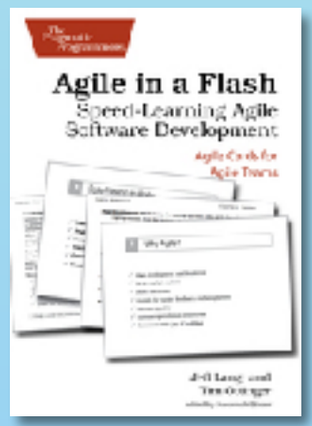
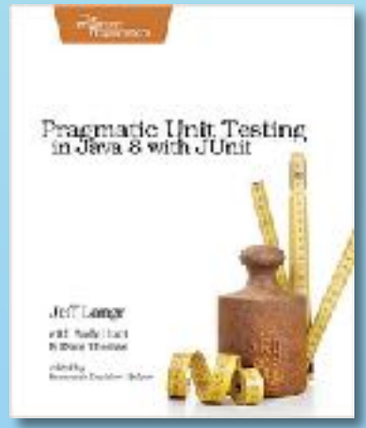
ICON
AGILITY SERVICES

Test-Driven Development Foundations: Scala v1.0

Jeff Langr

jeff@langrsoft.com
@JLangr





What's a Unit Test Look Like?

```
describe("something") {
  it("demonstrates some behavior") {
    // Arrange

    // Act

    // Assert
  }
}
```

The AAA mnemonic is courtesy of Bill Wake.

A Sample Unit Test

```
describe("an auto") {
  val auto = Auto()

  it("idles engine when started") {
    auto.depressBrake()

    auto.pressStartButton()

    auto.RPM() shouldBe 1000 +- 50
  }
}
```

What's an Assertion Look Like?

Some fundamentals:

```
someCondition shouldBe true
someCondition should be (true)
idleSpeed shouldEqual 1000
idleSpeed should not equal 2000
idleSpeed should equal (1000)
idleSpeed should not be < (900)
alphabetizedName shouldEqual "Schmoo, Kelly Loo"
alphabetizedName should startWith regex ("S.*,")
```

See http://www.scalatest.org/user_guide/using_matchers

What's an Assertion Look Like?

More interesting stuff:

```
someList should contain('O')
someList should contain theSameElementsInOrderAs
  Seq('O', 'T', 'T', 'F', 'F', 'S', 'S')
someList should contain inOrder('O', 'T', 'S')
someList should not be empty
someList should have length 7
forAll (someList) { c: Char => c.isLetter should be (true)}
someOption shouldBe empty
```

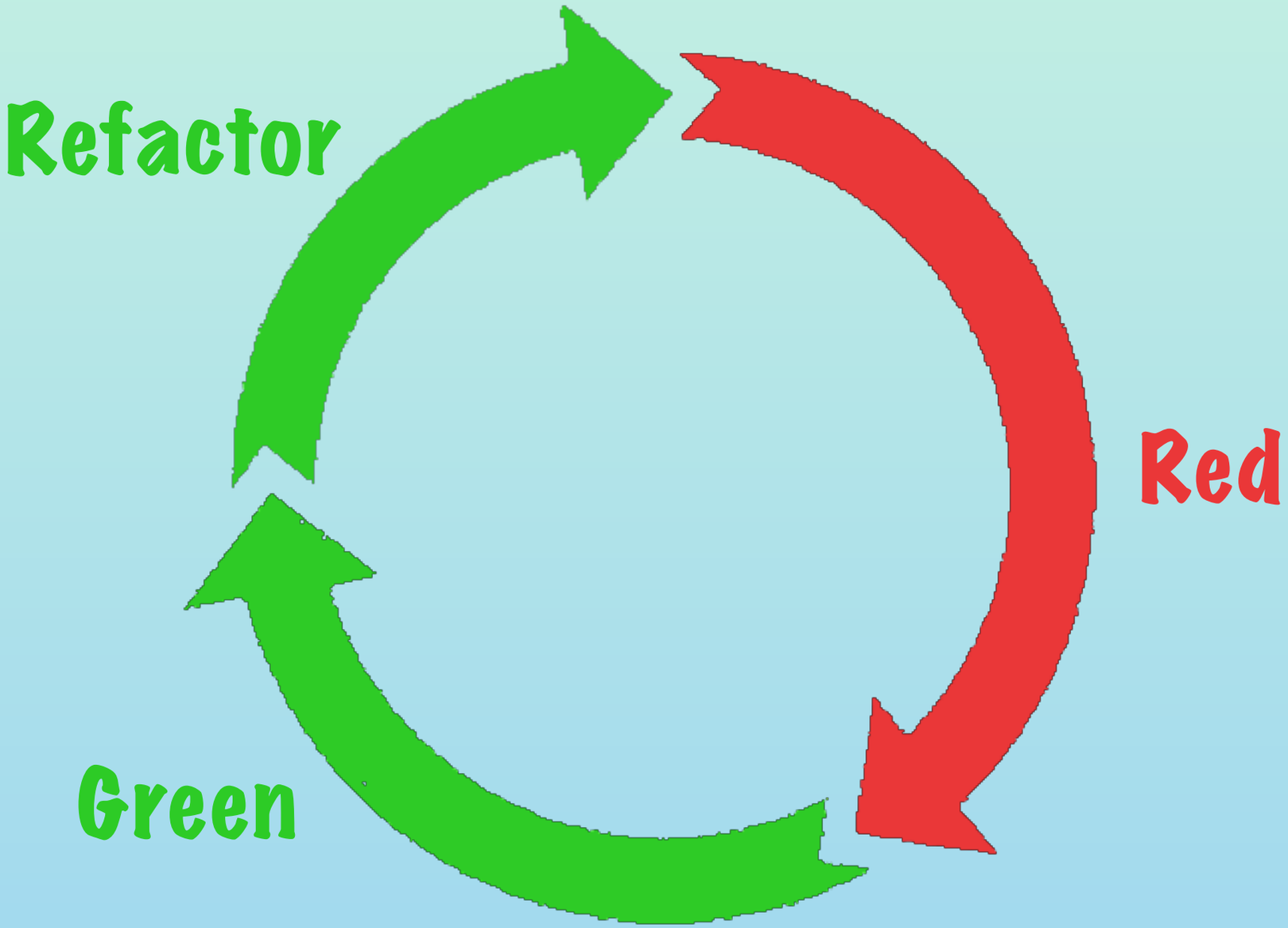
You can also create custom matchers!

See http://www.scalatest.org/user_guide/using_matchers

Exercise: Simple Outcomes

Flesh out the tests in com.langrsoft.util.BasicsTest

Test-Driven Development

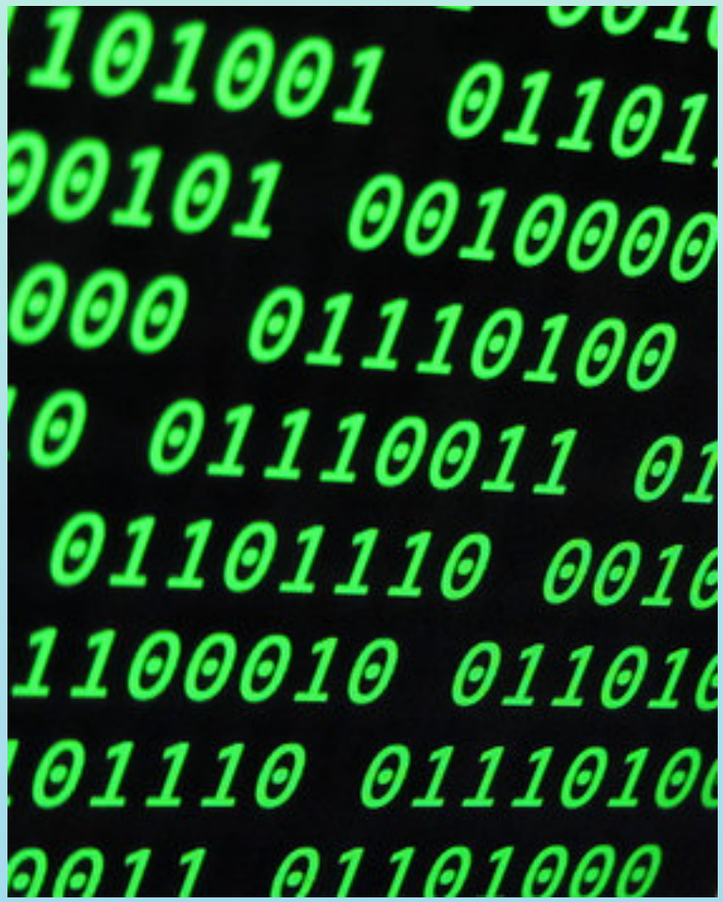


An incremental design technique

Exercise: (Test)-Code-Refactor
TDD Paint by Numbers

See com.langrsoft.util.NameNormalizerTest

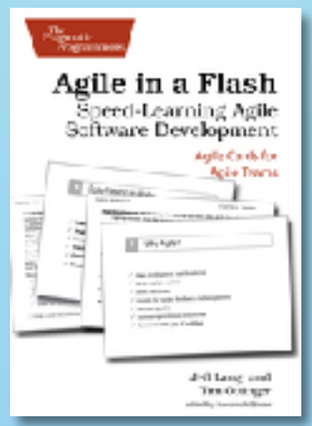
Core TDD Themes

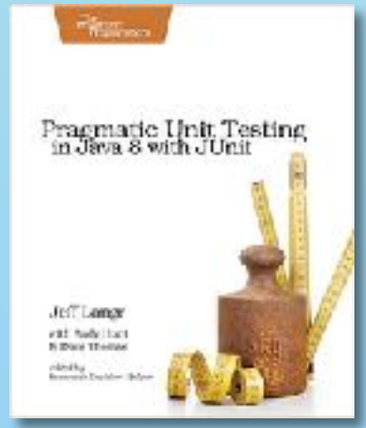


- Drive *behavior*
- Specification by example
- Small increments
- Stick to the cycle
  - Always see red
  - Always refactor

It's just code!

Stepping Back: Writing Tests





Recent File List

Create a list of recently-opened files (max: 5) for use in a GUI application.

What tests do we need?

ZOMBIES!

- **Z**ero
- **O**ne
- **M**any
- **B**oundaries
- **I**nterface definition
- **E**xceptional behavior
- **S**imple Solutions & Scenarios

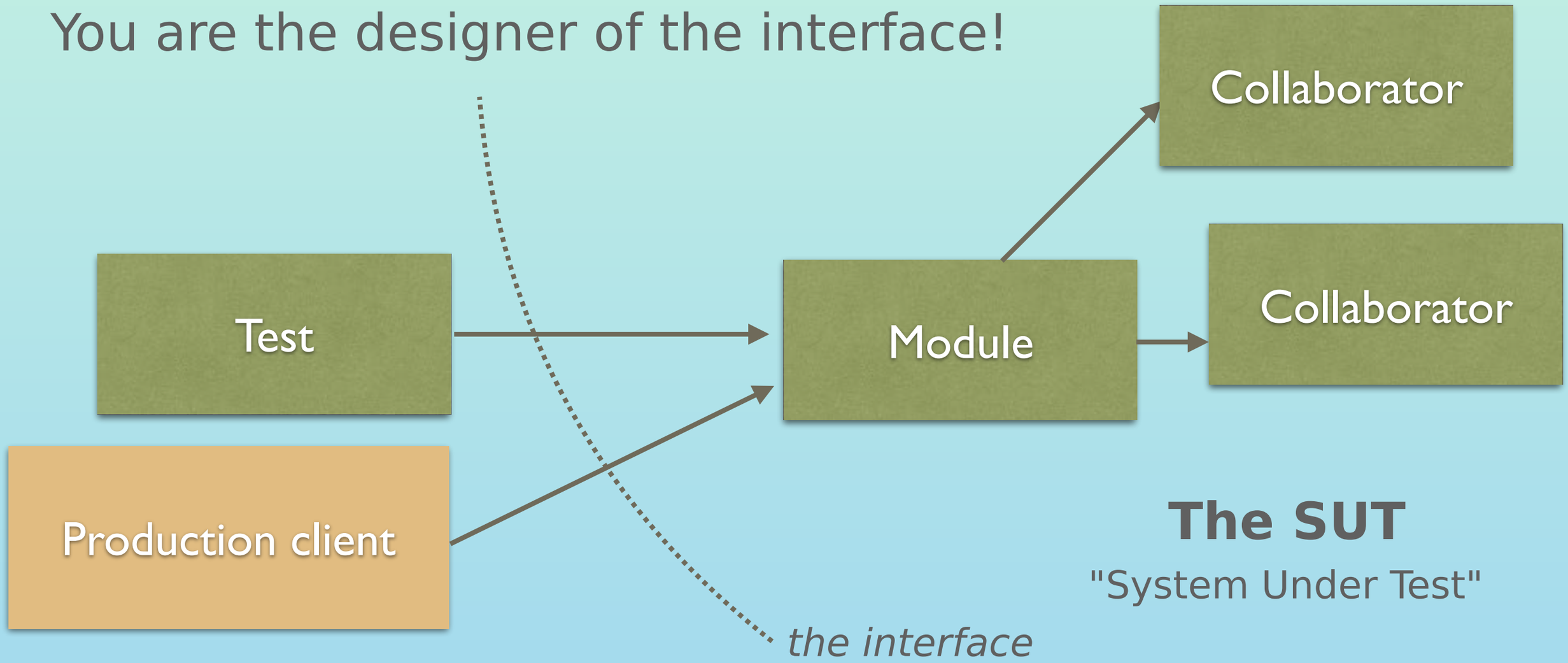
http://blog.wingman-sw.com/archives/677

Test Lists

- **Z**: No files opened
- **O**: One file opened
- **M**: Multiple files opened
- **B**: One more than capacity opened
- **E**: File opened twice

Your Test Is the First Client

You are the designer of the interface!



The SUT

"System Under Test"

Structuring the Test

"*sifts duplicate filename to top of recently-used list*"

- **Arrange**

  Add file with name **`opened-A.txt`**
  Add file with name **`opened-B.txt`**
  Add file with name **`opened-C.txt`**

- **Act**

  Add file with name **`opened-A.txt`**

- **Assert**

  Expect recently-used list to equal:

  `opened-A.txt`
  `opened-C.txt`
  `opened-B.txt`

Assert-First

```
it("should sift duplicate filename to top") {
  // ?

  recentlyUsedList.orderedFilenames shouldEqual
    Seq(duplicateOfAddedFirst, "3rd", "2nd")
}
```

Consider working from the outcome.

Assert-First

```
it("should sift duplicate filename to top") {
  // ?

  recentlyUsedList.add(duplicateOfAddedFirst)

  recentlyUsedList.orderedFilenames shouldEqual
    Seq(duplicateOfAddedFirst, "3rd", "2nd")
}
```

Assert-First

```
it("should sift duplicate filename to top") {
  recentlyUsedList.add("1st")
  recentlyUsedList.add("2nd")
  recentlyUsedList.add("3rd")
  val duplicateOfAddedFirst = "1st"

  recentlyUsedList.add(duplicateOfAddedFirst)

  recentlyUsedList.orderedFilenames shouldEqual
    Seq(duplicateOfAddedFirst, "3rd", "2nd")
}
```

Exercise: Stock Portfolio Module

- is it empty or not?
- what is the count of unique symbols?
- given a symbol and # of shares, make a purchase
- how many shares exist for a given symbol?
- given a symbol and # of shares, sell the shares
- throw an exception when selling too many shares

"Tokyo Stock Exchange," courtesy https://www.flickr.com/photos/31029865@N06/
License: https://creativecommons.org/licenses/by/2.0/

*** **Remember!** ***

Red: Ensure test fails

Green: Implement no more code than necessary

Refactor: Clarify and eliminate all duplication

Test-Driving a Functional Solution

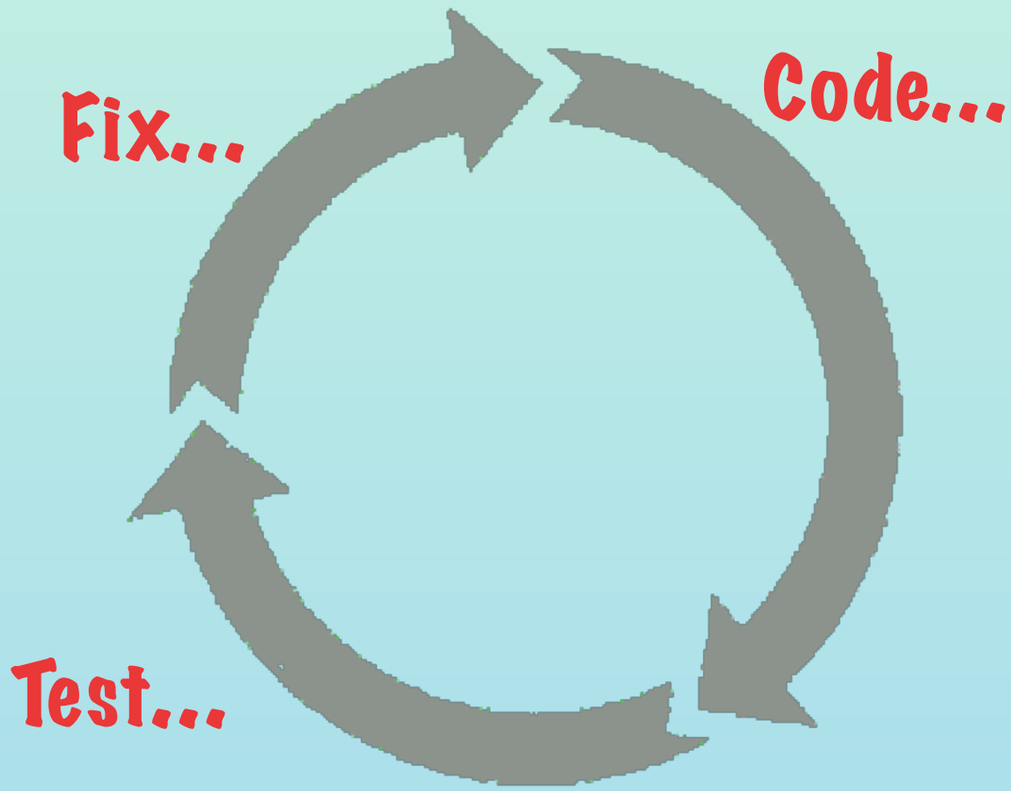
```
it("is empty for newly created data") {
  Portfolio.isEmpty(PortfolioData()) shouldBe true
}
```

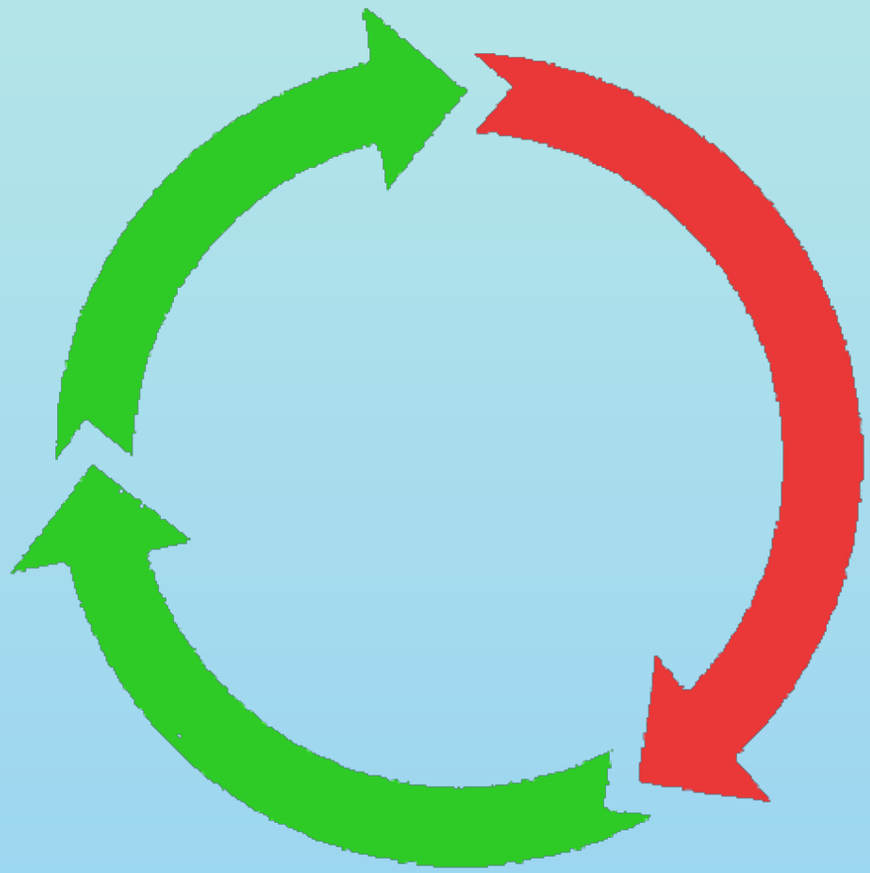
```
case class PortfolioData(/* ... */)
object Portfolio {
  def isEmpty(data: PortfolioData) = { /* ... */ }
}
```

Later...

```
it("increments size with each purchase") {
  var data = Portfolio.buy(PortfolioData(), "BAYN", 10)
  data = Portfolio.buy(data, "IBM", 10)
  Portfolio.symbolCount(data) shouldBe 2
}
```

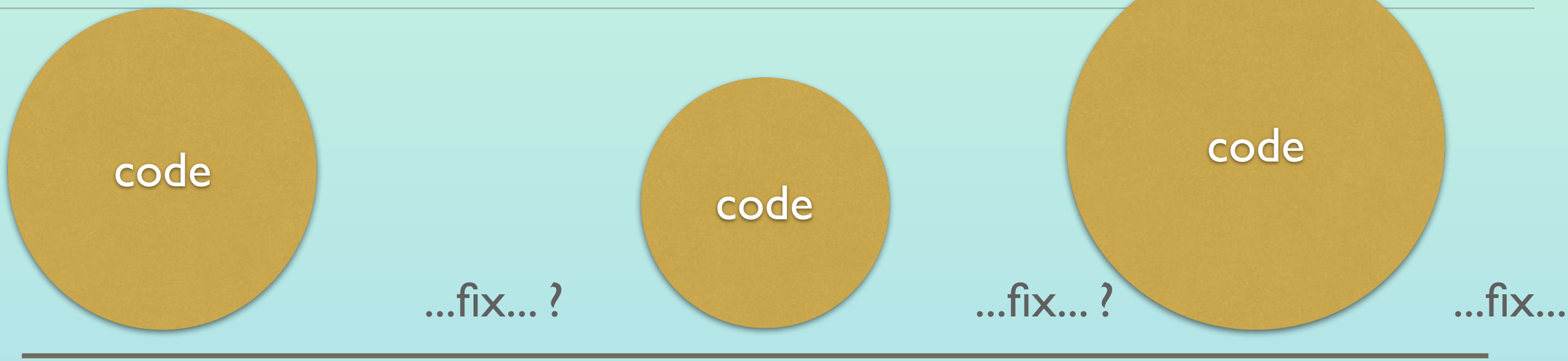
TAD** and TDD: What's the Difference?





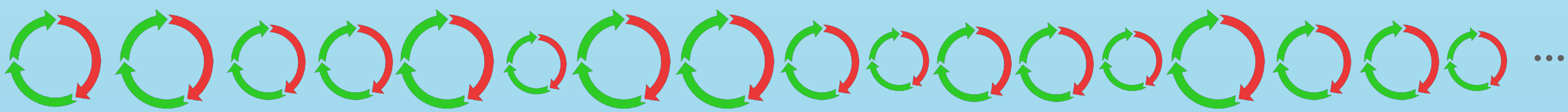
"Test-After Development"

Small Increments



TAD

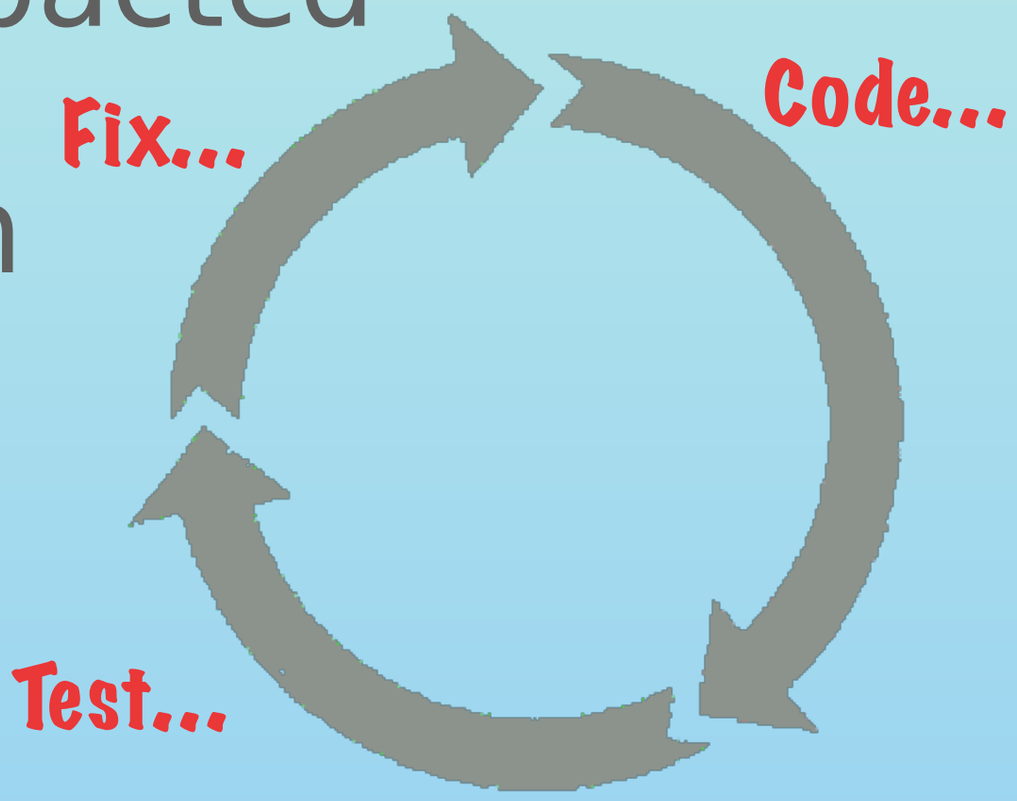
vs.



TDD

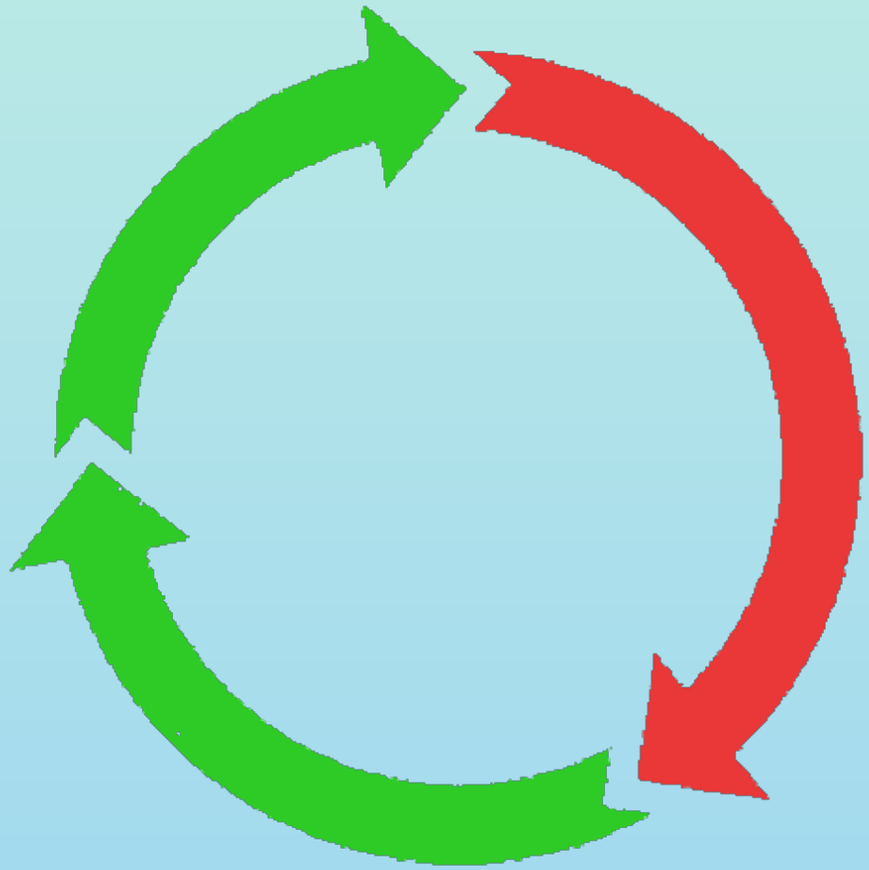
Test-After Development (TAD)

- Some refactoring accommodated
- Coverage: ~70%
- Design not usually impacted
- Some defect reduction
- Separate task?

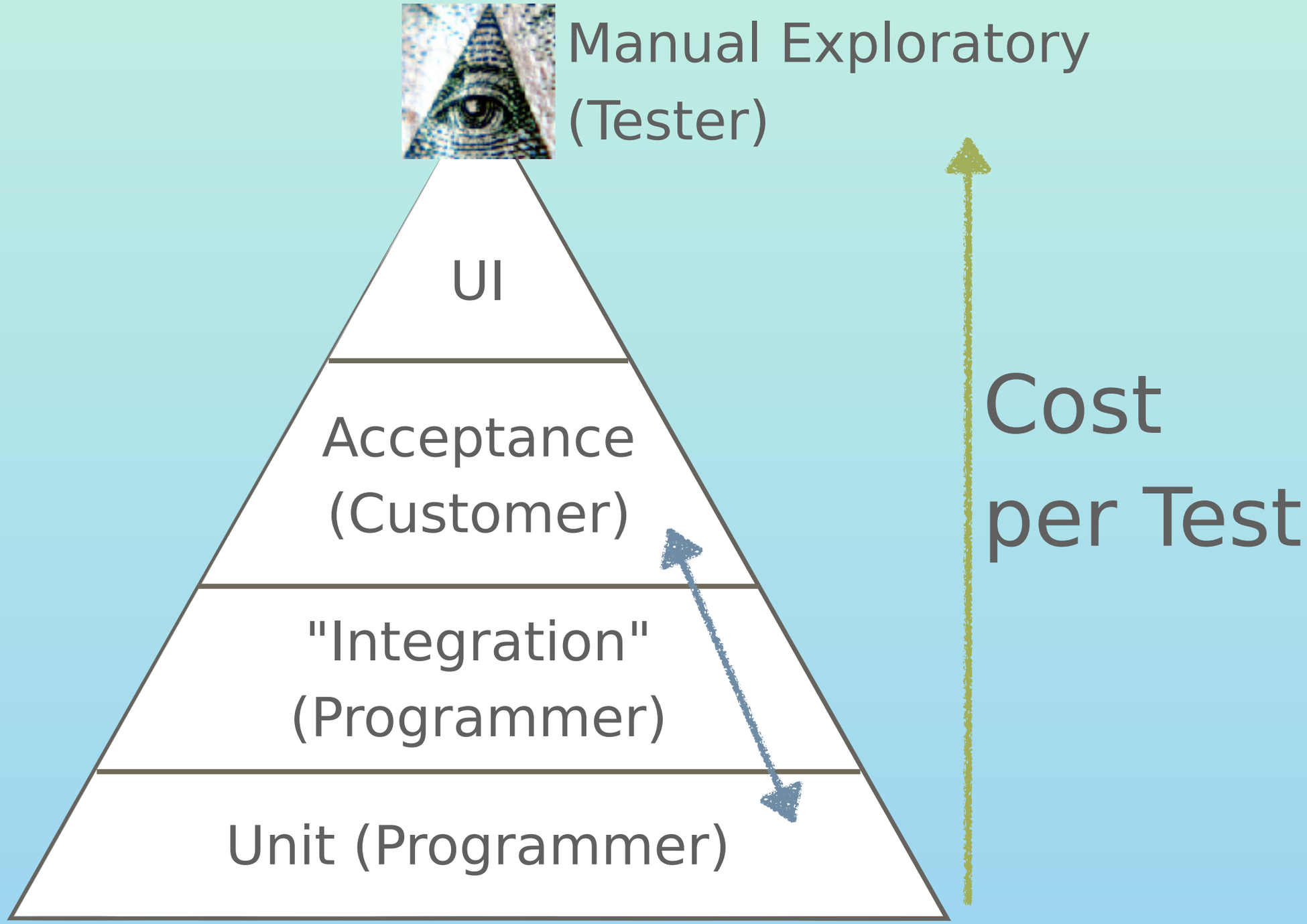


Test-Driven Development (TDD)

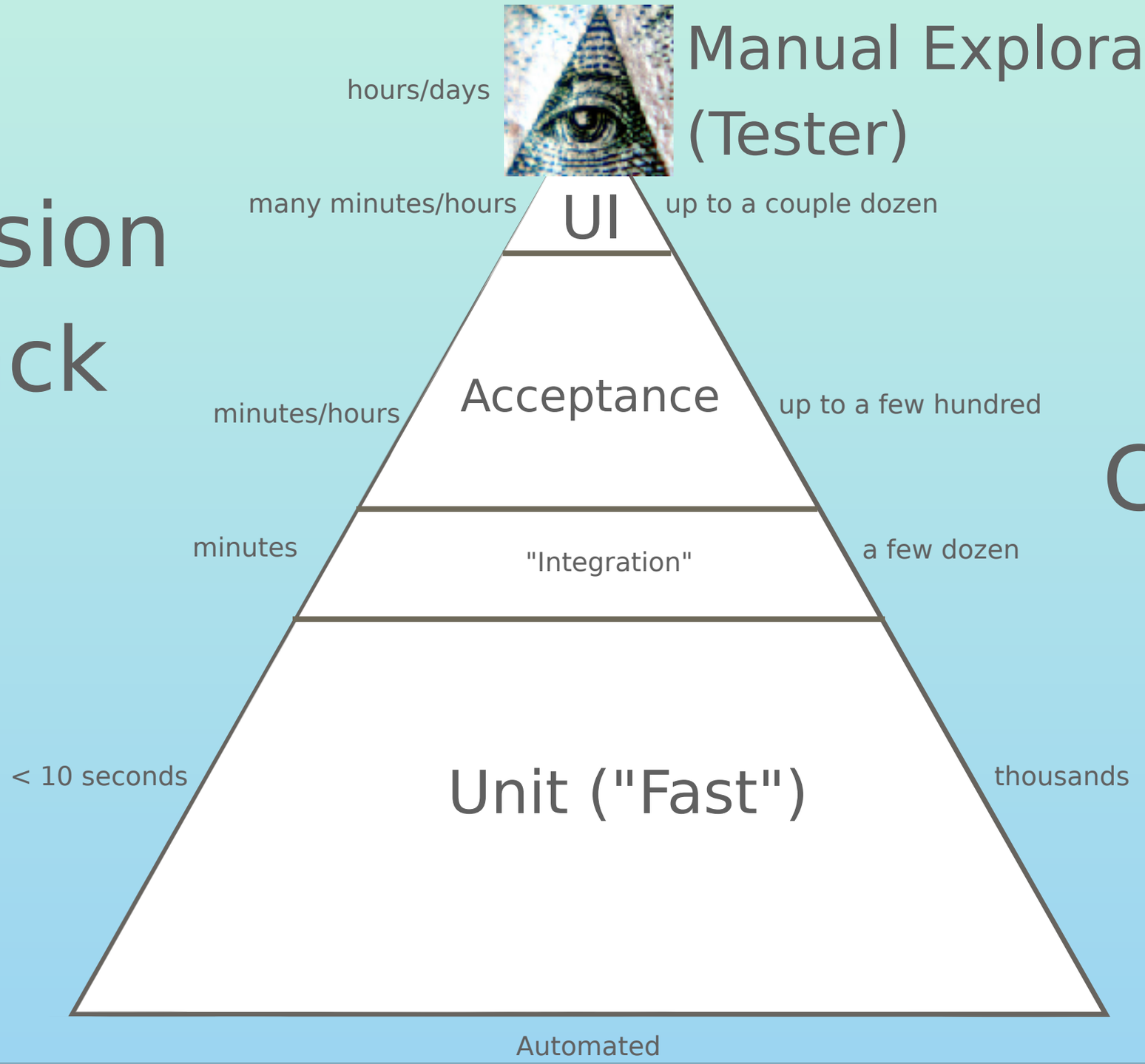
- Continual refactoring
- Coverage for all intended features
- Incremental design shaping
- Significant defect reduction
- Minimized debugging
- Integral part of coding process
- Clarify / document needs / choices
- Continual forward progress
- Consistent pacing
- Continual feedback / learning
- Sustainable



Unit Testing: Insufficient!



A Re-leveled Pyramid



Regression Feedback

Count

Katas

http://codekata.com

Other sites:

https://exercism.io

http://cyber-dojo.org

https://sites.google.com/site/tddproblems/

https://www.codewars.com

https://github.com/jlangr/name-normalizer

https://github.com/emilybache

https://projecteuler.net/archives

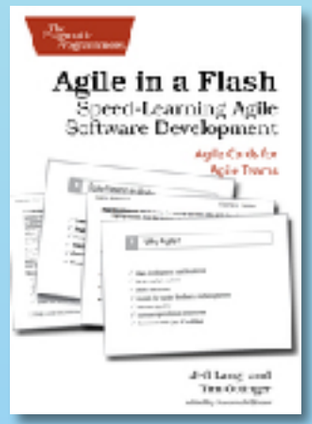
Roman Numeral Converter

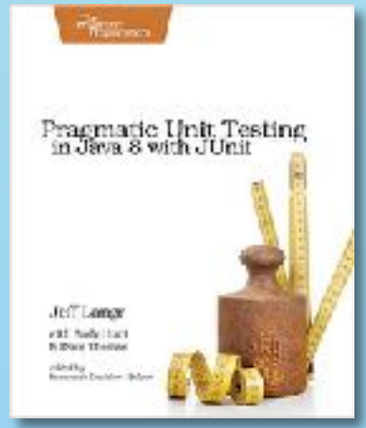
Given a positive integer
from 1 up to 4000,
answer its Roman equivalent

Feedback Q's

- **:-)** What have I learned of value?
- **%-|** What, if anything, am I unclear about regarding the discussion / exercises?
- **?:-/** What, if anything, did I find disturbing / disconcerting?

Documentation





Tests as Documents

what we're describing

```
describe("an unstarted auto") {
  val auto = Auto()
```

the generalized behavior it supports

```
  it("idles engine when started") {
    auto.depressBrake()
    auto.pressStartButton()

    auto.RPM() shouldBe 1000 +- 50
  }
}
```

one example of that behavior

Seek to first understand through the tests.

Behavior-Driven Structuring

```
describe("given some context") {
  describe("when some event occurs") {
    it("then can be verified") {


    }
  }
}
```

BDD Structuring Example

```
describe("given a checked-out material") {
  val material = new Material(AgileJava)
  val dueDate = material.borrow(PatronId)

  describe("when returned late") {
    material.returnIt(dueDate.plusDays(2))

    it("is marked available") {
      material.isAvailable shouldBe (true)
    }
    it("generates late fine") {
      material.fine shouldBe (2 * Material.FineAmount)
    }
  }
}
```

FunSpec Fixtures

Supporting functional tests (why?):

```
// ...
import org.scalatest.fixture

class PortfolioTest extends fixture.FunSpec with // ...
{
  type FixtureParam = PortfolioData
  // ...
  def withFixture(test: OneArgTest) = {
    var multipleHoldings = PortfolioData()
    multipleHoldings = purchase(multipleHoldings, "BAYN", BayerSharesPurchased)
    multipleHoldings = purchase(multipleHoldings, "IBM", IbmSharesPurchased)
    test(multipleHoldings)
  }
  // ...
}
```

- http://doc.scalatest.org/1.7.2/org/scalatest/fixture/FunSpec.html

Using FunSpec Fixtures

```
describe("a portfolio with multiple holdings") {
  describe("value") {
    it("is zero when created") { _ =>  // or not using them
      portfolioValue(PortfolioData(), mock[StockService]) shouldBe 0
    }

    it("accumulates prices for all symbols") { portfolioData =>
      stockService.price("BAYN") shouldReturn BayerPrice
      stockService.price("IBM") shouldReturn IbmPrice

      portfolioValue(portfolioData, stockService)
        .shouldBe(BayerPrice * BayerSharesPurchased
                + IbmPrice * IbmSharesPurchased)
    }
  }
}
```

Multiple FunSpec Fixtures

```
class PortfolioTest extends fixture.FunSpec
  with fixture.ConfigMapFixture // ...
{
  def withOnePurchase(test: PortfolioData => Any) = {
    var holdings = PortfolioData()
    holdings = purchase(holdings, "BAYN", BayerSharesPurchased)
    test(holdings)
  }

  def withMultiplePurchases(test: PortfolioData => Any) = {
    var data = PortfolioData()
    data = purchase(data, "BAYN", BayerSharesPurchased)
    data = purchase(data, "IBM", IbmSharesPurchased)
    test(data)
  }
```

Using Config Maps

```
describe("a portfolio") {
  it("is zero when created") { _ =>
    portfolioValue(PortfolioData(), mock[StockService]) shouldBe 0
  }

  it("returns the number of shares purchased") { configMap =>
    withOnePurchase { portfolioData =>
      shares(portfolioData, "BAYN") shouldBe BayerSharesPurchased
    }
  }

  it("accumulates prices for all symbols") { configMap =>
    withMultiplePurchases { portfolioData =>
      stockService.price("BAYN") shouldReturn BayerPrice
      stockService.price("IBM") shouldReturn IbmPrice

      portfolioValue(portfolioData, stockService)
        .shouldBe(BayerPrice * BayerSharesPurchased + IbmPrice * IbmSharesPurchased)
    }
  }
}
```

Iterative Naming

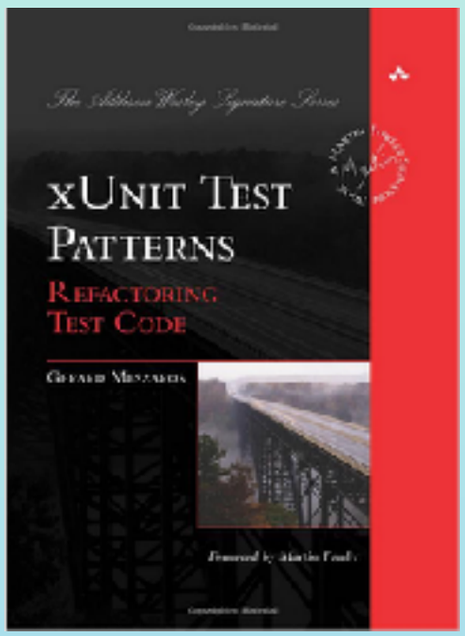
- Re-consider name continually

```
it("does something")

it("verifies engine start")

it("verifies engine start idle speed")

it("has low idle on engine start")
```

- Review often and holistically!

Sustainable Tests

The long answer:



A quicker route:

- Single behavior tests
- AAA
- Correlate result with context
- Test abstraction

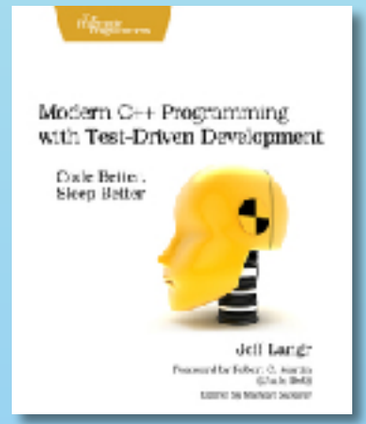
Exercise: Test Smells

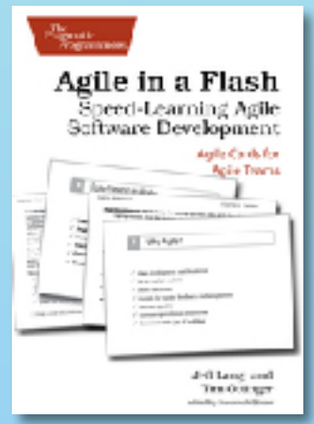
Find and fix test smells.
Paraphrase cleaned tests
    to your pair.

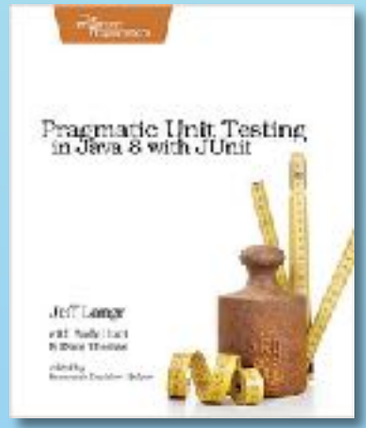
Further instructions: com.langrsoft.pos.CheckoutTest

"skunk_dog," courtesy https://www.flickr.com/photos/istolethetv/
License: https://creativecommons.org/licenses/by/2.0/

Continual Design

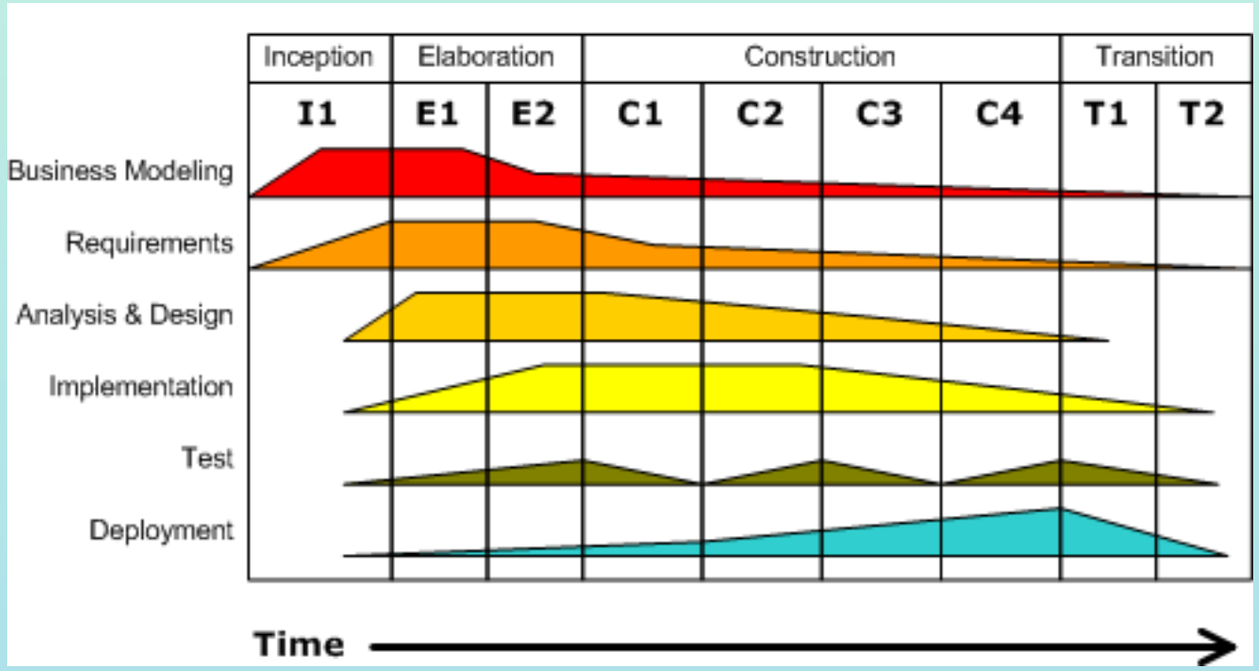






Software Development

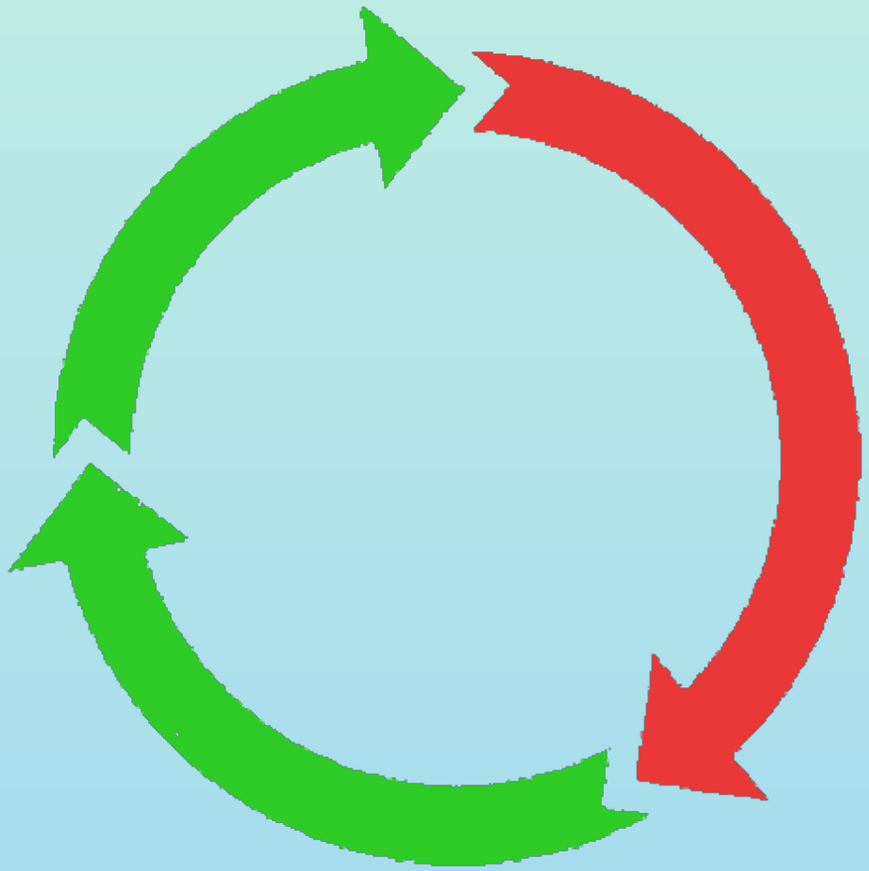
- Activities:
  - Analysis, design, coding, testing, review, documentation, planning, deployment, ...



- Agile:
  - *All activities all the time*

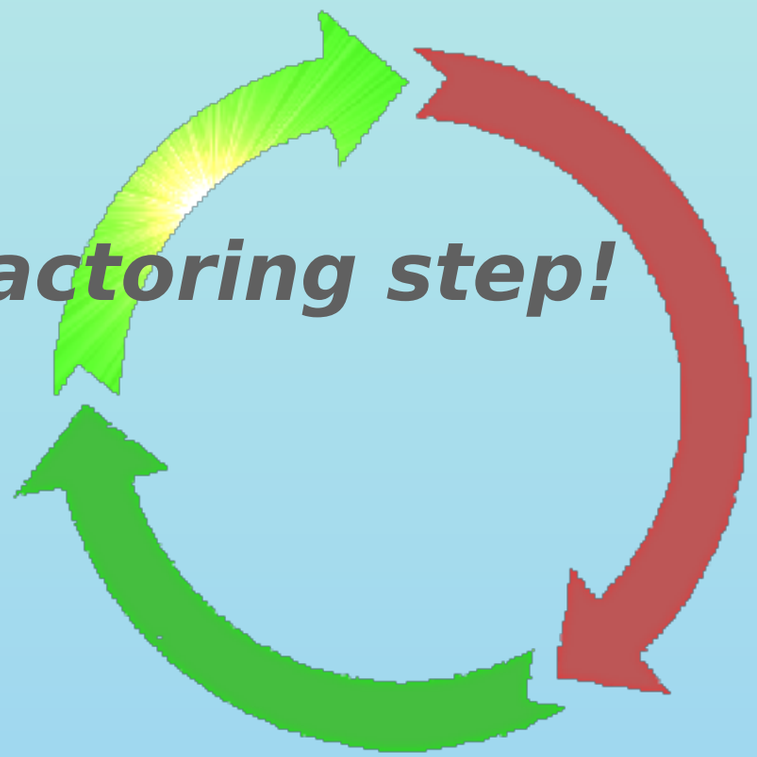
TDD: Continual ...

- Testing
- Coding
- Design
- Documentation
- Review



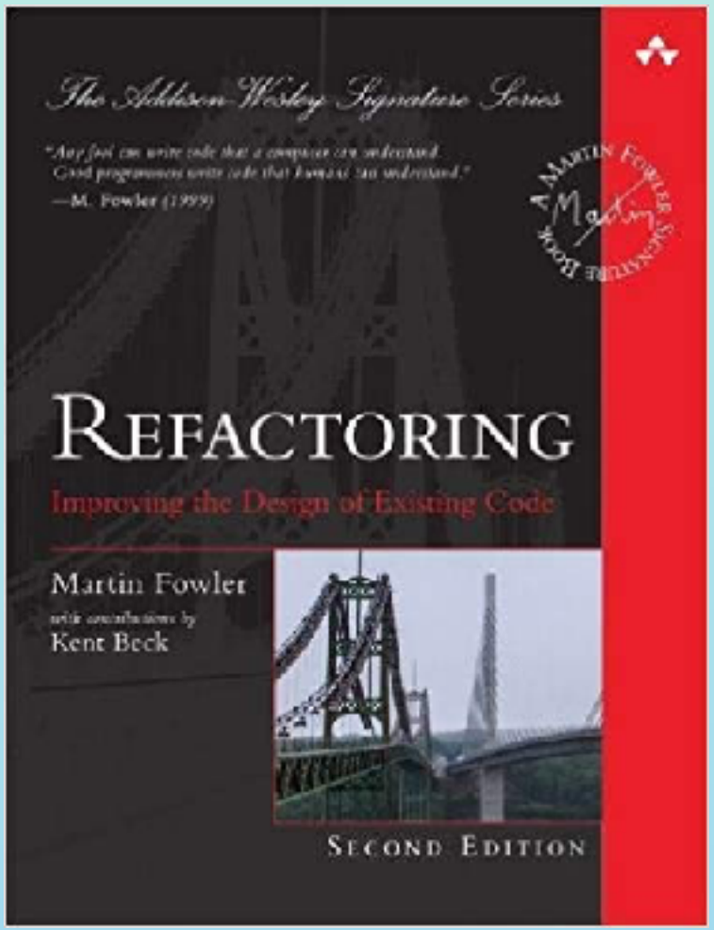
Continual Design

- Always retain an optimal design
- Entropy is unavoidable



Never skimp on the refactoring step!

Refactoring



Same "*externally recognized*" behavior

Code Smells

- Comments
- Duplicate Code
- Feature Envy
- Large Class
- Long Method
- Long Parameter List
- Primitive Obsession
- Shotgun Surgery
- Speculative Generality
- Switch Statements
- **. . . and many more**

"*A complete code smells reference:*"
https://github.com/lee-dohm/code-smells

The Nature of the Smell

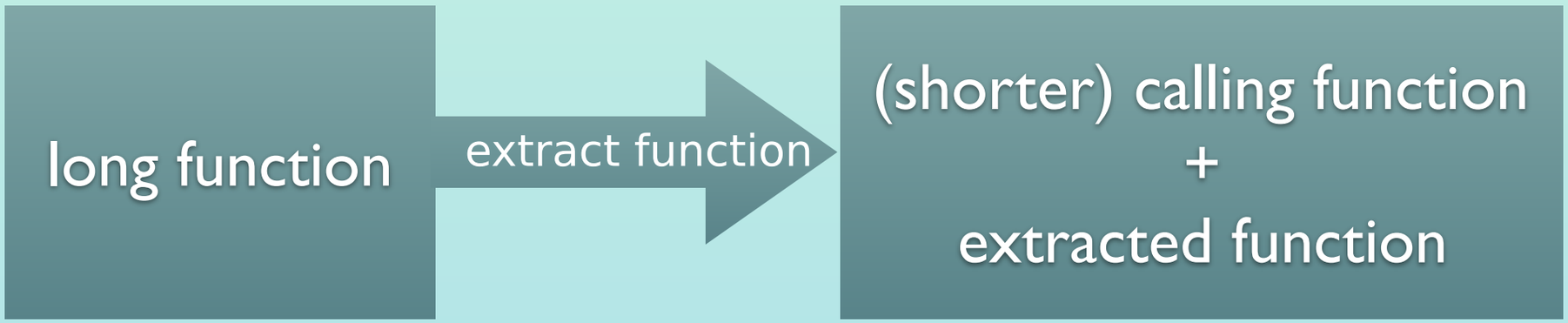
Aroma?

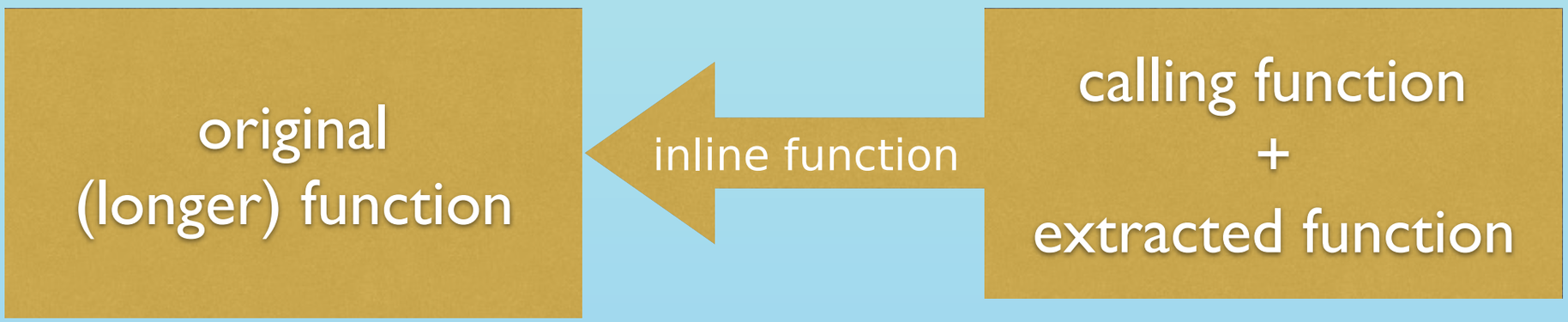
Stench?

"beagle smelling roses," courtesy Grangernite, https://www.flickr.com/photos/ldoty/2573672102 https://creativecommons.org/licenses/by/2.0/

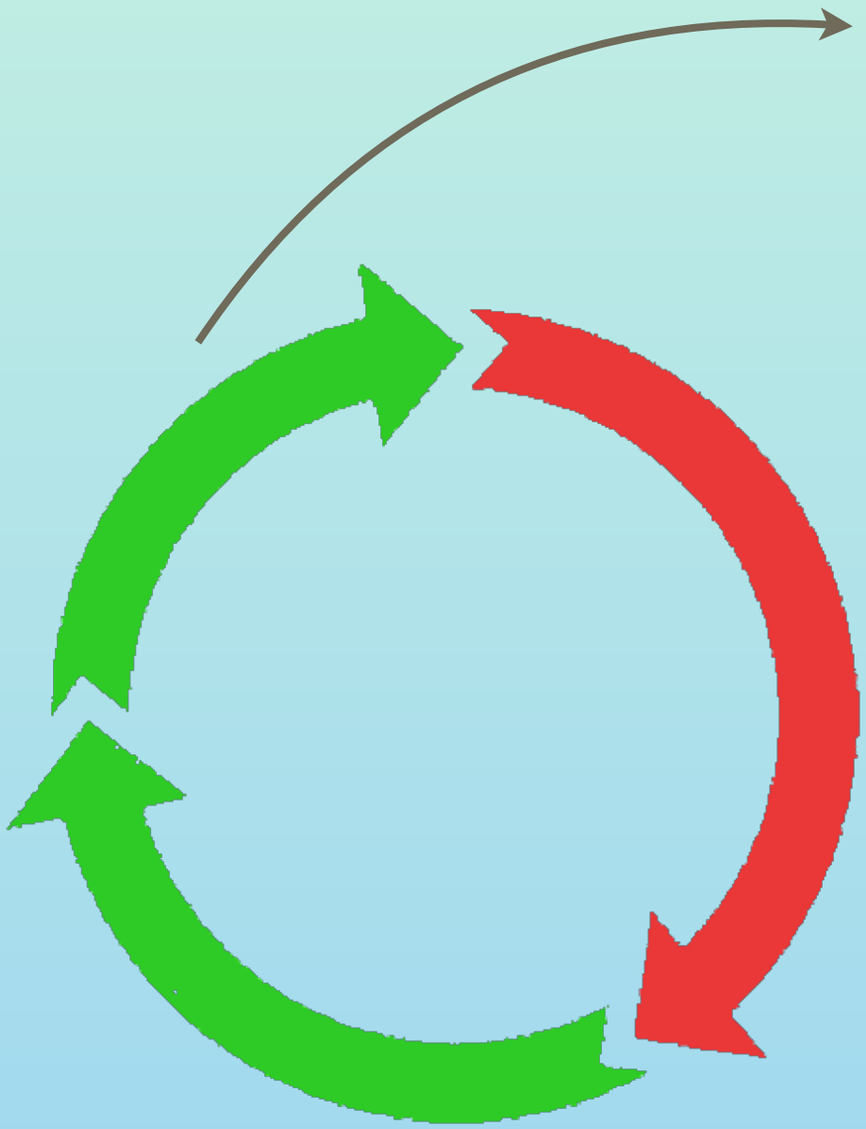
adapted from "Yum, that smells good!", courtesy Tankboy, https://www.flickr.com/photos/tankboy/284958387; https://creativecommons.org/licenses/by-sa/2.0/

For *(almost)* Every Transform...





Refactoring Opportunities



small cleanup

verify

small cleanup

verify

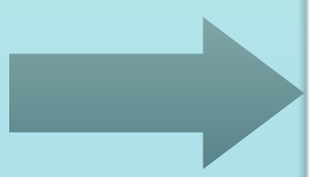
...

One thing at a time!

Break things once in a while.

Refactoring: Extract Function

```
def uglyFunction() = {
   // stuff a
   ...
   // stuff b
   ...
   // some smaller behavior
   doSomething()
   doSomethingElse()
   // ...
   // stuff c
   // ...
}
```

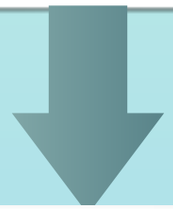


```
def lessUglyFunction() = {
   // stuff a   ...
   // stuff b
   ...
   someSmallerBehavior()
   // ...
   // stuff c
   // ...
}

def someSmallerBehavior() = {
   doSomething()
   doSomethingElse()
}
```

Why?

Single-Line Extract?

```
catch {
  case e: RuntimeException => {
    val msg =
      s"${new DateTime()}: ${System}-${Module} HIGH ${trunc(e.getMessage, 80)}"
    logError(msg)
    throw new RuntimeException(errMsg, e)  } }
```



```
  catch {
    case e: RuntimeException => {
      logError(format(e, "HIGH"))
      throw new RuntimeException(format(e, "HIGH"), e)
    }
  }

private def format(e: RuntimeException, severity: String) = {
  s"${new DateTime()}: ${System}-${Module} $severity ${trunc(e.getMessage, 80)}"
}
```

Exercise: Extract Function

- In com.langrsoft.pos.CheckoutRoutes:
  - Start with a single-line function extract on `createReceipt`
  - Apply additional function extracts
  - Otherwise focus on renaming and eliminating lies

Refactoring-Inhibiting Temp

```
retrievedCheckout.items.foreach(item => {
  val price = item.price
  val isExempt = item.isExemptFromDiscount
  if (!isExempt && discount > 0) { // exempt form discount and pos. disc
    val discountAmount = discount * price
    val discountedPrice = price * (1.0 - discount)

    totalOfDiscountedItems += discountedPrice

    var text = item.description
    val amount = (price * 100 / 100).setScale(2).toString
    val amountWidth = amount.length
    var textWidth = LineWidth - amountWidth
    lineItems += pad(text, textWidth) + amount

    val discountPctFormatted = (discount * 100).round(new MathContext(0)).toInt
    val discountFormatted = "-" + discountAmount.setScale(2, RoundingMode.HALF_EVEN)
    textWidth = LineWidth - discountFormatted.length
    text = s"   ${discountPctFormatted}% mbr disc"
    lineItems += s"${pad(text, textWidth)}${discountFormatted}"

    total += discountedPrice

    totalSaved += discountAmount
  }
```

Refactoring: Replace Temp With Query

```
val discountAmount = discount * price
// ...
val discountPctFormatted = (discount * 100).round(new MathContext(0)).toInt
val discountFormatted = "-" + discountAmount.setScale(2, RoundingMode.HALF_EVEN)
textWidth = LineWidth - discountFormatted.length
text = s"   ${discountPctFormatted}% mbr disc"
lineItems += s"${pad(text, textWidth)}${discountFormatted}"
total += discountedPrice
totalSaved += discountAmount
```

```
  val discountPctFormatted = (discount * 100).round(new MathContext(0)).toInt
  val discountFormatted = "-" + discountAmount(discount, price).setScale(2, RoundingMode.HALF_EVEN)
  textWidth = LineWidth - discountFormatted.length
  text = s"   ${discountPctFormatted}% mbr disc"
  lineItems += s"${pad(text, textWidth)}${discountFormatted}"
  total += discountedPrice
  totalSaved += discountAmount(discount, price)
}

def discountAmount(discount: BigDecimal, price: BigDecimal) = discount * price
```

Replace Temp With Query

Steps:

- Make temp `const`
- Extract Function on the rhs
- Replace temp references with the query
- Remove temp

Why?

Concerns?

Can we go the other way?

Exercise: Replace Temp with Query

- In com.langrsoft.pos.CheckoutRoutes
- Apply Replace Temp with Query in `postCheckoutTotal` as appropriate
- Extract as many additional functions as you can

Code Smell: Feature Envy

```
class BigOldClass {
  val someValue = 123

  def bigOldFunction(): Unit = {
    val x = someComplexCalculation()
    // ...
  }

  def someComplexCalculation() = {     // <-- the envious function
    val that = SomeOtherBigClass()
    val result = that.doStuff(this.someValue)
    that.doMoreStuff(result)
    that.answer
  }
}
```

Why is this a problem?

Refactoring: Move Function

```
class BigOldClass {
 def bigOldFunction(): Unit = {
    val x = SomeOtherBigClass().someComplexCalculation(someValue)
    // ...
  }
}
```

```
case class SomeOtherBigClass() {
  def someComplexCalculation(someValue: Int) = {
    val result = doStuff(someValue)
    doMoreStuff(result)
    answer
  }
  // ...
}
```

What must you also do when you move a function?

Exercise: Move Function

- In com.langrsoft.pos.CheckoutRoutes
- Move at least 2 envious functions to better (or new!) homes
- Ensure you've added documentation (i.e tests)!

Macro Refactorings

Might need to backtrack!

Planning: Up-Front Design

- Not just once!
  - Planning: project, release, iteration, day, task, test
  - Any estimation
- **Minimal**: sketches & conversations
  - Not detailed specs

"UML Diagram," courtesy https://www.flickr.com/photos/acehoward/
License: https://creativecommons.org/licenses/by/2.0/

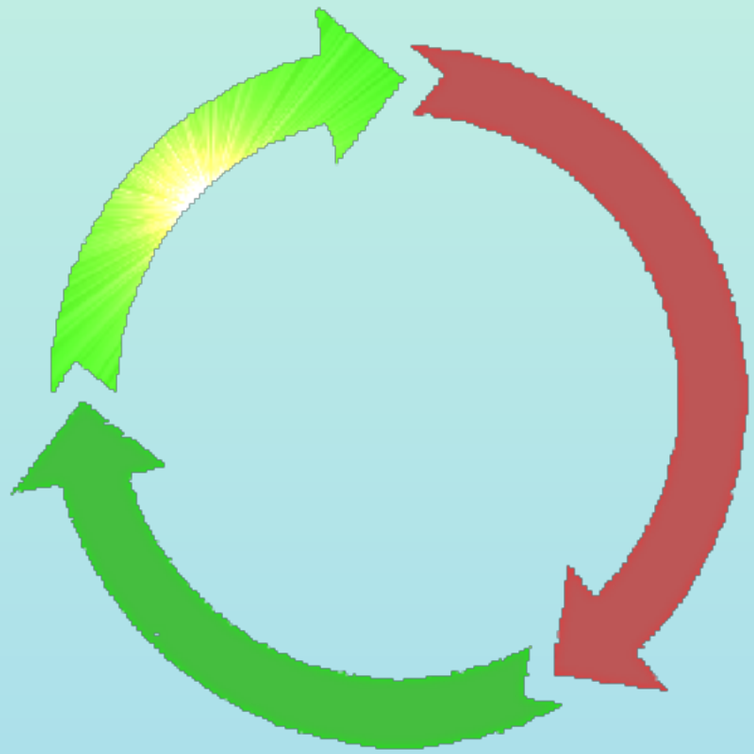
Premature Generalization

- Need might never materialize
- Details might change
- Interim complexity $

Refactoring Guidelines

Never skip!

Single-goal



Run *all* tests

It's your responsibility

Design Drivers / Guidelines

- Code smells
- SOLID
- Design patterns
- GRASP

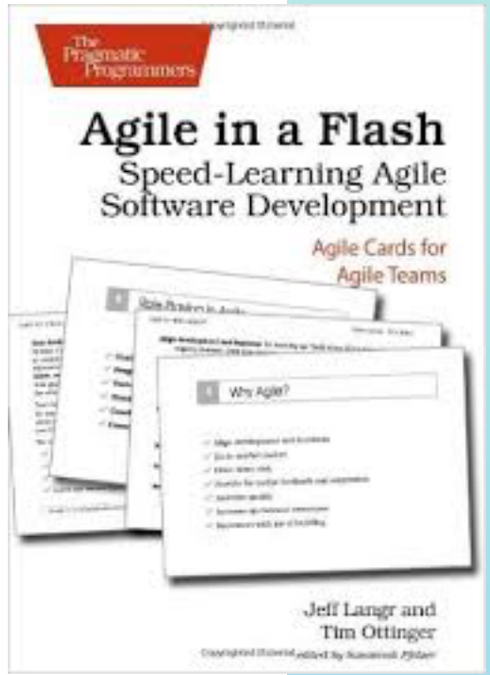
- Simple design
- DRY
- ...

It's all good!

Does everything point to the same place?

41 Build Superior Systems with Simple Design

- All tests must pass
- No code is duplicated
- Code is self-explanatory
- No superfluous parts exist

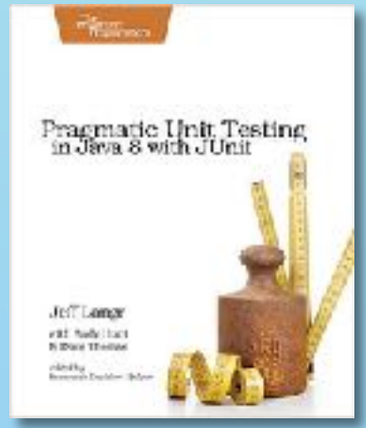


Kent Beck's (ordered) rules for emergent design

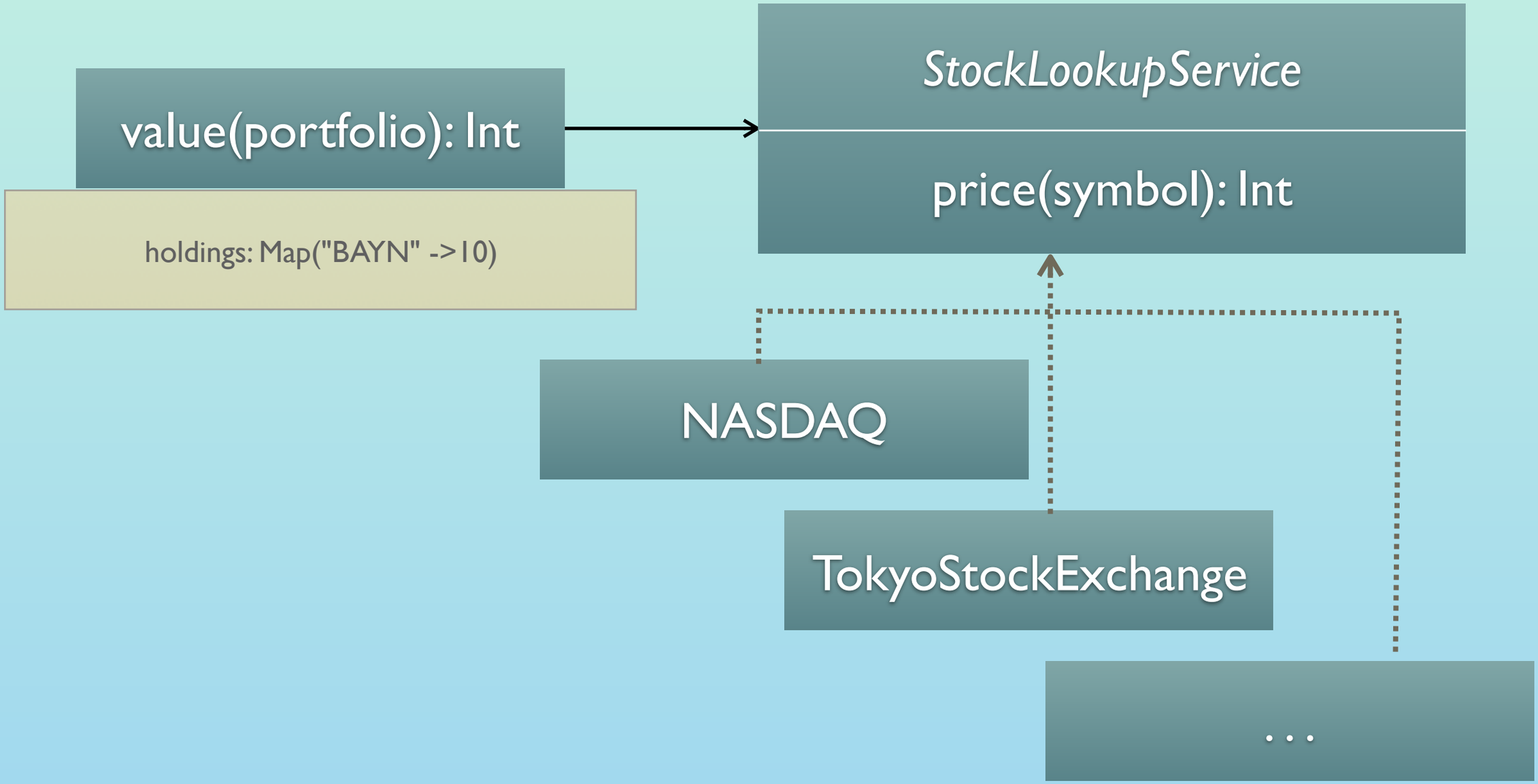
Exercise: Simple Design Rules

- In com.langrsoft.pos.CheckoutRoutes
  - Stamp out duplication!
  - Strive for rapid readability
  - Have you gone too far?

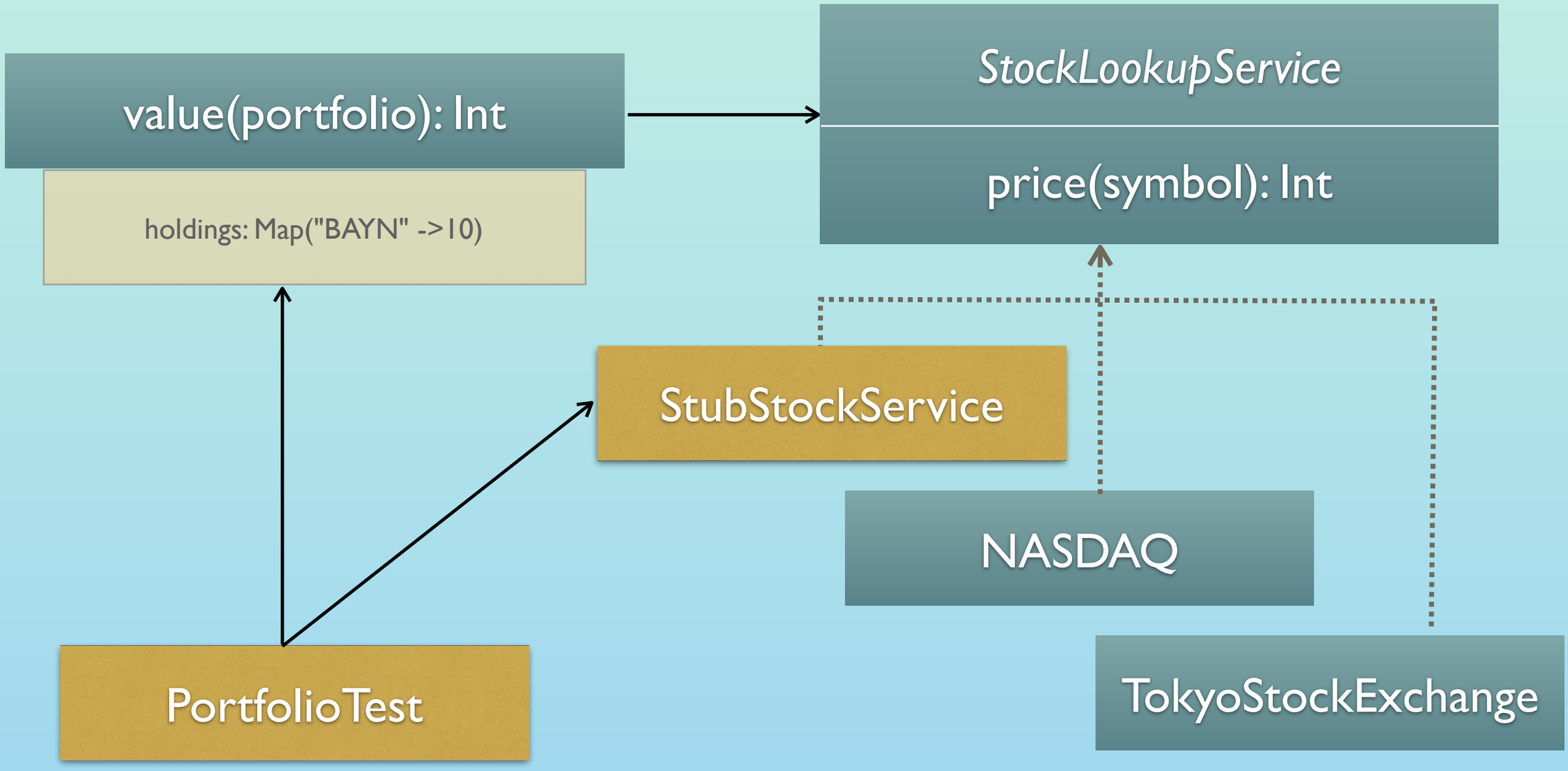
Test Doubles



Testing Challenge: Portfolio



Using a Test Double



Portfolio Value...

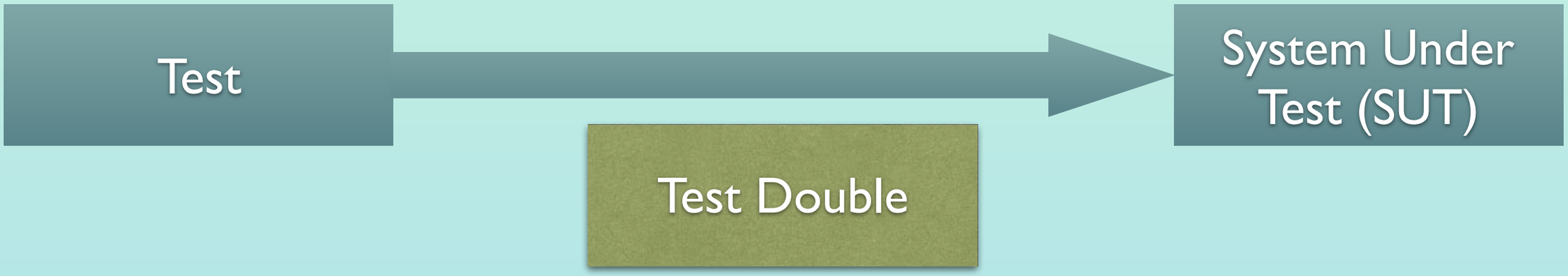
```
trait StockService { def price(symbol: String): Int }
```

```
it("is share value after purchase of one share") {
  val stockService = new StockService {
    override def price(symbol: String): Int = BayerPrice
  }

  portfolio.purchase("BAYN", 1)

  portfolio.value(stockService) shouldBe BayerPrice
}
```

Incremental implementation in Portfolio:

```
def value(service: StockService) = {
  val soleSymbol = symbols.keySet.head
  service.price(soleSymbol)
}
```

Test Double Injection Techniques



Function argument
Constructor
Factory method override
Cake pattern
Thin cake pattern
Structural typing
Implicit declarations
Using the reader monad

Guice
MacWire
Mockito
Spring

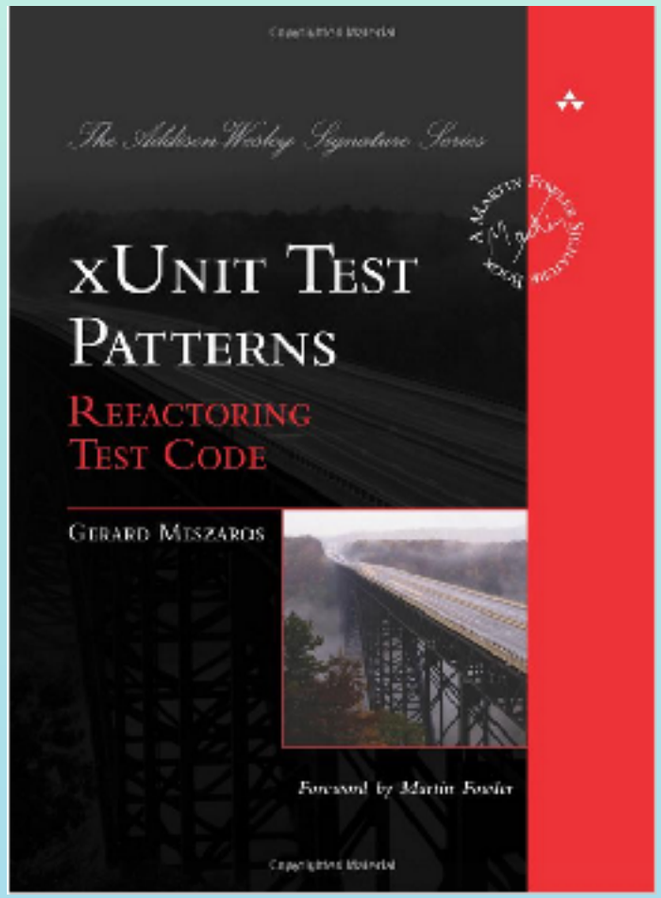
Test Double Terms

Stub: dumb emulation

Spy: captures values to verify

Mock: self-verifies

Fake: whole collaborator emulation



Mock Tools

(and mockito-scala)

ScalaMock (paul butcher)

jMock

History suggests more & changes coming!

Mockito / Mockito-Scala

http://site.mockito.org

https://github.com/mockito/mockito-scala

Mockito-Scala: A Simple Stub

```
class PortfolioTest extends FunSpec with IdiomaticMockito
// ...
```

```
val stockService = mock[StockService]
val portfolio = new Portfolio(stockService)
stockService.price("BAYN") shouldReturn(BayerPrice)
stockService.price("IBM") shouldReturn(IbmPrice)

portfolio.purchase("BAYN", 10)
portfolio.purchase("IBM", 20)

portfolio.value shouldBe BayerPrice * 10 + IbmPrice * 20
```

Exercise: Mockito

Replace your hand-crafted test double with a Mockito-defined stub

Mock Tools Are Trackers

In the debugger:

```
.mockitoInterceptor
  .handler
  .mockHandler
.invocationContainer
.registeredInvocations
.invocations
```

Constructor Injection

```
val stockService = mock[StockService]
val portfolio: Portfolio = new Portfolio(stockService)
```

```
class Portfolio(stockService: StockService) {
   // ...
}
```

Mockito Injection

```
import org.mockito.{InjectMocks, Mock, MockitoAnnotations, // ...}
// ...
class PortfolioTest extends FunSpec // ... {
  @InjectMocks var portfolio: Portfolio = _
  @Mock var stockService: StockService = _

  before {
    portfolio = new Portfolio
    MockitoAnnotations.initMocks(this)
  }
  // ...
```

```
class Portfolio {
  var stockService: StockService = _
  // ...
```

Mockito: Exceptions

```
it("sets price to 0 when price lookup throws") {
  stockService.price("IBM") shouldThrow(new RuntimeException)

  portfolio.purchase("IBM", 20)

  portfolio.value shouldBe 0
}
```

Exercise: Exceptions

When calculating the portfolio value,
use zero dollars for the current stock price
if the symbol lookup throws an error.

Verifying a "Tell"

```
def purchase(symbol: String, sharesToBuy: Integer) =
  sharesToBuy match {
    case n if n > 0 =>
      symbols += symbol -> (sharesToBuy + shares(symbol))
      auditor.audit(
        s"Purchased $sharesToBuy shares of $symbol")
    // ...
  }
```

How to test-drive the call to `audit`?

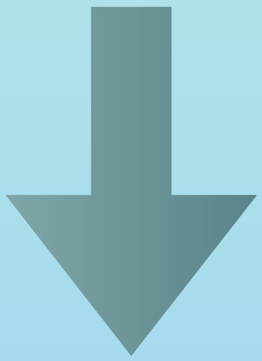
Spying on the Audit Call

```
it("audits on purchase") {
  val stockService = mock[StockService]
  val auditor = mock[Auditor]
  val portfolio = new Portfolio(stockService, auditor)

  portfolio.purchase("BAYN", 10)

  auditor.audit("Purchased 10 shares of BAYN") was called
}
```

Argument Matching

```
trait Auditor {
  def audit(symbol: String, timestamp: DateTime)
}
```

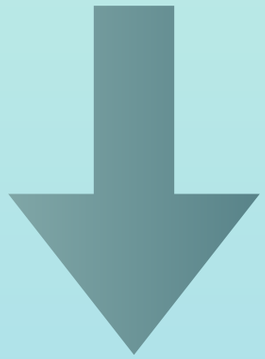
```
auditor.audit("Purchased 10 of BAYN",
  any[DateTime]) was called
```



```
auditor.audit(s"Purchased $sharesToBuy of $symbol",
  new DateTime)
```

Argument Matching... Hmm.

```
auditor.audit("Purchased 10 of BAYN",
  any[DateTime]) was called
```



```
auditor.audit(s"Purchased $sharesToBuy of $symbol",
  null)
```

This passes!

Argument Capture

```
val captor = ArgCaptor[DateTime]
val now = new DateTime

portfolio.purchase("BAYN", 10)

auditor.audit("buy: 10 of BAYN", captor) was called
secondsBetween(captor.value, now) should be < 1
```

Exercise: Spies

Verify that sell transactions are audit-logged.

```
trait Auditor {
  def audit(
    symbol: String,
    shares: Int,
    transactionType: String,
    timestamp: DateTime)
}
```

Mockito-Scala: Still More!

- Expect # of invocations or "never"
- Spies of real objects / partial mocks (avoid!)
- Verification in order
- Mocking consecutive calls
- Support for by-name arguments

See https://github.com/mockito/mockito-scala

Cake Pattern

```
trait StockServiceComponent {
  val service: PriceService

  trait PriceService {
    def price(symbol: String): Int
  }
}
```

```
trait ProdStockServiceComponent
     extends StockServiceComponent {
  val service = new ProdPriceService()

  class ProdPriceService() extends PriceService {
    def price(symbol: String): Int = { /* */ }
  }
}
```

```
class Portfolio {
  this: StockServiceComponent => // "self type;" allows mixing-in a stock service

 // ...

 def value =
    symbols.keysIterator.foldLeft(0) {
      (total, symbol) =>
        total + shares(symbol) * service.price(symbol)
    }
}
```

Testing Via the Cake Pattern

```
class PortfolioTest // ...
{
  trait TestStockServiceComponent extends StockServiceComponent {
    val service = new TestPriceService()
    class TestPriceService() extends PriceService {
      def price(symbol: String): Int = {
        symbol match {
          case "BAYN" => BayerPrice
          case "IBM" => IbmPrice
        }
      }
    }
  }

  var portfolio = new Portfolio with TestStockServiceComponent
```

... Using Mockito

```
trait MockitoTestStockServiceComponent extends StockServiceComponent
    with IdiomaticMockito {
  val service = mock[PriceService]
  service.price("BAYN") shouldReturn BayerPrice
  service.price("IBM") shouldReturn IbmPrice
}
```

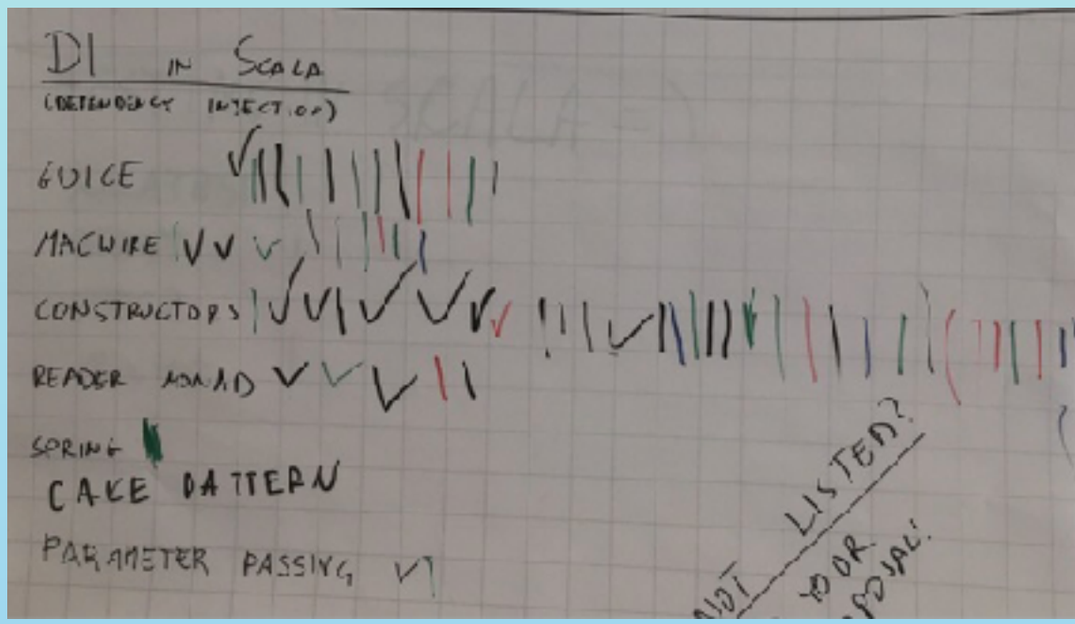
Cake Is a Mess...

Debatable.

- Violates ISP, SRP, OCP
- Uses "is a," not "has a" inheritance

Bryan's Oreo Frenzy, courtesy H. Michael Karshis. Licence.

via Bartosz Mikulski:The Cake Pattern Is a Lie:



Some Resources:

http://di-in-scala.github.io

http://jonasboner.com/real-world-scala-dependency-injection-di/

https://www.originate.com/thinking/stories/reader-monad-for-dependency-injection/

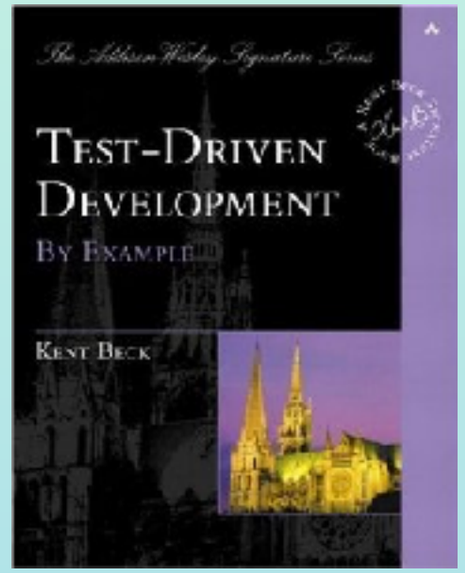
Schools of Mock

Classic ("Detroit")

algorithmic approach

verification of state

tests drive code from specific to general

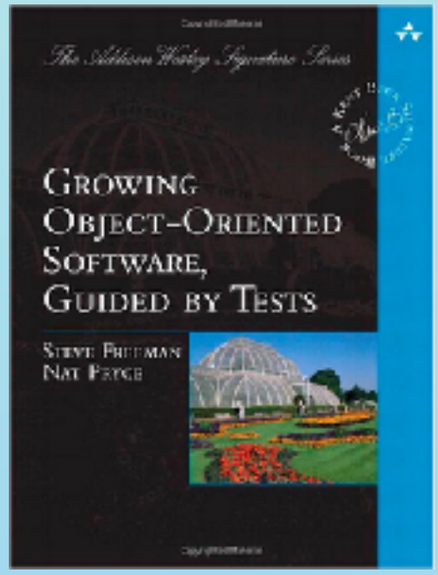


London

roles, responsibilities, and interactions

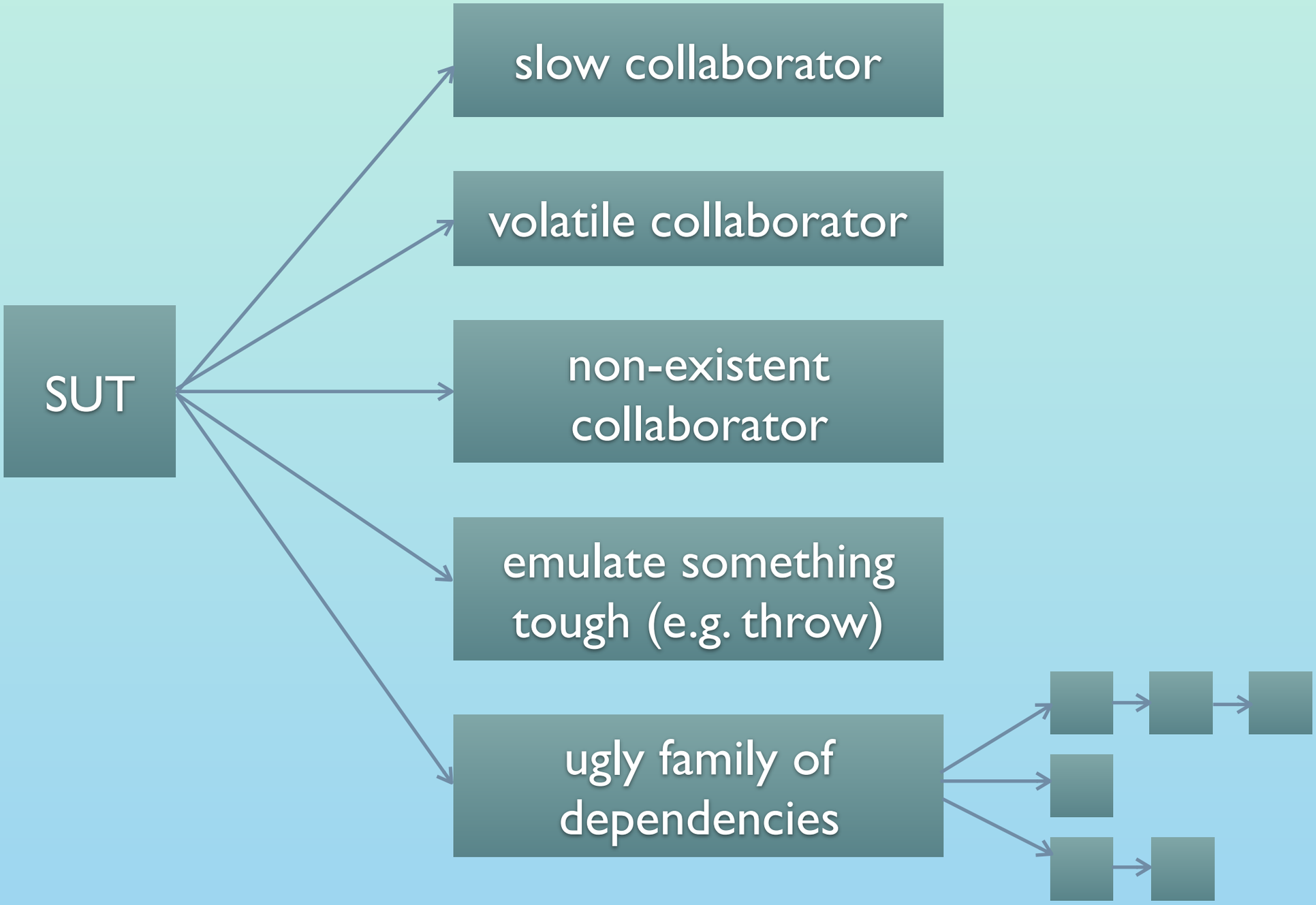
"Fake it until you make it"

drive incrementally from the outside in



Read Martin Fowler's "Mocks Aren't Stubs"

Classic School: When to Mock

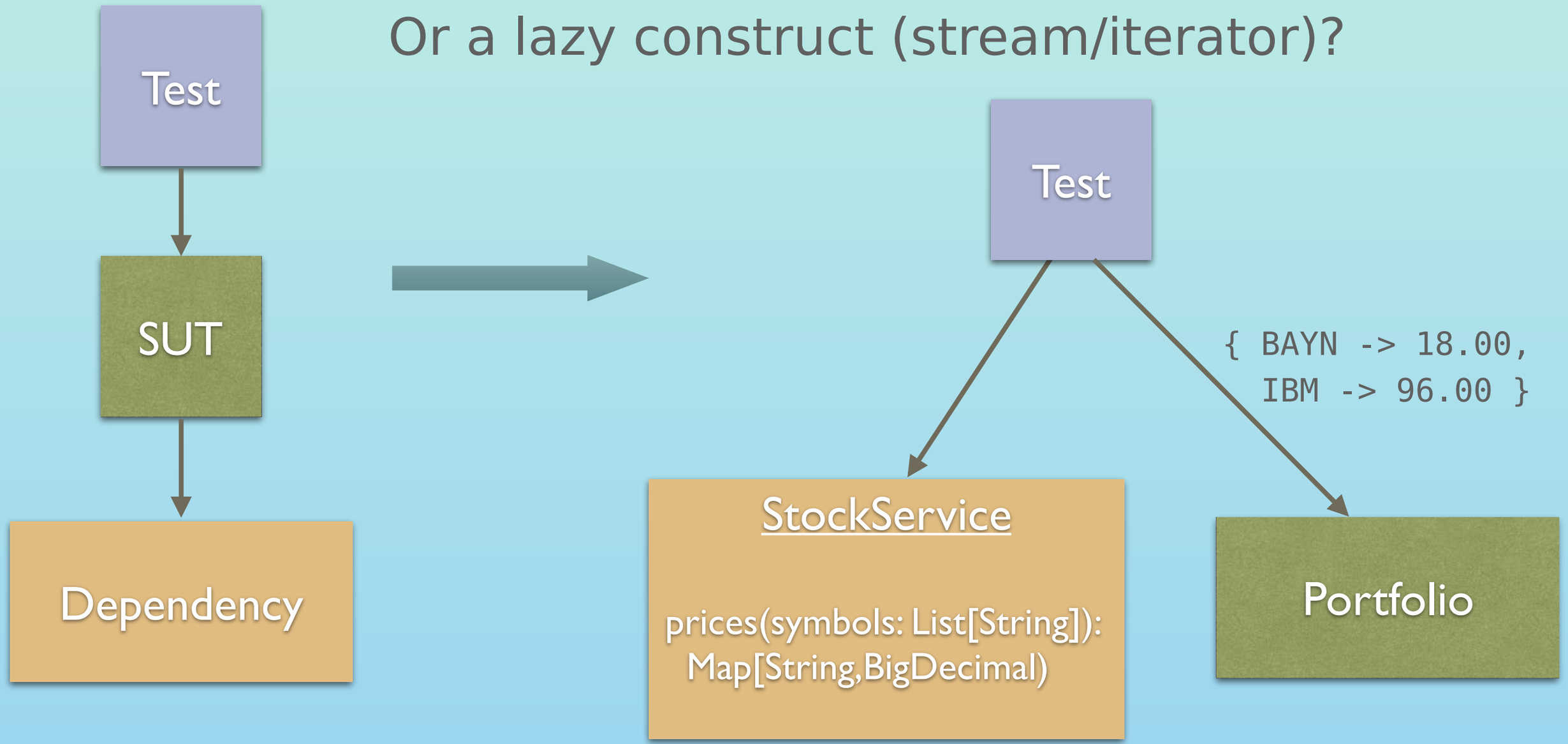


When *Not* to Mock?

Push the dependency up

Can you inject data instead?

Or a lazy construct (stream/iterator)?



The Pragmatic Mocker

- Writes integration tests where mocks are used
- Watches coupling between tests & implementation
- Seeks to mock only direct collaborators
- Avoids mocking what they don't own
- Avoids fakes (and if necessary, test-drives 'em!)
- Knows their mock tool in & out
- Isolates, minimizes the use of test doubles
  - But prefers testability

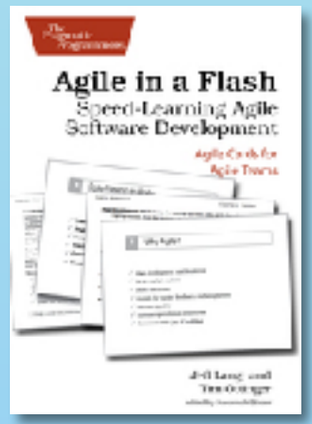
Wrap-Up Exercise

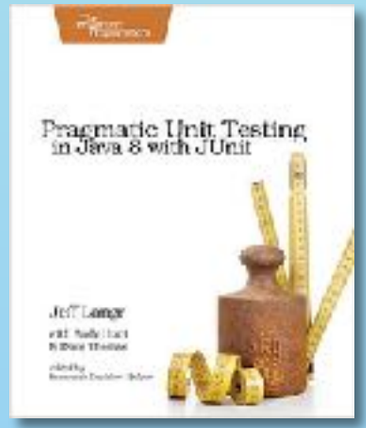
- Support voids on checkout

Work outside in:

- Stub collaborators until ready to build them out

Growing & Sustaining TDD





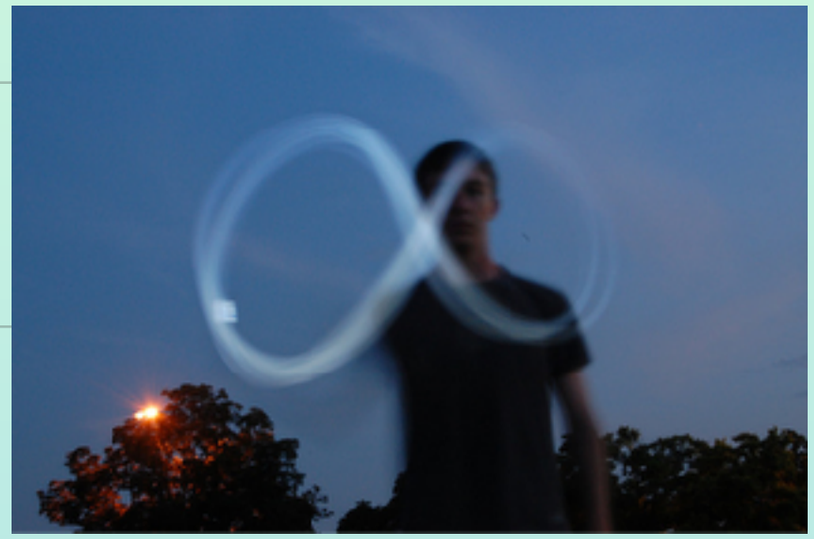
Starting TDD

- TDD-specific team policies/standards
- "Stop the line" CI mentality
- Review the tests, too
- Mob!

Growing TDD

- Sharing sessions
- Competitions
- Coaches & champions
- Dynamic metrics
- Mob!

Sustaining TDD



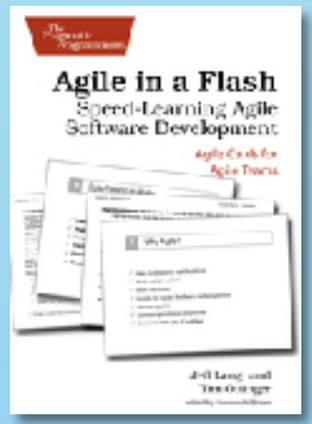
- TDD-specific reflection/adaptation
  - Continual?
- Regular reminders: "why?"
- Dynamic standards
- Fast tests
- Read tests as an entry point
- Refactor, refactor, refactor.
  - Tests too!
- Mob!

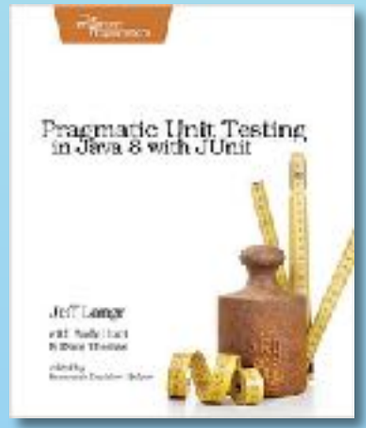
Mastering TDD

TDD is a skill.

Practice, practice, practice.

Miscellaneous Topics



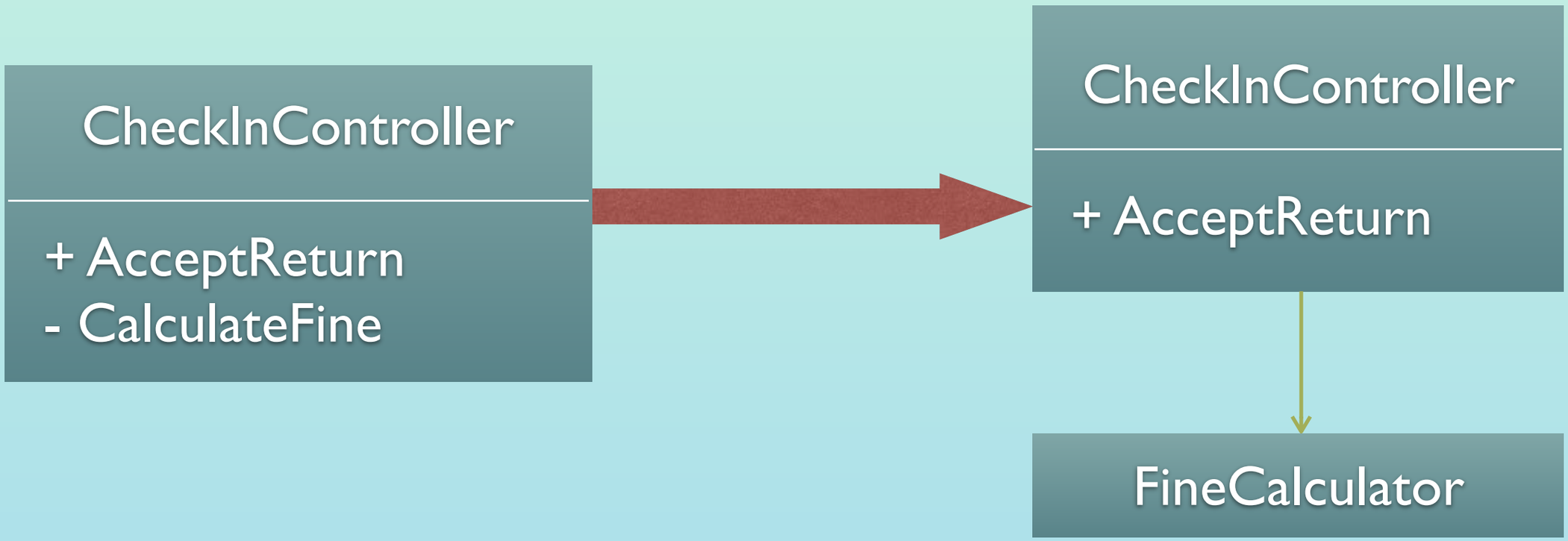


Asynchronous Testing

```
class FutureTest extends org.scalatest.AsyncFunSpec with Matchers
{
  def retrievePage(url: String) = Future {
    scala.io.Source.fromURL(url).mkString
  }

  describe("example.com")  {
    it("contains identifying text") {
      val page = retrievePage("http://example.com")
      page map { page => page should include("Example Domain")}
    }
  }
}
```

http://www.scalatest.org/user_guide/async_testing

Testing Non-Public Behavior?



Or simply relax access.

Rules of Ten

Green & clean in < 10 (minutes)

Delete and repeat if you're late!

... taking smaller steps this time.

Rules of Ten

Debate stops at 10 (minutes)

"Show me."

Rules of Ten

All unit tests run in < 10 (seconds).

Fixing a Slow Test Run

Warn on tests < ***n*** *ms*

Fail on tests > ***n*** ms

Running a subset of tests increases risk.

Scratch Refactoring

***Discard** the results!*

Uncle Bob's TPP

Transformations have a preferred ordering, which if maintained by ordering of tests, prevents "long outages" in TDD.

The Priority List

(**{}->nil)** no code at all->code that employs nil
(nil->constant)
(constant->constant+) a simple constant to a more complex constant
(constant->scalar) replacing a const. with a variable or an argument
(statement->statements) adding more unconditional statements.
(unconditional->if) splitting the execution path
(scalar->array)
(array->container)
(statement->tail-recursion)
(if->while)
(statement->recursion)
(expression->function) replacing expression w/ a function or algorithm
(variable->assignment) replacing the value of a variable.
(case) adding a case (or else) to an existing switch or if

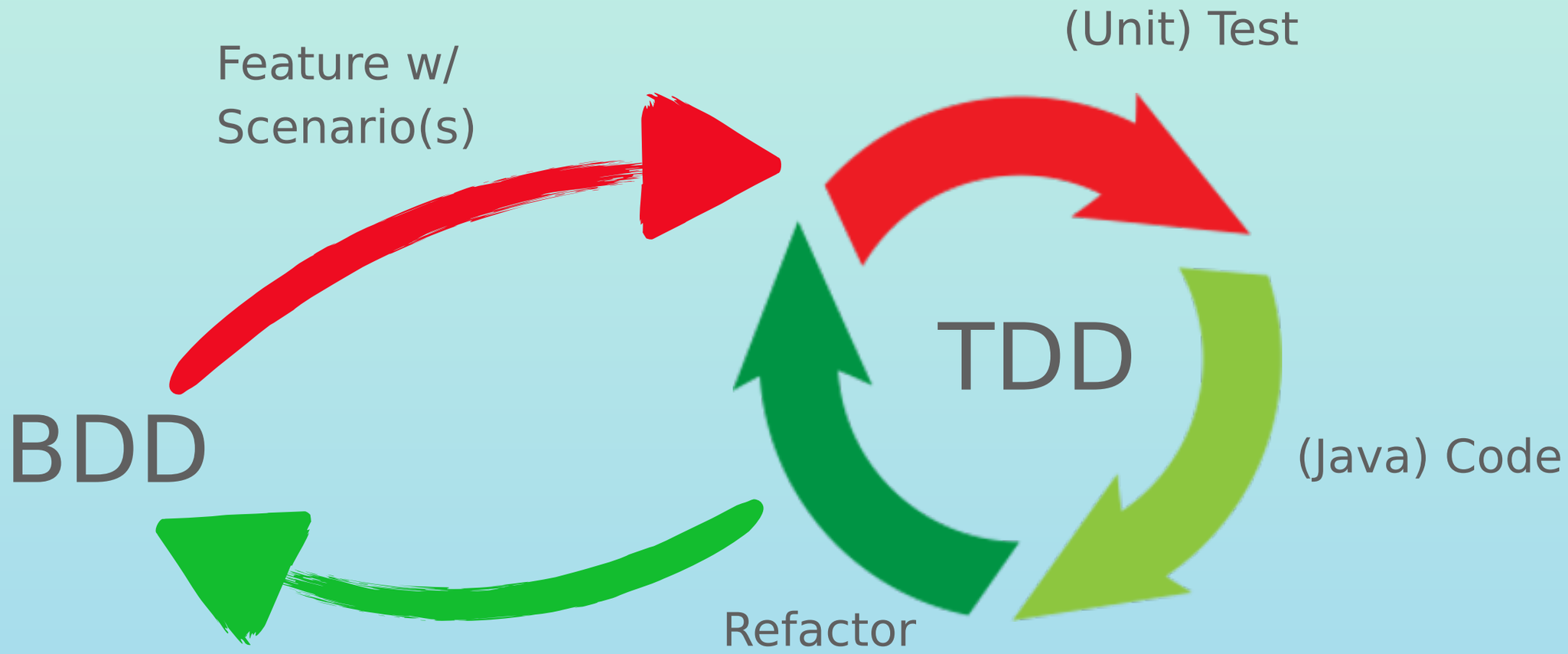
"As the tests get more specific, the code gets more generic."

http://thecleancoder.blogspot.com/2011/02/fib-t-p-premise.html

https://8thlight.com/blog/uncle-bob/2013/05/27/TheTransformationPriorityPremise.html

Per and updated by Uncle Bob.

Behavior-Driven Development (BDD)



References / Reading List

"Chat" icon courtesy Gregor Cesnar, Noun Project (Creative Commons)

[Beck2002] Beck, Kent. **Test-Driven Development: By Example**. Addison-Wesley, 2002.

[Feathers2005] Feathers, Michael. **Working Effectively With Legacy Code**. Prentice Hall, 2005.

[Fowler1999] Fowler, Martin. **Refactoring: Improving the Design of Existing Code**. Addison-Wesley, 1999.

[Freeman, 2009]. Freeman, S. and Pryce, N. **Growing Object-Oriented Software, Guided By Tests**. Addison-Wesley, 2009.

[Langr2005] Langr, Jeff. **Agile Java: Crafting Code With Test-Driven Development**. Prentice Hall, 2005.

[Langr2011] Langr, Jeff and Ottinger, Tim. **Agile in a Flash**. Pragmatic Programmers, 2011.

[Langr2013] Langr, Jeff. **Modern C++ Programming With Test-Driven Development**, Pragmatic Programmers, 2013.

[Langr2015] Langr, Jeff, et. al. **Pragmatic Unit Testing in Java 8 with Junit.** Pragmatic Programmers, 2015.

[Martin2002] Martin, Robert C. **Agile Software Development: Principles, Patterns, and Practices**. Prentice Hall, 2002.

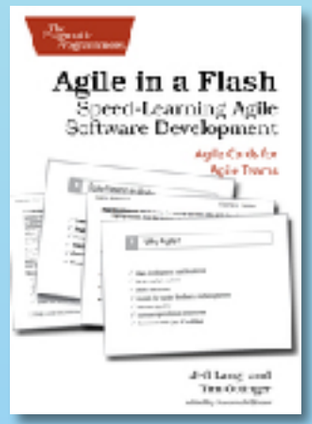
[Meszaros2007] Meszaros, Gerard. **xUnit Test Patterns: Refactoring Test Code**. Addison-Wesley, 2007.

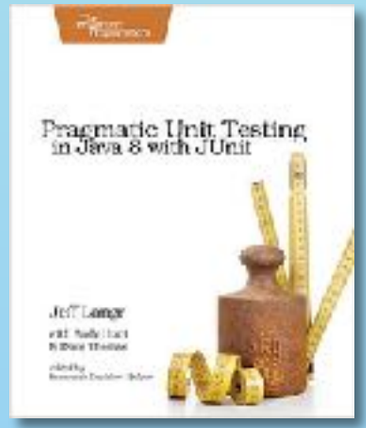
Thank you!


ICON
AGILITY SERVICES
Langr
Software Solutions
SOFTWARE TRAINING/CONSULTING
TDD
AGILE


JAVA
STYLE


Modern C++ Programming
with Test-Driven Development
Dale Better.
Sleep Better
Jeff Langr


Agile in a Flash
Speed-Learning Agile
Software Development


Pragmatic Unit Testing
in Java 8 with JUnit
Jeff Langr


Agile
Java
Crafting Code
with Test-Driven
Development


Clean Code
A Handbook of Software Craftsmanship