

Clean Code:

A Reader-Centered Approach

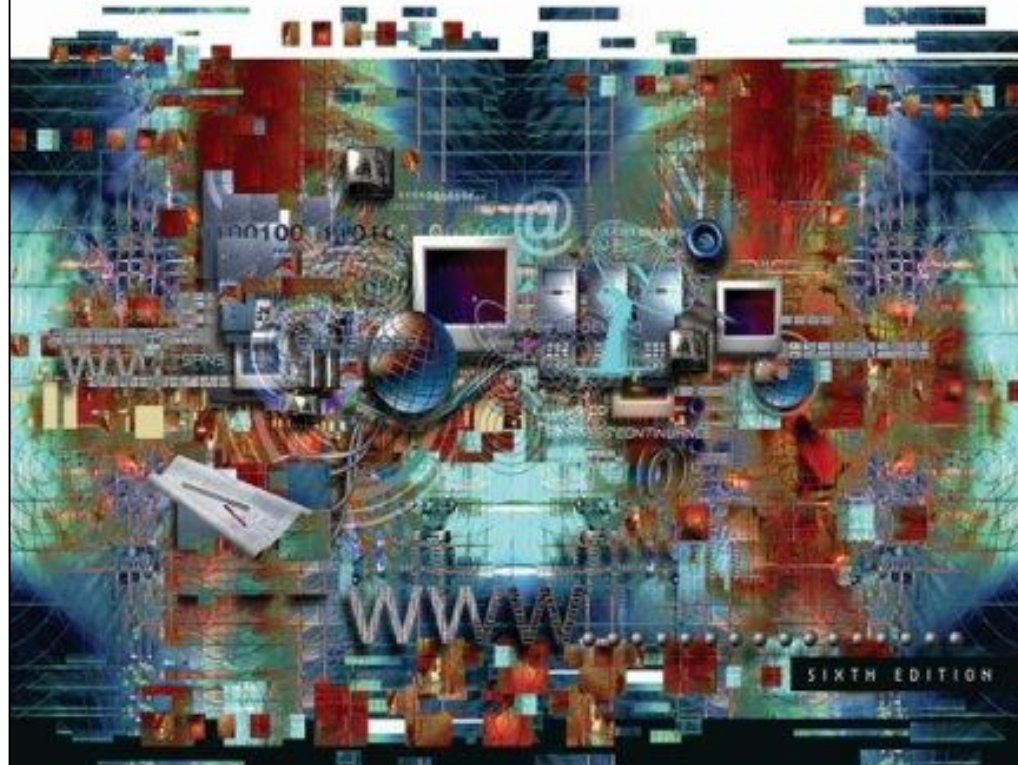
@matthewrenze

#ndclondon



TECHNICAL COMMUNICATION

[A READER-CENTERED APPROACH]



SIXTH EDITION

PAUL V. ANDERSON



Consider it the
new standard in
software development

Robert C. Martin Series

Clean Code

A Handbook of Agile Software Craftsmanship



Foreword by James O. Coplien

Robert C. Martin

ALWAYS LEARNING

PEARSON

Robert C. Martin (aka. Uncle Bob)



About Me

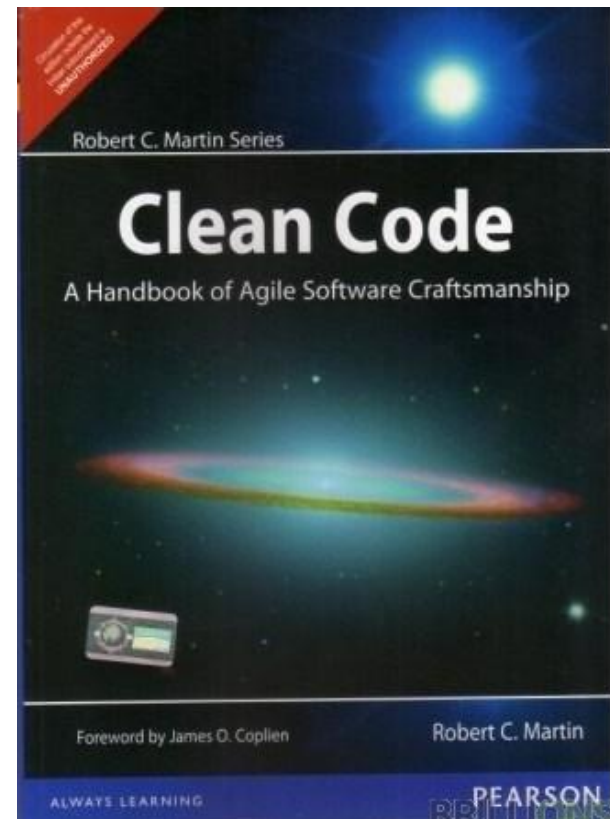
- Independent software consultant
- Education
 - B.S. in Computer Science
 - B.A. in Philosophy
- Community
 - Pluralsight Author
 - ASPInsider
 - Public Speaker
 - Open-Source Software

IOWA STATE
UNIVERSITY

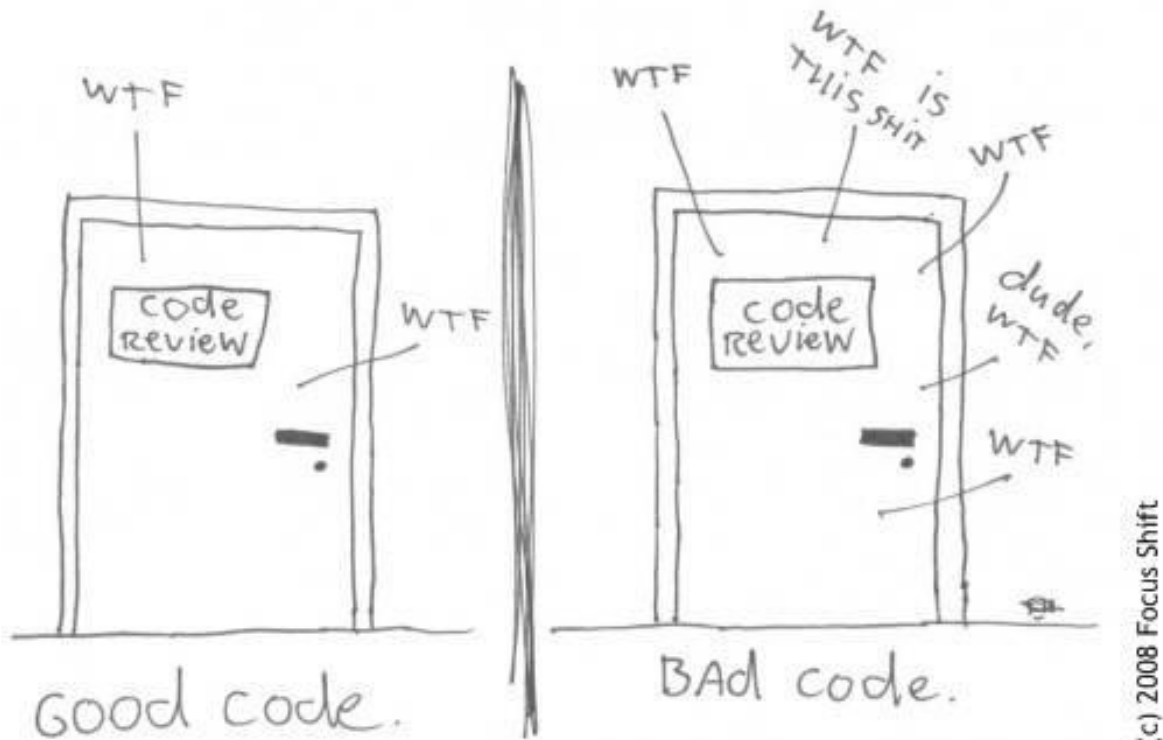


Overview

- Clean Code
- Names
- Functions
- Classes
- Comments
- Process



The ONLY valid measurement of code quality: WTFs/minute

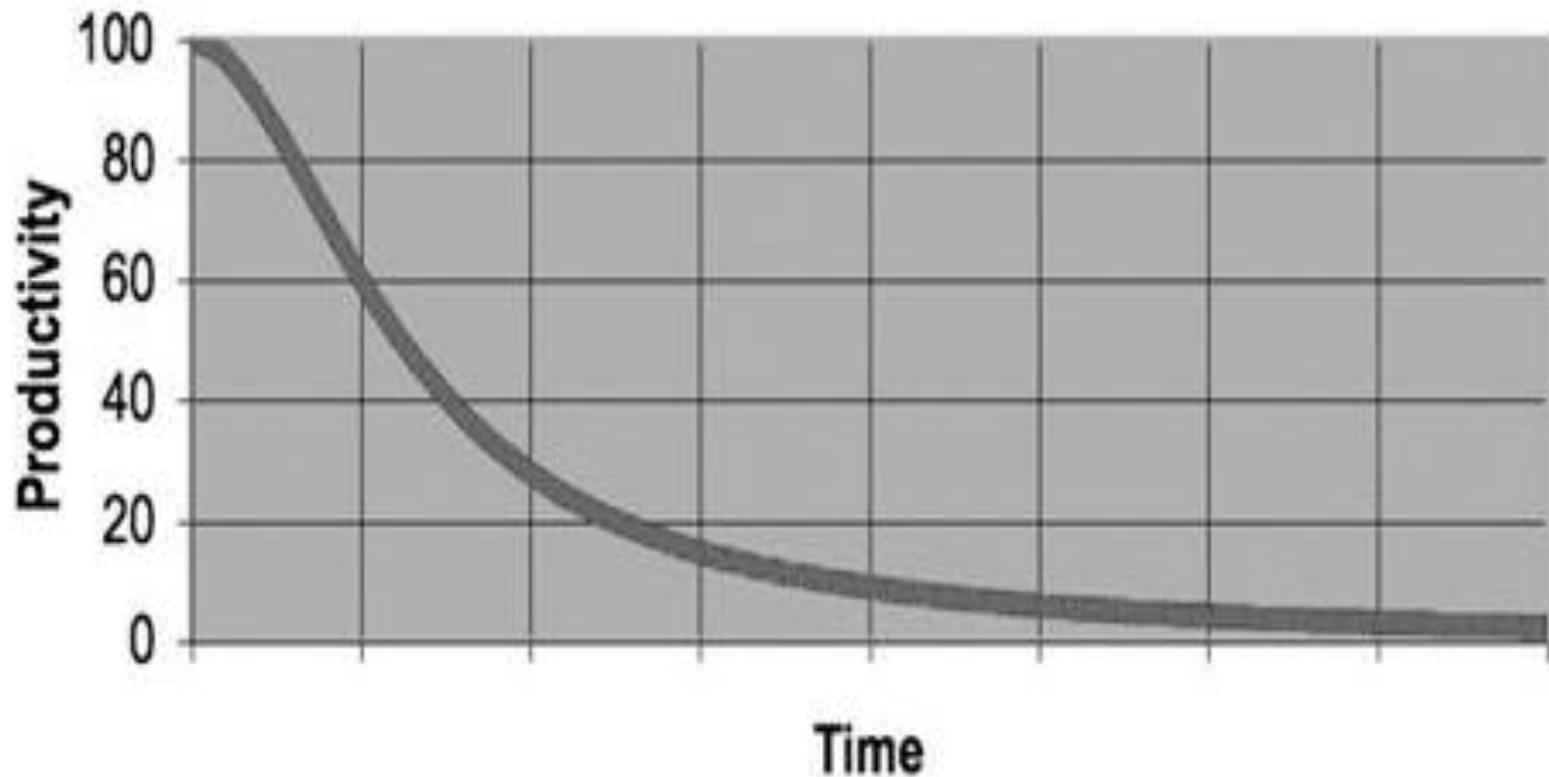


What is Bad Code?

- Difficult to read
- Difficult to understand
- Difficult to maintain
- Contains bugs
- Contains surprises



The Total Cost of Owning a Mess



Source: Clean Code

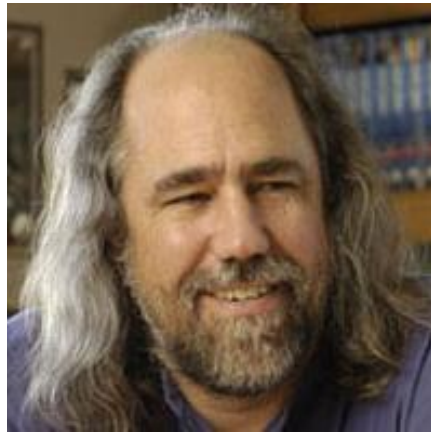






The way we avoid a mess is by
keeping our code clean.

What is Clean Code?



What is Clean Code?

- Simple and direct
- Reads like well-written prose
- Never obscures the designer's intent
- Full of crisp abstractions
- Contains straightforward lines of control



Grady Booch
Co-inventor of UML

What is Clean Code?

- Runs all the tests
- Expresses all the design ideas in the system
- Minimizes the number of entities
- Minimizes duplication
- Expresses ideas clearly



Ron Jeffries
Co-inventor of XP

What is Clean Code?

- Readable by others
- Has unit tests
- Has meaningful names
- Has minimal dependencies
- Do one thing



Dave Thomas

Co-Author of
The Pragmatic Programmer

What is Clean Code?

“You know you are working on clean code when each routine you read turns out to be pretty much what you expected.”



Ward Cunningham

Inventor of the Wiki
Co-inventor of XP

What is Clean Code?

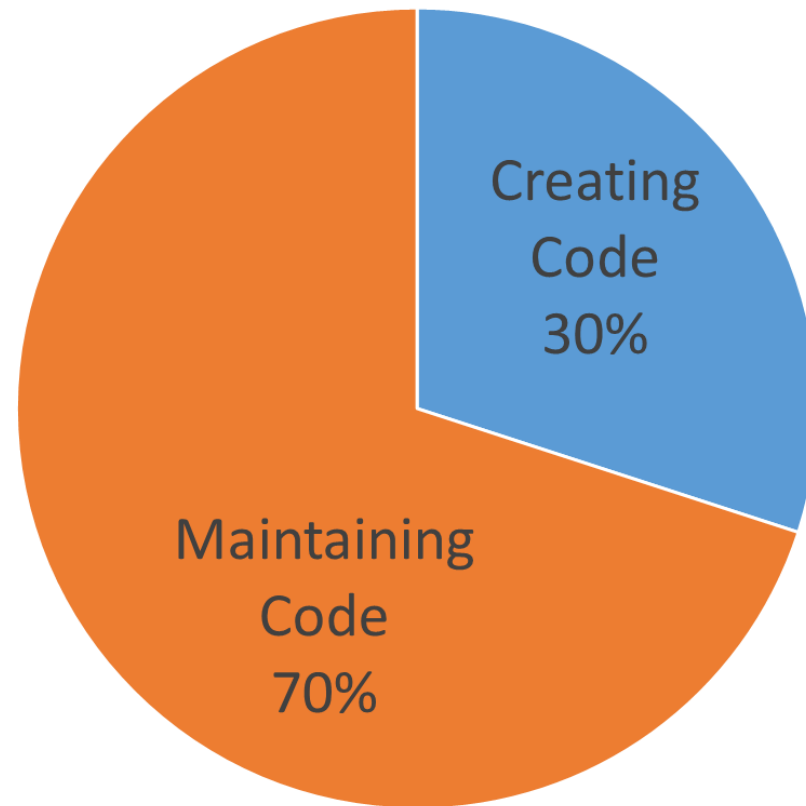
- Clean code is:
 - Simple
 - Readable
 - Understandable
 - Maintainable
 - Testable
- Clean code is a philosophy of writing code for the reader



Matthew Renze

Genius, Billionaire, Playboy,
Philanthropist :)

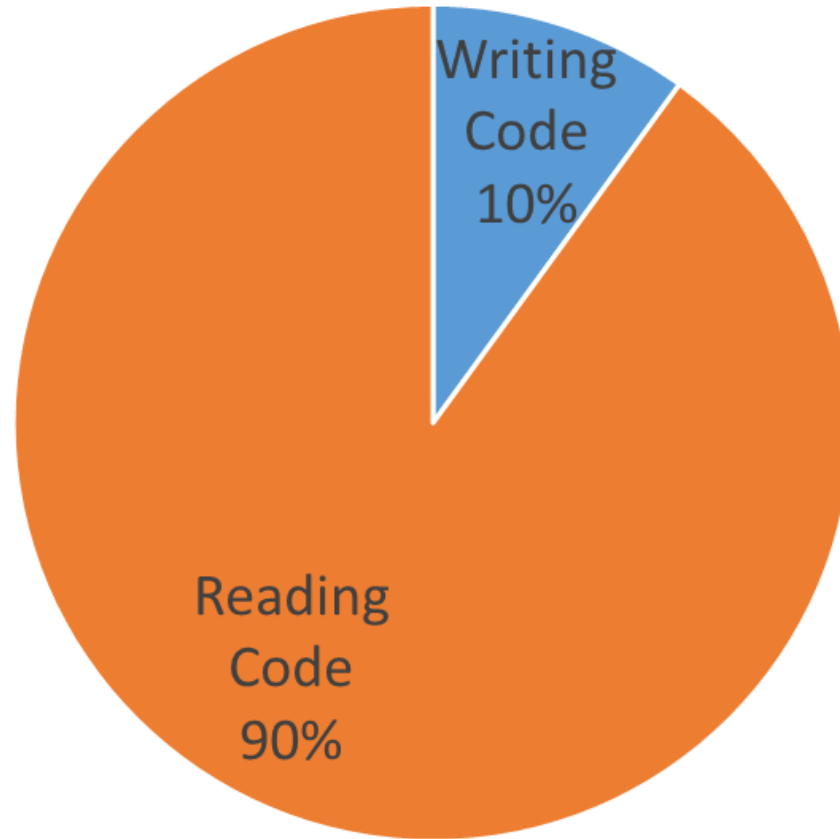
Why Should We Invest in Clean Code?



Sources:

- Barry Boehm - Software Engineering Economics, Prentice Hall
- Schach, R., Software Engineering, Fourth Edition, McGraw-Hill
- Glass, Robert, Frequently Forgotten Fundamental Facts about Software Engineering

Why Should We Invest in Clean Code?



Source: Clean Code

Clean Code is an Investment

- Clean code makes it easier to:
 - Write new code
 - Maintain old code
- Invest in code readability



How Do You Write Clean Code?

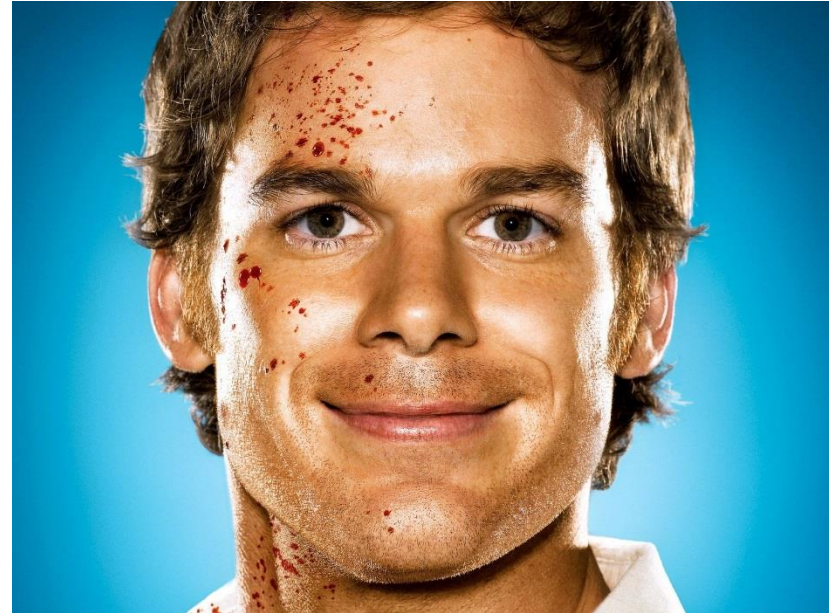
- Write code for the *reader*
- Not for the *author*
- Not for a *machine*



How Do You Write Clean Code?

“Always code as if the person who ends up maintaining your code is a violent psychopath who knows where you live!”

- Author Unknown



Names

Choose Names Thoughtfully

HELLO

my name is

Inigo Montoya

Use Intention-Revealing Names

```
// Bad - Terse variable name  
int d; // days in queue
```

```
// Good  
int daysInQueue;
```

Use Intention-Revealing Names

```
// Bad – Unclear method name  
private int Process();
```

```
// Good  
private int ParseCustomerIdFromFile();
```

Use Names from Problem Domain

```
// Problem domain  
public class Customer {}  
  
public void AddAccount();
```

Use Names from Solution Domain

```
// Solution domain  
public class Factory {}  
  
public void AddToJobQueue();
```

Use Names from Both Domains

```
// Both domains  
public class CustomerFactory {}  
  
public void AddAccountToJobQueue();
```

Avoid Disinformation

```
// Bad - misleading  
ISet<Customer> customerList;
```

Use Pronounceable Names

```
// Bad - Not pronounceable names
public class DtaRcrd102
{
    private DateTime genymdhms;

    private DateTime modymdhms;

    private string pszqint = "102";
}
```

Use Pronounceable Names

```
// Bad - Not pronounceable names
public class DtaRcrd102
{
    private DateTime genymdhms;

    private DateTime modymdhms;

    private string pszqint = "102";
}

// Good - Pronounceable names
public class Customer
{
    private DateTime generationTimestamp;

    private DateTime modificationTimestamp;

    private string recordId = "102";
}
```


Avoid Encodings

```
// Bad - Hungarian Notation  
private int intSomeValue = 123;
```

Avoid Encodings

```
// Bad - Module prefixes  
private int m_SomeField = 0;
```

Avoid Encodings

```
// OK... Maybe?  
private int _someField = 0;
```

Class Names

```
// Good - Noun or noun phrase  
public class Customer
```

```
public class AddressParser
```

```
public class AddAccountCommand
```

Class Names

// Good - Noun or noun phrase

```
public class Customer
```

```
public class AddressParser
```

```
public class AddAccountCommand
```

// Bad - Fuzzy names

```
public class ObjectManager
```

```
public class EntityProcessor
```

```
public class Stuff
```

Method Names

```
// Good - Verb or verb phrase  
public void AddCustomer()
```

```
public void DeleteAccount()
```

```
public string ParseAddress()
```

Method Names

```
// Good - Verb or verb phrase  
public void AddCustomer()
```

```
public void DeleteAccount()
```

```
public string ParseAddress()
```

```
// Bad - Fuzzy names  
public string Process()
```

```
public void DoWork()
```

Method Names

```
// Good - Boolean predicates  
public bool IsValid()  
  
public bool HasAccount()
```


Length of Variable Names Should Increase with Scope

```
// Good - Very short range variable names  
for (int i = 0; i < 10; i++) {}
```

```
list.Sum(p => p.GetAmount());
```

Length of Variable Names Should Increase with Scope

// Good - Very short range variable names

```
for (int i = 0; i < 10; i++) {}
```

```
list.Sum(p => p.GetAmount());
```

// Good - Short method variable names

```
var balance = GetAccountBalance();
```

Length of Variable Names Should Increase with Scope

// Good - Very short range variable names

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for (int i = 0; i < 10; i++) {}
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```
list.Sum(p => p.GetAmount());
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// Good - Short method variable names

```
var balance = GetAccountBalance();
```

// Good - Longer field variable names

```
private int totalAccountBalance = 0;
```

Length of Variable Names Should Increase with Scope

```
// Good - Very short range variable names  
for (int i = 0; i < 10; i++) {}
```

```
list.Sum(p => p.GetAmount());
```

```
// Good - Short method variable names  
var balance = GetAccountBalance();
```

```
// Good - Longer field variable names  
private int totalAccountBalance = 0;
```

```
// Good - Even longer global variable names  
public int totalBalanceInAllBankAccounts;
```

Length of Method Names Should Decrease with Scope

// Good - Short public method names

```
public void GetCustomers();
```

```
public void Save();
```

Length of Method Names Should Decrease with Scope

// Good - Short public method names

```
public void GetCustomers();
```

```
public void Save();
```

// Good - Longer private method names

```
private string ParseHtmlFromFile()
```

```
private int GetIdFromAccountHolder()
```

Length of Class Names Should Decrease with Scope

```
// Good - Short public class name  
public class Account
```

Length of Class Names Should Decrease with Scope

```
// Good - Short public class name  
public class Account
```

```
// Good - Longer private class name  
private class AccountNumberGenerator
```


Length of Class Names Should Decrease with Scope

```
// Good - Short public class name  
public class Account
```

```
// Good - Longer private class name  
private class AccountNumberGenerator
```

```
// Good - Longer derived class name  
public abstract class Account
```

```
public class SavingsAccount : Account
```

Functions

Functions Should Be Small

- Simpler
- Easier to read
- Easier to understand
- Easier to test
- Contain less bugs



How Small?

- Most evidence says:
 - Less than 20 lines
- Uncle Bob says:
 - Less than 10 lines
 - Average 3 to 6 lines
- Yes, I know... it sounds impossible and crazy



Large Functions are Where
Classes Go to Hide

Functions Should Do One Thing



Source: <http://www.wengerna.com/giant-knife-16999>

One Level of Abstraction per Function

```
// Good - Separate levels of abstraction
public File CreateFile()

public Html RenderHtml()

private string RenderHtmlBody()

private string RenderHtmlElement()

private char RenderHtmlElementClosingTag()
```

Minimize the Number of Parameters

```
// Try to minimize the # of arguments  
public void SetNone() {}
```

```
public void SetOne(int arg1)
```

```
public void SetTwo(int arg1, int arg2)
```

```
public void SetThree(int arg1, int arg2, int arg3)
```

```
public void SetMany(Args args)
```


Avoid Flag Arguments

```
// Bad - Flag arguments  
public void Render(bool useColor)
```

Avoid Flag Arguments

```
// Bad - Flag arguments  
public void Render(bool useColor)
```

```
// Good - No flag arguments  
public void RenderInColor()
```

```
public void RenderInGrayScale()
```

Avoid Output Arguments

```
// Bad - Uses 'out' argument
public void AppendFooter(out Report report)
{
    ...
}

AppendFooter(out report);
```

Avoid Output Arguments

```
// Bad - Uses 'out' argument  
public void AppendFooter(out Report report)  
{  
    ...  
}
```

```
AppendFooter(out report);
```

```
// Good - No 'out' argument  
public ReportBuilder AppendFooter()  
{  
    ...  
}
```

```
reportBuilder.AppendFooter();
```

Command-Query Separation

Command

- Does something
- Modifies state
- Should not return a value (ideally)

Command-Query Separation

Command

- Does something
- Modifies state
- Should not return a value (ideally)

Query

- Answers a question
- Does not modify state
- Always returns a value

Command-Query Separation

Command

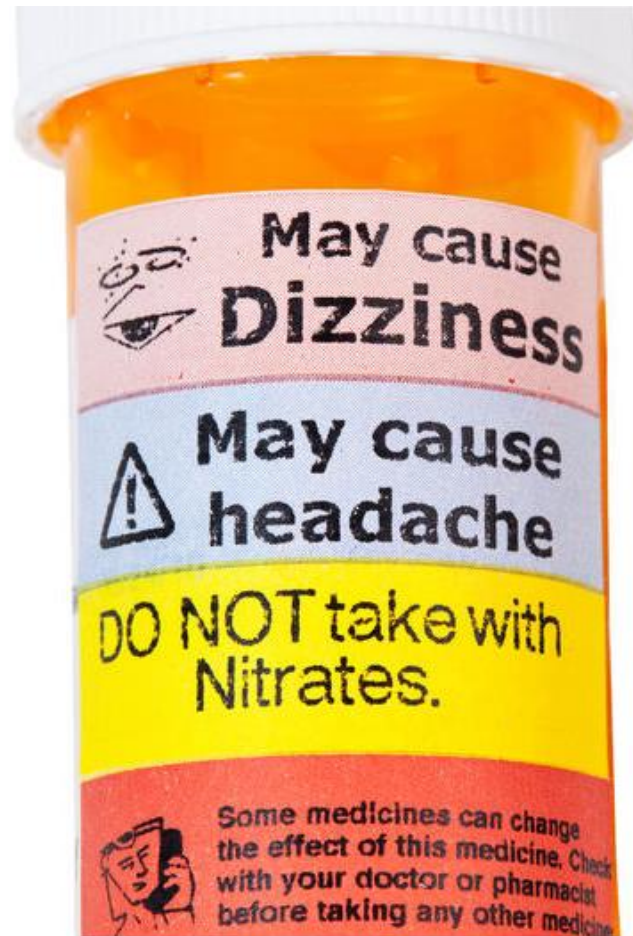
- Does something
- Modifies state
- Should not return a value (ideally)

Query

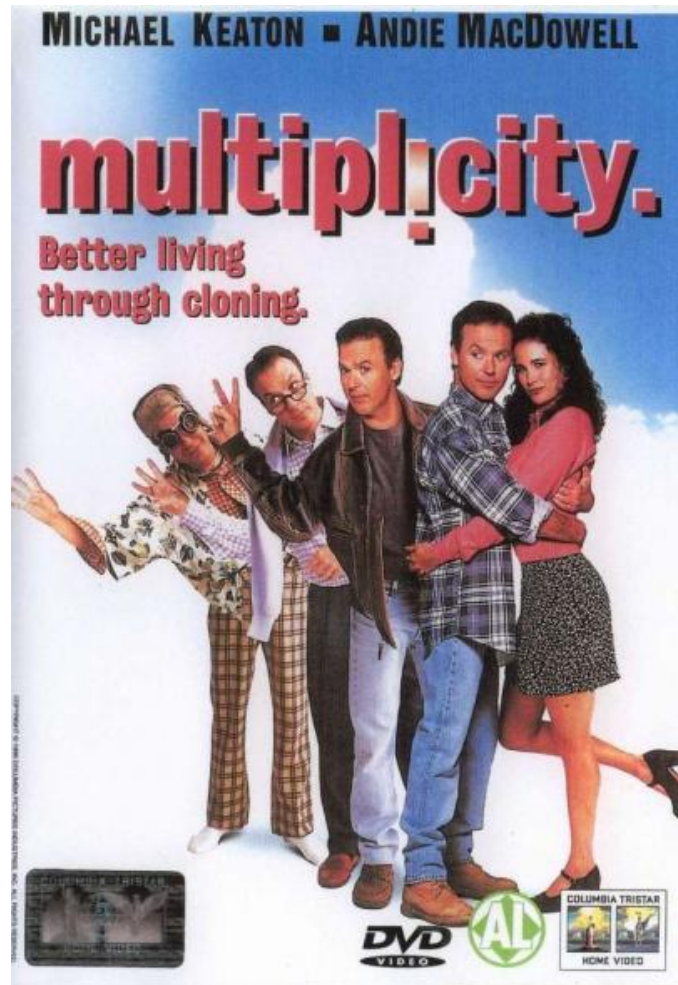
- Answers a question
- Does not modify state
- Always returns a value

Avoid mixing the two!

Avoid Side Effects



Avoid Duplication



Source: Sony Pictures Home Entertainment

Use Functions to Enhance Readability

```
// Bad - One giant chunk of code  
public void CreateReport()  
{  
    ... Giant block of code ...  
}
```

Use Functions to Enhance Readability

// Bad – One giant chunk of code

```
public void CreateReport()  
{  
    ... Giant block of code ...  
}
```

// Good – Uses small named functions

```
public void CreateReport()  
{  
    CreateHeader();  
  
    CreateBody();  
  
    CreateFooter();  
}
```

Classes, Objects, and Data Structures

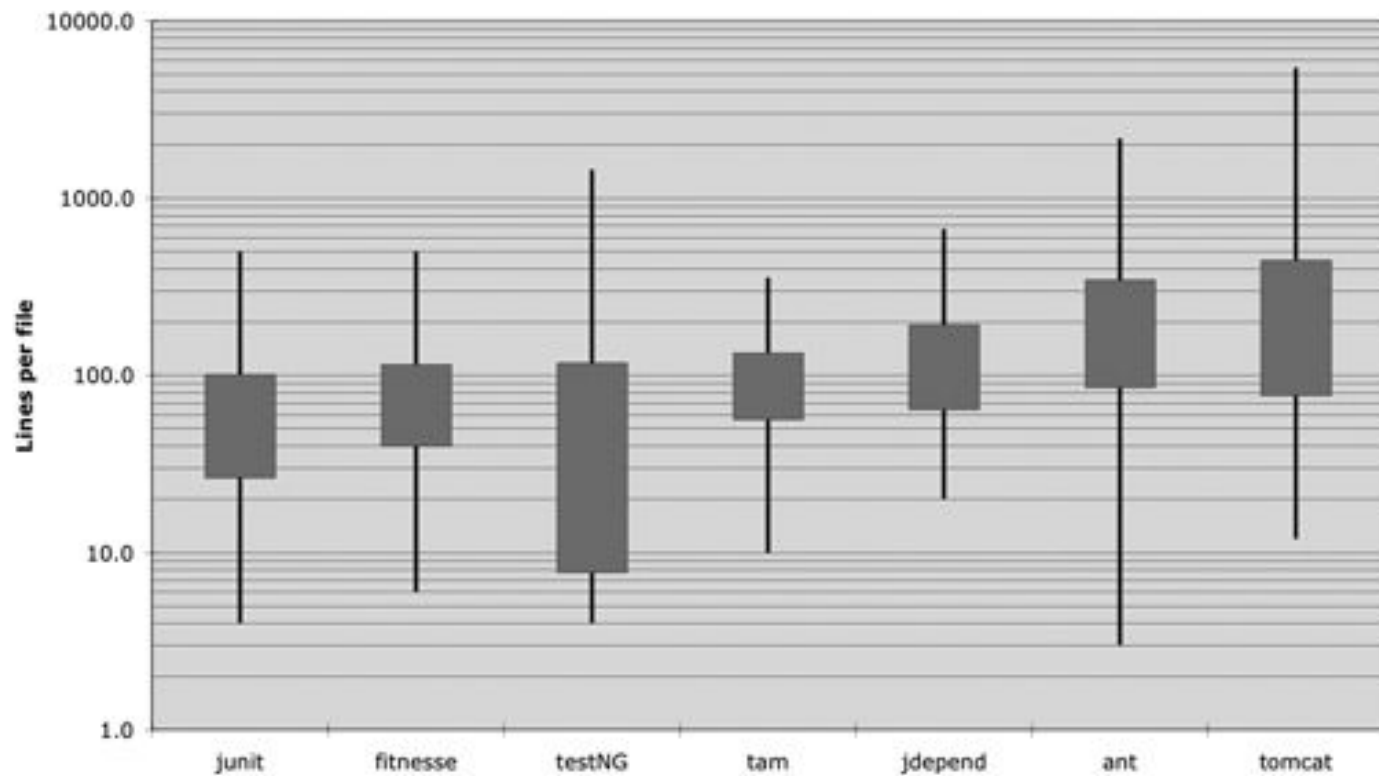
Classes Should Be Small

- Similar benefits as small functions
- Single-Responsibility Principle



How Small?

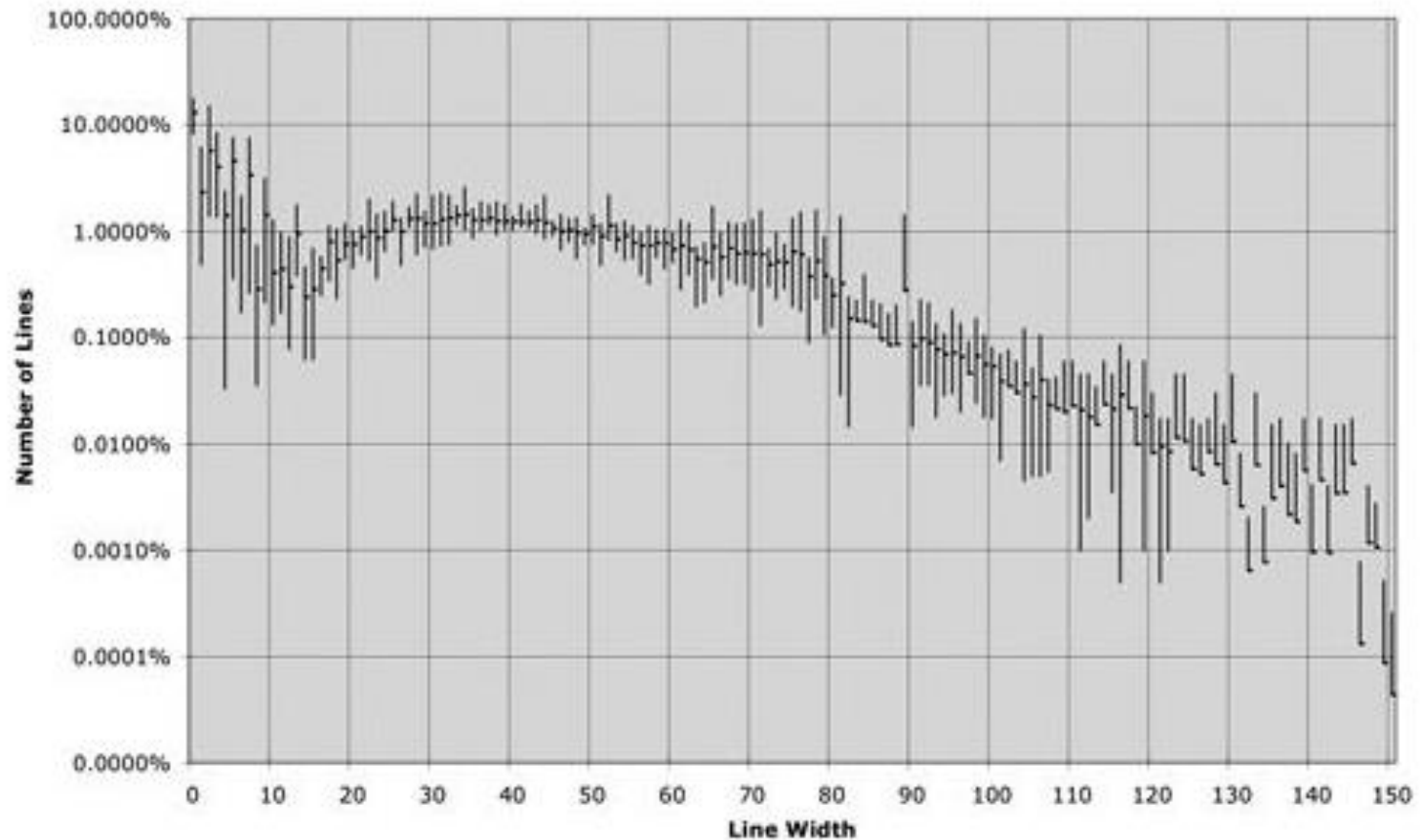
Figure 5-1 File length distributions LOG scale (box height = sigma)



Source: Clean Code

Classes Should Be Narrow

Figure 5-2 Java line width distribution



Source: Clean Code

Follow the Law of Demeter

```
// Bad - Law of Demeter violation  
var rent = customer.Pocket.Wallet  
    .Money.GetRentMoney();
```


Follow the Law of Demeter

```
// Bad - Law of Demeter violation  
var rent = customer.Pocket.Wallet  
    .Money.GetRentMoney();
```

```
// Good - No violation  
var rent = customer.GetRentMoney();
```

Follow the Law of Demeter

// Bad - Law of Demeter violation

```
var rent = customer  
    .Pocket.Wallet  
    .Money.GetRentMoney();
```

// Good - No violation

```
var rent = customer.GetRentMoney();
```



Source: Athens Banner-Herald

Object vs. Data Structure

```
public class Rectangle
{
    private double x;
    ...
    public double GetX()
    {
        return x;
    }
    ...
    public double GetArea()
    {
        return width * height;
    }
}
```

Object vs. Data Structure

```
public class Rectangle
{
    private double x;
    ...
    public double GetX()
    {
        return x;
    }
    ...
    public double GetArea()
    {
        return width * height;
    }
}
```

```
public struct Rectangle
{
    public double X;
    public double Y;
    public double Width;
    public double Height;
}
```

Avoid Hybrid Object/Structures



Source: <http://www.layoutsparks.com/1/147428/alien-resurrection-scary-dreadful-31000.html>

Have a Consistent Order

```
public class SomeClass
{
    private const int SomeConst = 123;

    private int _someField;

    private int SomeProperty {...}

    public SomeClass() {...}

    public void DoSomethingPublic() {...}

    private void DoSomethingPrivate() {...}
}
```

Choose the Right Abstractions

- Model
- View
- Controller
- Repository
- Factory
- Builder
- Adapter

Other Practices for Classes

- DRY Principle
- High Cohesion
- Low Coupling
- Dependency Injection
- Testability

Comments

Comments Represent a Failure



Source: http://a.tgcdn.net/images/products/zoom/no_comment.jpg

Obsolete Comments Lie



Explain Yourself in Code

```
// Bad - Code explained in comment
```

```
// Check to see if the employee is eligible for full benefits
```

```
if ((employee.FullTime || SalaryFlag)  
    && (employee.Age > 65))
```

Explain Yourself in Code

```
// Bad - Code explained in comment
```

```
// Check to see if the employee is eligible for full benefits
```

```
if ((employee.FullTime || SalaryFlag)  
    && (employee.Age > 65))
```

```
// Good - Code explains itself
```

```
private bool IsEligibleForFullBenefits(Employee employee)  
{  
    return ((employee.FullTime || SalaryFlag)  
            && employee.Age > 65))  
}
```

Explain Yourself in Code

```
// Bad - Code explained in comment
```

```
// Check to see if the employee is eligible for full benefits
```

```
if ((employee.FullTime || SalaryFlag)  
    && (employee.Age > 65))
```

```
// Good - Code explains itself
```

```
private bool IsEligibleForFullBenefits(Employee employee)  
{  
    return ((employee.FullTime || SalaryFlag)  
            && employee.Age > 65))  
}
```

```
if (IsEligibleForFullBenefits(employee))
```

Bad Comments

```
// All of these comments are bad
```

```
// Opens the file  
var file = File.Open();
```

```
// Returns day of month  
private int GetDayOfWeek()
```

```
// 08-07-2013 - Fixed Bug (MLR)
```

```
Main()  
{  
    ...  
} // end main
```

Zombie Code

```
// Zombie Code  
// if (a == 1)  
//     b = c + 1
```



Source: The Walking Dead

Zombie Code

```
// Zombie Code  
// if (a == 1)  
//     b = c + 1
```

Kill it with fire!



Source: The Walking Dead

Necessary Comments

```
// Copyright © 2013 Matthew Renze
```

```
// Trim is necessary to prevent a  
// search term mismatch
```

```
// Warning: Slow running test
```

```
// TODO: Refactor to factory pattern
```

```
/// <summary>
```

```
/// Opens the file for reading
```

```
/// </summary>
```

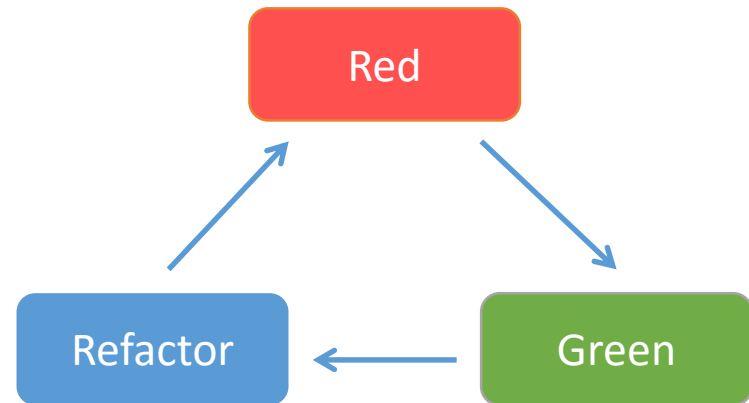
The Best Comment is
No Comment at All

(but only if our code clearly explains itself)

The Process

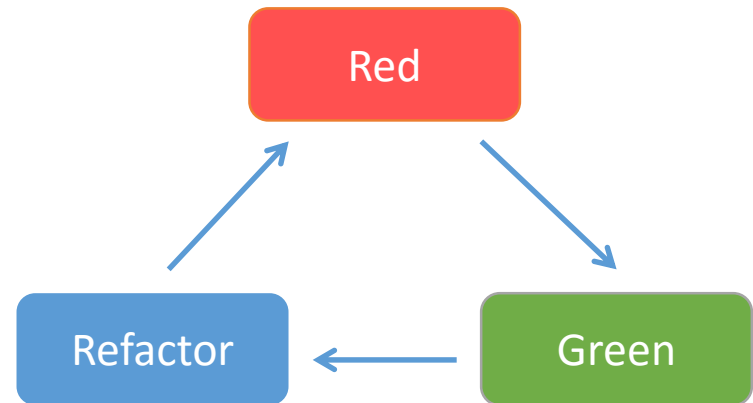
The Principles

- Test-Driven Development (TDD)
- Simplicity (KISS)
- Continuous Refactoring



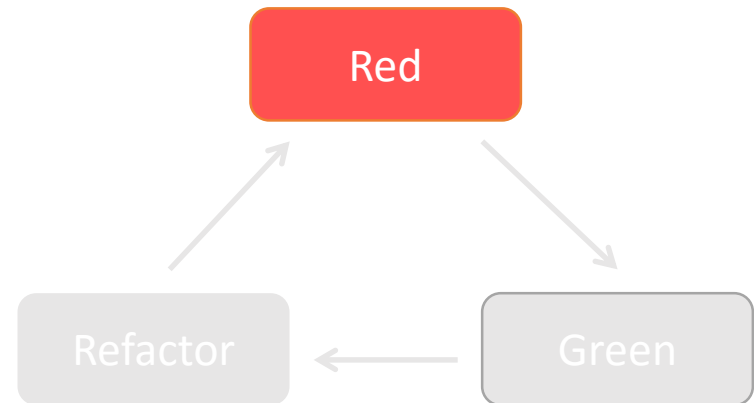
Test-Driven Development Process

1. Create a failing unit test
2. Code the simplest thing
3. Refactor until the code is clean



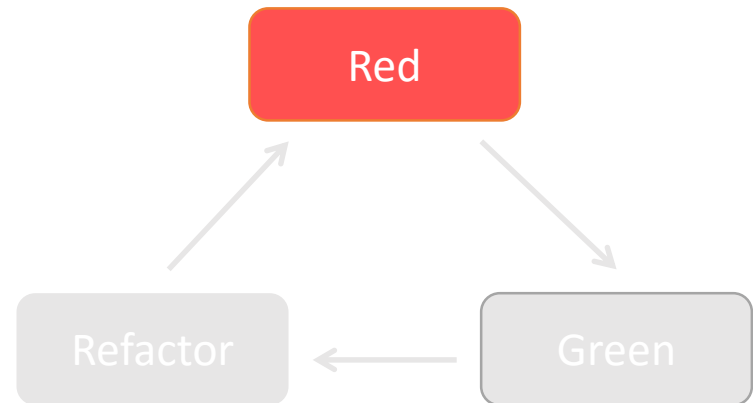
Test-Driven Development

- Starts with a test
- Tests drive the design
- Code evolves over time



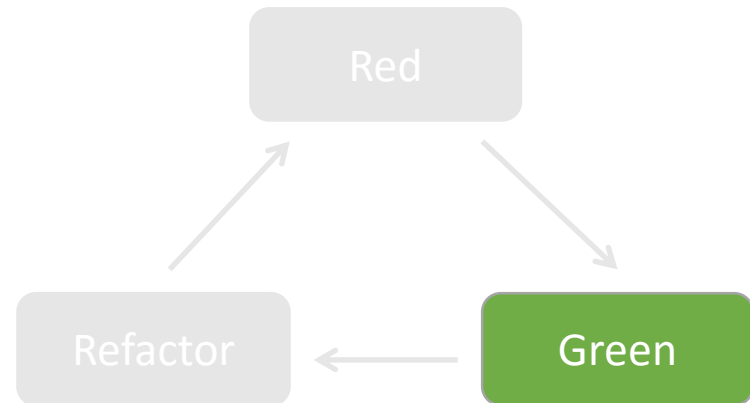
TDD Code is:

- Testable
- Maintainable
- Reliable
- Self-documenting
- Clean
- Easy to keep clean



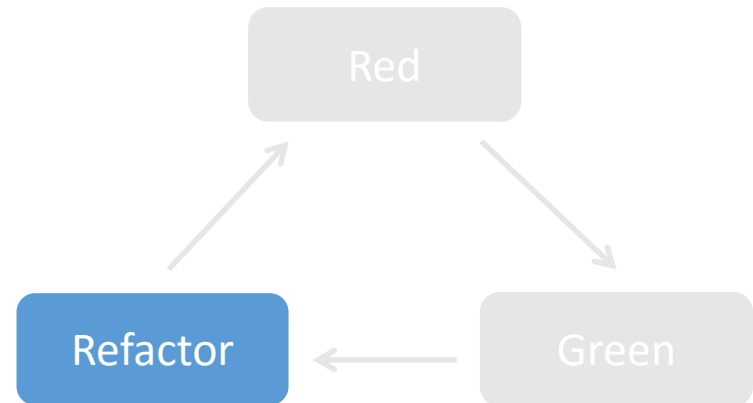
Simplicity

- KISS
- Unnecessary complexity
- YAGNI
- Incremental algorithmics



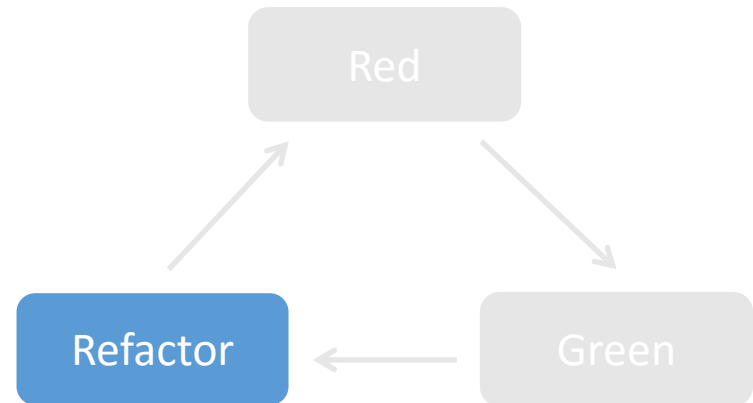
Continuous Refactoring

- Working code is *not* the last step
- Refactor until clean
- Continuous process



Continuous Refactoring

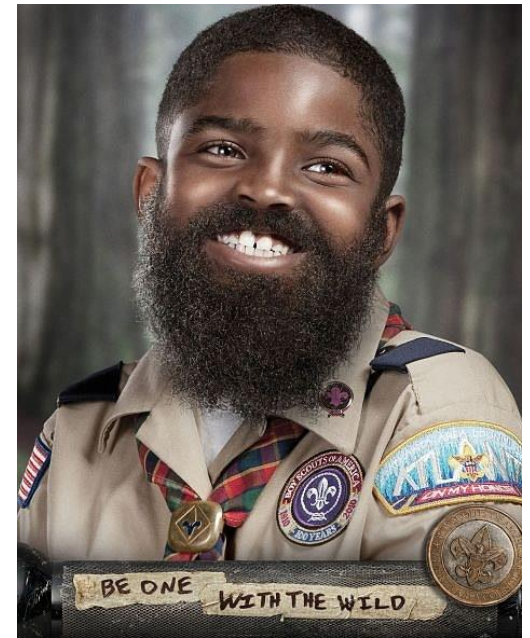
- All creative endeavors are iterative processes



Follow the Boy Scout Rule

“Leave the campground just a little bit cleaner than you found it.”

– adapted from Robert Stephenson Smyth Baden-Powell’s farewell message to the scouts: *“Try and leave this world a little better than you found it.”*

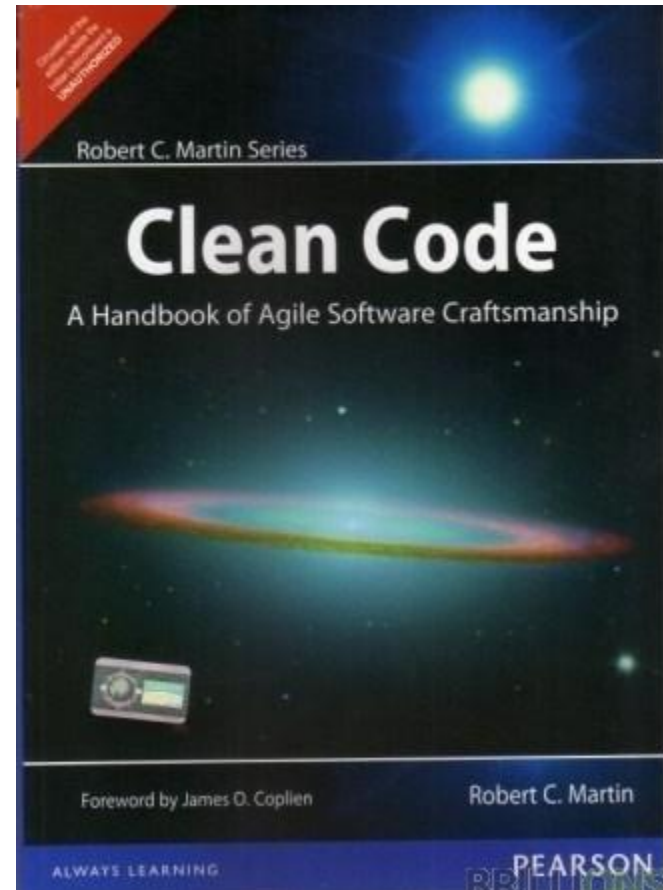


“Leave the campground just a little bit cleaner than you found it.”

Conclusion

Conclusion

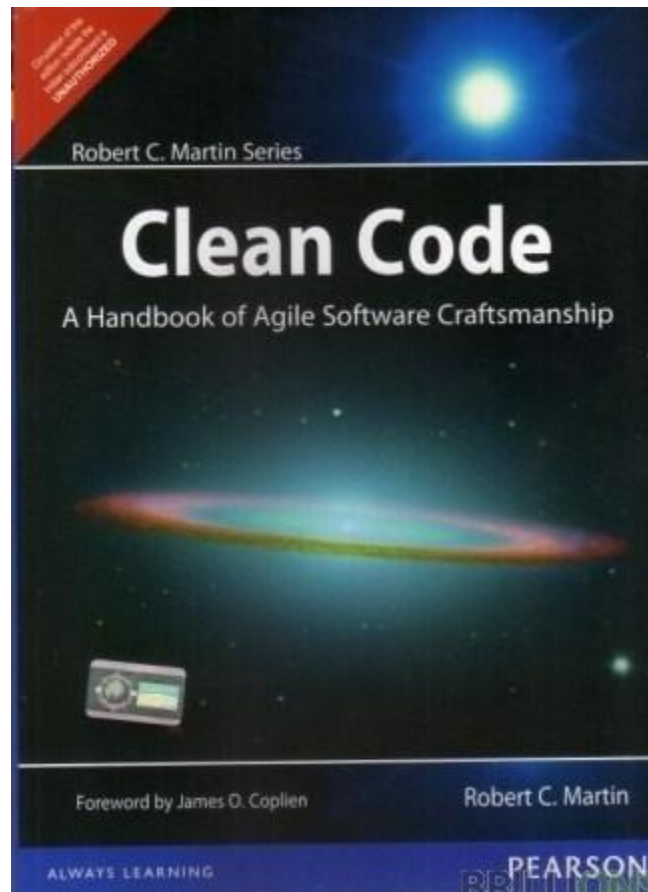
- Clean code is:
 - Simple
 - Readable
 - Understandable
 - Maintainable
 - Testable
- Clean code is a philosophy of writing code for the reader



Conclusion

- Use intention revealing names
- Classes and functions should be small and do one thing well
- Use comments to express a failure to communicate in code
- The process is:
 1. Test First (TDD)
 2. Simplest solution
 3. Continuously refactor

Where to Go Next...



Where to Go Next...

Uncle Bob presents the

Clean Code

Video Series



Episode 1 - Clean Code	Episode 12 - The Interface Segregation Principle
Episode 2 - Names++	Episode 13 - The Dependency Inversion Principle
Episode 3 - Functions	Episode 14 - SOLID Case Study
Episode 4 - Function Structure	Episode 15 - SOLID Components
Episode 5 - Form	Episode 16 - Component Cohesion
Episode 6 - TDD - Part 1	Episode 17 - Component Coupling
Episode 6 - TDD - Part 2	Episode 18 - Component Case Study
Episode 7 - Architecture	Episode 19 - Advanced TDD - Part 1
Episode 8 - SOLID Foundations	Episode 19 - Advanced TDD - Part 2
Episode 9 - The Single Responsibility Principle	
Episode 10 - The Open-Closed Principle	
Episode 11 - The Liskov Substitution Principle	

Episode 20 - Clean Tests

Where to Go Next...



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Clean Code: Writing Code for Humans

Anyone can write code a computer can understand, but professional developers write code *humans* can understand. Clean code is a reader-focused development style that produces software that's easy to write, read and maintain.

 22  Tweet 30  Like  Share 27  Share 19



<http://pluralsight.com/training/Courses/TableOfContents/writing-clean-code-humans>

Feedback

- Feedback is very important to me!
- One thing you liked?
- One thing I could improve?

Uncle Bob Wants You:



“To leave the campground just a little bit cleaner than you found it.”

Contact Info

Matthew Renze

- Twitter: [@matthewrenze](https://twitter.com/matthewrenze)
- Email: matthew@renzeconsulting.com
- Website: www.matthewrenze.com

“Programming is not about telling the computer what to do.

Programming is the art of telling another human what the computer should do.”

- Donald Knuth

“Any fool can write code that a computer can understand.

Good programmers write code that humans can understand.”

- Martin Fowler