iTechArt

Software
Engineering
Services

Intro. OOP & FP. Scala basic syntax

Goals

- Repeat **Object Oriented** programming (**OOP**) paradigm
- Understand **Functional** programming (**FP**) paradigm
- Compare **FP** with **OOP**
- Make an overview of the **Scala** programming language
- Get familiar with **Scala** basic syntax

Object Oriented Programming

→

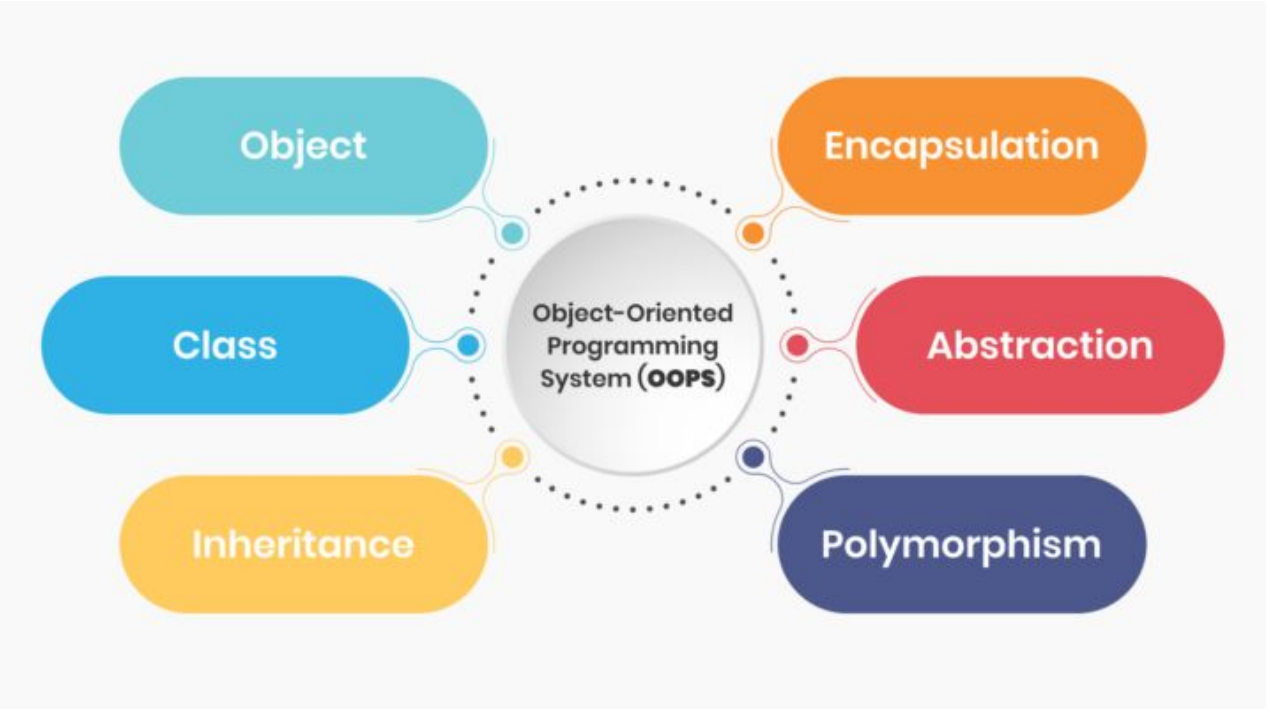
What is the greatest difficulty in software engineering?

- **Complexity**

What do I expect from my program besides doing the task correctly?

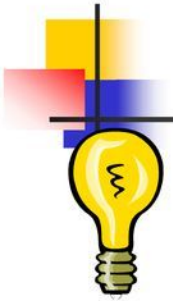
- easy to:
  - understand (**abstraction**)
  - change and refactor
  - add new features
- modular reusable and flexible code
- effective problem solving

Object Oriented Programming



Object Oriented Principles

Examples of Objects



LightBulb

- **state/attributes**
  - on (true or false)
- **behavior**
  - switch on
  - switch off
  - check if on

Car

- **state/attributes**
  - # of gallons of gas in tank
  - total # of miles run so far
  - efficiency (mpg)
- **behavior**
  - drive
  - load gas
  - change efficiency
  - check gas
  - check odometer reading

BankAccount

- **state/attributes**
  - balance
- **behavior**
  - deposit
  - withdraw
  - check balance

Note

- **each object is an "instance" of that "type" of object**
- **each instance has its own values for its attributes**
  - e.g., different accounts can have different balances

What is the greatest difficulty in software engineering?

- Complexity
  - Software systems get replaced not when they wear out but when they crumble under their own weight because they have become too complex

Where does the complexity come from?

- Changing requirements
- Changing developers
- Attitudes

… we aren’t sure!

Software generally becomes **more complex** the **older** it gets. Constant fight!

Why functional programming?

Because it removes one important **dimension** of **complexity**

- *To understand a program part (a function) you need no longer account for the possible **histories** of executions that can lead to that program part*

What is Functional Programming?

- Process of building software by
  - composing **Pure Functions** (**Referential Transparency**)
  - avoiding
    - **Mutable Data**
    - **Side Effects**
    - **Shared State**

- Application state flows through
  Pure Functions

Functional Programming examples

How does functional code look like?

```scala
def double(i: Int): Int = i * 2

def isPrime(n: Int): Boolean =
  n != 1 && (2 until n).forall(n % _ != 0)

def pureFunction(name : String): String = s"My name is $name"

def impureFunction(name : String): Unit = println(s"My name is $name")
```

Functional Programming

Pros

- Pure functions much easier for parallelization and composition
- Declarative style of programming helps to define complex logic in a smaller piece of code
- Testing (especially Unit Testing)
- Ability to define pure core of your application
- Horizontal scalability

Cons

- High entry threshold comparing with OOP
- Difficult to switch your thinking from imperative to functional way

So what is better?

OOP vs FP

Encapsulation
Abstraction
Inheritance
Polymorphism

Pure Functions
Immutable Data
Referential Transparency
No side effects

Or use them together! Hybrid or synergy

Scala

→

Scala in production

Big Data, Data Science

Apache Flink

Backend

Scala programming language

- Statically typed + Exhaustiveness checking
- Object oriented
- Functional (contains various features and tools to build true functional code)

  - Higher order functions
  - Carrying
  - Match Expression
  - For Expression
  - Monads
  - Various frameworks and libraries (http4s, slick, doobie, cats, zio, akka ...)
  - ...

- JVM language
- Backward compatible with Java
- ~~Slow~~ Complex Compiler

Scala in production

How Tech Giants use Scala

- Linkedin
- Twitter
- Netflix
- Tumblr
- Foursquare
- AirBnB

Scala in production

Twitter Technological Stack

- Originally built as a **Ruby on Rails** app (everything was pleasant due to scaling problem)
- Almost all *backend services* are moved to **Scala**
  - Though there is some use of plain **Java**
  - A few services are still in **Ruby on Rails**
  - Some services where **performance** is extremely important are using **C++**
- **Java**, **Kotlin**, **Objective-C**, **Swift** in *Mobile Development*
- **Python** is much more common on *Internal tools side* (also Bash)
- **Javascript with React** on the *UI*

Scala and other JVM languages

Scala and **Java**

- Less amount of code even comparing with Java 8+ (2-3 times)
- More expressive
- (Scala) Poor support with such code quality tools like Sonar Lint/Cloud

Scala and **Groovy**

- Statically typed

Scala and **Kotlin**

- More production development
- Different use cases in production
- Rich libraries and frameworks ecosystem
- More tools for implementing true and complete FP

Scala Community

- What's next for Scala?

Resources

Books:

- Essential Scala
- Functional Programming in Scala
- Practical FP in Scala: A hands-on approach

Other:

- Tour of Scala & Scala Book from scala-lang.org
- Rock the JVM courses - video courses
- Scala Exercises - for practicing
- Coursera Scala Specialization

Scala Basic Syntax

→