Clean Code

“Tìm những người mày mang ơn trả.
Mọi thứ cứ để nhân quả”
– Mở Mắt (Lil Wuyn, Đen)

Outline

1. Clean Code
    - What is Clean Code?
    - Objectives
    - How to Write Clean Code
2. Practices
    - Conventions
    - Tips
    - Code Reviews
3. Code Review

Is She Pretty?

Is It Clean, Neat?

Is This Clean?

```java
public class KafkaProducerMetrics implements AutoCloseable {

    public static final String GROUP = "producer-metrics";
    private static final String FLUSH = "flush";
    private static final String TXN_INIT = "txn-init";
    private static final String TXN_BEGIN = "txn-begin";
    private static final String TXN_SEND_OFFSETS = "txn-send-offsets";
    private static final String TXN_COMMIT = "txn-commit";
    private static final String TXN_ABORT = "txn-abort";
    private static final String TOTAL_TIME_SUFFIX = "-time-ns-total";
    private static final String METADATA_WAIT = "metadata-wait";

    private final Map<String, String> tags;
    private final Metrics metrics;
    private final Sensor initTimeSensor;
    private final Sensor beginTxnTimeSensor;
    private final Sensor flushTimeSensor;
    private final Sensor sendOffsetsSensor;
    private final Sensor commitTxnSensor;
    private final Sensor abortTxnSensor;
    private final Sensor metadataWaitSensor;

    public KafkaProducerMetrics(Metrics metrics) {
        this.metrics = metrics;
        tags = this.metrics.config().tags();
        flushTimeSensor = newLatencySensor(
            FLUSH,
            "Total time producer has spent in flush in nanoseconds."
        );
        initTimeSensor = newLatencySensor(
            TXN_INIT,
            "Total time producer has spent in initTransactions in nanoseconds."
        );
        beginTxnTimeSensor = newLatencySensor(
            TXN_BEGIN,
            "Total time producer has spent in beginTransaction in nanoseconds."
        );
        sendOffsetsSensor = newLatencySensor(
            TXN_SEND_OFFSETS,
            "Total time producer has spent in sendOffsetsToTransaction in nanoseconds."
        );
        commitTxnSensor = newLatencySensor(
            TXN_COMMIT,
            "Total time producer has spent in commitTransaction in nanoseconds."
        );
```

Congrats! You can write clean code! 🥳

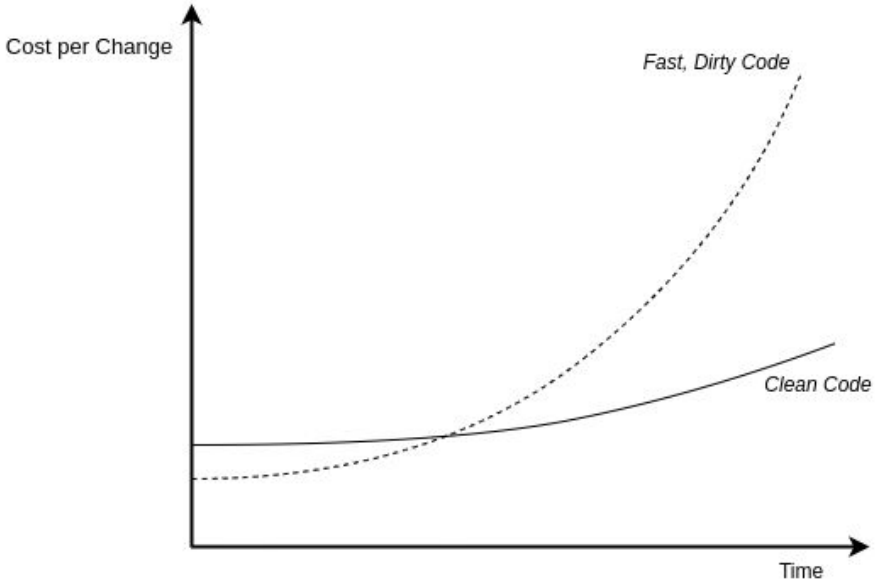
1.1. Why Clean Code?

Software Development Problems:

- Buggy
- Slow to market

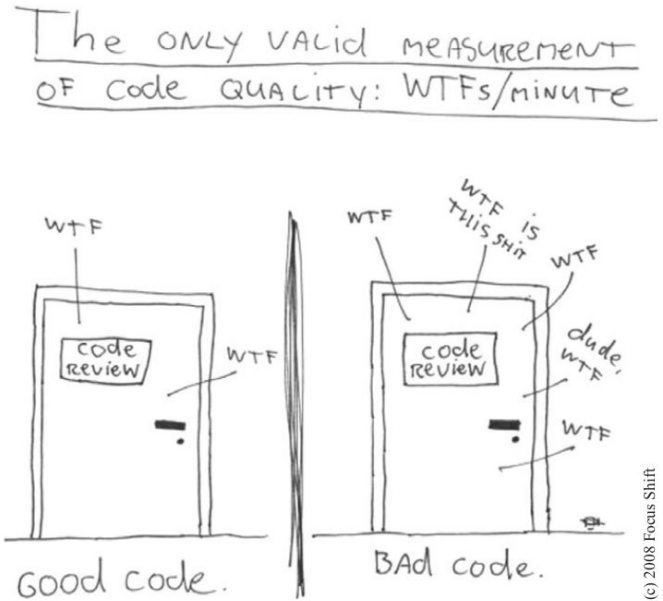
“If you think good architecture is expensive, try bad architecture”

- Brian Foote and Joseph Yoder



1.2. What is Clean Code?

Clean code is code that very **easy** to **understand** and **change**



1.3. Objectives/Mindset

Fourable:

- **Read**able
- **Maintain**able
- **Test**able
- **Scal**able

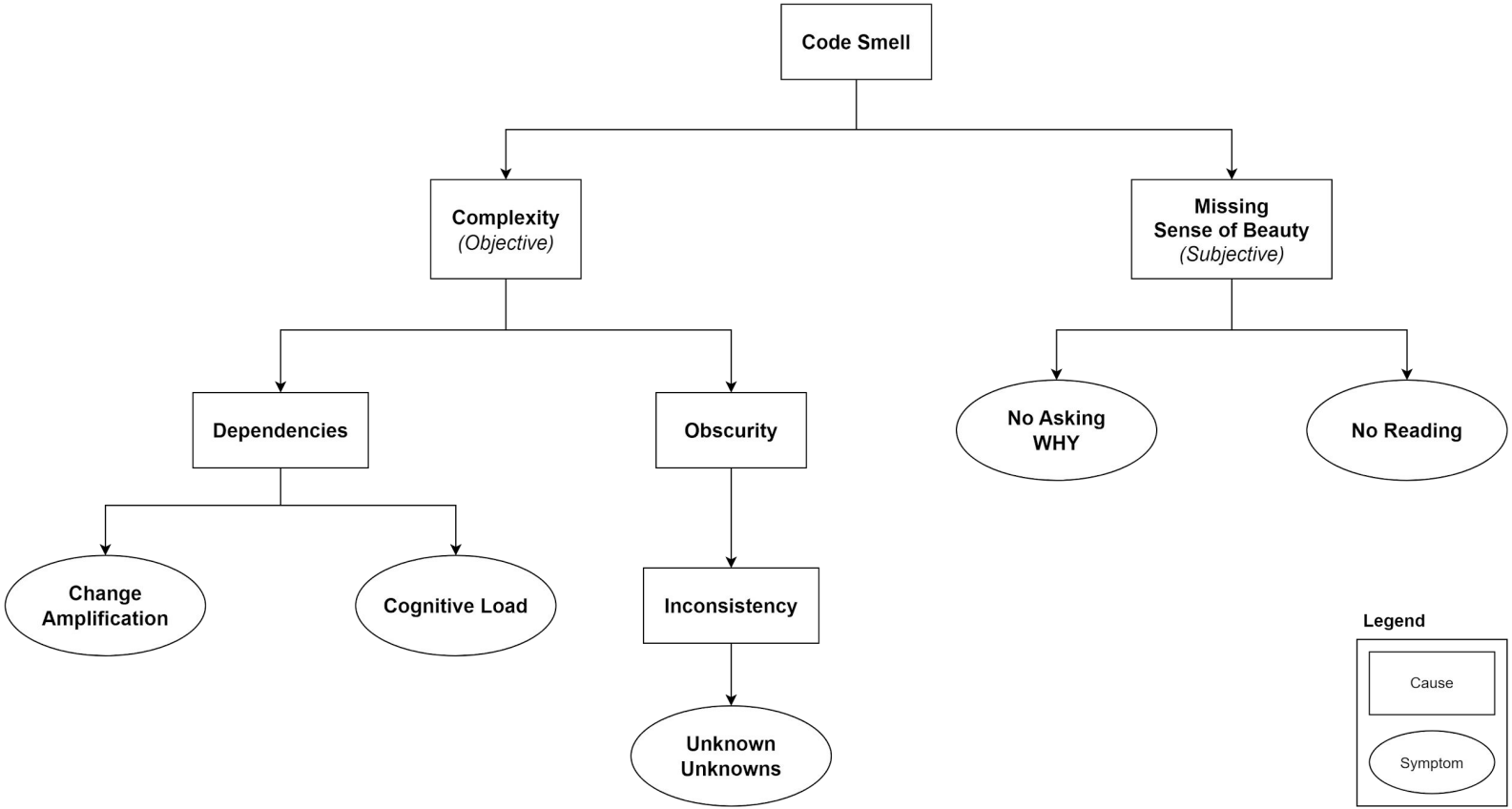
Objectives: same to clean architect

“to minimize the human resources required to build and maintain the required system”

Trade-offs:

- Clean Code vs Performance
- Clean Code vs Speed of Market Delivery

1.4. Causes of Code Smell



1.5. How To Write Clean Code

Abstract Ways:

- **Easy to understand**: Naming, Conventions, Format, Code Review, Static Scanning, …
- **Easy to change**: Principles, Design Patterns, Unit Test, Refactoring, …

Practice Ways:

- **Read** → Got the sense of beauty
  - Codes of others (distinguish clean code vs smell code)
  - Books (Tech & Non-Tech)
- **Be Disciplined and Be pragmatic**
  - Think of objectives, principles and conventions first
- **Practices** → Handle with complexity
  - Understand fundamentals and the domain
  - Fix symptoms
  - Refactor frequently
  - Pair programming

1.6. Principles

- **KISS**
  - Break down the problem into small enough or understandable enough pieces
  - Don’t start with over-engineering
- **SOLID**
  - Single Responsibility Principle
  - Open-Closed Principle
  - Liskov Substitution Principle
  - Interface Segregation Principle
  - Dependency Inversion Principle
  - “If the Open-Closed Principle states the goal of OO architecture,
    the Dependency Inversion Principle states the primary mechanism”

2. Practices

2.0. Coding Steps

1. Abstract the main steps
2. Write code according to the main steps
3. Before running and self-testing, review code again and refactor partially.
4. Self-test & unit test → OK
5. Merge Request (minor) → Tester test
6. Optional: refactor
    a. Clean
    b. Performance

2.1. Name Things

- *“There are only two hard things in Computer Science: cache invalidation and naming things”* - Phil Karlton
- Meaningful names
  - Simple: a noun that **express its function/goal**
    - DiscountCalculator
  - Distinction
    - Using attribute
      - Interface: Cache
      - Impl: LocalCache, RemoteCache
  - Avoid vague names. Ex:
    - Data
    - Msg1, msg2

2.1. Name Things

- Exercise:
  - ✗ `boolean scope = checkScope();`
  - ✓ `boolean isScope = checkScope();`
- Use pronounceable names
- Don't use prefix to the name of container
- **Consistent Spelling**

2.2. Function

- Top to Bottom Rule, **Tell a story** → Easy to read
- **Do one thing**, SRP → Easy to maintain
  - Have no side effects
  - Command Query Separation
- **Keep it small** → Easy to test
  - <= 40 lines
  - 1 switch-case
  - <= 3 params
- **Prefer pure functions**
- **Avoid deep nesting**: condition nesting, callback nesting, …
- **Don’t repeat yourself** → Avoid duplication

2.3. Class

- Keep it small
- Single Responsibility Principle
  - To find out if class has too much responsibility is how it is named
- Open-Closed Principle - Organizing for Change
  - An existing class A is used to generate SQL select statement
  - Requirement: Generating SQL update statement
  - Approach: Creating a subclass B of class A

```java
public class A {
        public static final String DOMAIN = "onemount.com";
        public static final Integer PORT = 80;

        private static String name;

        private String age;

        public A() {}

        public void method1() {
            method3();
        }

        public void method2() {
            method4();
        }

        private void method3() {}

        private void method4() {}
}
```

2.4. Abstract

```
func createPizza(order *Order) *Pizza {
  pizza := &Pizza{Base: order.Size,
                  Sauce: order.Sauce,
                  Cheese: "Mozzarella"}
  if order.kind == "Veg" {
    pizza.Toppings = vegToppings
  } else if order.kind == "Meat" {
    pizza.Toppings = meatToppings
  }
  oven := oven.New()
  if oven.Temp != cookingTemp {
    for (oven.Temp < cookingTemp) {
      time.Sleep(checkOvenInterval)
      oven.Temp = getOvenTemp(oven)
    }
  }
  if !pizza.Baked {
    oven.Insert(pizza)
    time.Sleep(cookTime)
    oven.Remove(pizza)
    pizza.Baked = true
  }
  box := box.New()
  pizza.Boxed = box.PutIn(pizza)
  pizza
.Sliced = box.SlicePizza(order.Size)
  pizza.Ready = box.Close()
  return pizza
}
```

Step 1. prepare

Step 2. bake

Step 2.1. heat

Step 2.2. bake

Step 3. Box

```
func createPizza(order *Order) *Pizza {
  pizza := prepare(order)
  bake(pizza)
  box(pizza)
  return pizza
}
func prepare(order *Order) *Pizza {
  pizza := &Pizza{Base: order.Size,
                  Sauce: order.Sauce,
                  Cheese: "Mozzarella"}
  addToppings(pizza, order.kind)
  return pizza
}
func addToppings(pizza *Pizza, kind stri
  if kind == "Veg" {
    pizza.Toppings = vegToppings
  } else if kind == "Meat" {
    pizza.Toppings = meatToppings
  }
}
func bake(pizza *Pizza) {
  oven := oven.New()
  heatOven(oven)
  bakePizza(pizza, oven)
}
func heatOven(oven *Oven) { … }
func bakePizza(pizza *Pizza, oven *Oven)
func box(pizza *Pizza) { … }
```

2.5. Simplify Your Control Flow

- Early returns to handle edge/corner cases

```java
public Booking createBooking() {
    if (user.getStatus() == false) {
        System.out.println("User is not active");
    }
    else if (seat.isBooked() == true) {
        System.out.println("Seat is already
booked");
    }
    else {
        // Happy case: too much logic here
        return new Booking();
    }
}
```

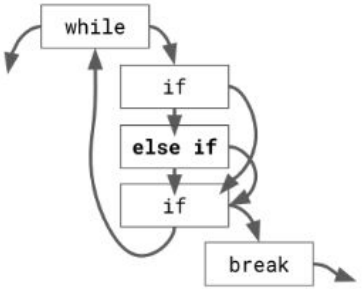
```java
public Booking createBooking() {
    if (user.getStatus() == false) {
        throw new RuntimeException("User is not active");
    }

    if (seat.isBooked() == true) {
        throw new RuntimeException("Seat is already
booked");
    }

    // Happy case: too much logic here
    return new Booking();
}
```

2.5. Simplify Your Control Flow

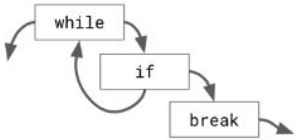
```
while (commode.StillOccupied()) {
  if (commode.HasPreferredCustomer()) {
    commode.WarmSeat();
  } else if (commode.CustomerOnPhone()) {
    commode.ChillSeat();
  }
  if (commode.ContainsKale()) {
    commode.PrintHealthCertificate();
    break;
  }
}
```



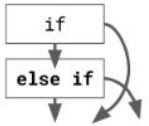
Code Control Flow with 5 structures and 9 edges: challenging for a reader to retain in memory.

2.5. Simplify Your Control Flow

```
while (commode.StillOccupied()) {
  commode.AdjustSeatTemp();
  if (commode.ContainsKale()) {
    commode.PrintHealthCertificate();
    break;
  }
}
```



3 control structures and 5 edges: easier to remember



Commode::AdjustSeatTemp()
with 2 structures and 4 edges

2.6. Error Handling

- Write try-catch-final statement first
- Try blocks should be treated like transactions
- Catch blocks leaves your code in a consistent state
- Provide context with exceptions,
  add error messages:
  - Type of failure, level
  - Where failed: subject + verb + object
  - Why it did
- Checked Exception vs Unchecked exception
- **Centralized Handling**

	Checked Exception	Unchecked exception
Definition	• Checked at compile time. • Represent errors outside the control of the program. • If some code within a method throws a checked exception, then the method must either handle the exception or it must specify the exception using the throws keyword	• Unchecked at compile time. • Reflect errors inside the program logic • Don't have to declare unchecked exceptions in a method with throws keyword
Pros	• Remind of handling exceptions	• Preserve encapsulation • Low Cost
Cons	• Violate Open/Closed Principle • Break encapsulation	• Forget to handle exceptions
When to use	Building a critical library	Building general, robust apps

2.7. Comments & Formating

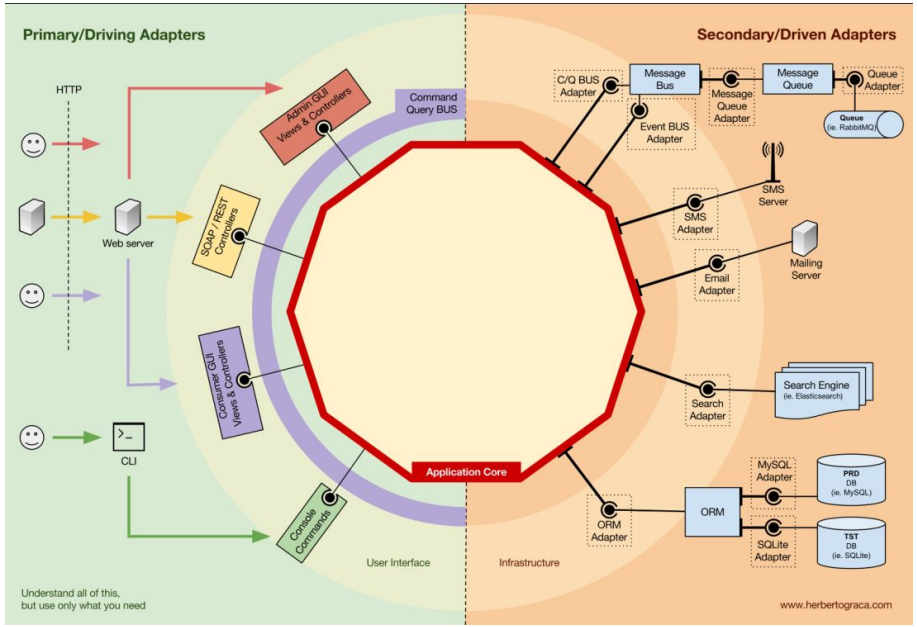
- Comments:
  - Do:
    - Complex algorithms
    - Summaries on interfaces
  - Don’t:
    - Explain methods → Self-explain
- Formating:
  - Linting

2.8. Test

- Include only relevant details in tests
- Don’t overuse mocks in tests

2.9. Boundary

- Boundaries are points within your code where it **meets others' code**.
  A boundary is an **unpredictable** area.
- Avoid passing a third party object around within your own system
- Do not return a function from it or accept it as an argument to your public APIs
- Buffer code boundaries using **adapters**
  - Limiting dependency on external software
  - Future maintenance will be easier
- Write tests that explore your understanding of such codes based on its intended usage (learning tests)



2.10. Refactoring

- Techniques:
  - Composing Methods
  - Moving features between objects
  - Organizing Data
  - Dealing with generalization
- Best Practices:
  - 3 in-depth classes
  - 10 files
  - Unit tests

3. Code Review

3.1. The Goal of Code Review

- Quality Control
  - Products
  - Codebase
- Self Growth
  - Hard Skills
  - Soft Skills
    - Presentation
    - Listening

3.2. Code Review Points

- Functionality
- Design
- Readability
- Consistency
- Testing
- Documentation
- **Good Things**

3.3. Code Review Process

- **Types:**
  - **Peer Review: Minor Changes**
  - **Group Review: Major Changes**
- Process:
  1. Reviewee (developer) completes feature / fix bugs
  2. Reviewee create MR (with context)
  3. Reviewee make sure that code is compiled, tested successfully
  4. Reviewee inform reviewer(s) to schedule code review
  5. Reviewer create checklist
  6. (optional) Reviewee implements fixes that is agreed in both sides
  7. Reviewer approves MR

3.4. Attitude

- **Polite**
- **Contribution**
- **Education without criticism**

3.5. How to Write Code Review Comments

- Be Polite
- Tell why
- Show approaches
- Labeling comments:
  - **TODO (Critical)**
  - NIT (Nitpick)
  - OPTIONAL
  - FYI (For Your Information)

3.6. Best Practices

- **Less is more. Small Commit** → Short Review → Better Code
  - Google: ~250 lines of code / CR
  - < 400 lines of code / CR
- Checklist
- Leverage Tools such as Static Code Analysis
- Speed up code review

3.7. Resolving Conflicts

- Listen and understand ideas of both sides
- Analyse pros and cons of solutions
- Determine the context
    - **Ordering the priorities of characteristics, requirements at the moment**
- Choose the right solution according to the context
- What if both sides still have no same view?
    - **PoC (Proof of Concept)**
    - **Expose the problem** to:
        - The whole team
        - Tech Lead / SA
        - Head of Engineer

Recap

- Fourable:
  - Readable
  - Maintainable
  - Testable
  - Scalable
- Abstraction reduces complexity
- Inconsistency → Unknown unknowns
- Read, practice and practice
- Clean Code is not goal, consider other factors: speed of market delivery, collaboration, …

References

- 2 Hard Things: https://martinfowler.com/bliki/TwoHardThings.html
- Quotes: Quotes on Design -
- Principles:
  - SOLID: https://www.freecodecamp.org/news/solid-principles-explained-in-plain-english/
  - KISS: https://people.apache.org/~fhanik/kiss.html
- Books:
  - Best tips and tricks in the world of Clean Coding: https://libgen.rocks/ads.php?md5=481473f6104d2f187dfcc11c340ca4f3
  - Clean Code: https://libgen.rocks/ads.php?md5=838cc6ac8cb0d8ddb98fdb1ae0c8a443
  - https://testing.googleblog.com/2023/11/write-clean-code-to-reduce-cognitive.html
- Talks:
  - https://www.youtube.com/watch?v=YtQGQ9Eg0Lo
  - https://www.youtube.com/watch?v=UjhX2sVf0eg
  - https://www.youtube.com/watch?v=c40HPauhawQ

Homework

- Refactor then show >= 300 lines of code in your project ? (any project).
- Nice to have:
  - Multiple class
  - Functions
  - Domain business or complex logic
  - The less comments, the better
- Note:
  - Do not include trivial code such as getter, setter, …
  - Do not include sensitive info of projects/companies

Thank you 🙏