



Introduction to Test Driven Development



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Let's start with
Development



Now add **Test Driven**

Software development practice

Clean code that works

Test first

Small steps, fast feedback



Clean code

Easy to understand

Easy to evolve

Easy to maintain

Sustains delivery pace



Example of Ugly Code

TerrariaClone class from the GitHub repository [TerrariaClone](#).

- > 6500 lines of code
- > 1300 lines of code for init() method
- Deeply nested if and for statements
- Many other “issues”

```
3056     if (ic != null) {
3057         if (ic.type.equals("workbench")) {
3058             for (ux=0; ux<3; ux++) {
3059                 for (uy=0; uy<3; uy++) {
3060                     if (mousePos[0] >= ux*40+6 && mousePos[0] < ux*40+46 &&
3061                         mousePos[1] >= uy*40+inventory.image.getHeight()+46 &&
3062                         mousePos[1] < uy*40+inventory.image.getHeight()+86) {
3063                         checkBlocks = false;
3064                         if (mouseClicked) {
3065                             mouseNoLongerClicked = true;
3066                             moveItemTemp = ic.ids[uy*3+ux];
3067                             moveNumTemp = ic.nums[uy*3+ux];
3068                             if (moveItem == ic.ids[uy*3+ux]) {
3069                                 moveNum = (short)inventory.addLocationIC(ic, uy*3+ux, moveItem, moveNum, moveDur);
3070                                 if (moveNum == 0) {
3071                                     moveItem = 0;
3072                                 }
3073                             }
3074                             else {
3075                                 inventory.removeLocationIC(ic, uy*3+ux, ic.nums[uy*3+ux]);
3076                                 if (moveItem != 0) {
3077                                     inventory.addLocationIC(ic, uy*3+ux, moveItem, moveNum, moveDur);
3078                                 }
3079                                 moveItem = moveItemTemp;
3080                                 moveNum = moveNumTemp;
3081                             }
3082                         }
3083                     }
3084                 }
3085             }
3086         }
3087         if (mousePos[0] >= 4*40+6 && mousePos[0] < 4*40+46 &&
3088             mousePos[1] >= 1*40+inventory.image.getHeight()+46 &&
3089             mousePos[1] < 1*40+inventory.image.getHeight()+86) {
3090             checkBlocks = false;
3091             if (mouseClicked) {
3092                 if (moveItem == ic.ids[9] && moveNum + ic.nums[9] <= MAXSTACKS.get(ic.ids[9])) {
3093                     moveNum += ic.nums[9];
3094                     inventory.useRecipeWorkbench(ic);
3095                 }
3096                 if (moveItem == 0) {
3097                     moveItem = ic.ids[9];
3098                     moveNum = ic.nums[9];
3099                     if (TOOLDURS.get(moveItem) != null) {
3100                         moveDur = TOOLDURS.get(moveItem);
3101                     }
3102                     inventory.useRecipeWorkbench(ic);
3103                 }
3104             }
3105         }
3106     }
3107 }
```



Ugly code is

Rigid

Fragile

Inseparable

Opaque



Why does code **grow ugly?**

We have no time to clean it

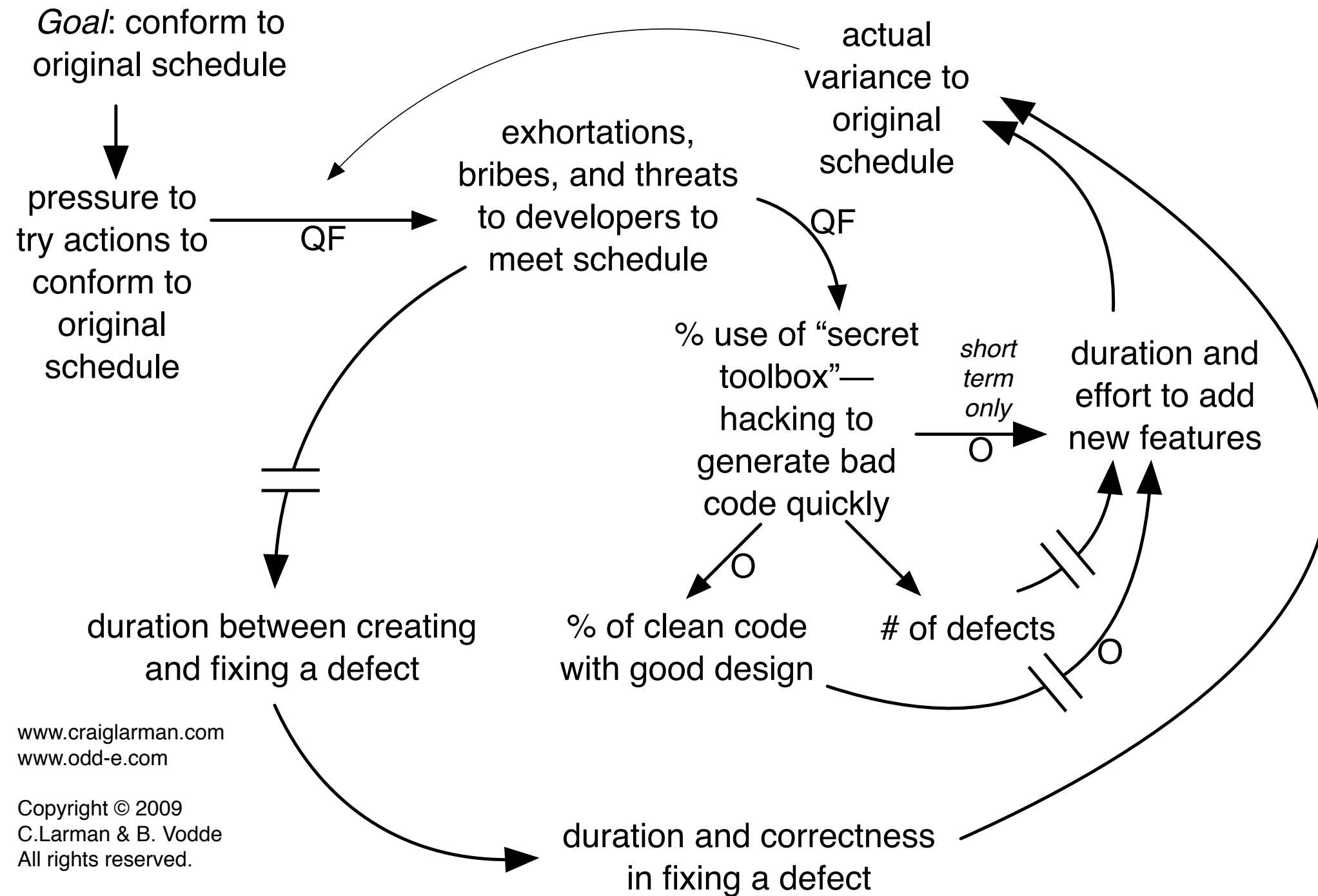
We need to go “faster”

We are afraid of breaking it

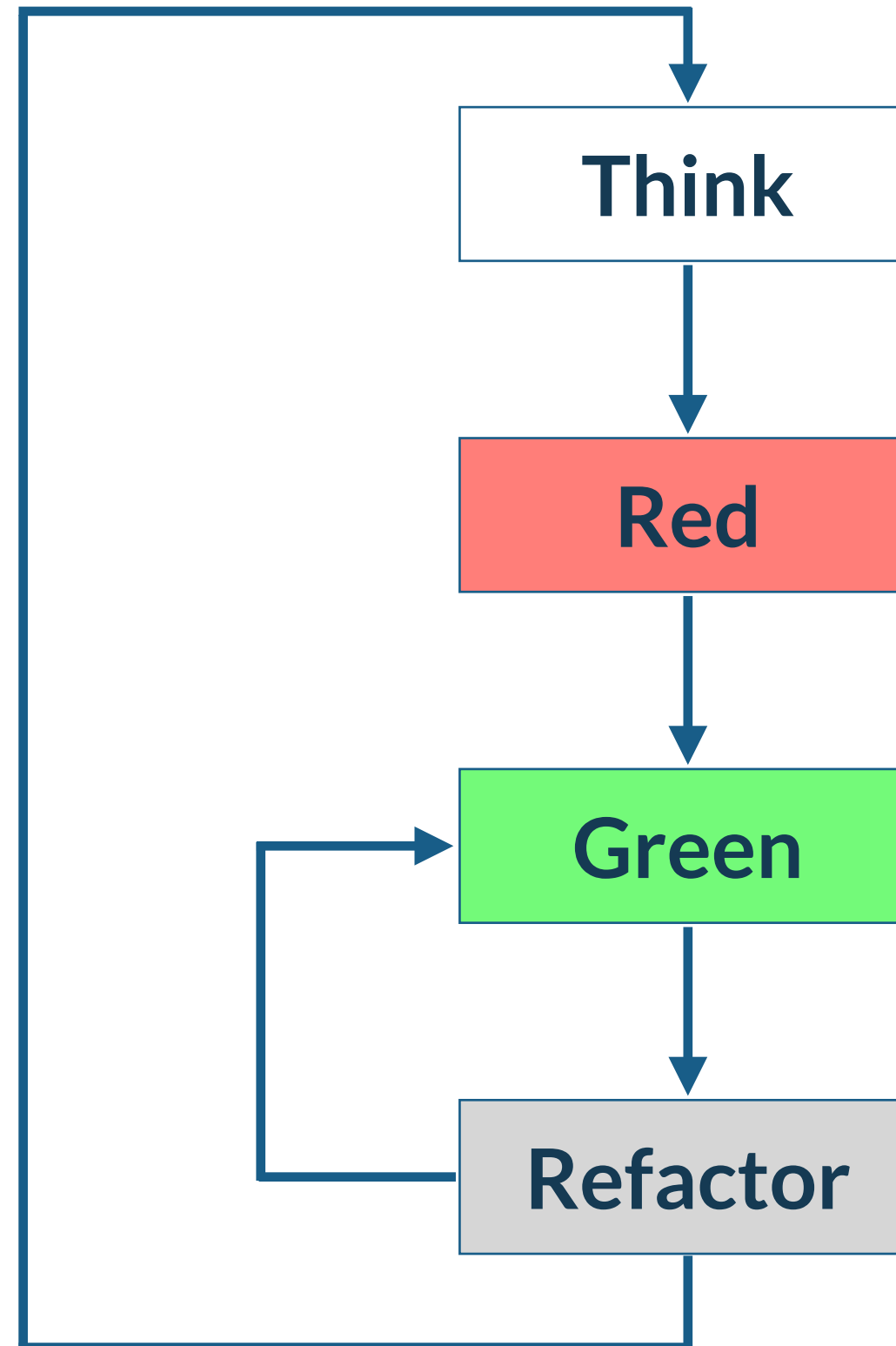
Fear prevents us to clean it



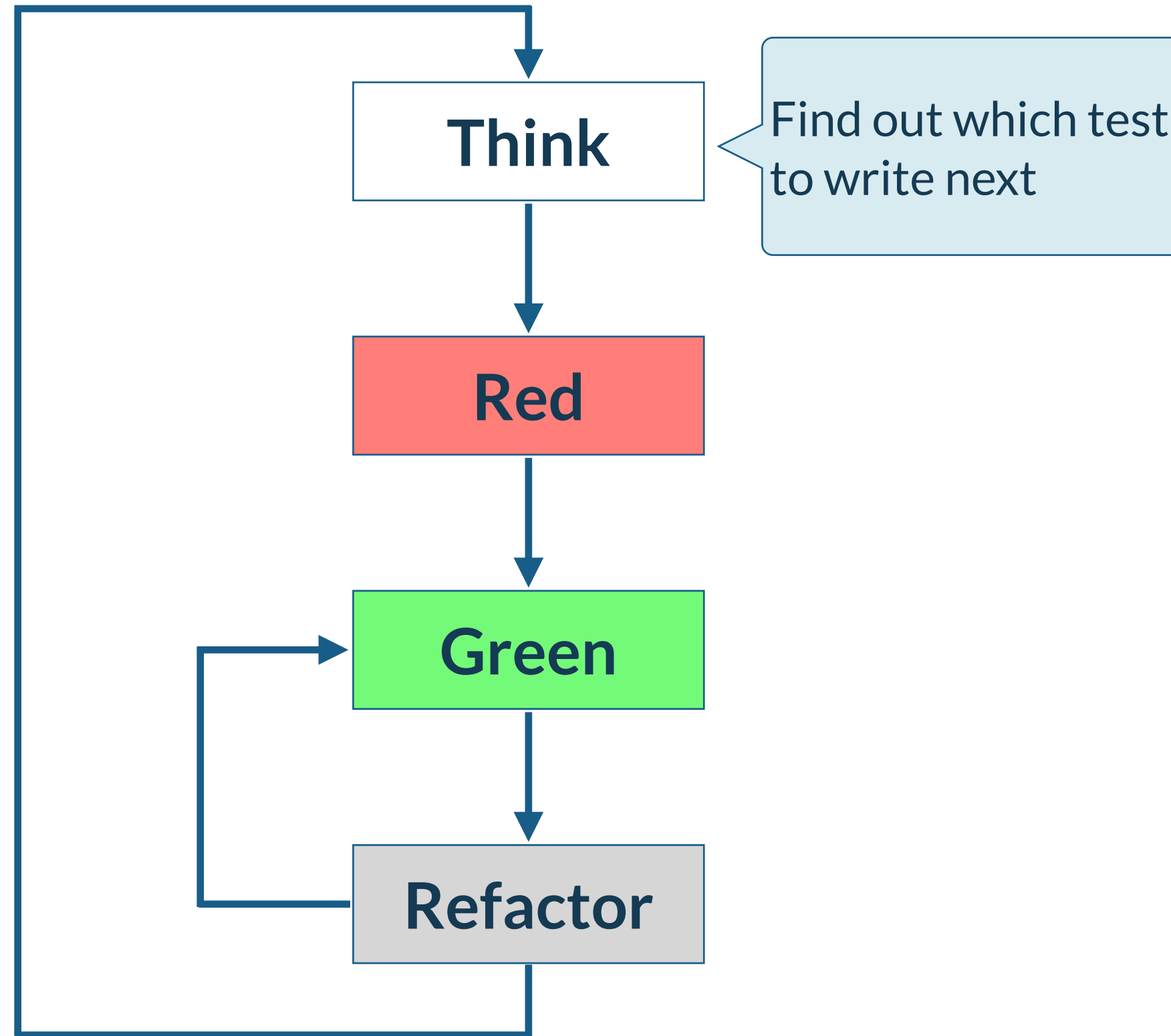
The “Faster is Slower” Dynamic



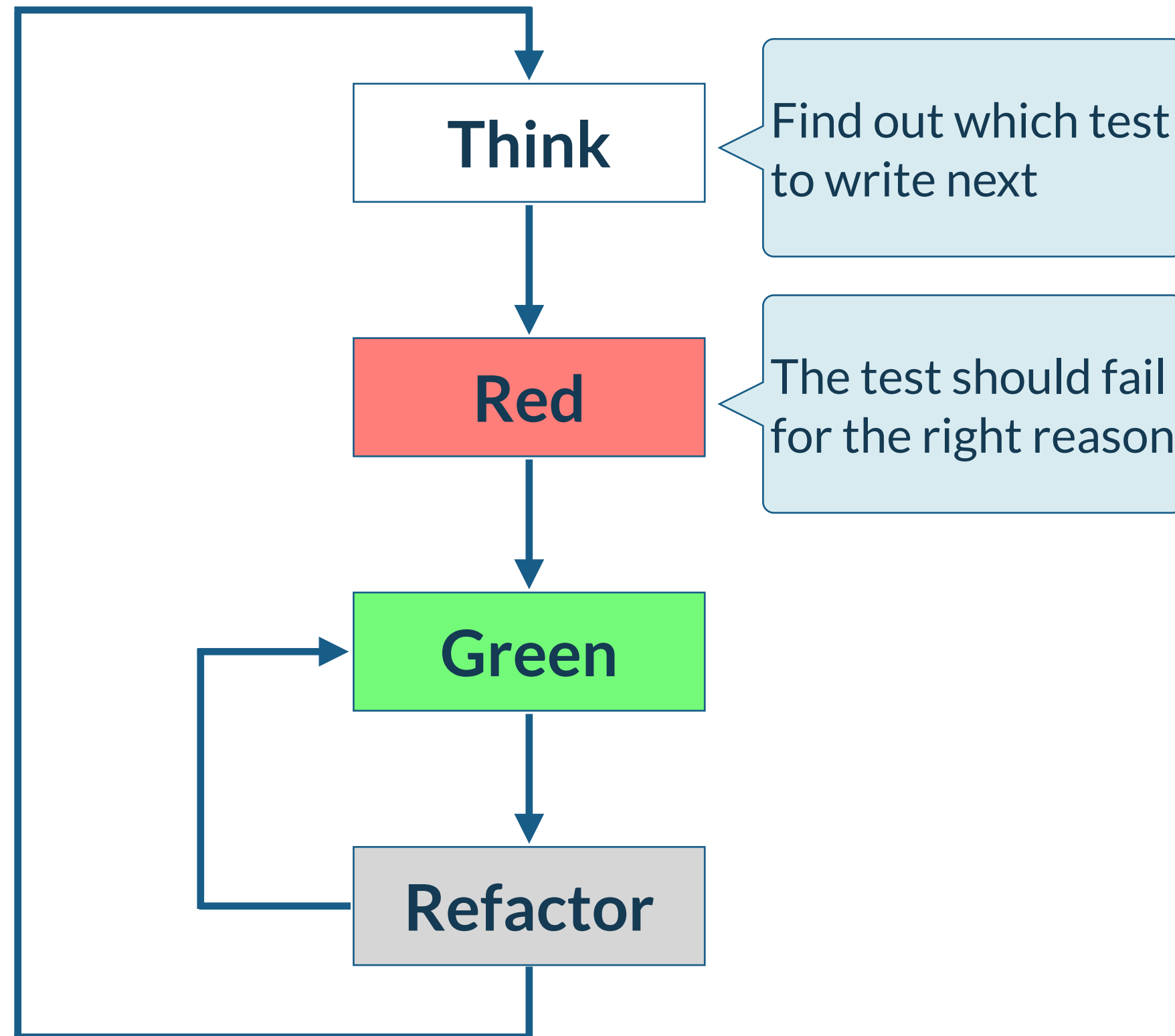
Test Driven Development (TDD) Cycle



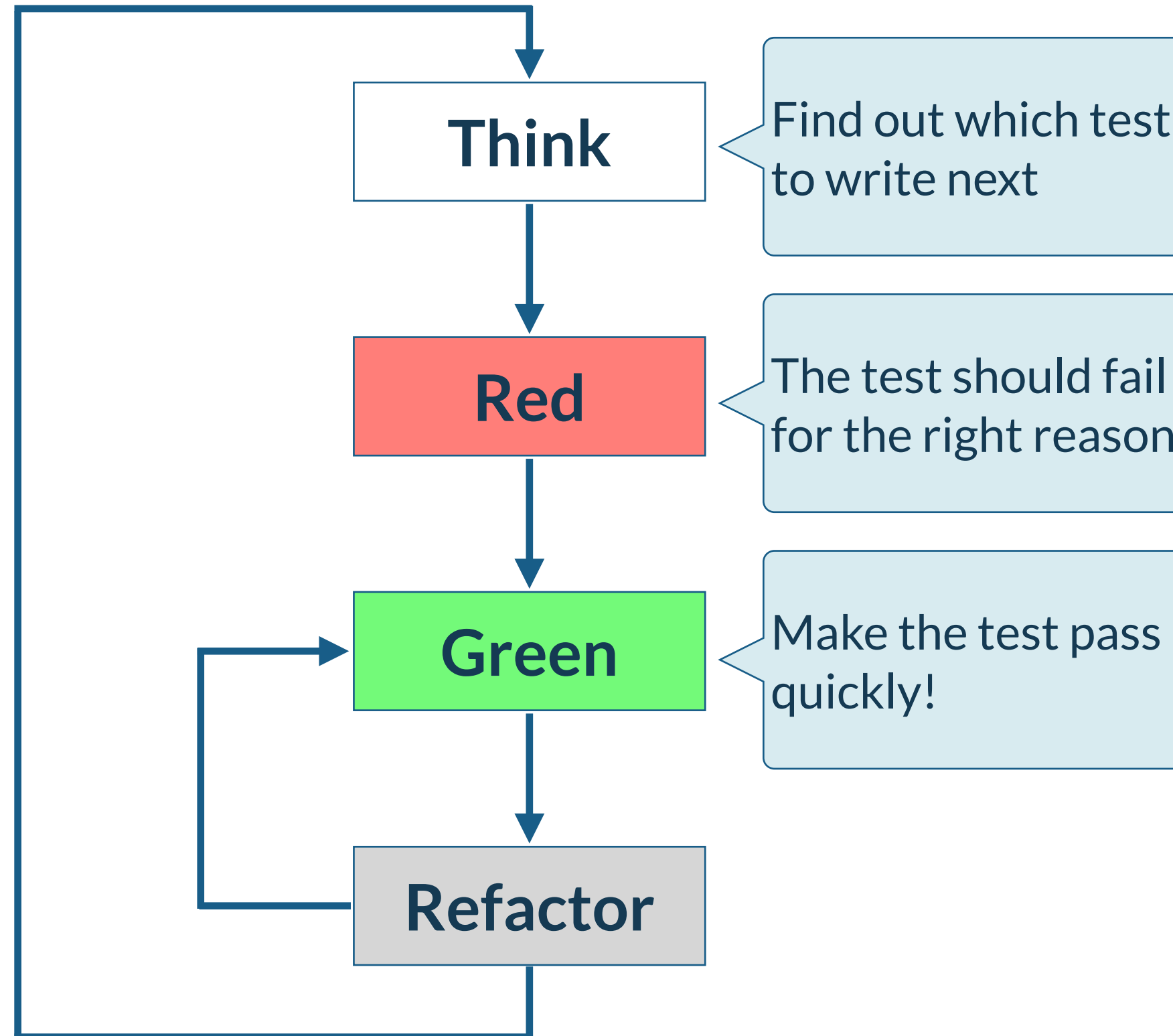
Test Driven Development (TDD) Cycle



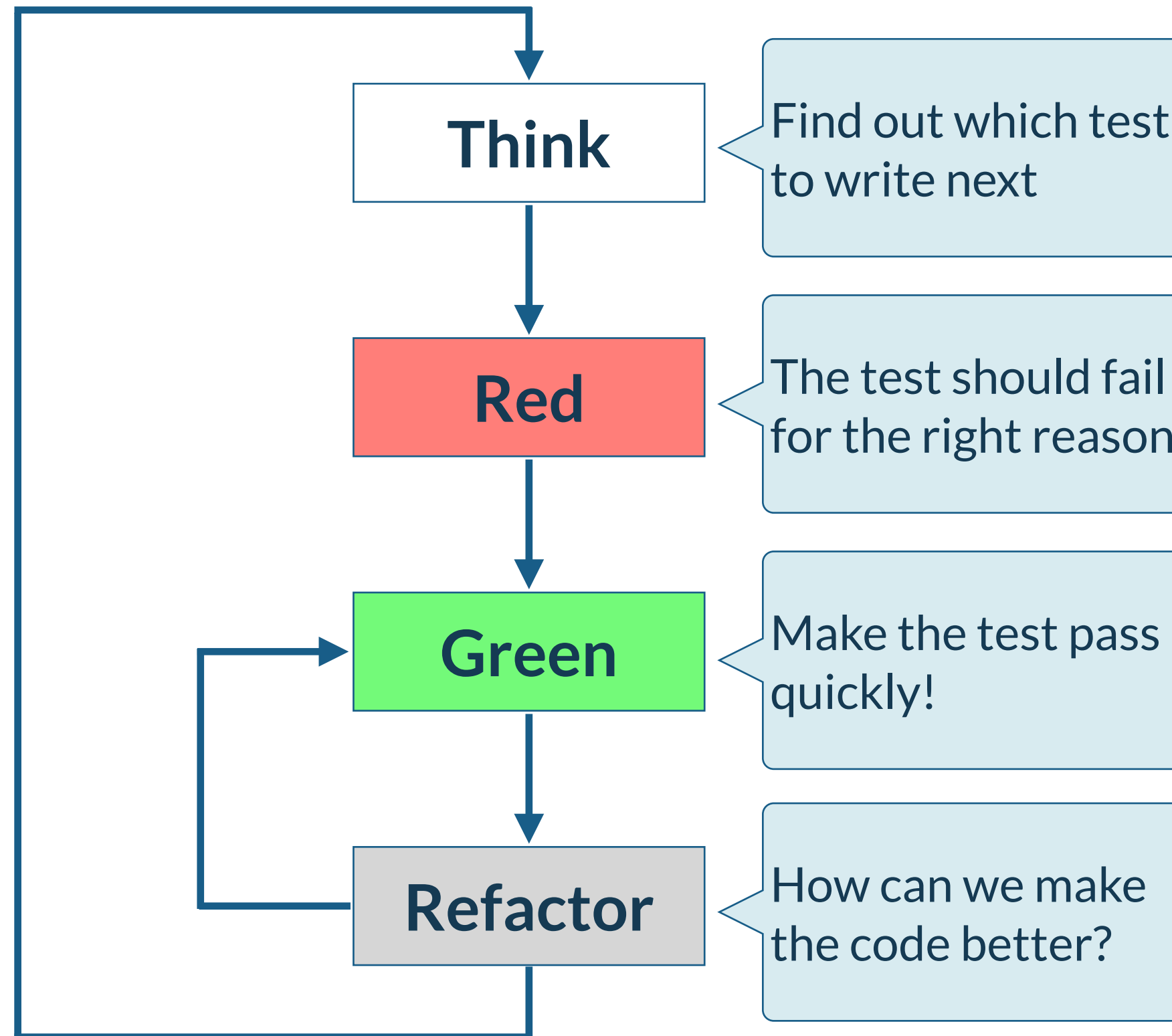
Test Driven Development (TDD) Cycle



Test Driven Development (TDD) Cycle



Test Driven Development (TDD) Cycle



Test Infrastructure

Things we need to practice TDD

Automated build

Test framework

Assertion library

Arrange/Act/Assert

Why?

To run the tests, as fast as possible

To build the test suite

To check test status

A way to write tests



Code Kata

A system of coding practice incorporating techniques and notions that have been cultivated and polished for decades.

[Dave Nicolette](#)

- The purpose is to practice and internalize programming *technique*
- (Some are) Designed to reflect programming problems that have particular *shapes*



Good tests

Describe

Tests should have names that describe a business feature or behavior.

Avoid

Technical names and leaking implementation details.

Communicate

Tests should clearly express required functionalities to the reader.



Ways to move forward

Fake it

Just return the exact value you need.

Something that works is better than something that doesn't work!

Obvious implementation

When you are sure of the code you need to write, write it, and see the test go green!

Triangulation

Write a new and more specific test that forces the code to be more generic.



Refactor to remove duplication

Types of duplication

Code, data, knowledge.

Wait

Avoid removing duplication too soon, as this may lead you to extract the wrong abstractions.

Rule of Three

Extract duplication only when you see it for the third time.



Duplication of knowledge

```
public class Cylinder {  
  
    private final double radius;  
    private final double height;  
  
    public Cylinder(double radius, double height) {  
        this.radius = radius;  
        this.height = height;  
    }  
  
    public double volume() {  
        return Math.PI * Math.pow(radius, 2) * height;  
    }  
  
    public double surface() {  
        return 2 * Math.PI * Math.pow(radius, 2) + 2 * Math.PI * radius * height;  
    }  
}
```



Duplication of knowledge

```
public class Cylinder {  
  
    private final double radius;  
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    public Cylinder(double radius, double height) {  
        this.radius = radius;  
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    public double volume() {  
        return Math.PI * Math.pow(radius, 2) * height;  
    }  
  
    public double surface() {  
        return 2 * Math.PI * Math.pow(radius, 2) + 2 * Math.PI * radius * height;  
    }  
}
```



Duplication of knowledge

Extract method.

```
public class Cylinder {  
  
    private final double radius;  
    private final double height;  
  
    public Cylinder(double radius, double height) {  
        this.radius = radius;  
        this.height = height;  
    }  
  
    public double volume() {  
        return baseSurface() * height;  
    }  
  
    public double surface() {  
        return 2 * baseSurface() + 2 * Math.PI * radius * height;  
    }  
  
    private double baseSurface() {  
        return Math.PI * Math.pow(radius, 2);  
    }  
}
```



Duplication of knowledge

Extract method.

```
public class Cylinder {  
  
    private final double radius;  
    private final double height;  
  
    public Cylinder(double radius, double height) {  
        this.radius = radius;  
        this.height = height;  
    }  
  
    public double volume() {  
        return baseSurface() * height;  
    }  
  
    public double surface() {  
        return 2 * baseSurface() + 2 * Math.PI * radius * height;  
    }  
  
    private double baseSurface() {  
        return Math.PI * Math.pow(radius, 2);  
    }  
}
```



Duplication of hard coded data

```
@Test
public void productNotFound() throws Exception {
    Display display = new Display();
    Sale sale = new Sale(display);

    sale.onBarcode("99999");

    assertEquals("Product not found for 99999", display.getText());
}
```

```
public class Sale {

    private Display display;

    public Sale(Display display) {
        this.display = display;
    }

    public void onBarcode(String barcode) {
        display.setText("Product not found for 99999");
    }

}
```



Duplication of hard coded data

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@Test
public void productNotFound() throws Exception {
    Display display = new Display();
    Sale sale = new Sale(display);

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public class Sale {

    private Display display;

    public Sale(Display display) {
        this.display = display;
    }

    public void onBarcode(String barcode) {
        display.setText("Product not found for 99999");
    }

}
```



Duplication of hard coded data

Replace literal value with variable.

```
@Test
public void productNotFound() throws Exception {
    Display display = new Display();
    Sale sale = new Sale(display);

    sale.onBarcode("99999");

    assertEquals("Product not found for 99999", display.getText());
}
```

```
public class Sale {

    private Display display;

    public Sale(Display display) {
        this.display = display;
    }

    public void onBarcode(String barcode) {
        display.setText("Product not found for " +
            barcode);
    }
}
```



Duplication of hard coded data

Replace literal value with variable.

```
@Test
public void productNotFound() throws Exception {
    Display display = new Display();
    Sale sale = new Sale(display);

    sale.onBarcode("99999");

    assertEquals("Product not found for 99999", display.getText());
}
```

```
public class Sale {

    private Display display;

    public Sale(Display display) {
        this.display = display;
    }

    public void onBarcode(String barcode) {
        display.setText("Product not found for " +
            barcode);
    }
}
```



Tests in TDD

Should be...

Isolated and composable

Fast and automated

Behavioral and structure-insensitive

Specific and deterministic

Inspiring and predictive

Writable and readable

Beware of

Databases

Network communications

File system

Other shared fixtures

Configurations



Should you **always** practice
Test Driven Development?



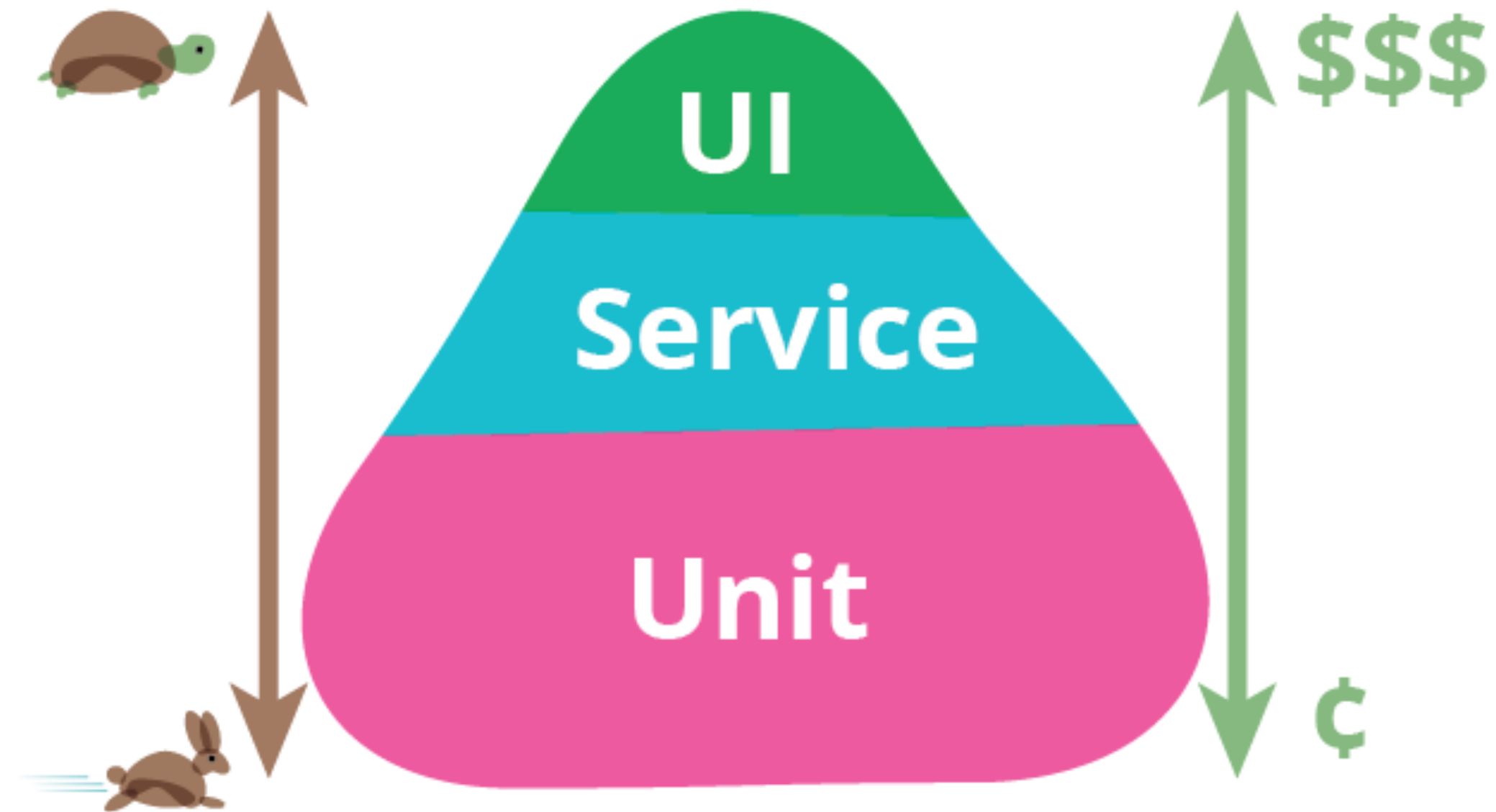
TDD is a **tool**

To get value from a tool, it's necessary to:

1. Choose the right tool for the job.
2. Use the tool properly.



Test Pyramid



<https://martinfowler.com/bliki/TestPyramid.html>
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References



Test Driven Development by Example

Kent Beck

Agile Technical Practices Distilled

Pedro Moreira Santos, Marco Consolaro,
Alessandro Di Gioia

Extreme Programming Explained

Kent Beck