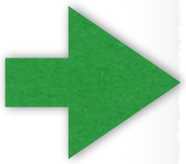
Parameterize Constructor

```
public class Foo {
    public Foo() {
        this(new Bar());
    }

    public Foo(Bar b) {
        Bar bar = b
        bar.init();
    }

    public baz() {
         bar.qux();
    }
}
```

Step 3: Remove the body of the old constructor and replace it with a call to the new constructor

Parameterize Constructor with Lambdas to overcome static calls

Parameterize Constructor



```
public class Foo {
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 1: Identify the static method that you want to parameterize in a constructor

Parameterize Constructor

```
public class Foo {
    public Foo() {}
    public Foo() {}
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 1.1: Make a copy of the constructor
(in this case there was no explicit constructor, so I made two to preserve signatures)

Parameterize Constructor

```
public class Foo {
    public Foo() {}
    public Foo(Function<String, Resource> f) {}
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 2.1: Add a parameter to the new constructor for the functional interface that matches your static’s signature

Parameterize Constructor

```
public class Foo {
    private Function<String, Resource> f;
    public Foo() {}
    public Foo(Function<String, Resource> f) {}
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 2.2: Create a member variable to store the function

Parameterize Constructor

```
public class Foo {
    private Function<String, Resource> f;
    public Foo() {}
    public Foo(Function<String, Resource> f) {
      this.f = f;
    }
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 2.2: Add an assignment from the parameter to the member variable in the copied constructor

Parameterize Constructor

```
public class Foo {
    private Function<String, Resource> f;
    public Foo() {
      this(s -> Server.getResource(s))
    }
    public Foo(Function<String, Resource> f) {
      this.f = f;
    }
    public void bar(int a, int b) {
      Resource r = Server.getResource(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 3: Remove the body of the old constructor (if applicable) and replace it with a call to the new constructor

Parameterize Constructor

```
public class Foo {
    private Function<String, Resource> f;
    public Foo() {
      this(s -> Server.getResource(s))
    }
    public Foo(Function<String, Resource> f) {
      this.f = f;
    }
    public void bar(int a, int b) {
      Resource r = f.apply(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Step 4: Replace the static with your function

Parameterize Constructor

```
public class Foo {
    private Function<String, Resource> f;
    public Foo() {
      this(Server::getResource)
    }
    public Foo(Function<String, Resource> f) {
      this.f = f;
    }
    public void bar(int a, int b) {
      Resource r = f.apply(“account”)
      r.send(r.process(a, b) * 10);
    }
}
```

Addendum: test your method with TDD, refactor

Sprout Class & Method

Sprout Method

Sprout Method

```
public class Foo {
    int i;
    public void bar {
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 1: Identify where you need to make your code change.

Sprout Method

```
public class Foo {
    int i;
    public void bar {
        //baz()
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 2: If the change can be formulated as a single sequence of statements in one place in a method, write down a call for a new method that will do the work involved and then comment it out.

Sprout Method

```
public class Foo {
    int i;
    public void bar {
        //baz(i)
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 3: Determine what local variables you need from the source method, and make them arguments to the call.

Sprout Method

```
public class Foo {
    int i;
    public void bar {
        //float f = baz(i)
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 4: Determine whether the sprouted method will need to return values to source method. If so, change the call so that its return value is assigned to a variable.

Sprout Method

```
public class Foo {
    int i;
    public void baz {...}
    public void bar {
        //float f = baz(i)
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

```
public class FooTest {
    @Test
    public void testBaz {
        Foo foo = new Foo();
        assertEquals(
            19.0f,foo.baz(10))
    }
}
```

Step 5: Develop the sprout method using test-driven development

Sprout Method

```
public class Foo {
    int i;
    public void baz {...}
    public void bar {
        float f = baz(i)
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

```
public class FooTest {
    @Test
    public void testBaz {
      Foo foo = new Foo();
      assertEquals(
          19.0f,foo.baz(10))
    }
}
```

Step 5: Remove the comment in the source method to enable the call.

Sprout Class

Sprout Class

```
public class Foo {
    int i;
    public void bar() {
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 1: Identify where you need to make your code change.

Sprout Class

```
public class Foo {
    int i;
    public void bar() {
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 2.1: If the change can be formulated as a single sequence of statements in one place in a method, think of a good name for a class that could do that work.

Sprout Class

```
public class Foo {
    int i;
    public void bar() {
        // Other other = new Other();
        // other.baz();
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 2.2: Write code that would create an object of that class in that place, and call a method in it that will do the work that you need to do; then comment those lines out.

Sprout Class

```
public class Other {
  public Other(int i) {}
  public void baz(){}
}
```

```
public class Foo {
   int i;
   public void bar() {
        // Other other = new Other(i);
        // other.baz();
        doSomething1;
        doSomething2;
        doSomething3;
   }
}
```

Step 3: Determine what local variables you need from the source method, and make them arguments to the classes' constructor.

Sprout Class

```
public class Other {
  public Other(int i) {}
  public float baz(){}
}
```

```
public class Foo {
    int i;
    public void bar() {
        // Other other = new Other(i);
        // other.baz();
        doSomething1;
        doSomething2;
        doSomething3;
    }
}
```

Step 4.1: Determine whether the sprouted class will need to return values to the source method. If so, provide a method in the class that will supply those values,

Sprout Class

```
public class Other {
  public Other(int i) {}
  public float baz(){}
}
```

```
public class Foo {
   int i;
   public void bar {
        // Other other = new Other(i);
        // float f = other.baz();
        doSomething1;
        doSomething2;
        doSomething3;
   }
}
```

Step 4.2: Add a call in the source method to receive those values.

Sprout Class

```
public class Other {
  public Other(int i) {}
  public float baz(){}
}
```

```
public class OtherTest {
   @Test
   public void testBaz() {
      ...
      assertEquals(...)
   }
}
```

Step 5: Develop the sprout class test first (TDD)

Sprout Class

```
public class Other {
  public Other(int i) {}
  public float baz(){}
}
```

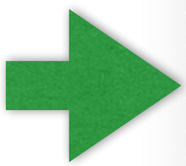
```
public class Foo {
   int i;
   public void bar {
        Other other = new Other(i);
        float f = other.baz();
        doSomething1;
        doSomething2;
        doSomething3;
   }
}
```

Step 6: Remove the comments

Wrap Class & Method

Wrap Method

Wrap Method (v1)



```
public class Foo {
    public void deposit(int amt) {...}
}
```

1. Identify a method you need to change.

Wrap Method (v1)

```
public class Foo {
    protected void depositTx(int amt) {...}
    public void deposit(int amt) {}
}
```

Step 2: Rename the method and then create a new method with the same name and signature as the old method.

Wrap Method (v1)

```
public class Foo {
  protected void depositTx(int amt) {
    ...
  }
  public void deposit(int amt) {
    depositTx(amt);
  }
}
```

Step 3: Place a call to the old method in the new method

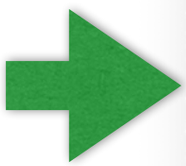
Wrap Method (v1)

```
public class Foo {
    public void depositTx(int amt) {...}
    public void deposit(int amt) {
      audit(amt, “Depositing”);
      depositTx(amt);
      audit(amt, “Deposited”);
    }
    protected void audit(int amt, String msg) {...}
}
```

Step 4: Develop a method for the new feature, test first, and call it from the new method

Wrap Method (v2)

Wrap Method (v2)



```
public class Foo {
    public void deposit(int amt) {...}
}
```

1. Identify a method you need to change.

Wrap Method (v2)

```
public class Foo {
    public void deposit(int amt) {...}
    protected void audit(int amt, String msg) {...}
}
```

Step 2: Develop a new method for it using test-driven development.

Wrap Method (v2)

```
public class Foo {
    public void deposit(int amt) {...}
    protected void audit(int amt, String msg) {...}
    public void auditedDeposit(int amt) {
        audit(amt, “Depositing”);
        deposit(amt);
        audit(amt, “Deposited”);
    }
}
```

Step 3: Create another method that calls the new method and the old method.

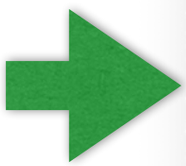
Wrap Method (v2)

```
public class Foo {
    public void deposit(int amt) {...}
    protected void audit(int amt, String msg) {...}
    public void auditedDeposit(int amt) {
        audit(amt, “Depositing”);
        deposit(amt);
        audit(amt, “Deposited”);
    }
}
```

Addendum: You now have a choice, regular or audited

Wrap Class

Wrap Class



```
public class Foo {
    public void deposit(int amt) {...}
}
```

1. Identify a method you need to change.

Wrap Class

```
public interface Foo {
    public void deposit(int amt);
}
```

```
public class FooImpl implements Foo {
    public void deposit(int amt) {...}
}
```

2. Extract an interface from a class

Wrap Class

```
public interface Foo {
    public void deposit(int amt);
}
```

```
public class FooLogger implements Foo {
    public FooLogger(Foo foo) {..}
    public void deposit(int amt) {}
}
```

3. Create a class that accepts the interface you are going to wrap as a constructor argument

Wrap Class

```
public class FooLogger implements Foo {
    public FooLogger(Foo foo) {..}
    protected void audit(int amt, String msg) {...}
    public void deposit(int amt) {}
}
```

```
public class FooLoggerTest {
  @Test
  public void testAudit() {...}
}
```

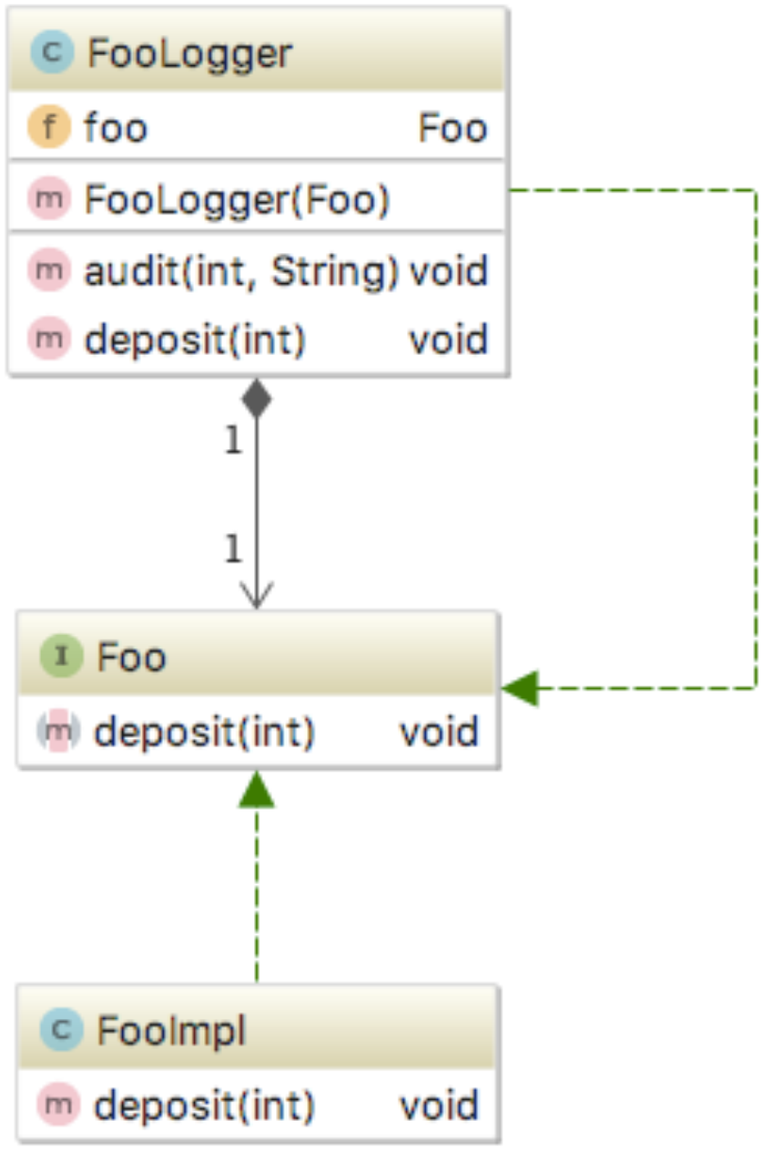
4. Create a new method using TDD that does the new work and behavior

Wrap Class

```
public class FooLogger implements Foo {
    private Foo foo;
    public FooLogger(Foo foo) {this.foo = foo;}
    protected void audit(int amt, String msg) {...}
    public void deposit(int amt) {
        audit(amt, “Depositing”);
        foo.deposit(amt);
        audit(amt, “Deposited”);
    }
}
```

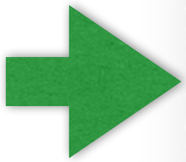
5. Ensure that you call the old methods on the old class

Wrap Class


FooLogger
foo Foo
FooLogger(Foo)
audit(int, String) void
deposit(int) void
1
1
Foo
deposit(int) void
FooImpl
deposit(int) void

Introduce Instance Delegator

Introduce Instance Delegator



```
public class Foo {
    public static bar(int x, String y) {..}
}
```

Step 1: Identify a static method that is problematic to use in a test.

Introduce Instance Delegator

```
public class Foo {
    public static void bar(int x, String y) {..}
    public void inBar(int x, String y) {
    }
}
```

Step 2: Create an instance method for the static method on the class, preserving signatures

Introduce Instance Delegator

```
public class Foo {
    public static void bar(int x, String y) {..}
    public void inBar(int x, String y) {
        bar(x, y);
    }
}
```

Step 3: Make the instance method delegate to the static method.

Introduce Instance Delegator

```
public class Nom {
   public void chomp(int i, int j, String status) {
      Foo.bar(i + j, status);
   }
}
```

Step 4: Find locations where the static call was made.

Introduce Instance Delegator

```
public class Nom {
    public Nom() {}
    public Nom(Foo foo) {this.foo = foo;}
    public void chomp(int i, int j, String status) {
        foo.inBar(i + j, status);
    }
}
```

Step 5. Use ParameterizeMethod or ParameterizeConstructor to exchange it for the instance call.

Passing Null

Passing Null

- It's important to get the test out as soon as possible.
- If you need to create a test and the subject under test (SUT) is hard to construct *pass null!*

Subclass and Override Method

Subclass and Override Method

```
public class InterestRateCalc {
    private final float callWS() {..}
    public float calculate {..}
}
```

Step 1: Identify the method dependencies that are complex, gather those that are giving you problems

Subclass and Override Method

```
public class InterestRateCalc {
    private float callWS() {..}
    public float calculate {..}
}
```

Step 2: Make each method overridable

Subclass and Override Method

```
public class InterestRateCalc {
    protected float callWS() {..}
    public float calculate {..}
}
```

Step 3: Adjust the visibility

Subclass and Override Method

```
public class TestableInterestRateCalc extends InterestRateCalc {
   protected float callWS() {return 100.0;} //fake
   public float calculate {..} //testable
}
```

Step 4: Create a subclass that overrides the methods. Verify that you are able to build it in your test harness.

Subclass and Override Method

```
public class InterestRateCalcTest
             extends InterestRateCalc {
   @Override
   protected float callWS() {return 100.0;} //fake

   @Test
   public void testCalculate() {
      assertEquals(200, this.calculate());
   }
}
```

Addendum: You can also extend in a test class!

Sensing Variables

Sensing Variables

- A publicly accessible public variable used to determine if a certain behavior is triggered.
- It is then used in a test to verify and used to test other regressions.
- Once long methods have been broken up the tests and sensing variable can be removed.
- Great for the long “inverted pyramid” code

Sensing Variables

```
public class TaxCode {
   public void applyTaxAndSurcharge(Order order) {
     Money total = order.total();
     if (order.after(LocalDate.of(“2001-01-01))) {
         if (order.customer.getState().equals(“FL") ||
            order.customer.getState().equals("NY"))
            order.applySurcharge(new Money(10))
            order.applyTax(new Money(total *
              TaxWS.findTaxRate(order.customer.getState());
         else
            order.applyTax(new Money(
         }
     } else {
       order.applyTax(0)
       order.applySurcharge(0)
     }
   }
}
```

Sensing Variables

```
public class TaxCode {
    public boolean nyFLTaxApplied = false
    public void applyTaxAndSurcharge(Order order) {
      Money total = order.total();
      if (order.after(LocalDate.of(“2001-01-01))) {
          if (order.customer.getState().equals(“FL") ||
             order.customer.getState().equals("NY"))
             order.applySurcharge(new Money(10))
             order.applyTax(new Money(total *
               TaxWS.findTaxRate(order.customer.getState()));
             nyFLTaxApplied = true;
          else
             order.applyTax(new Money(
          }
      } else {
        order.applyTax(0)
        order.applySurcharge(0)
      }
    }
}
```

Sensing Variables

```
public class TaxCode {
    public boolean nyFLTaxApplied = false
    public void applyTaxAndSurcharge(Order order) {
      Money total = order.total();
```

```
public class TaxCodeTest {
  public void testNYFLTaxApplied() {
      Order fakeOrder = ...;
      TaxCode taxCode = new TaxCode();
      taxCode.applyTaxAndSurchage(fakeOrder);
      assertTrue(taxCode.nyFLTaxApplied());
   }
}
```

```
      } else {
        order.applyTax(0)
        order.applySurcharge(0)
      }
    }
}
```

Soft Skills

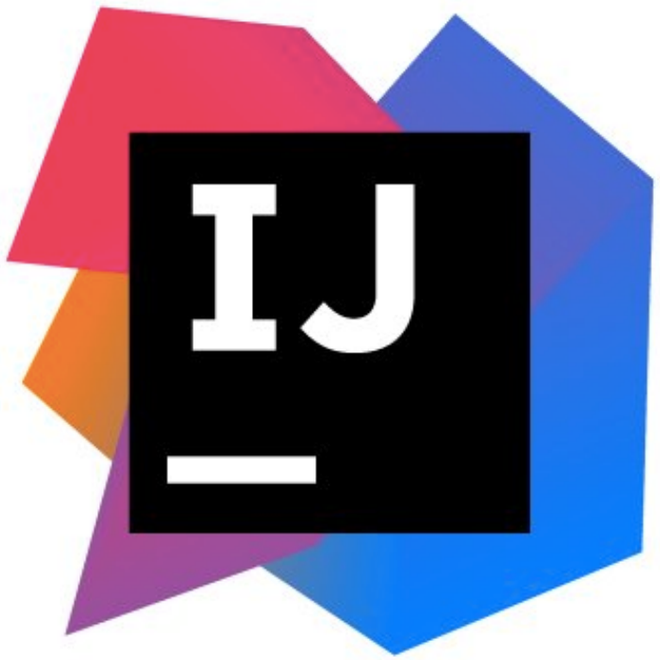
Learn your IDEs well

Learn to Jump from Test to Production Quickly

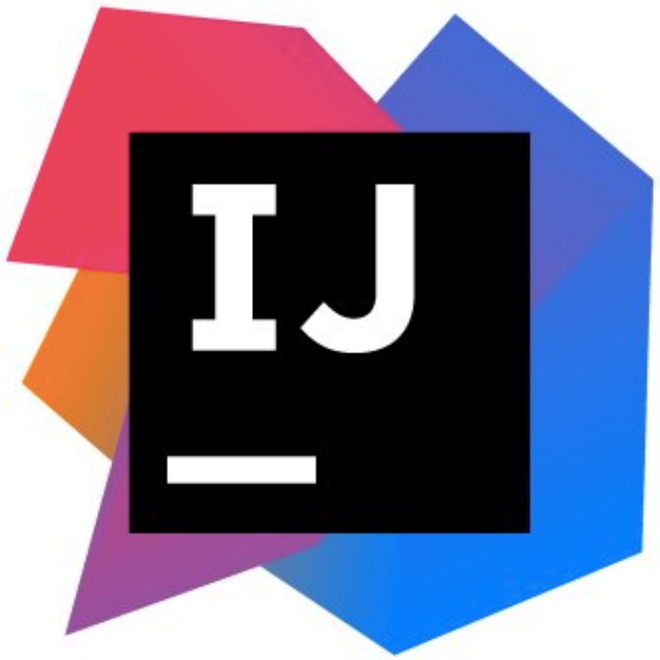
Install MoreUnit on Eclipse

- **CTRL-J** : Toggle between Test & Production
- **CTRL-R** : Run the Test

* Same on all OSes



CTRL + SHIFT + T : Toggle Between Production and Test
CTRL + SHIFT + F10 : Run Test



⌘ ⇧ **T :** Toggle Between Production and Test
^ ⇧ **F10 :** Run Test

Testing Thursdays

or you can choose the day

Scratch Refactoring

Scratch Refactoring Rules

- Checkout a new branch in version control
- Move stuff around
- **Refactor without tests!**
- **No matter what happens, never, never merge!**

Lambdas will be your friend

Delete Unused Code

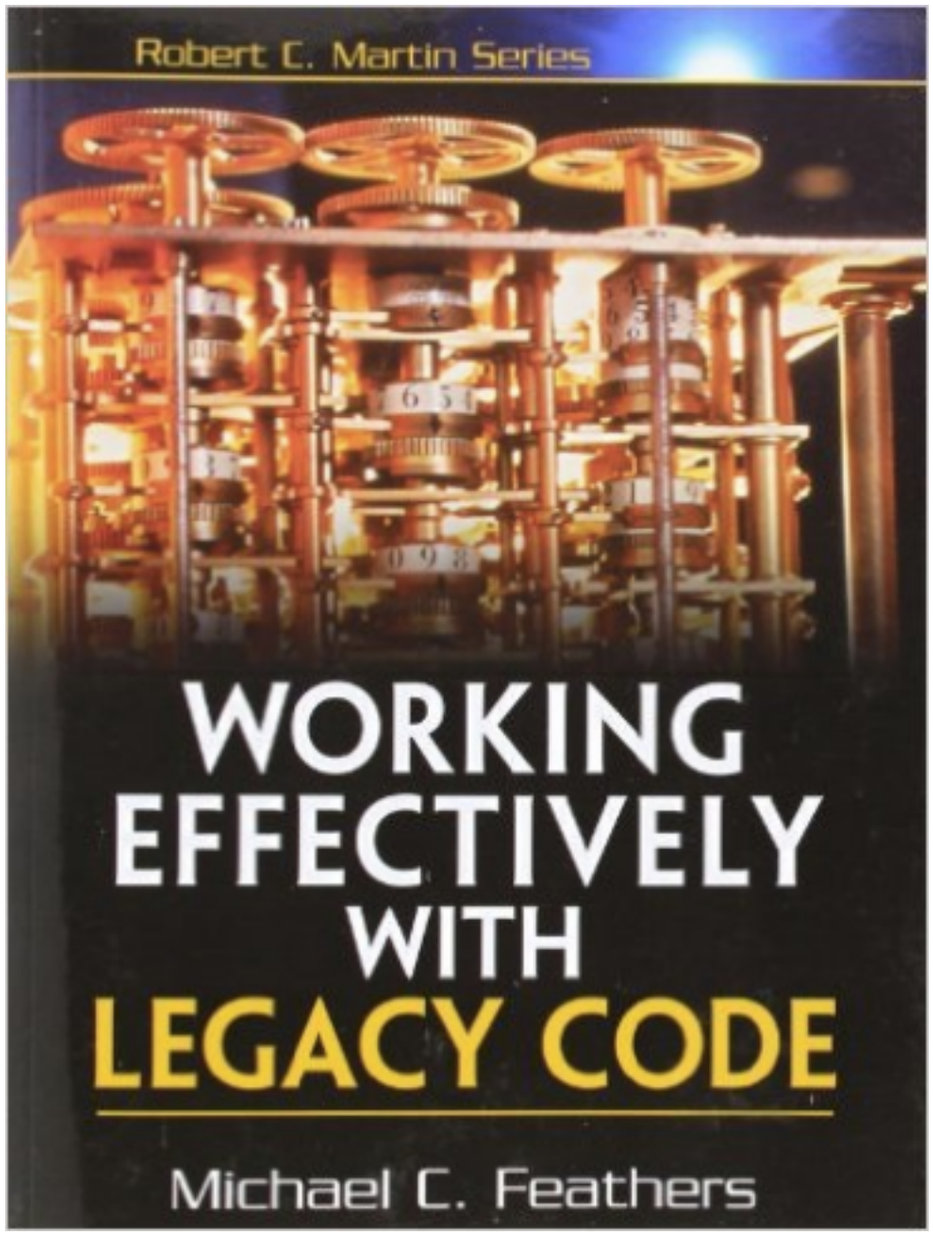
Do you even version control?

Delete Commented Code

You may never need it

“Programming is the art of doing one thing at a time.”

Michael Feathers


Robert C. Martin Series
WORKING
EFFECTIVELY
WITH
LEGACY CODE
Michael C. Feathers

Thank You