Test-Driven Development training

Are you ready?

- Install mob tool.

  See https://github.com/remotemobprogramming/mob under "how to install."

  (Under Windows? Use git bash to execute the curl command.)
- Set up codebase:
  - `git clone https://github.com/jlangr/jan2021_ruby_tdd`
  - `git clone git@github.com:jlangr/jan2021_ruby_tdd.git`
  - Make sure you can run the tests
- **Pull the latest source**
- Install Kahoot! on your phone (or not, and wait for browser links)
- Email me your cell #
- Send me your GitHub user id / email address
  - Accept the invitation to the `jan2021_ruby_tdd` repo
- Take note of my contact info below

Jeff Langr / @jlangr / jeff@Langrsoft.com / +1-719-287-GEEK

TDD Jump-Start in Ruby

Jeff Langr

jeff@langrsoft.com
@jlangr

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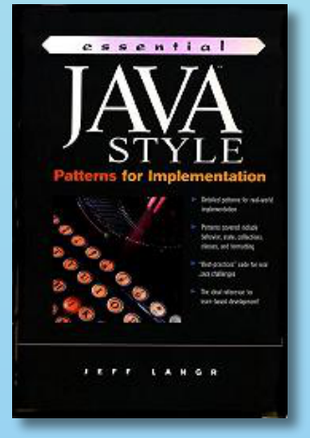
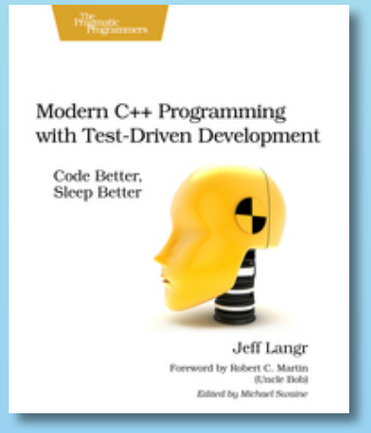
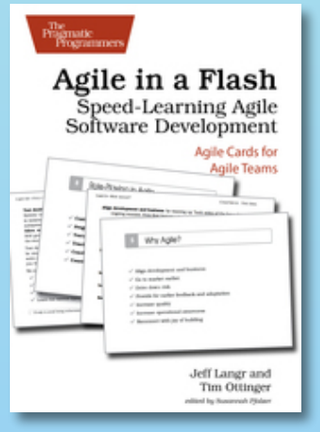
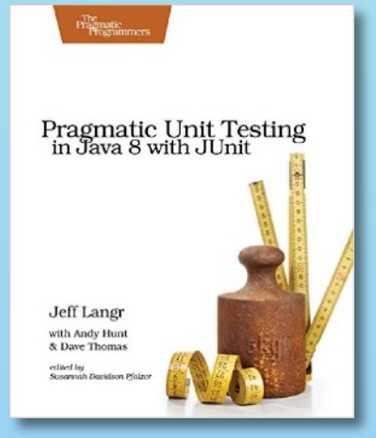
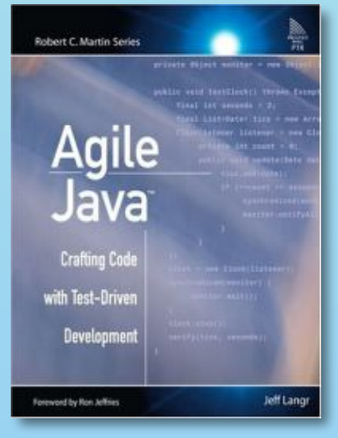
http://langrsoft.com

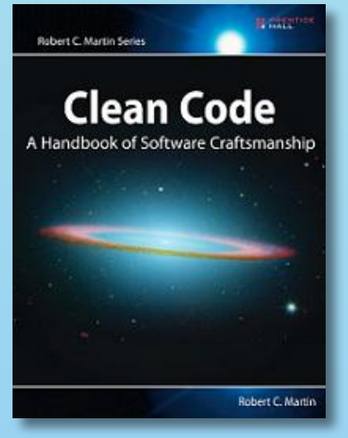












Exercise: Reading code

Describe the behaviors in ./lib/misc/n_normalizer_horror.rb

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Kahoot!

What's a unit test (“spec”) look like?

```
describe TargetClass do
  it "provides some behavior" do
    # Arrange

    # Act

    # Assert
  end
end
```

The AAA mnemonic is courtesy of Bill Wake.

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A sample unit test

```
describe Auto do
  it "idles engine when started" do
    subject.depress_brake

    subject.press_start_button

    expect(subject.RPM).to be_between(950, 1100)
  end
end
```


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A sample unit test

```
describe Auto do
  subject(:auto) { Auto.new }

  it "idles engine when started" do
    auto.depress_brake

    auto.press_start_button

    expect(auto.RPM).to be_between(950, 1100)
  end
end
```


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What do assertions look like?

```
expect(condition).to be true
expect(something).to eq “expected text"
expect(condition).to be true
expect(something).to eq "expected text"
expect(something).not_to eq "unexpected text"
expect("technology").to include "tech"
expect("something").to match /.*thing$/
expect { 4 / 0 }.to raise_error(ZeroDivisionError)
expect(some_collection).to be_empty
expect(obj).to be_instance_of(Auto)
expect([12, 1, 1, 1, 2, 1, 3]).to include(12, 3)
expect([2, 4, 8, 16, 32]).to all(be_even.and be < 64)
```

Where’re the docs?

- https://github.com/rspec/rspec-expectations
- https://relishapp.com/rspec/rspec-expectations/docs/built-in-matchers
- Use your editor’s intellisense
- Browse source (matchers.rb)

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Exercise: Simple outcomes

Flesh out the tests in ./spec/lib/misc/basics_spec.rb

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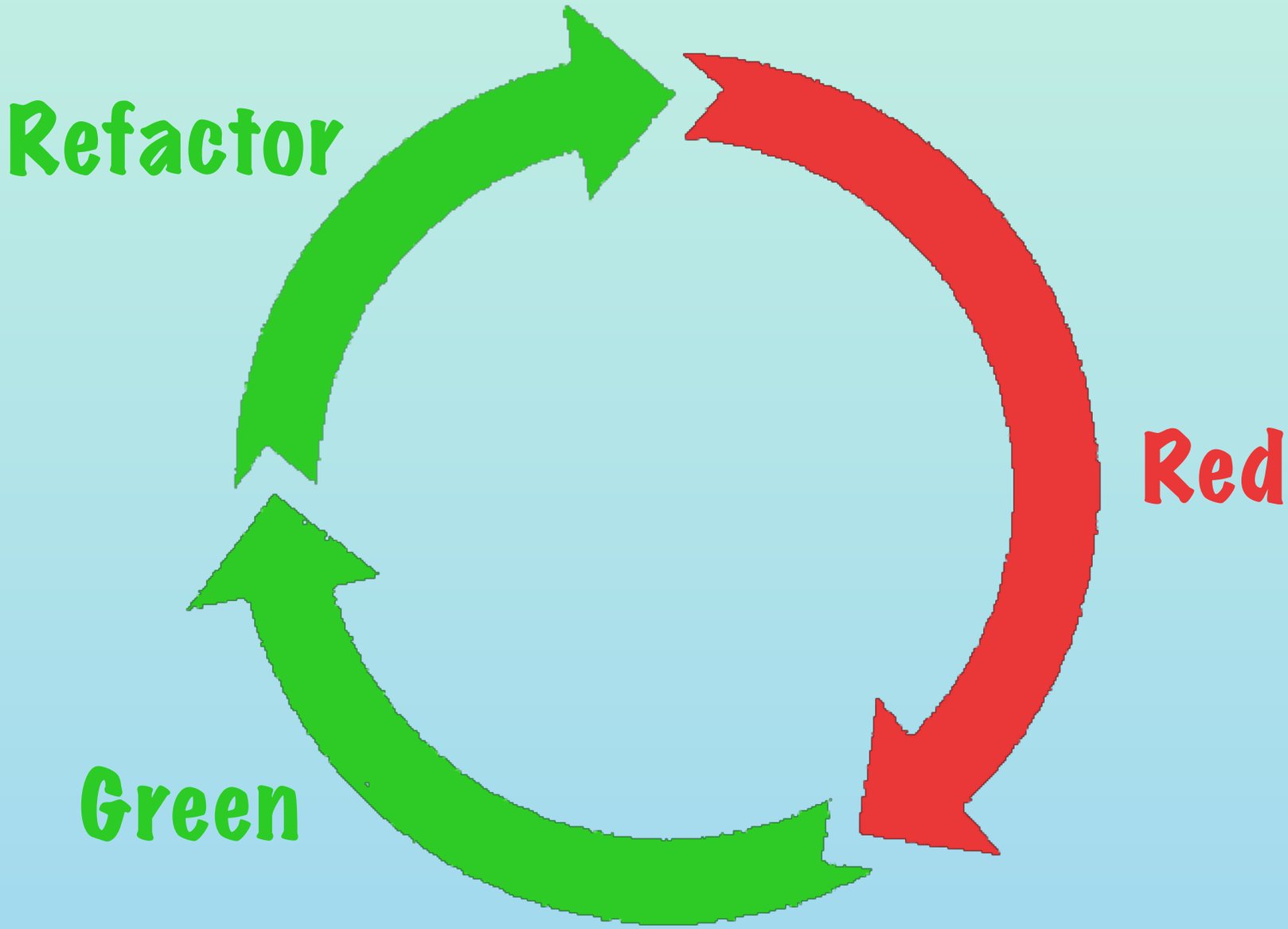
Test-Driven Development



An incremental design technique

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Mob programming

"All the brilliant people working on the same thing,
at the same time,
in the same place,
and on the same computer."

Woody Zuill

http://mobprogramming.org

Short focused, timed rotations

Strong-style navigation

"We go faster."

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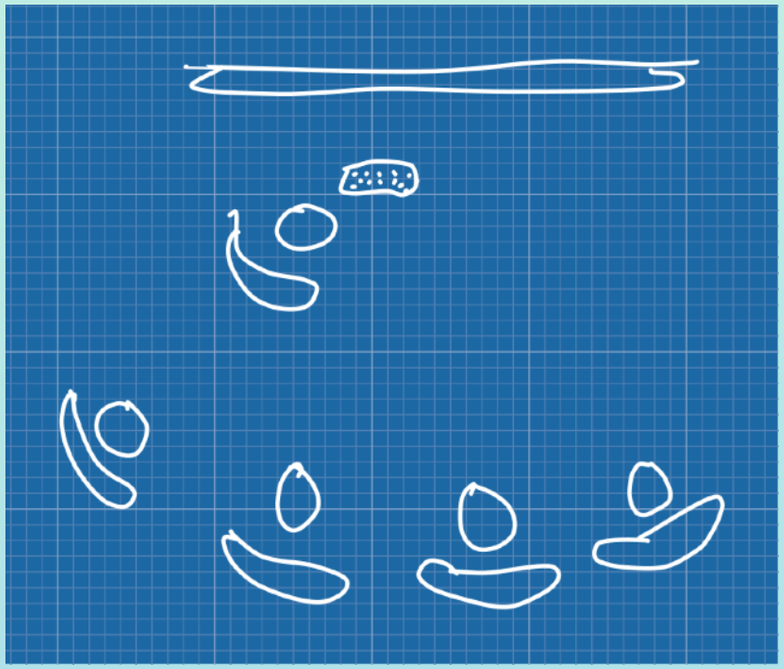
A tale of times past



*Once upon a time, there existed a quaint notion of an "**office**," a physical place where people could un-distance and work physically face-to-face…*

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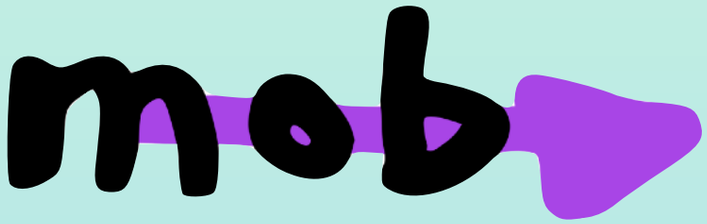
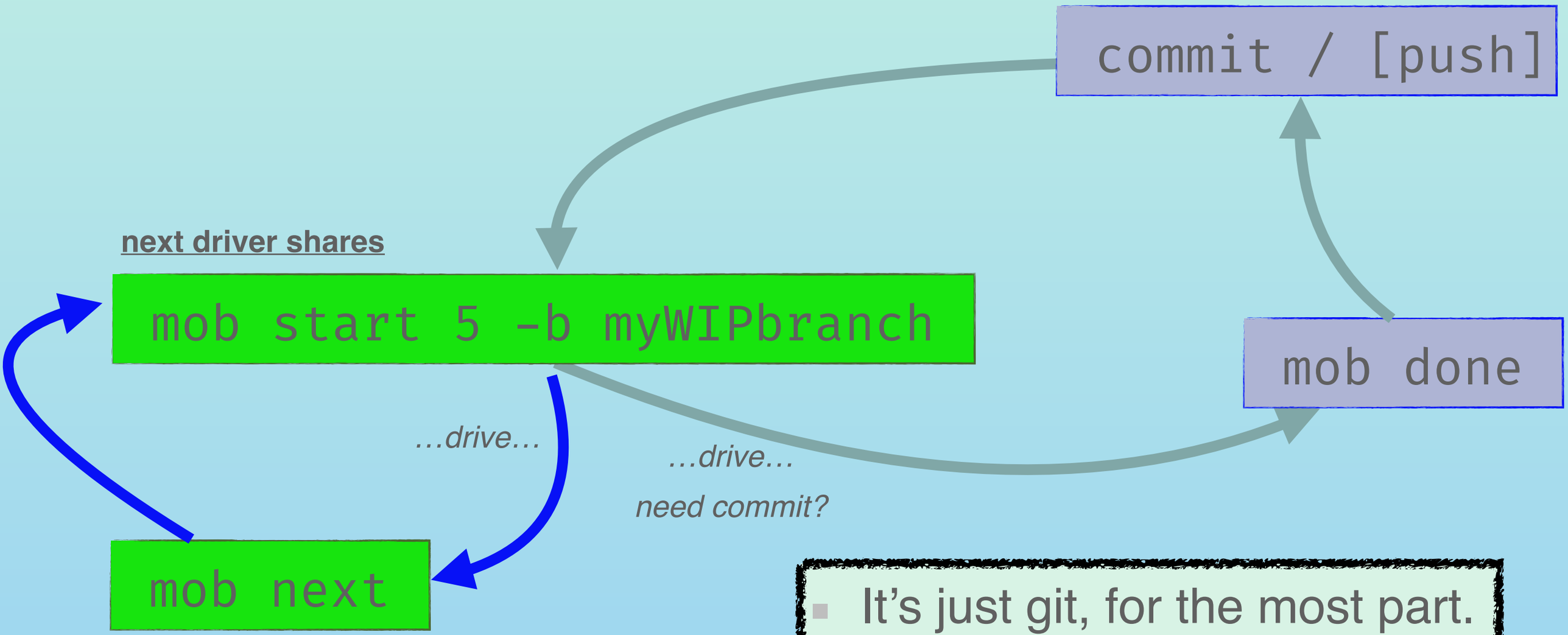
Remote mob programming via Git handover



http://github.com/remotemobprogramming/mob



- It's just git, for the most part.
- `git status` often

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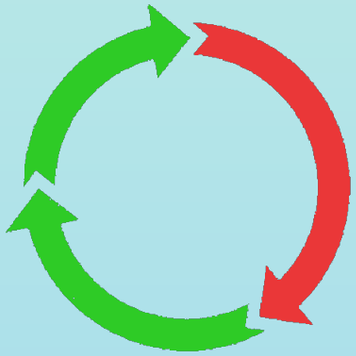
Exercise: (Test)-Code-Refactor

See ./spec/lib/misc/name_normalizer_spec.rb



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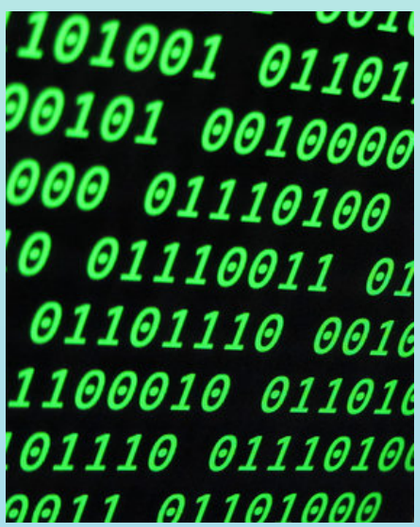
Why TDD?



Keep code malleable

Document choices

Gate defects

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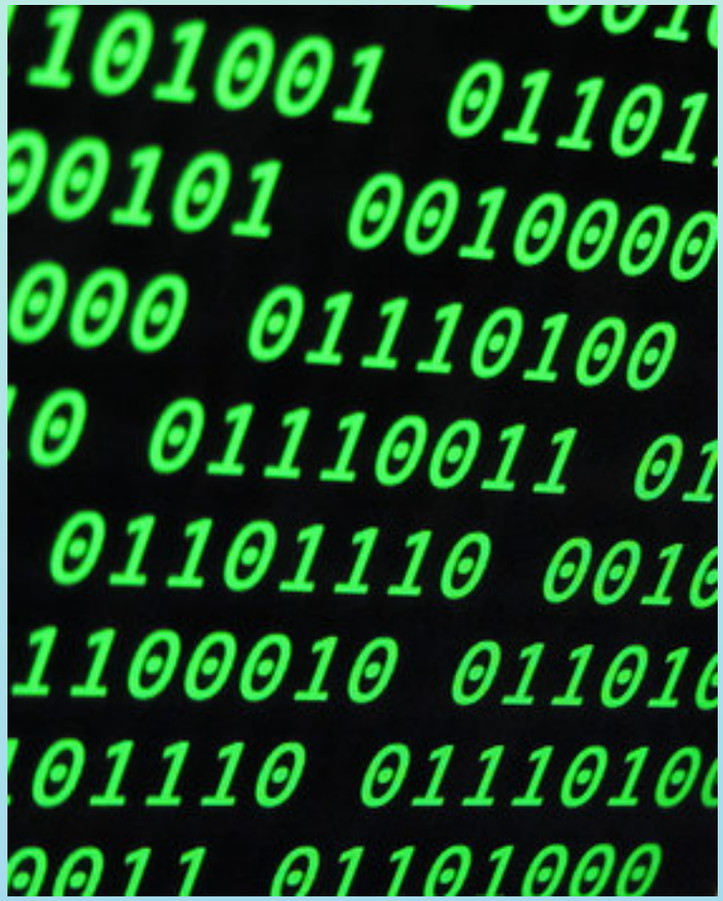
Core TDD themes



- Drive *behavior*
- Specify by example
- Grow in small increments
- Stick to the cycle
  - Always see red
  - Always refactor

It's just code!

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Kahoot!

DHH

Photo courtesy of @DHH's Twitter profile

"My name is David, and I do not write software test-first.

"I refuse to apologize for that any more, much less hide it. I'm grateful for what TDD did to open my eyes to automated regression testing, but I've long since moved on from the design dogma."

https://dhh.dk/2014/tdd-is-dead-long-live-testing.html

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Stepping back: Writing tests

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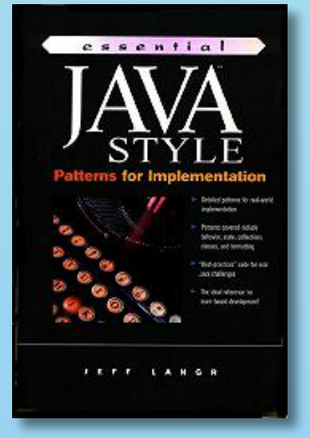

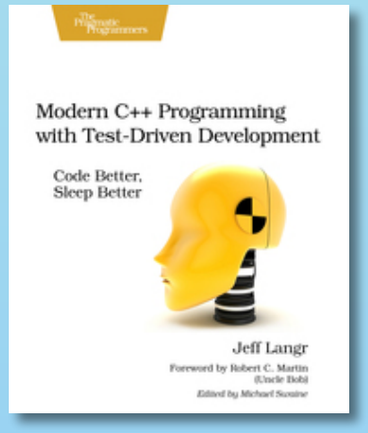

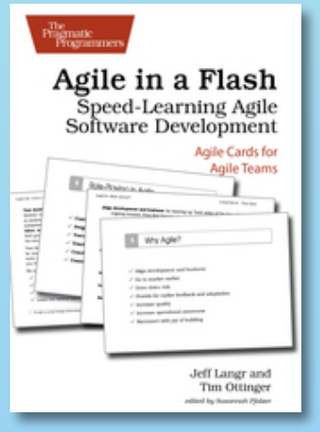

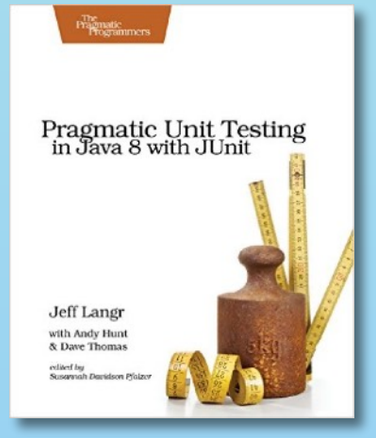

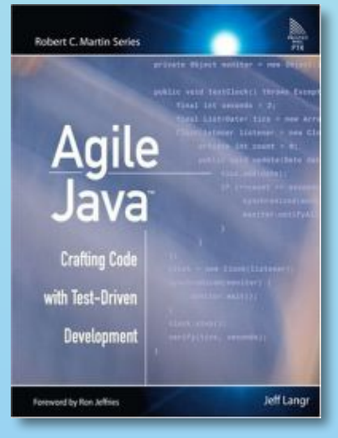

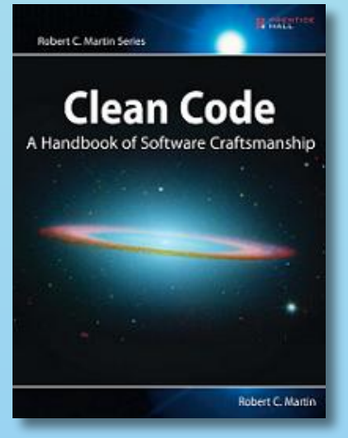

Recent file list

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

What tests do we need?

```
class RecentFileList
  attr_reader :filenames
  def open(filename)
    # ...
  end
end
```

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Ordering tests

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

ZOMBIES!

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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

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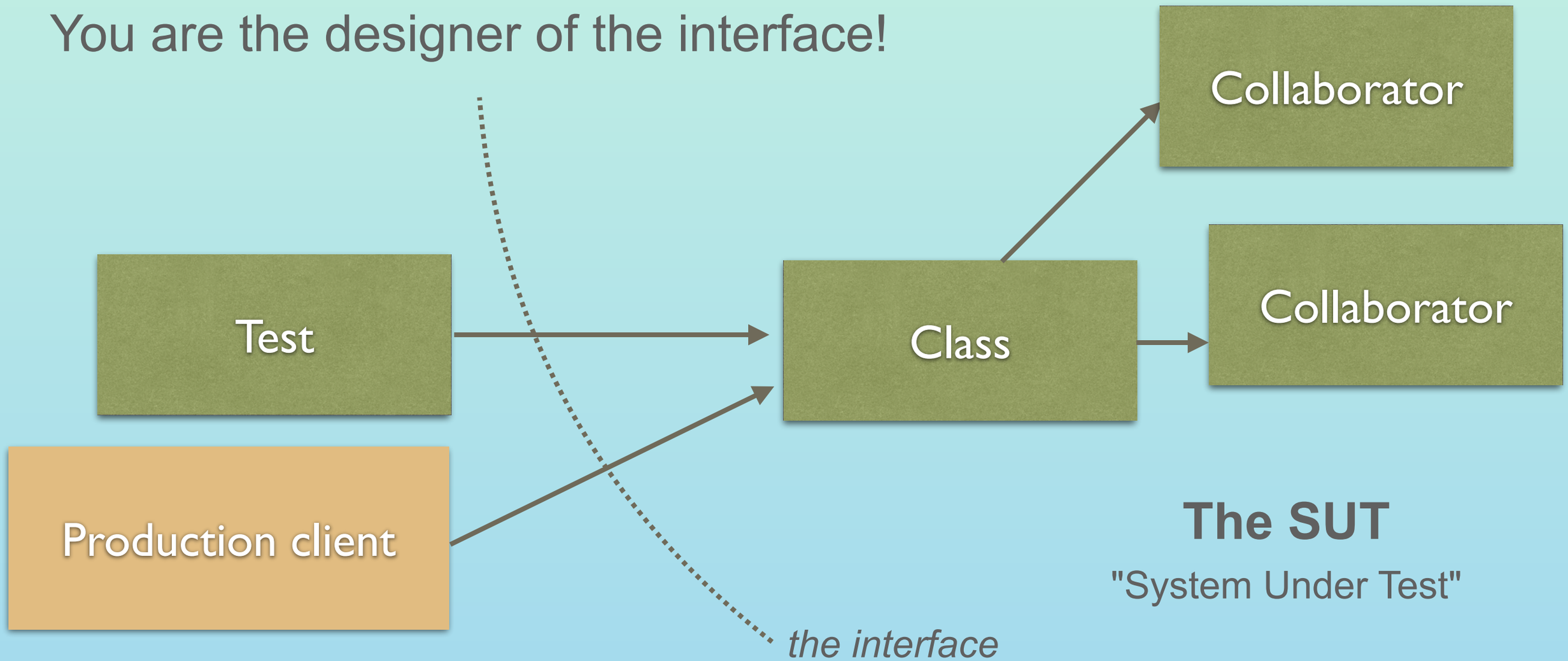
Your test is a client

You are the designer of the interface!



The SUT

"System Under Test"

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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**

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The test

```
it "sifts duplicate filename to top" do
  list.open("A")
  list.open("B")
  list.open("C")

  list.open("A")

  expect(list.filenames).to eq(%w[A C B])
end
```


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Assert-first

Consider working from the outcome.

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

```
expect(list.filenames).to eq([duplicate_of_first_opened, "C", "B"]
```


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Assert-first

Consider working from the outcome.

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

```
list.open(duplicate_of_first_opened)

expect(list.filenames).to eq([duplicate_of_first_opened, "C", "B"])
```

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Assert-first

Consider working from the outcome.

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

```
list.open("A")
list.open("B")
list.open("C")
duplicate_of_first_opened = "A"

list.open(duplicate_of_first_opened)

expect(list.filenames).to eq([duplicate_of_first_opened, "C", "B"])
```


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AAA is a visual mnemonic

Don't do this:

```
it "sifts duplicate filename to top" do
  # arrange
  list.open("opened-A")
  list.open("opened-B")
  list.open("opened-C")

  # act
  list.open("opened-A")

  # assert
  expect(list.filenames).to eq(%w[opened-A opened-C opened-B])
end
```

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Let space do the talking

```
it "sifts duplicate filename to top" do
  list.open("opened-A")
  list.open("opened-B")
  list.open("opened-C")

  list.open("opened-A")

  expect(list.filenames).to eq(%w[opened-A opened-C opened-B])
end
```

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Exercise: Portfolio

- 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

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

Red: Ensure test fails

Green: Implement no more code than necessary

Refactor: Clarify and eliminate all duplication

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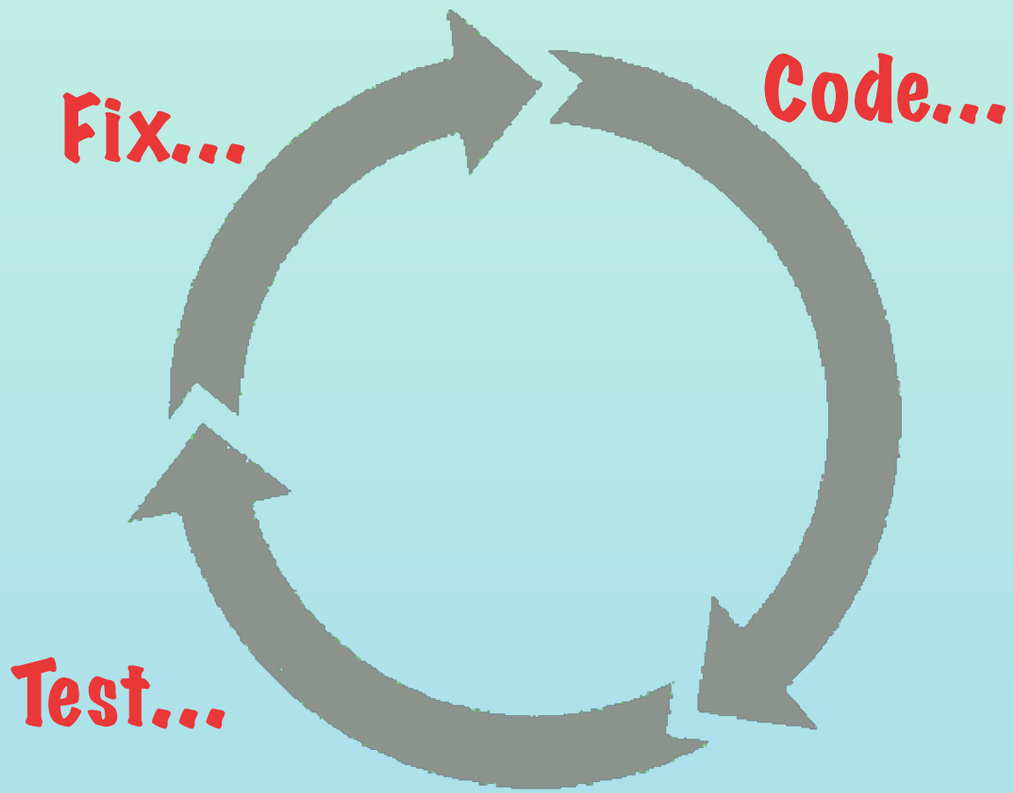
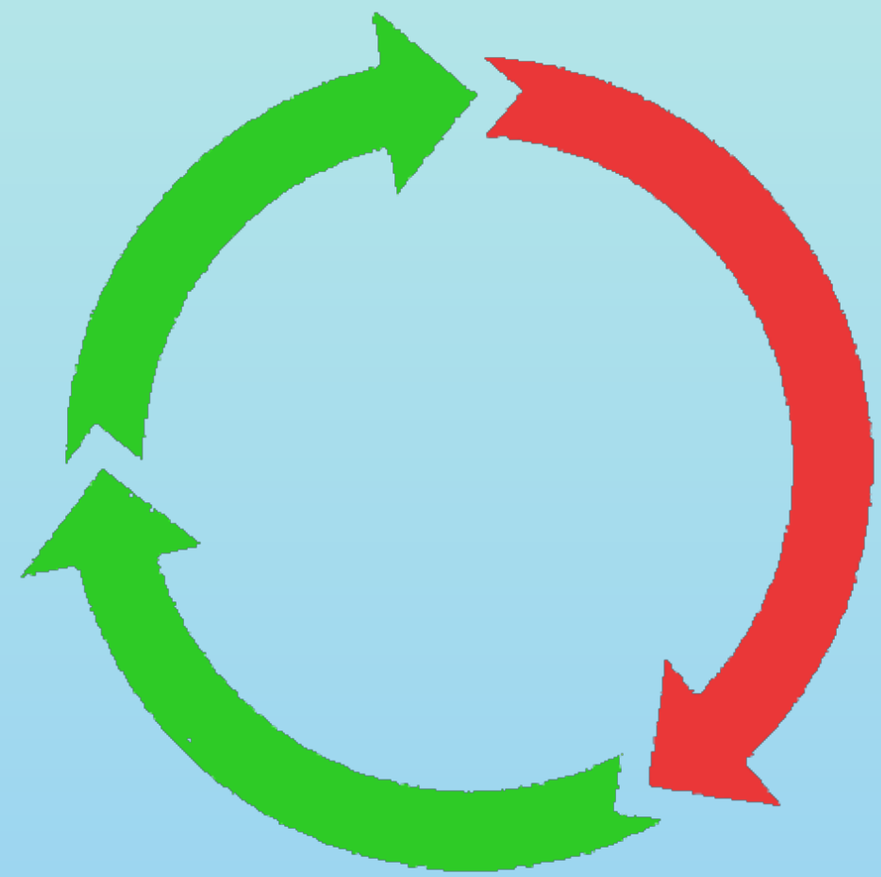
TAD** and TDD: What's the difference?





"Test-After Development"

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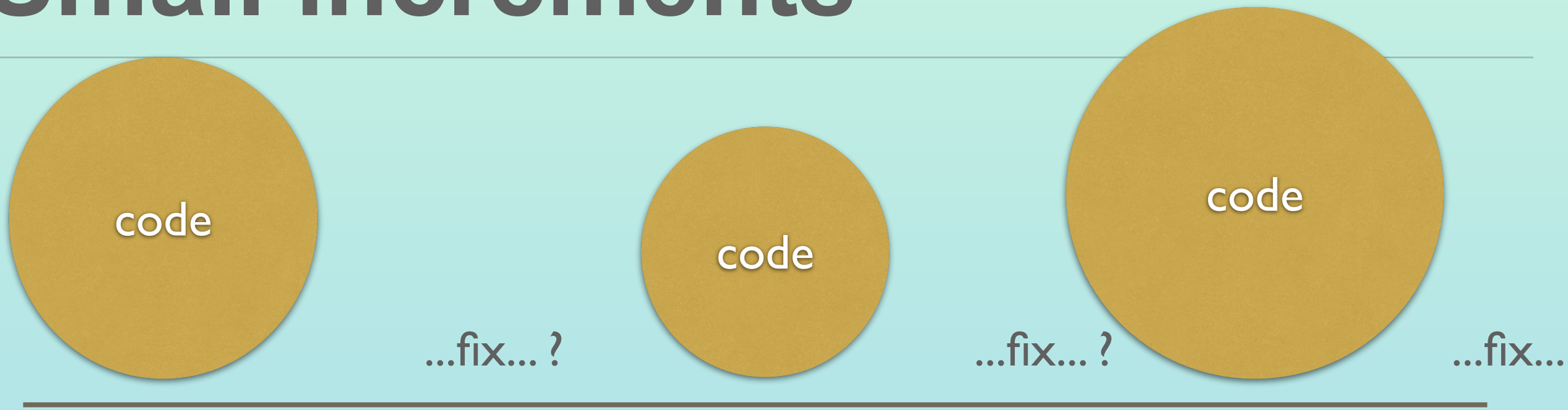
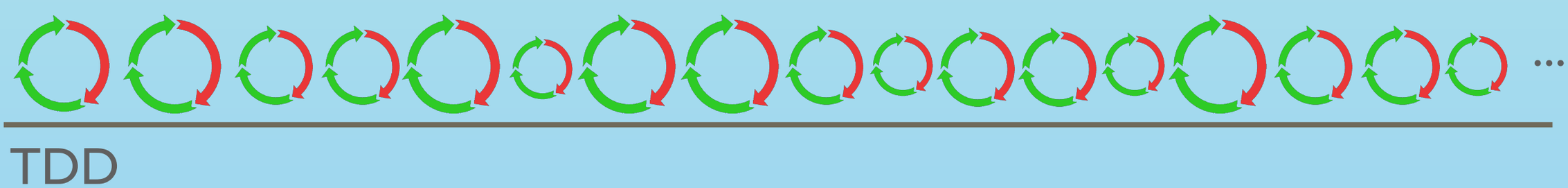
Small increments



vs.



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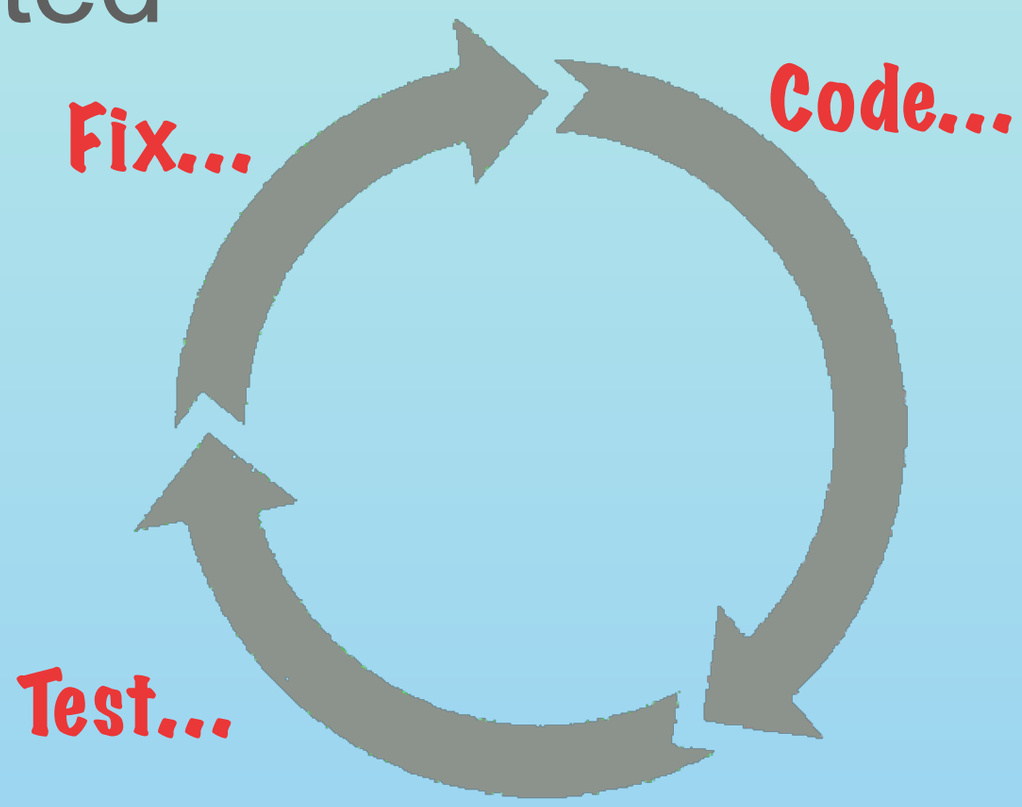
Test-After Development (TAD)

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



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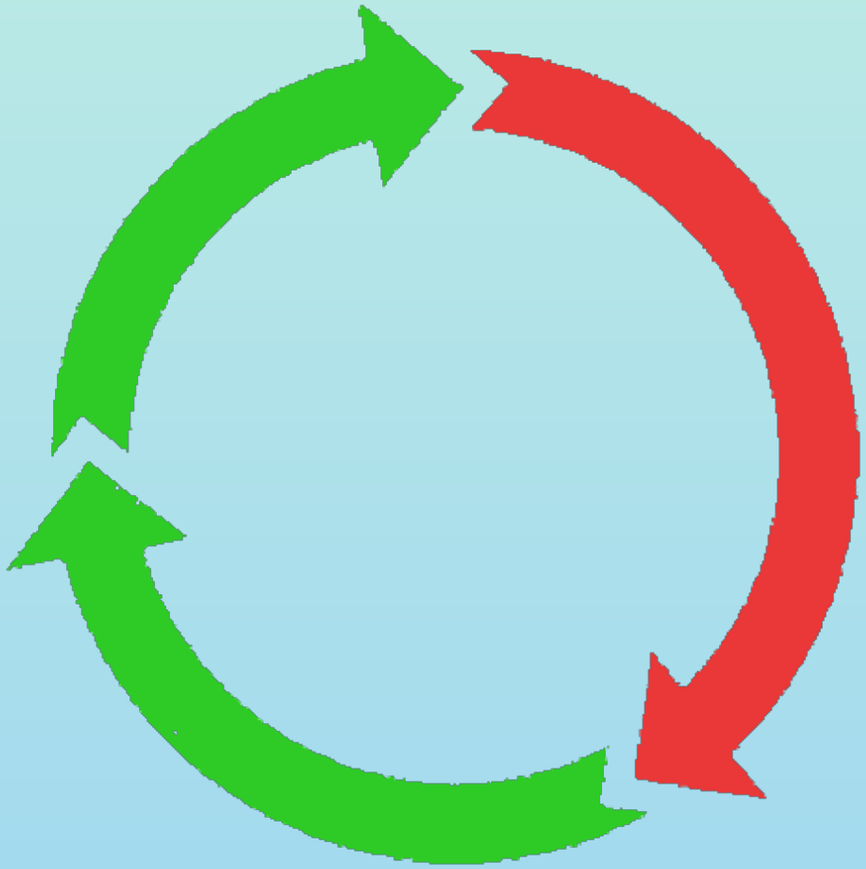
Test-Driven Development (TDD)

- 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



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Kahoot!

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

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Roman numeral converter

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

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Where does TDD fit?

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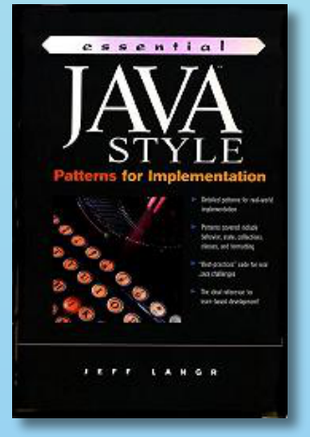
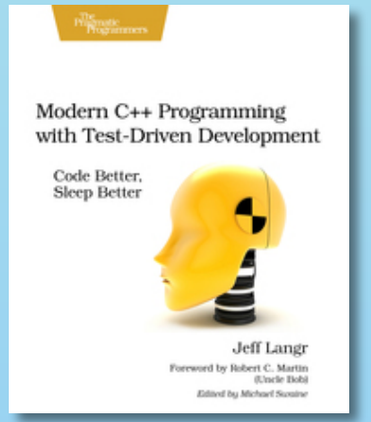
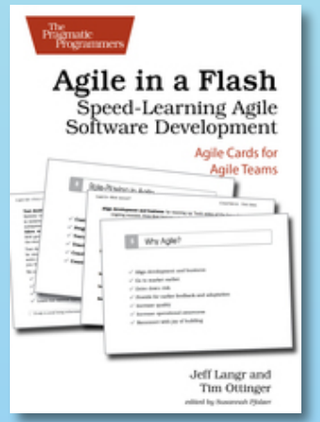
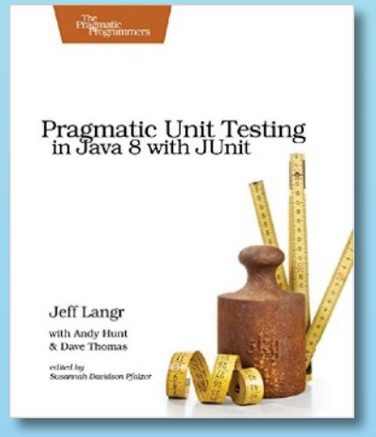
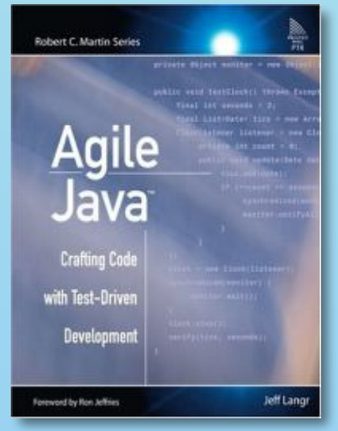
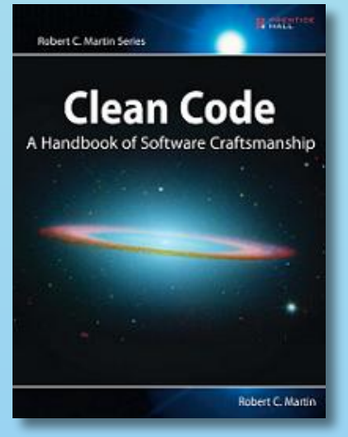




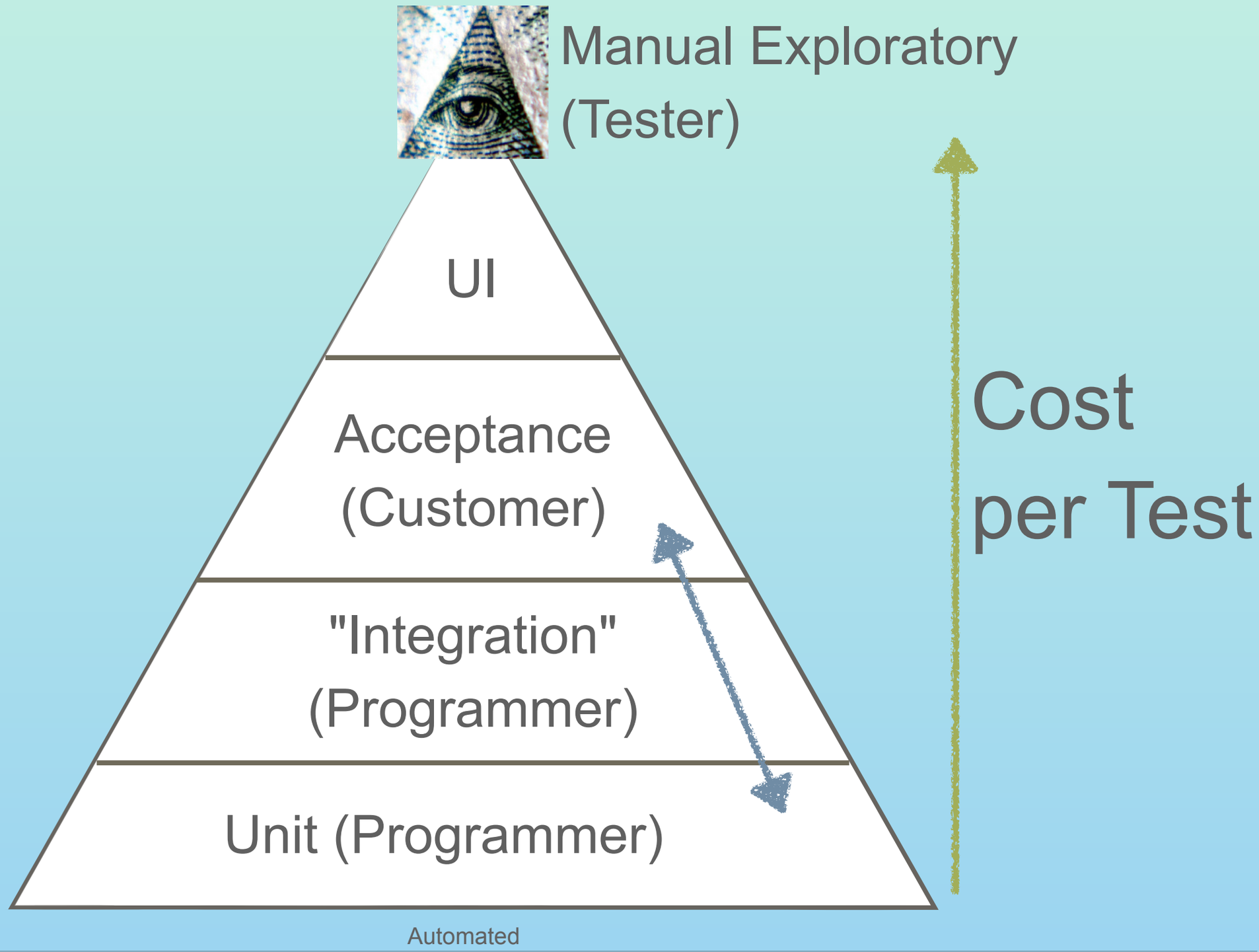








Unit testing is but a slice of the whole



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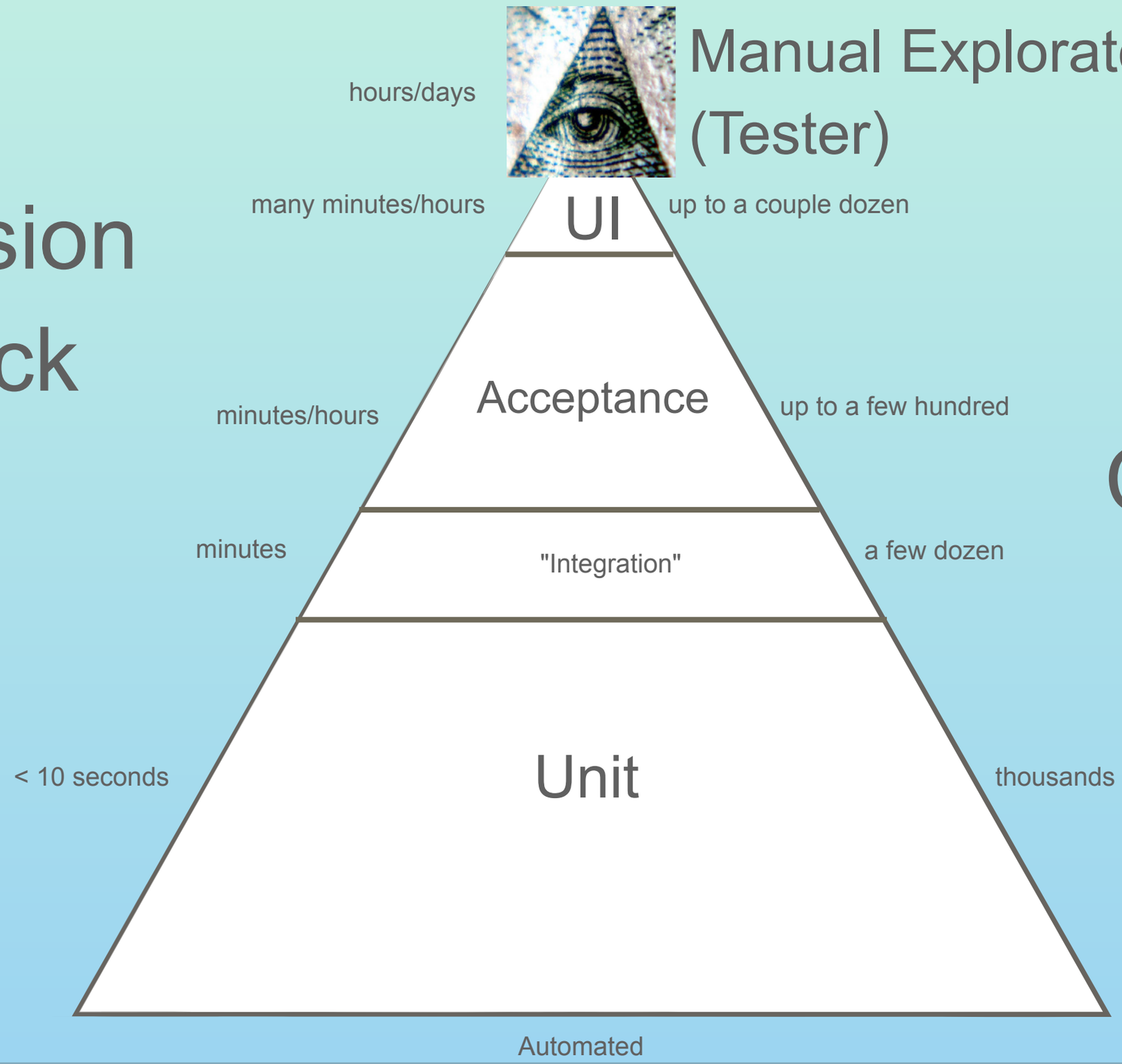
Right-sizing the pyramid

Regression Feedback



Count

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Feedback questions

:-)	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?

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Documenting unit behaviors

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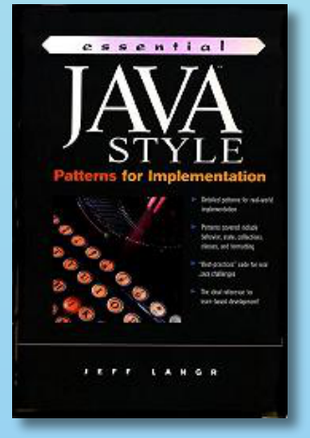

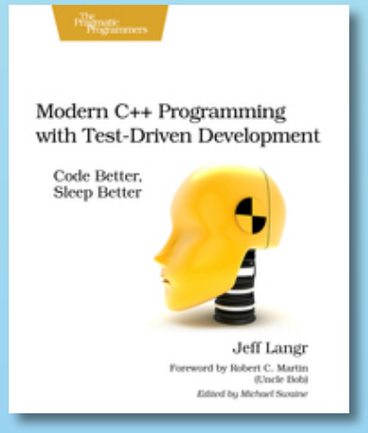

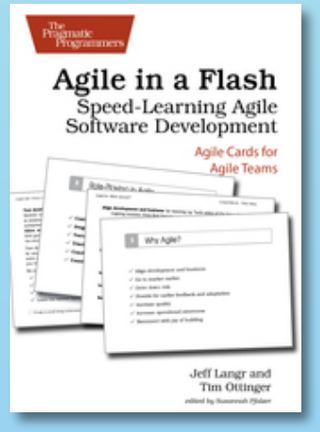

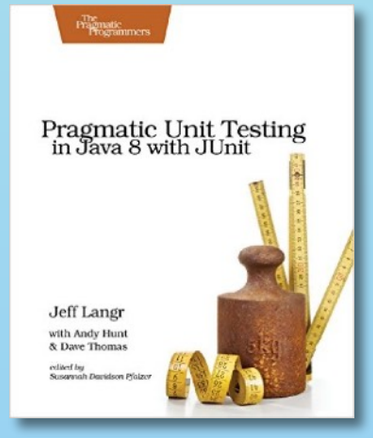

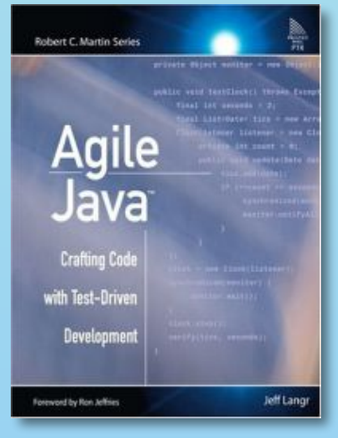

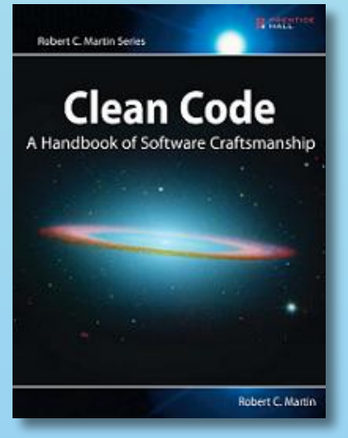

Specs as documentation

```
describe Auto do
  let(:auto) { Auto.new }

  it "idles engine when started" do
    auto.depress_brake

    auto.press_start_button

    expect(auto.RPM)
      .to be_between(950, 1100)
  end
end
```

what we're describing

the generalized behavior it supports

an example of that behavior

Seek to first understand through the tests.

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Behavior-driven structuring

```
describe "given some context" do
  context "when some event occurs" do
    it "then can be verified" do

    end
  end
end
```

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BDD Structuring

```
describe('given a checked-out material') do
  let(:library) { Library.new }

  before(:each) do
    @due_date = library.borrow(Agile_Java, Patron_Id)
  end

  context 'when returned late' do
    before(:each) do
      library.return_material(Agile_Java, @due_date + 1)
    end

    it 'is marked as available' do
      expect(library.available? Agile_Java).to be true
    end

    it 'generates a late fine' do
      # ...
    end

    it 'notifies patrons with hold' do
      # ...
    end
  end
end
```

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Iterative naming

- Re-consider name continually

```
it 'does something' do

it 'starts engine' do

it 'sets idle speed on engine start' do

it 'has low idle on engine start' do
```

- Review often and holistically!

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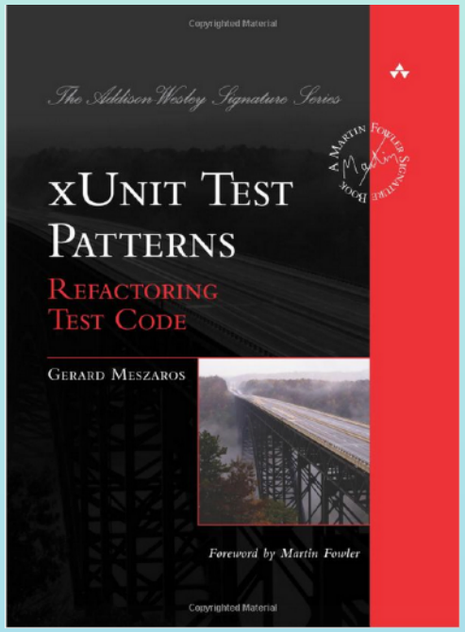
Sustainable tests

The long answer:



A quicker route:

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

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Exercise: Test smells

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

In: ./spec/controllers/checkouts_controller_spec.rb

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Kahoot!

Continual design

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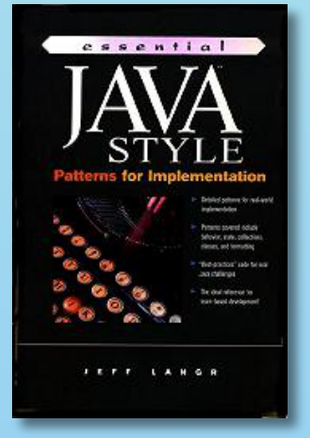
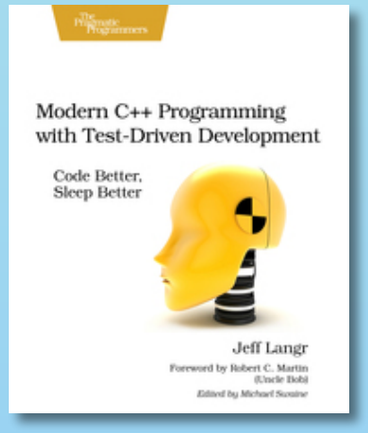
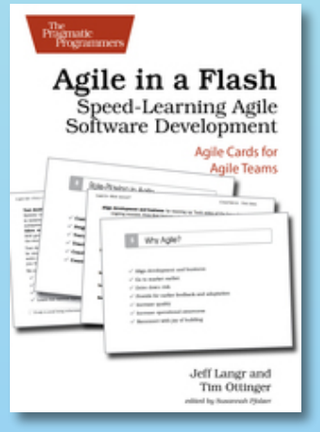
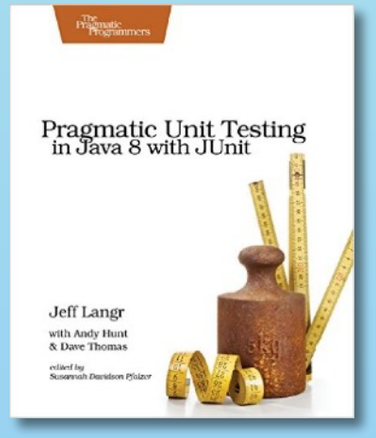
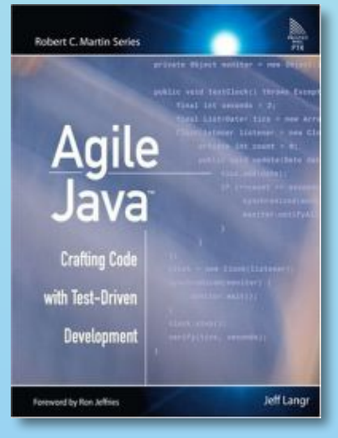
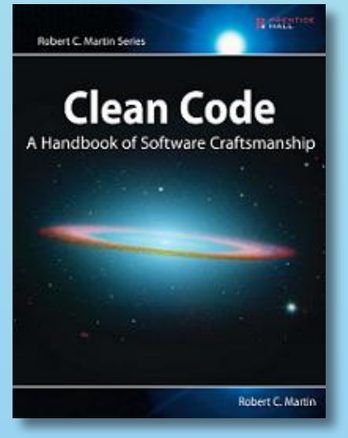






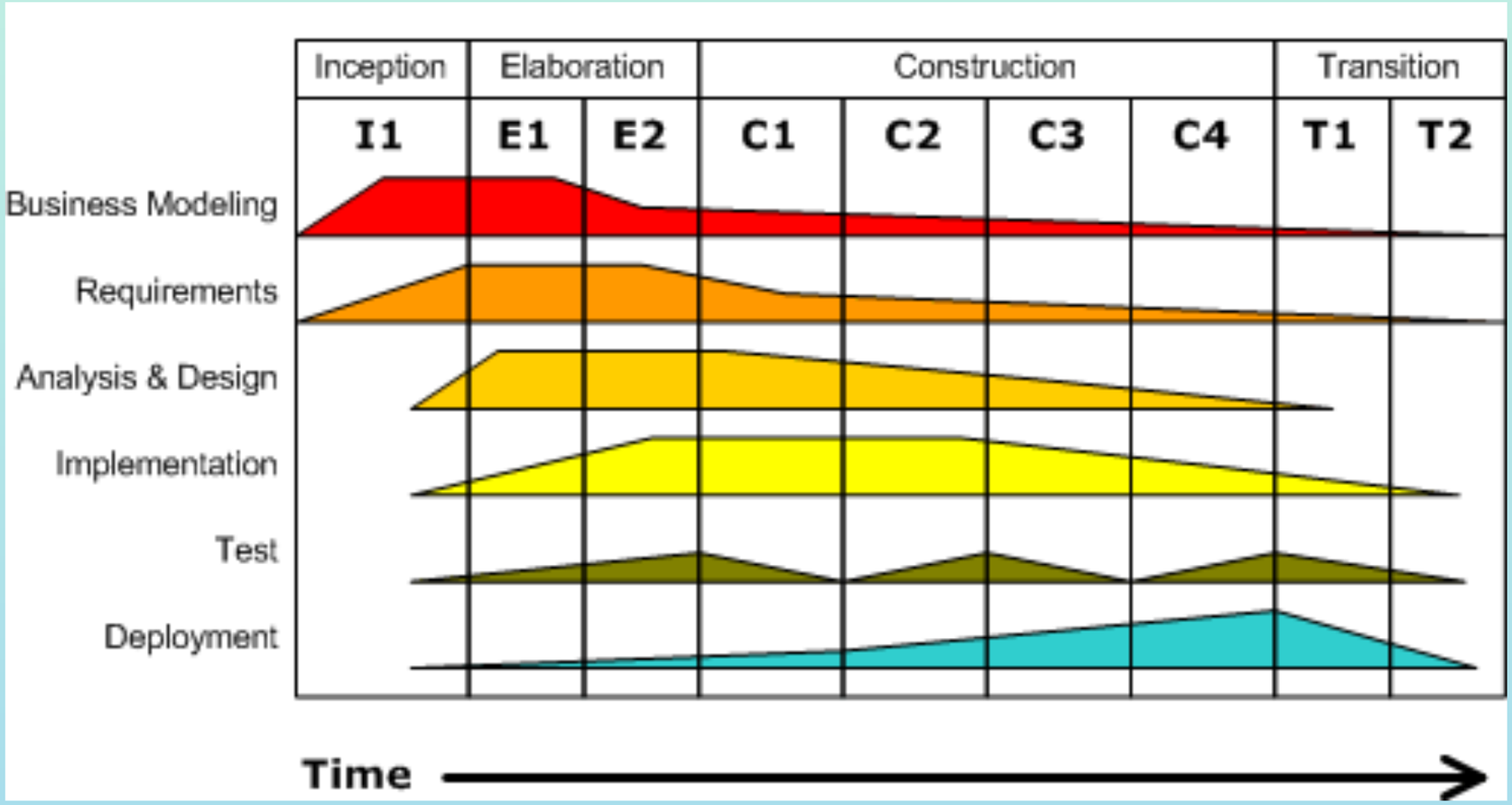






Software development activities

- Planning
- Analysis
- Design
- Coding
- Testing
- Review
- Documentation
- Deployment
- …



- Agile: *All activities all the time*

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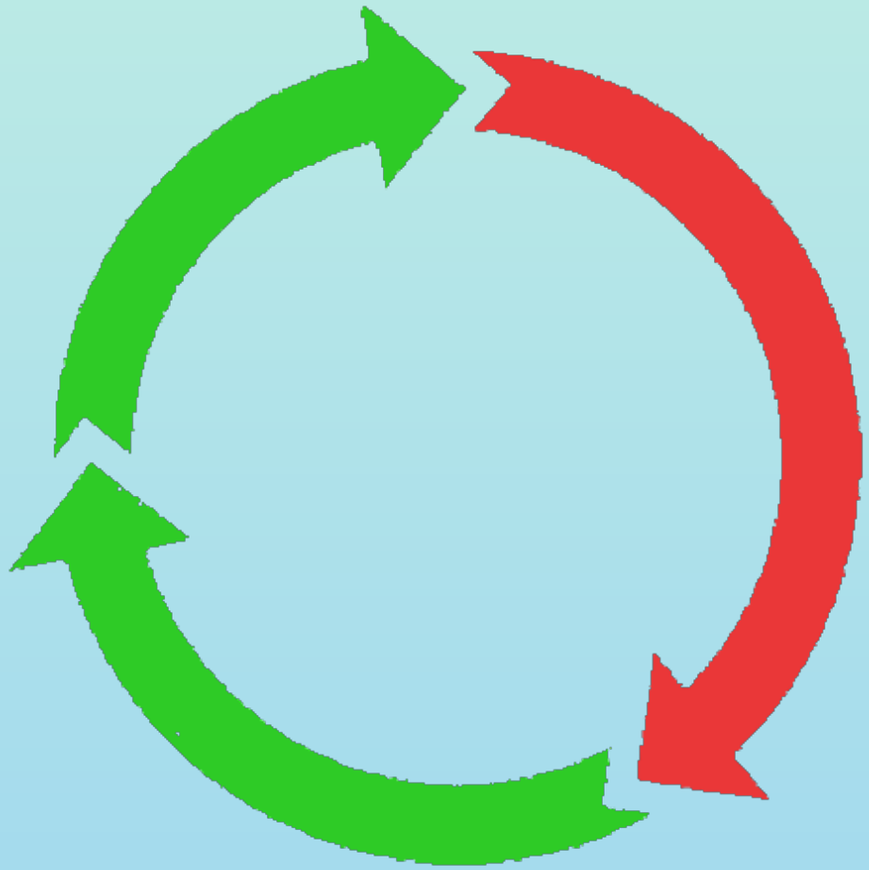
TDD is continual ...

- Testing
- Coding
- Documentation
- Review
- Design



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Design and TDD

What is design?

What aspects of building a solution involve design?

When / how does design occur in the TDD cycle?

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“What Is Design?”—Jack W. Reeves

- A program listing is a document that represents a software design.
- Programming is a design activity.
- Testing [is] the software equivalent of the design validation & refinement processes of other engineering disciplines.
- Other design activities exist—top level design, module design, structural design, architectural design, whatever.

“All design activities interact. A good software design process recognizes this and allows the design to change, sometimes radically, as various design steps reveal the need.”

https://www.developerdotstar.com/mag/articles/reeves_design.html

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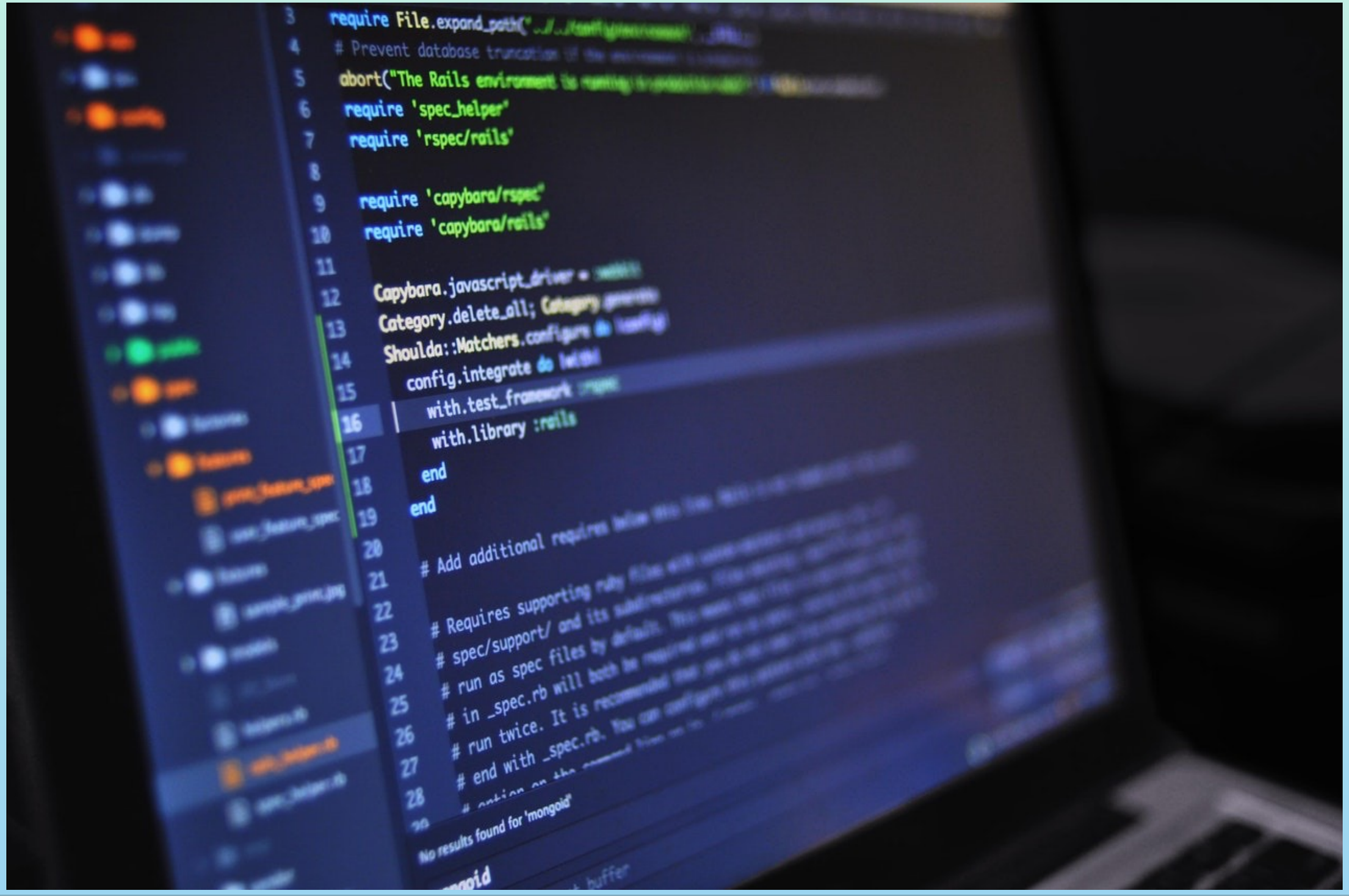
This is design



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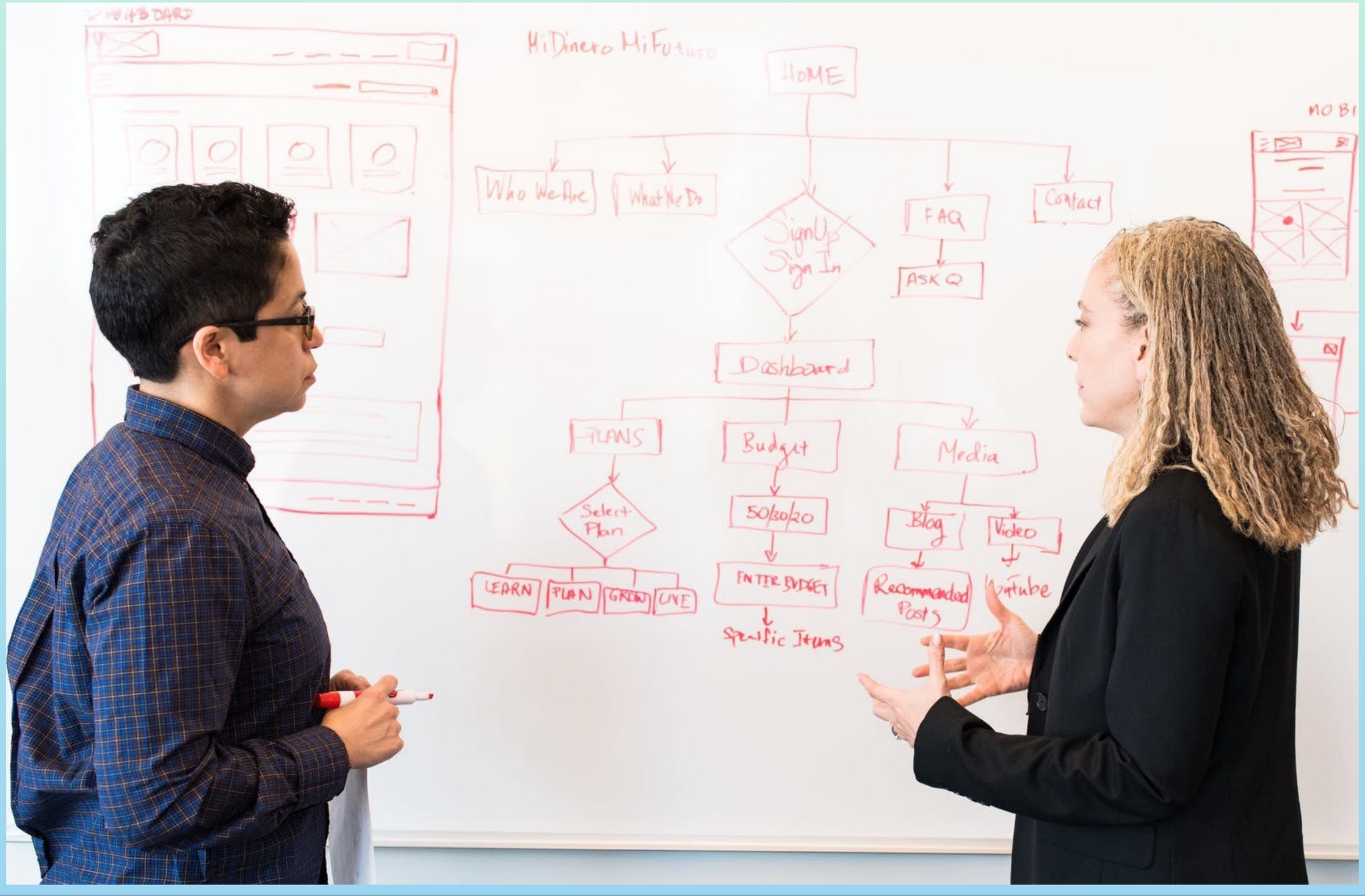
So is this



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And this

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Old-school design planning

“Big Design Up-Front” (BDUF)

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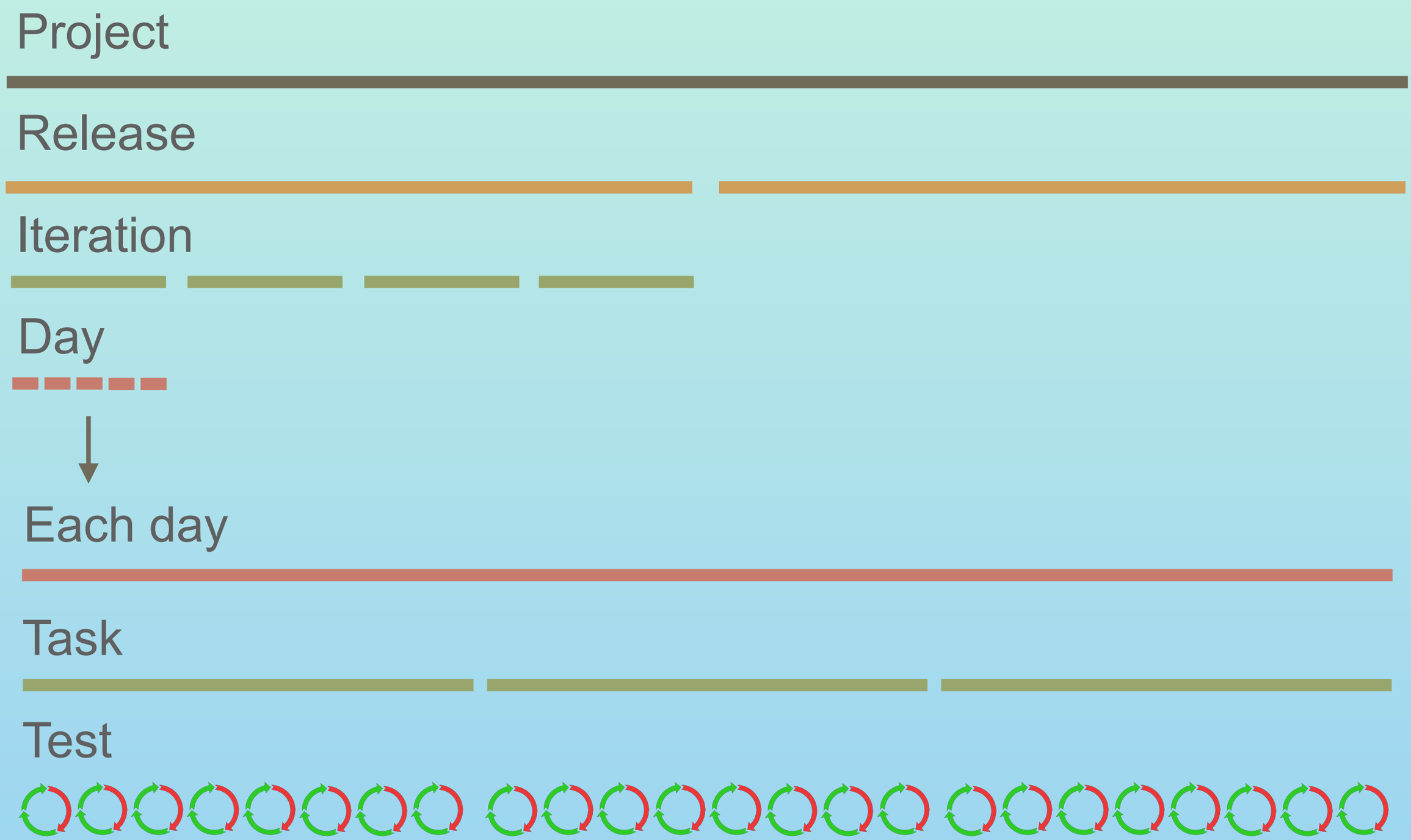
Design occurs at every possible juncture



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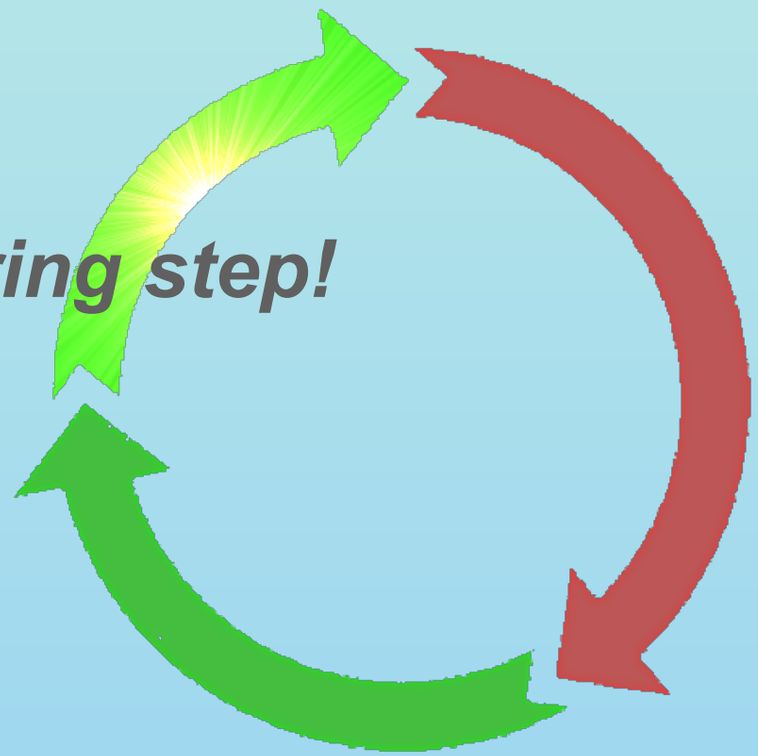
Continual design in TDD

- Always retain an optimal design
- Entropy is unavoidable

Never skimp on the refactoring step!



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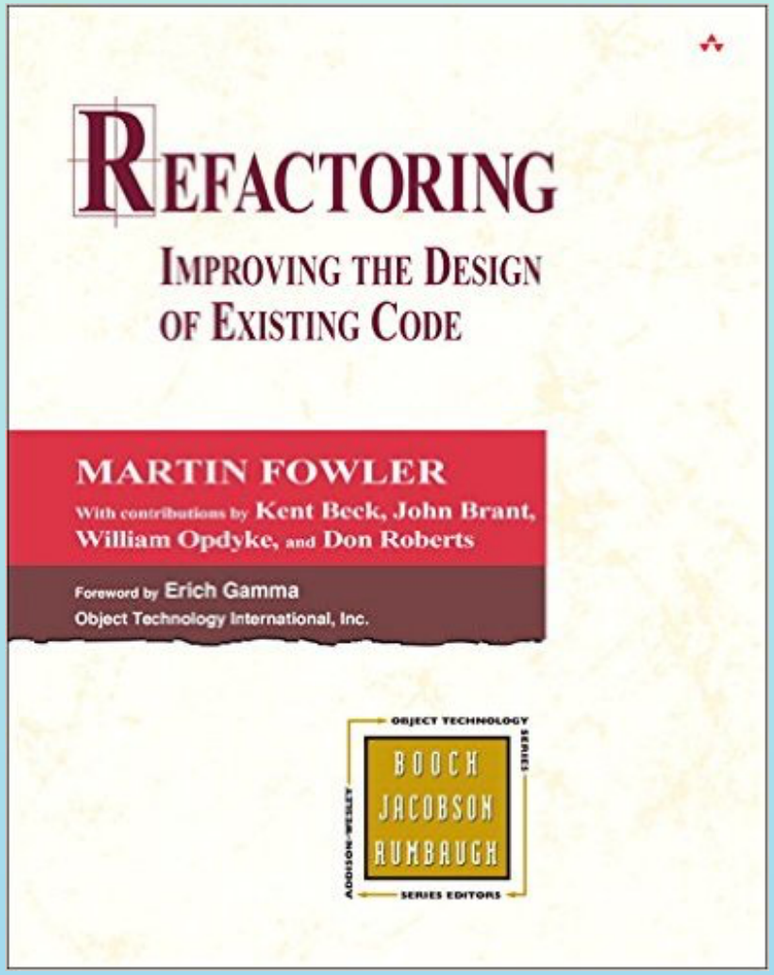
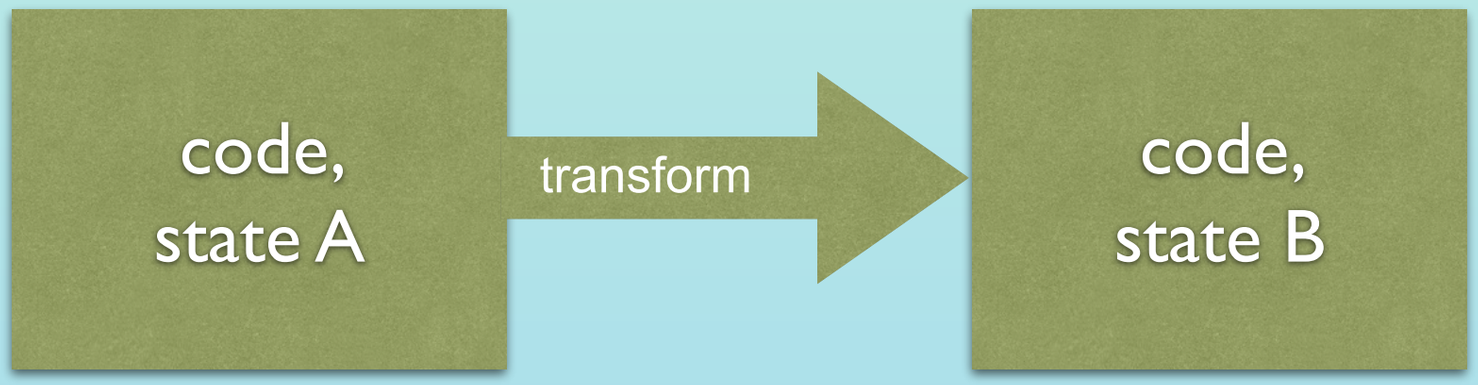
Refactoring



1999 / 2019



Same "externally recognized" behavior

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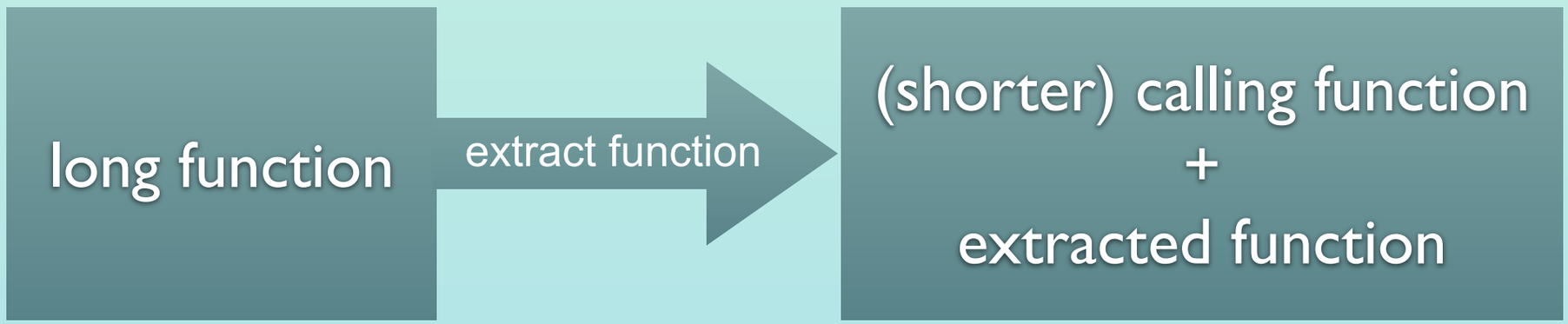
For *(almost)* every transform...



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Code smells

An aroma?

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

…or a stink?

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

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Exercise: Code smells

Identify code smells.

In ./app/controllers/checkouts_controller.rb

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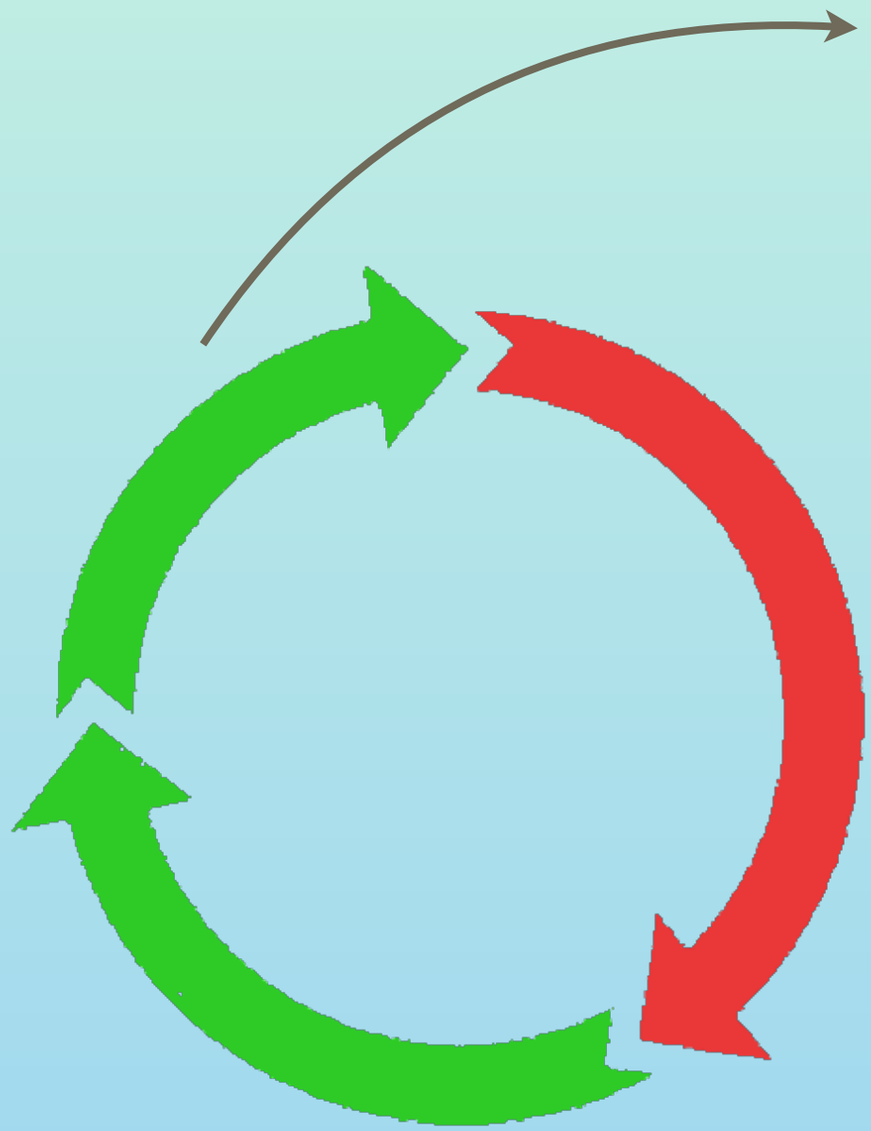
Refactoring opportunities



small cleanup
verify
small cleanup
verify
...

One thing at a time!

Break things once in a while.

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Renaming

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Refactoring: Extract method

```
def ugly_method
  # stuff a
  # ...

  # stuff b
  # ...

  # some smaller behavior
  x = X.new
  x.do_stuff

  # stuff c
end
```

```
def ugly_method
  # stuff a
  # ...

  # stuff b
  # ...

  do_some_smaller_behavior

  # stuff c
end

def do_some_smaller_behavior
  x = X.new
  x.do_stuff
end
```

Why?

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Single-line extract?

```
rescue DiagError => e
  errMsg = "#{Time.now}: #{System}-#{Module} ERROR #{truncate(e.msg, 80)}”
  log(errMsg)
  raise StandardError.new(errMsg)
end
```

```
  rescue DiagError => e
    errMsg = formatted_error_message(exception)
    log(errMsg)
    raise StandardError.new(errMsg)
  end
# ...

def formatted_error_message(exception)
  "#{Time.now}: #{System}-#{Module} ERROR #{truncate(e.msg, 80)}”
end
```


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Minimize duplication, simplify testing

```
  rescue DiagError => e
    log_and_reraise(e.message, Formats.method(:log_for_file))
  end
  ...

def log_and_reraise(message, format_fn)
  err_msg = format_fn.call(message)
  log(err_msg)
  raise StandardError.new(err_msg)
 end

class Formats
 def self.log_for_file(msg)
   "#{Time.now}: #{System}-#{Module} ERROR #{truncate(msg, 80)}"
 end
end
```


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Refactoring-inhibiting temp

```
if not is_exempt and discount > 0
  discount_amount = discount * price
  discounted_price = price * (1.0 - discount)

  total_of_discounted_items += discounted_price

  text = item.description
  # format percent
  amount = sprintf("%.2f", price.round(2))
  amount_width = amount.length

  text_width = LINE_WIDTH - amount_width
  messages << text.ljust(text_width) + amount

  total += discounted_price
  # ...
```


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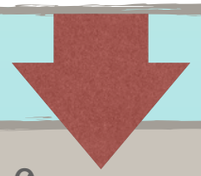
Refactoring: Replace temp with query

```
if not is_exempt and discount > 0
  discount_amount = discount * price
  discounted_price = price * (1.0 - discount)
  total_of_discounted_items += discounted_price
  total += discounted_price
```



```
  if not is_exempt and discount > 0
    discount_amount = discount * price
    discounted_price = price * (1.0 - discount)
    total_of_discounted_items += discounted_price(price, discount)
    total += discounted_price(price, discount)
    # ...
end

def discounted_price(price, discount)
  item.Amount * (1.0m - MemberDiscount)
end
```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Replace temp with query

Steps

- Extract Method on the right-hand-side
- Replace temp references with the query
- Remove temp

Why?

Concerns?

Can we go the other way?

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Exercise: Extract method

In ./app/controllers/checkouts_controller.rb, focus on extracts, renames, and eliminating lies in `#checkout_total`

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Code smell: Feature envy

```
class WrongPlace
  def some_public_behavior
    result = some_envious_method
    # ...
  end

  private

  def some_envious_method
    there = GreenerGrass.new
    result = there.do_stuff(@some_self_value)
    there.do_more_stuff(result)
    there.answer
  end
end
```

What's the problem?

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Refactoring: move method

```
class WrongPlace
  def some_public_behavior
    result = GreenerGrass.new
                          .homebody_method(@some_self_value)
    # ...
  end
end

class GreenerGrass
  def homebody_method(some_value)
    result = do_stuff(@some_self_value)
    do_more_stuff(result)
    @answer
  end
  # ...
```

What must you also do when you move a method?

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Exercise: Move method

- Create new homes for checkouts_controller code as appropriate.
- Write tests to document the moved behavior.

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Premature Generalization

- Details change.
- Need never materializes.
- A better solution becomes obvious.

In the meantime, we all pay for the speculative complexity.

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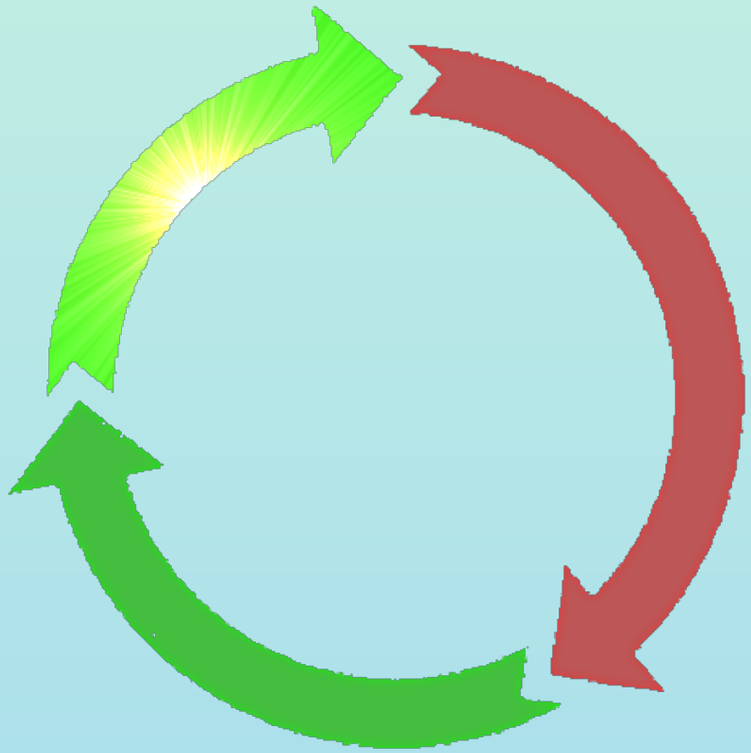
Refactoring Guidelines

Never skip!



Single-goal

Run *all* tests

It's your responsibility

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Design Drivers / Guidelines

- Code smells
- SOLID
- Design patterns
- GRASP
- Simple design
- ...

It's all good!

Does everything point to the same place?

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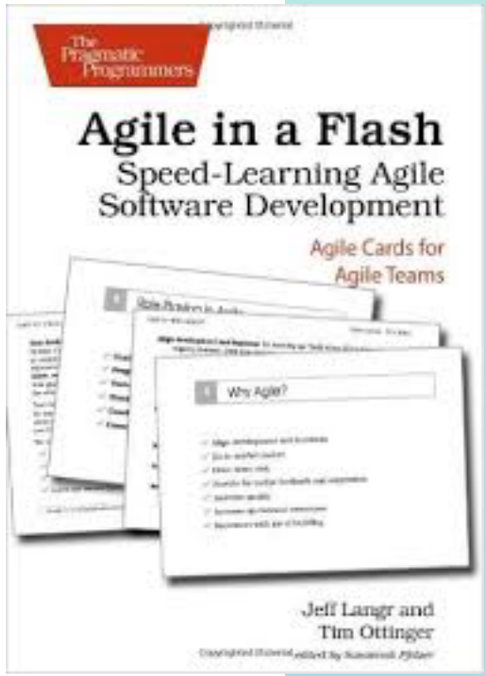
41 Build Superior Systems with Simple Design

- 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 checkouts_controller
  - Stamp out duplication!
  - Strive for rapid readability
  - Have you gone too far?

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Kahoot!

Test doubles

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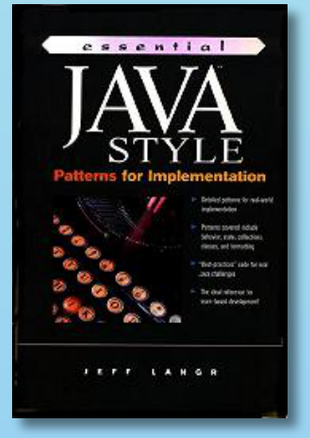
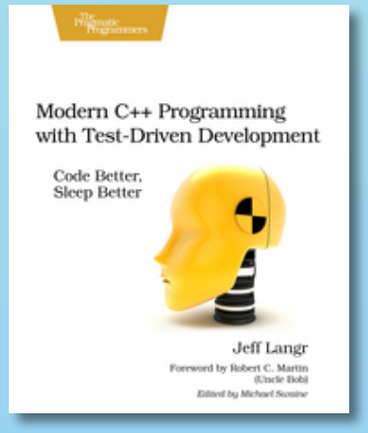
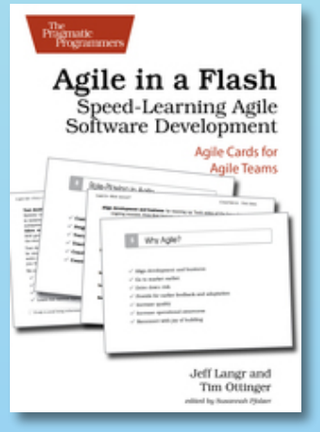
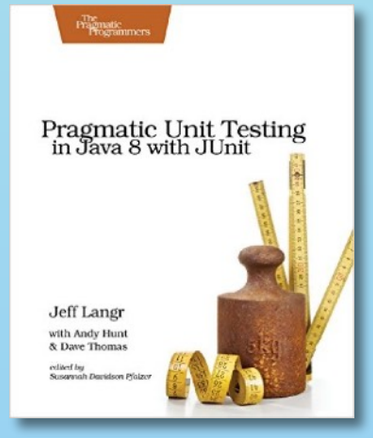
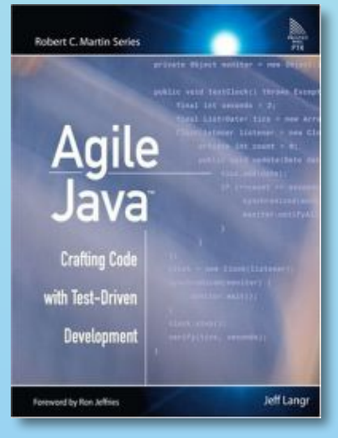
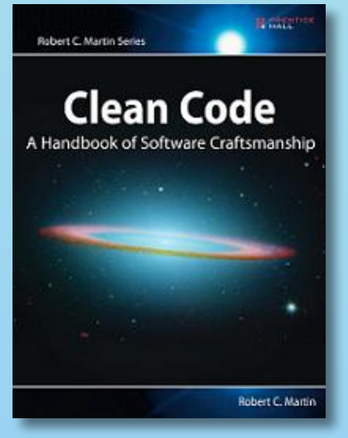




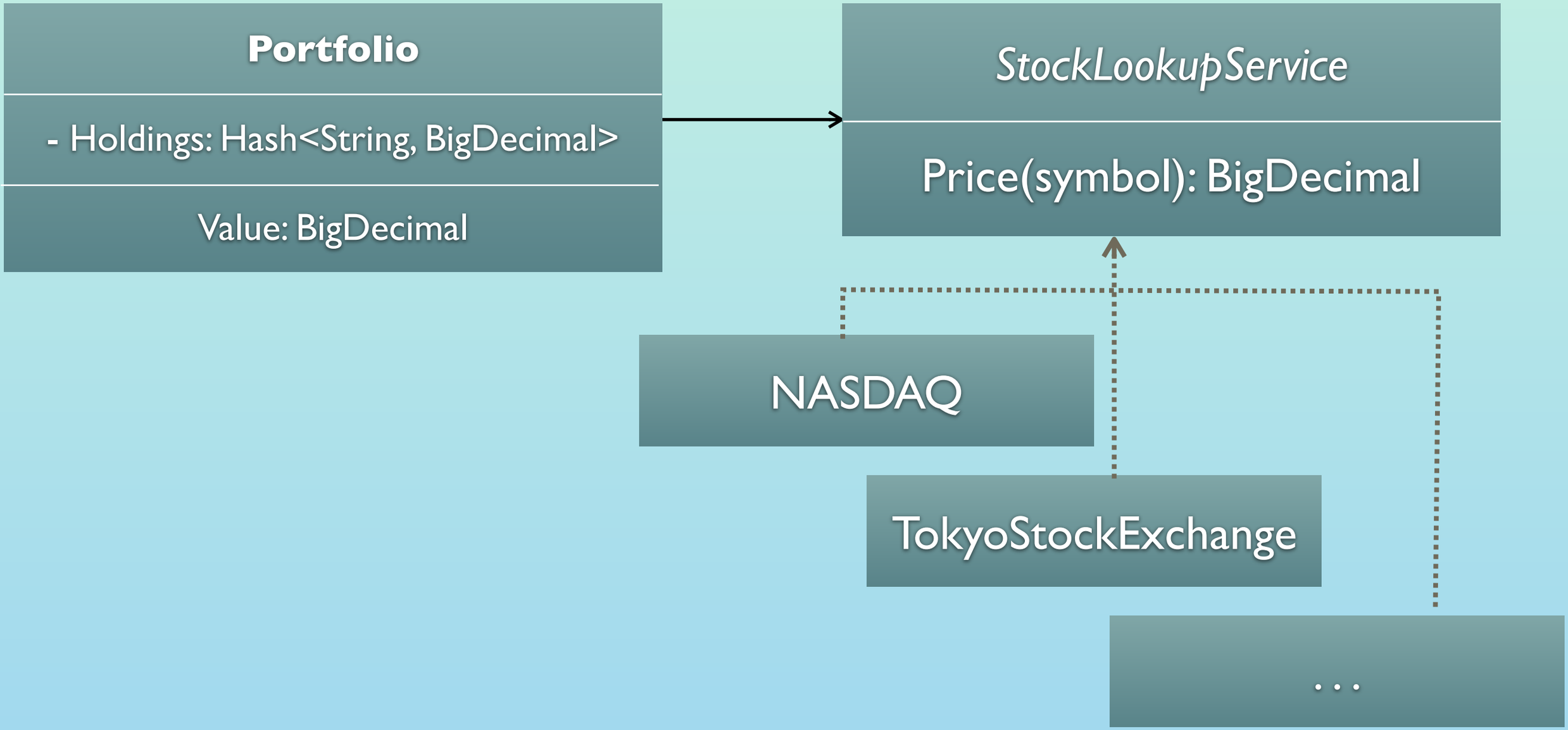








Testing challenge: Portfolio



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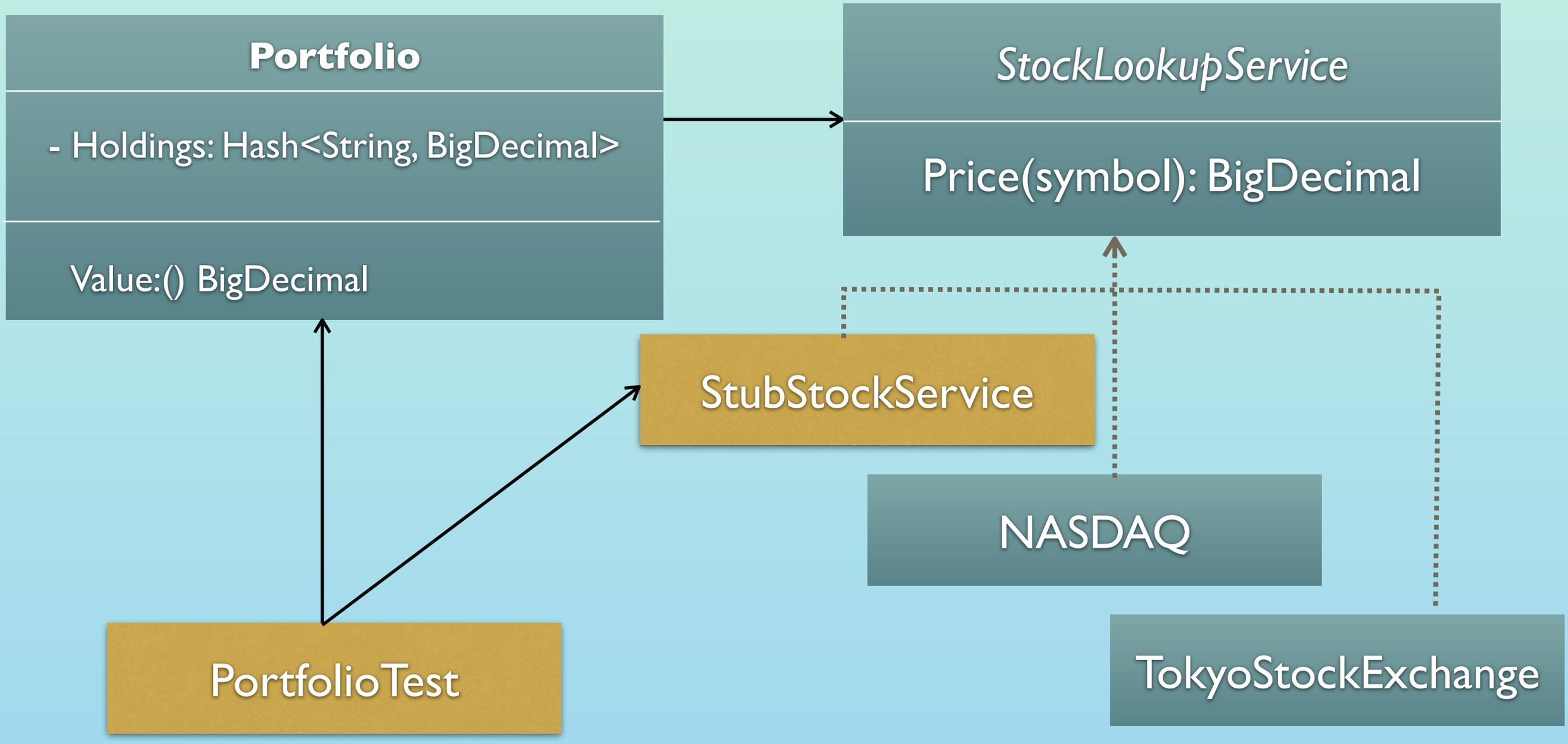
Using a test double



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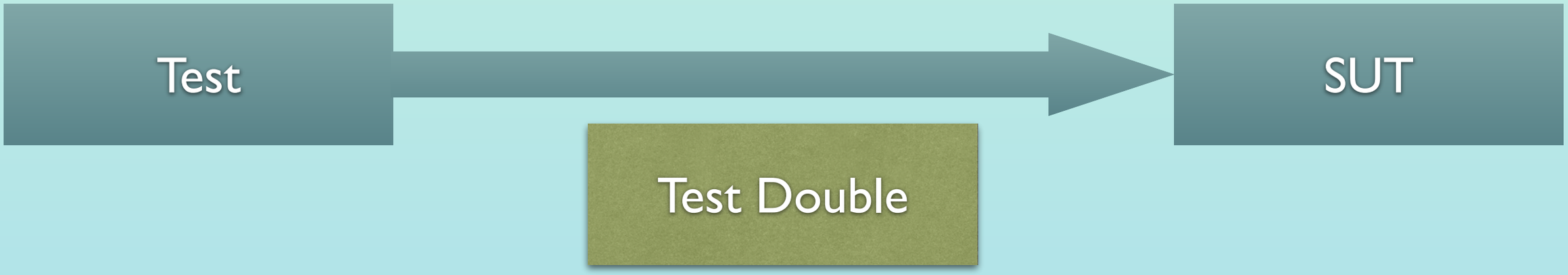
Substituting a test double

… for the production behavior



Various techniques:

- Constructor / setter / parameter injection
- Factory / FactoryBot
- Method redefinition
- Injection tool (e.g. dry-auto_inject)
- …

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Demo: portfolio value

Exercise: Portfolio value

Drive the full value behavior into the Portfolio class.
Create a double for StockLookupService.

```
class StockLookupService
  def price(symbol)
    raise "service unavailable"
  end
end
```

`StockLookupService` makes a live call.

You shouldn't be changing or instantiating this production class.

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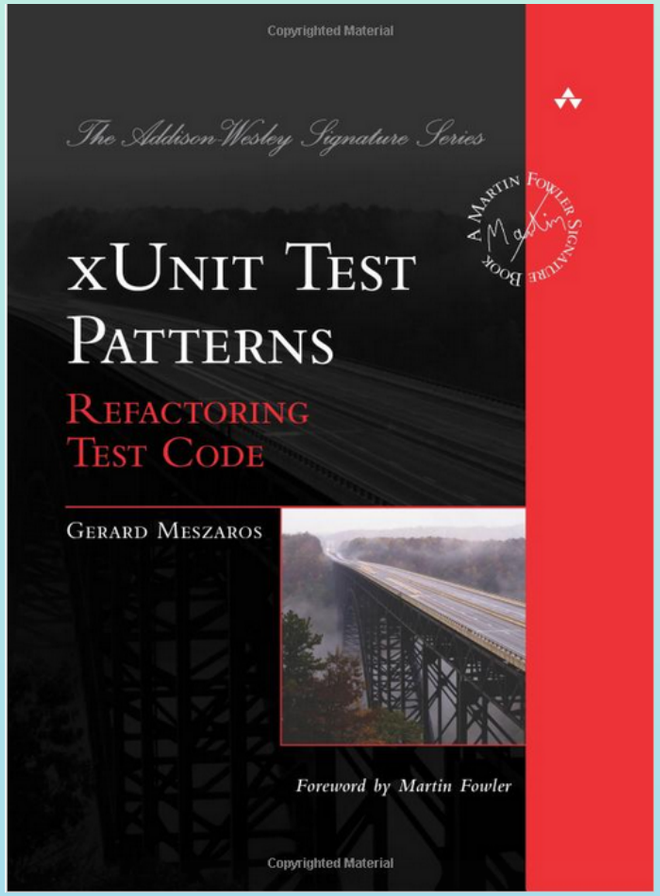
Test double terms

Stub: dumb emulation

Spy: captures values to verify*

Mock: self-verifies expectations

Fake: whole collaborator emulation



* Caution: Tool implementation of spies vary as to whether the real method gets called or not.

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Mock tools

RSpec Mocks

RR

Flexmock

freerange / mocha

Flexmock

History suggests more & changes coming!

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RSpec Mocks: A simple stub

https://rspec.info/documentation/3.9/rspec-mocks/

a method stub

```
weather_service = double
allow(weather_service)
 .to receive(:temperature).and_return(34)
expect(weather_service.temperature).to eq(34)
```


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RSpec Mocks Method Stubs: Alt. Forms

```
allow(weather_service)
 .to receive(:temperature).and_return(34)


allow(weather_service).to receive(:temperature) { 34 }


allow(weather_service)
  .to receive_messages(:temperature ⇒ 34,
                       :pressure ⇒ 29.04)
```

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RSpec Mocks Method Stubs: Shortcut

```
weather_service = double(:temperature ⇒ 34)
```

What’s not to like?

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Instance doubles

Verify that the double is in sync with the real object

```
subject(:stock_service) { instance_double(StockService) }
```

Oops:

```
expect(stock_service).to receive(:prlce).and_return(100)
```

the StockService class does not implement the instance method: prlce

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Exercise: RSpec Stubs

Replace your hand-crafted stub with an RSpec method stub, for the portfolio value spec involving purchase of only one symbol.

Use an instance double for StockService. Experiment with breaking things.

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A message expectation

https://rspec.info/documentation/3.9/rspec-mocks/

an expectation

```
weather_service = double
expect(weather_service)
 .to receive(:temperature).and_return(34)
expect(weather_service.temperature).to eq(34)
```


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Expectations

Replace `allow` with `expect`.

Remove the code that got the test to pass in the first place; run tests.

Discuss.

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RSpec Mocks: Expectations with args

```
expect(service)
  .to receive(:temperature).with("Miami") { 67 }
expect(service)
  .to receive(:temperature).with("Des Moines") { 34 }

expect(service.temperature("Miami")).to eq(34)
```

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RSpec: Argument matchers

```
expect(service)
  .to receive(:pressure).with(kind_of(String)) { 67 }
```

Also match via:

- `any_args`,
- regex,
- duck typing,
- "`array_including`," etc.

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Rspec Mocks: Miscellany

Expect:

- twice, n times, at least n times, at most n times
- messages received in specific order
- argument capture via blocks (“arbitrary handling”)
- `and_call_original`
- `and_raise(error)`
- `and_yield(value1, value2, …)`

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Exercise: RSpec

Use argument matchers for specs as appropriate for portfolio value specs

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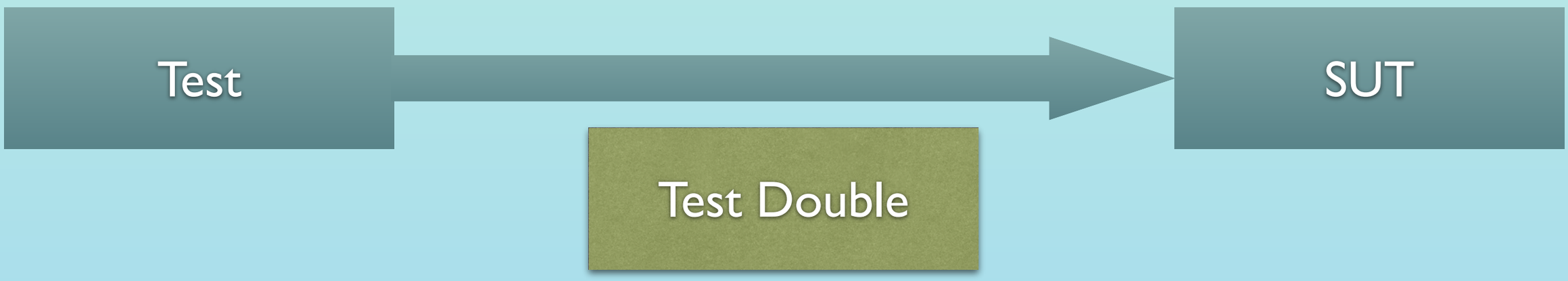
Engaging the double: Dependency Injection



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Engaging the double: Constructor injection

```
let(:stock_service) { double }
let(:portfolio) { Portfolio.new(stock_service) }

context "after purchase" do
  before() do
    portfolio.purchase(APPLE, 4
  end

  it "has value of share price" do
    expect(stock_service)
      .to receive(:price).and_return(CURRENT_APPLE_PRICE)
    expect(portfolio.value).to equal CURRENT_APPLE_PRICE * 42
  end
end
```

```
def initialize(service = StockService.new)
  @holdings = Hash.new
  @service = service
end
```


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Engaging the double: Method redefinition

```
let(:portfolio) { Portfolio.new }

describe Portfolio do
  it "has value of share price" do
    expect_any_instance_of(StockService)
      .to receive(:price).and_return(100)

    portfolio.purchase("QCOM", 1)

    expect(portfolio.value).to equal 100
  end
end
```

```
class Portfolio
  def initialize
    @holdings = Hash.new
    @service = StockService.new
  end
  # …
end
```

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Engaging the double: Stubbing new

```
let(:stock_service) { double }
before() do
  expect(StockService).to receive(:new).and_return(stock_service)
  @portfolio = Portfolio.new
end


describe "Portfolio", :focus do
  it "has value of share price" do
    expect(stock_service).to receive(:pric

    @portfolio.purchase("QCOM", 1)

    expect(@portfolio.value).to equal 100
  end
end
```

```
class Portfolio
  def initialize
    @holdings = Hash.new
    @service = StockService.new
  end
  # …
end
```


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Exercise: hand-crafted test double

Test-drive posting a charge to the checkouts controller.

```
class CardProcessor
  def charge(name, card, exp, amount)
end
```

- `CardProcessor#charge` returns “Approved” or “Declined”
  - CardProcessor makes a call to 3rd party validation. Do not change this class.
- `./config/routes.rb` declares the route.
- `CheckoutsController#charge` already exists
  - It only takes on parameters so far.
- Return a 200 from the controller if approved, 406 otherwise
- Use an alternate injection technique

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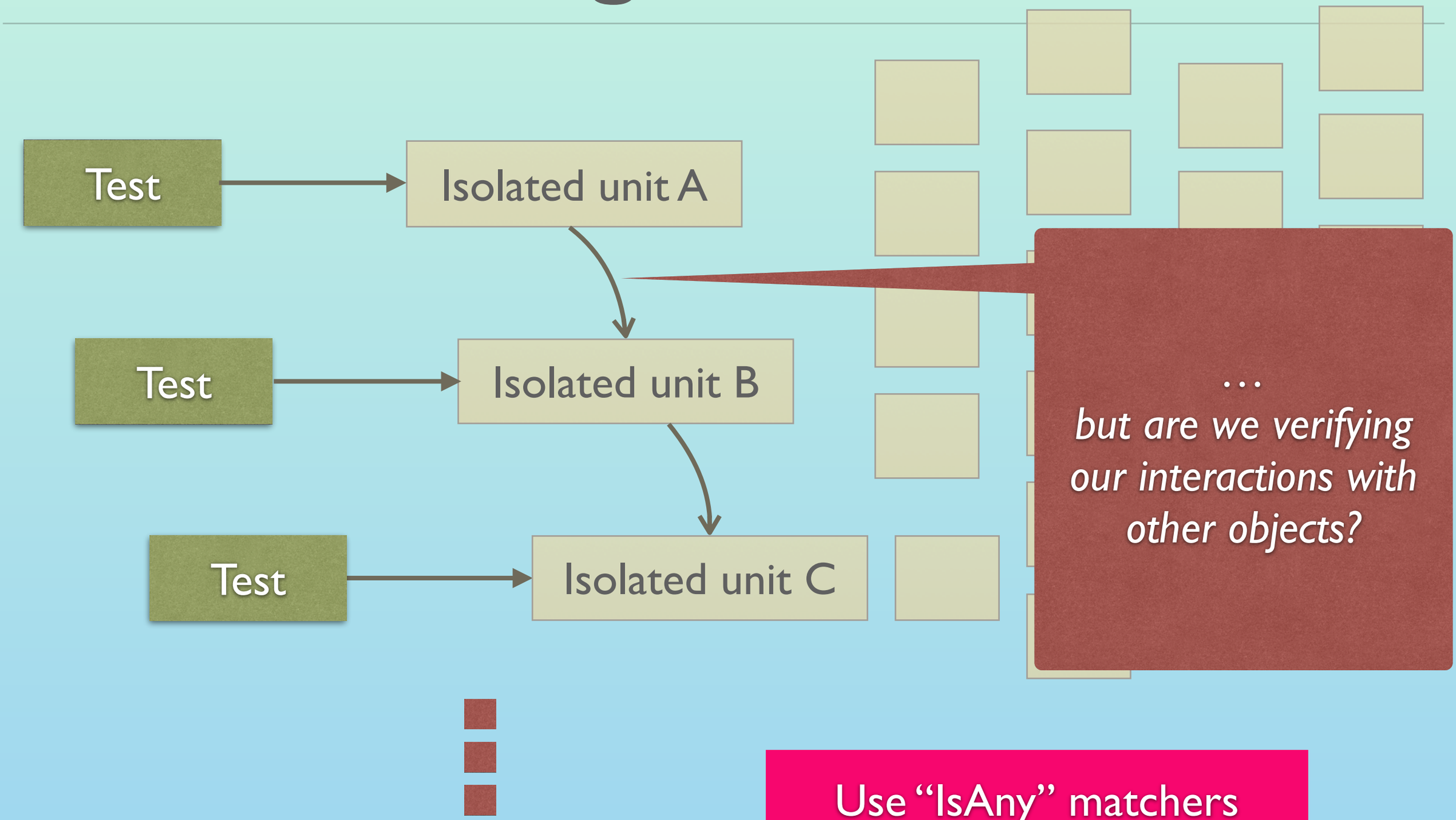
“Unit” testing



Use “IsAny” matchers sparingly!

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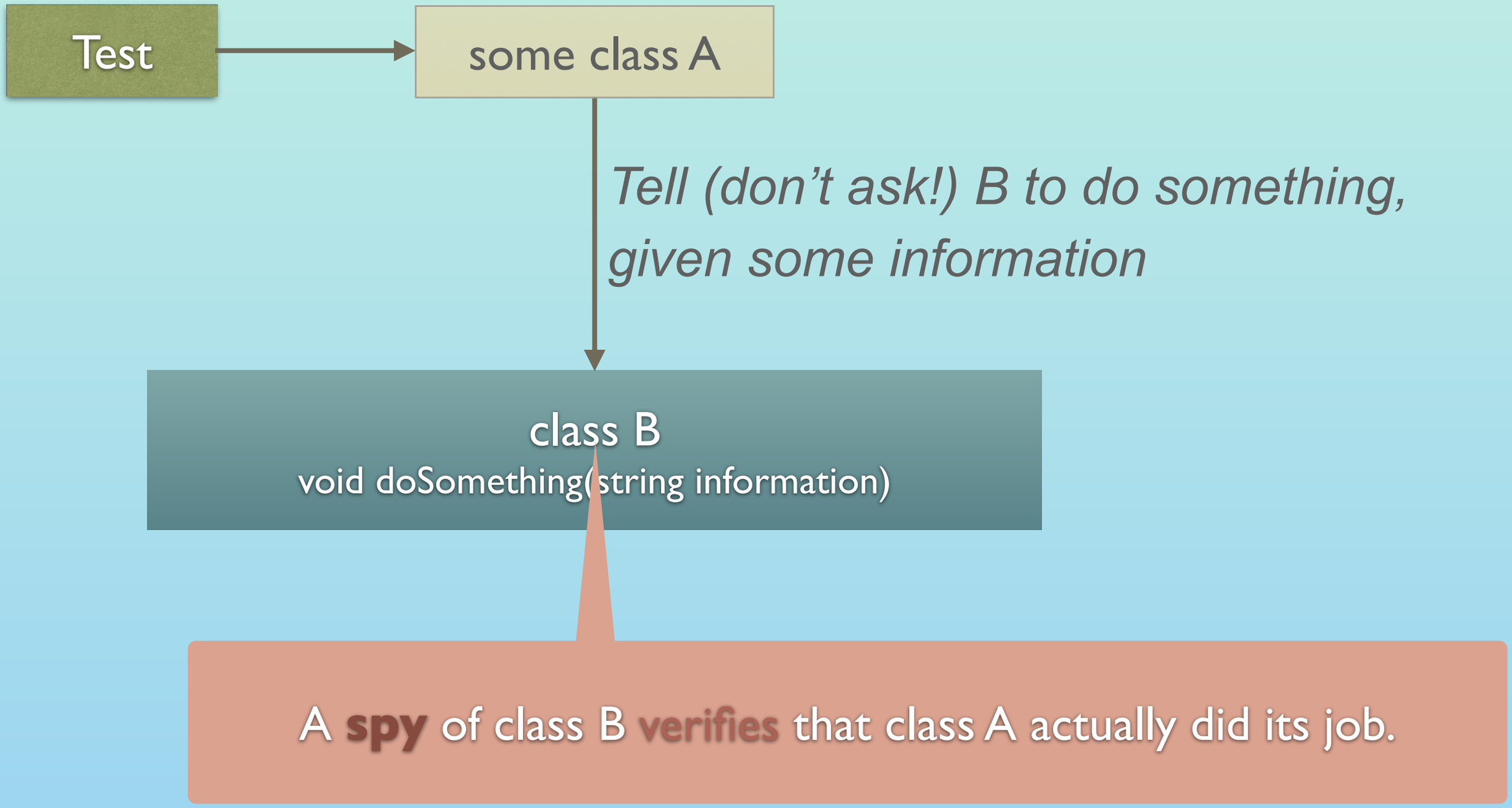
“Tell, Don’t Ask”



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Test-driving interactions

Given this code:

```
def add(word, definition)
  @definitions[word] = definition
  @auditor.log("added to dictionary”)
end
```

We want to test-drive this.

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RSpec Mocks: Spy

```
it "logs audit record on add" do
  auditor_spy = spy("auditor")
  dictionary.auditor = auditor_spy

  dictionary.add("smelt", "a small fish")

  expect(auditor_spy).to have_received(:log)
    .with("added to dictionary")
end
```

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Spy / verify exercise

Verify that each portfolio purchase is audited via a call to this interface:

```
class Auditor
  log_purchase(symbol, shares, timestamp)
end
```


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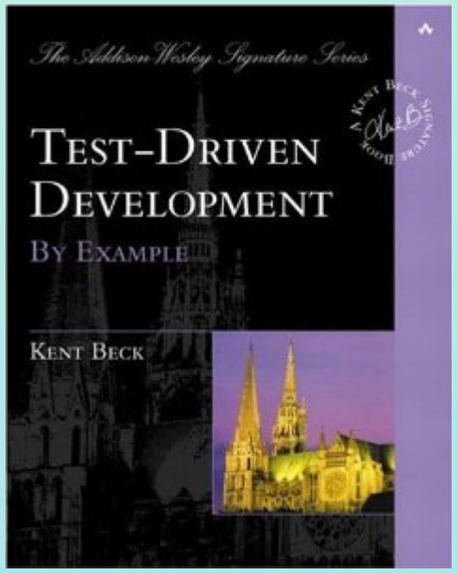
Schools of mock

Classic ("Detroit")

algorithmic approach

verification of state

tests drive code from specific to general

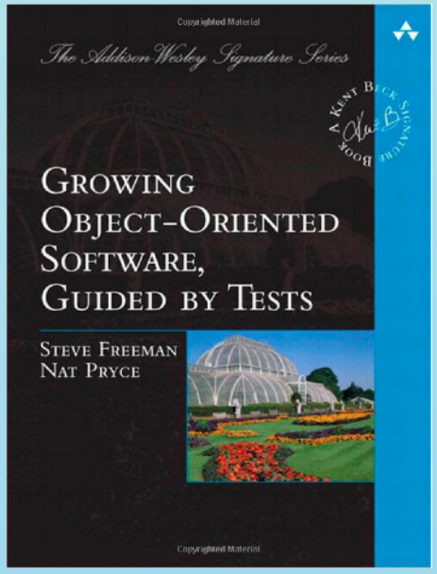


London

roles, responsibilities, and interactions

"Fake it until you make it"

drive incrementally from the outside in



Summarized well in Martin Fowler's "Mocks Aren't Stubs"

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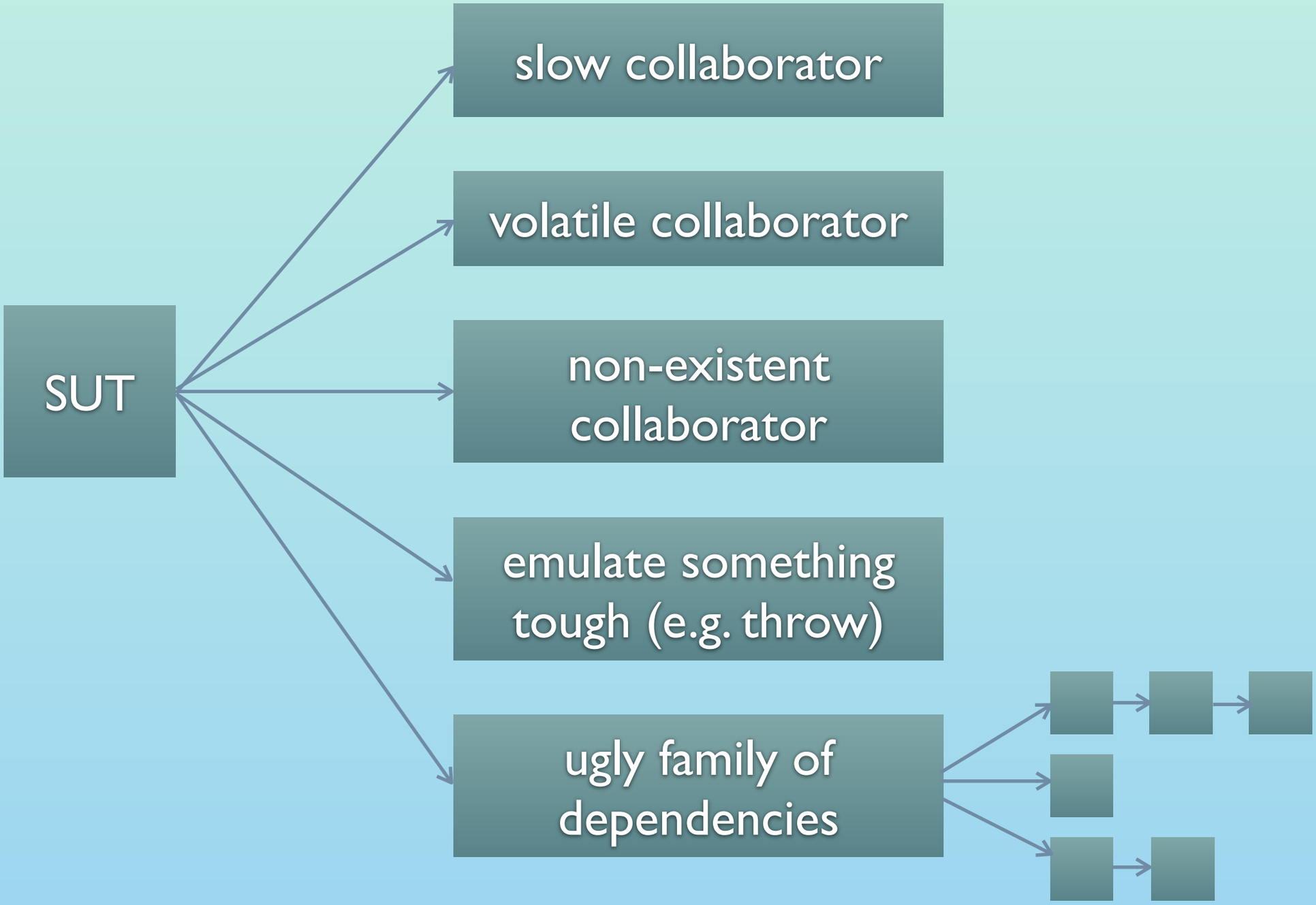
Classic school: When to mock



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The pragmatic mocker

- Writes integration tests where mocks are used
- Watches coupling between tests & implementation
- Seeks to mock only direct collaborators
- Avoids fakes (and if necessary, test-drives 'em!)
- Isolates, minimizes the use of test doubles
  - But prefers testability

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Simplifying testing

How would you redesign the system so that the portfolio `value` function (or any of Portfolio) didn't need to involve test doubles?

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TDD wrap-up exercise

Test-drive that the POS fully handles multi-item discounts.

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Sustaining TDD

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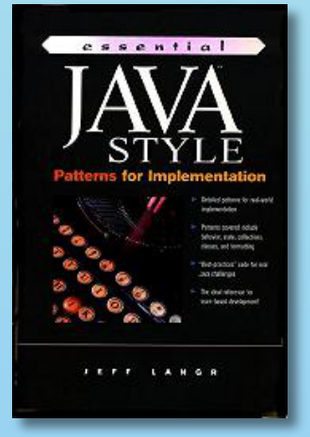

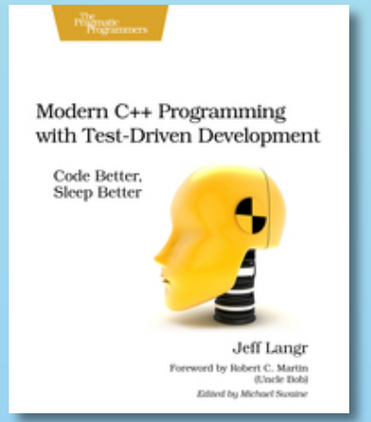

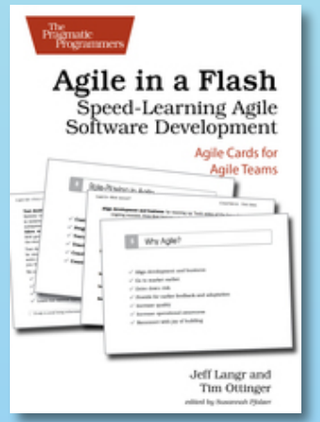

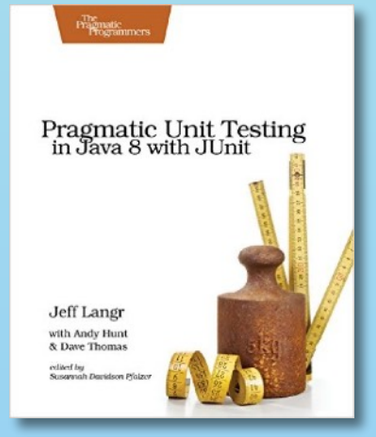

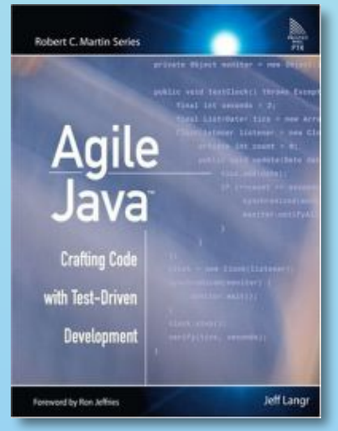

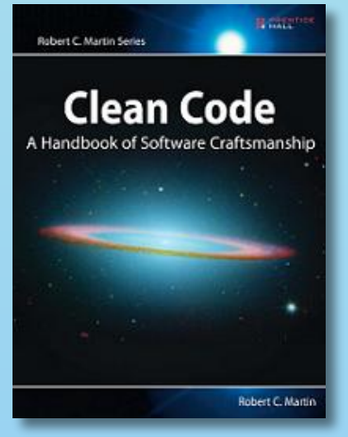

Next week

- TDD policies / standards
- CI build: “Stop the line”
- Reviews cover tests
- Kick off with mob programming

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Growing TDD

- Sharing sessions
- Daily stand-downs
- Challenges / contests
- Coaches & champions
- Influential, dynamic metrics
- Continued collaboration

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Sustaining TDD

- "Why?"
- Review standards regularly
- Keep tests fast
- Use tests as an entry point
- Refactor, refactor, refactor
  - *Tests too*

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Mastering TDD

TDD is a skill.

Practice it. **(Really.)**

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Miscellaneous Topics

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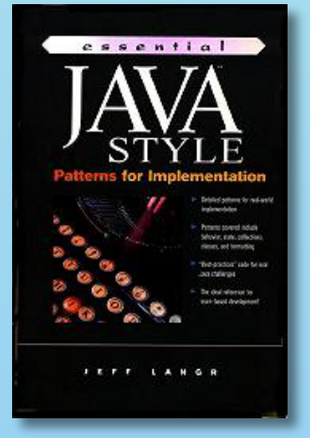

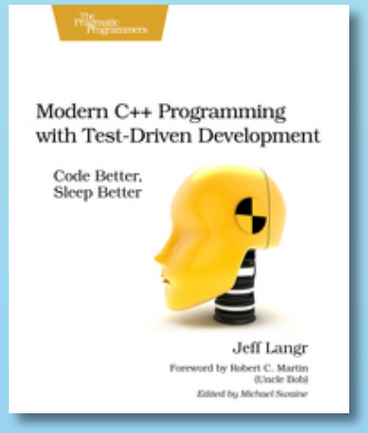

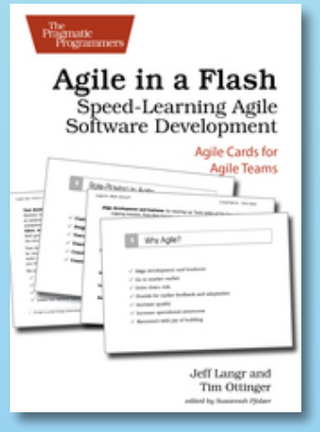

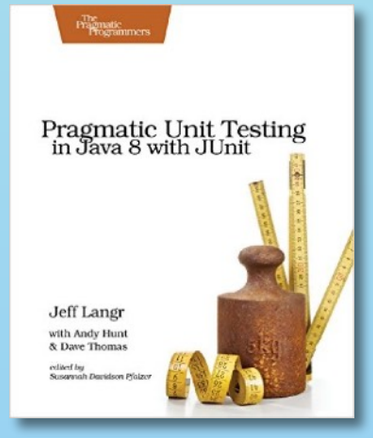

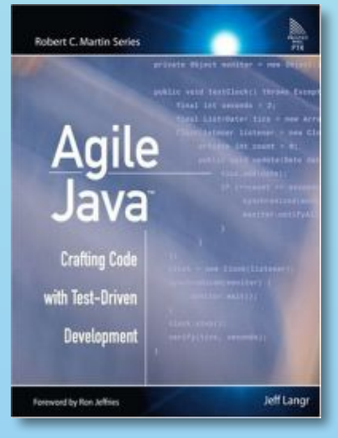

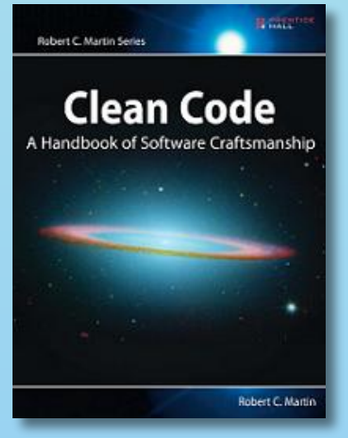

Rails: Model Testing

Using shoulda-matchers:

```
RSpec.describe Item, type: :model do
  it { should belong_to(:checkout) }
  it { should validate_presence_of(:name) }
  it { should validate_presence_of(:upc) }
end
```

Zzz.

```
class Item < ApplicationRecord
  belongs_to :checkout
  validates_presence_of :description
  validates_presence_of :upc
end
```


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Creating dependent objects

```
describe("discounting BOGO") do
  subject(:discount) { BogoDiscount.create(upc: "123", reqd_for_discount: 2) }
  before(:context) do
    Item.create!(upc: "123", price: 2.00, description: "eggs")
  end
```

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With FactoryBot + Faker

```
FactoryBot.define do
  factory :item do
    upc { Faker::Alphanumeric.alphanumeric(number: 8) }
    description { Faker::Lorem.word }
    is_exempt { Faker::Boolean.boolean(true_ratio: 0.05) }
    price { Faker::Number.between(from: 0.95, to: 8.95) }
  end
end
```

```
describe("discounting BOGO") do
  subject(:discount) { BogoDiscount.create(upc: "123", reqd_for_discount: 2) }
  before(:context) do
    create(:item, upc: "123", price: 2.00)
  end
  …
```

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FactoryBot: Creating objects

`build`

instance that’s not saved (fastest)

`create`

instance that’s saved (slowest)

`build_stubbed`

instance w/ all defined attributes stubbed out.

will populate timestamps, id

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build_stubbed and a mock

```
describe("discounting BOGO") do
  subject(:discount) { Discount.create(upc: "123", reqd_for_discount: 2 }
  let(:item) { build_stubbed(:item, upc: "123", price: 2.00) }
  before() { expect(Item).to receive(:find_by).and_return(item) }
```

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Exercise: Model test-driving

Items must be priced (and discounted) as they are scanned.

Support applying a multi-item discount to the latest scanned item in a checkout.

In the MultiItemDiscount model, test-drive a `price_last` method. Given a list of all item UPC scans (e.g. `[{upc: "123"}, {upc: "234"}]`, `price_last` should decorate the last scan with base & discounted prices:

```
{upc: "123", price: 2.00, discounted_price: 1.00}
```

- Price comes from the Item model, using the UPC that the MultiItemDiscount applies to.
- The last item by definition will be the UPC of the MultiItemDiscount.
- Discounted price is the regular item price unless the discount applies.
- The discount applies if this the ***nth*** item with the same scan code
  - ***n*** corresponds to `number_required_for_discount` (in the model)
- If the discount applies, the discounted price is price - (`discount_at_required` * price).
- A "BOGO:" `number_required_for_discount` => 2, `discount_at_required` => 1.0
- "Buy 2 get 3rd 50% off:" `number_required_for_discount` => 3, `discount_at_required` => 0.5
- Discounts continue to apply. For BOGO, every even item is free.

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Controller Specs vs Request Specs

Request specs:

* Recommended by RSpec
* Test the entire stack, including routing

Controller specs:

* Simulate a single HTTP request per example
* Views not rendered
  * stubbed w/ template that renders “”

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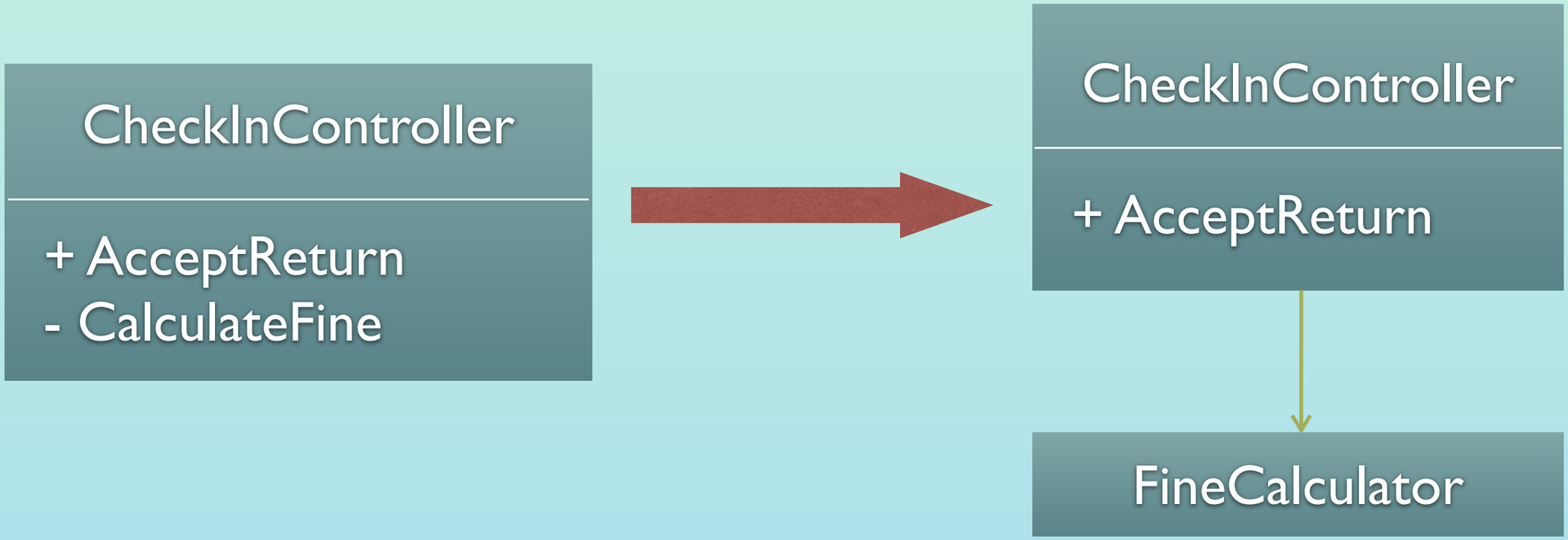
Testing Private Behavior?



Or simply relax access.

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Rules of Ten

Green & clean in < 10 (minutes)

Delete and repeat if you're late!

... taking smaller steps this time.

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Rules of Ten

Debate stops at 10 (minutes)

"Show me."

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Rules of Ten

All unit tests run in < 10 (seconds).

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Run Tagged Tests

```
it “ … ”, :focus do
```

Command line:

```
rspec --tag focus
```

Remember: Running a subset of tests increases risk.

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Fixing a Slow Test Run

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

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

Running a subset of tests increases risk.

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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

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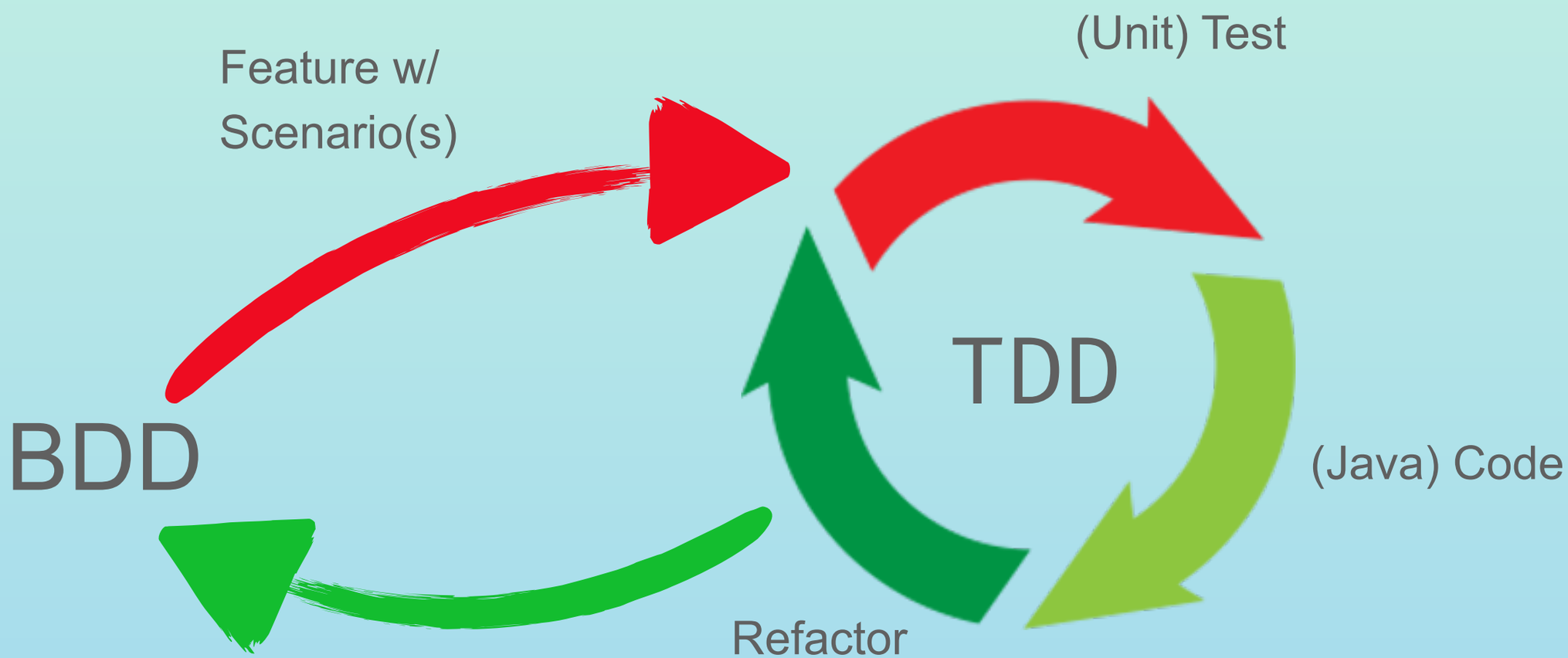
Per and updated by Robert C. Martin.

Behavior-Driven Development (BDD)



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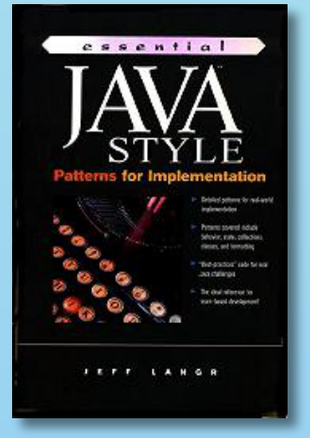
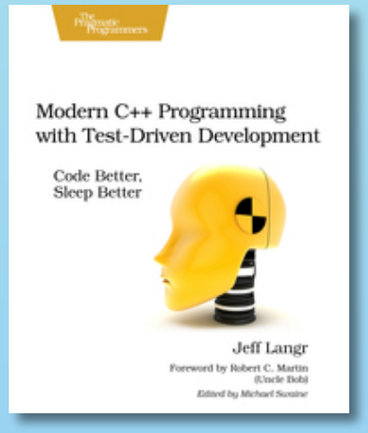
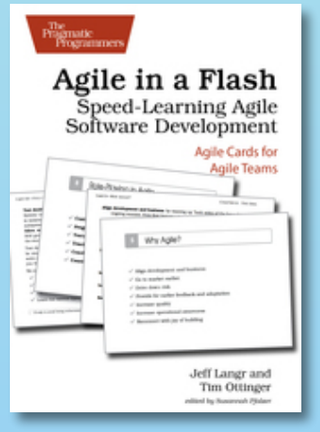
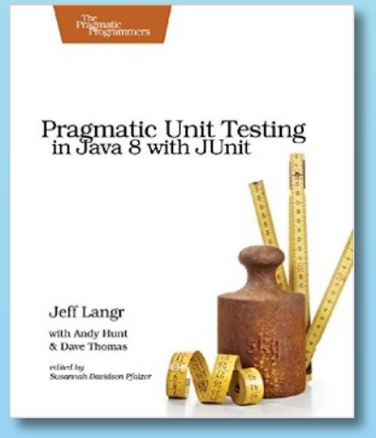
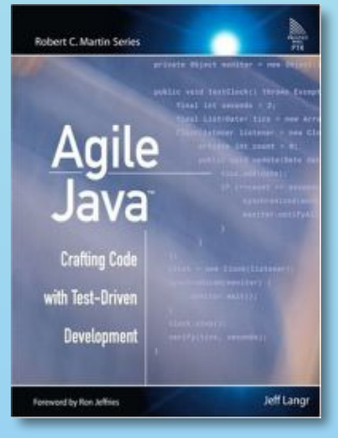
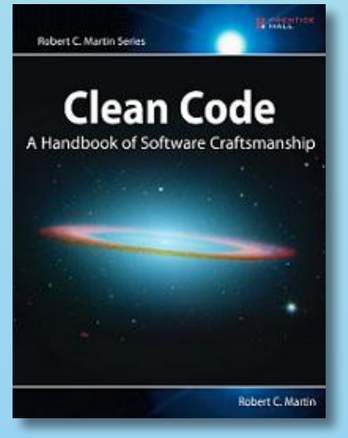
Thank you!

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