# AntiPatterns & Code Smell

## Software Modeling

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# Outline


1. Model-View-Controller Pattern
2. Design Principles underlying Design Patterns
3. Anti-Patterns & Code Smells


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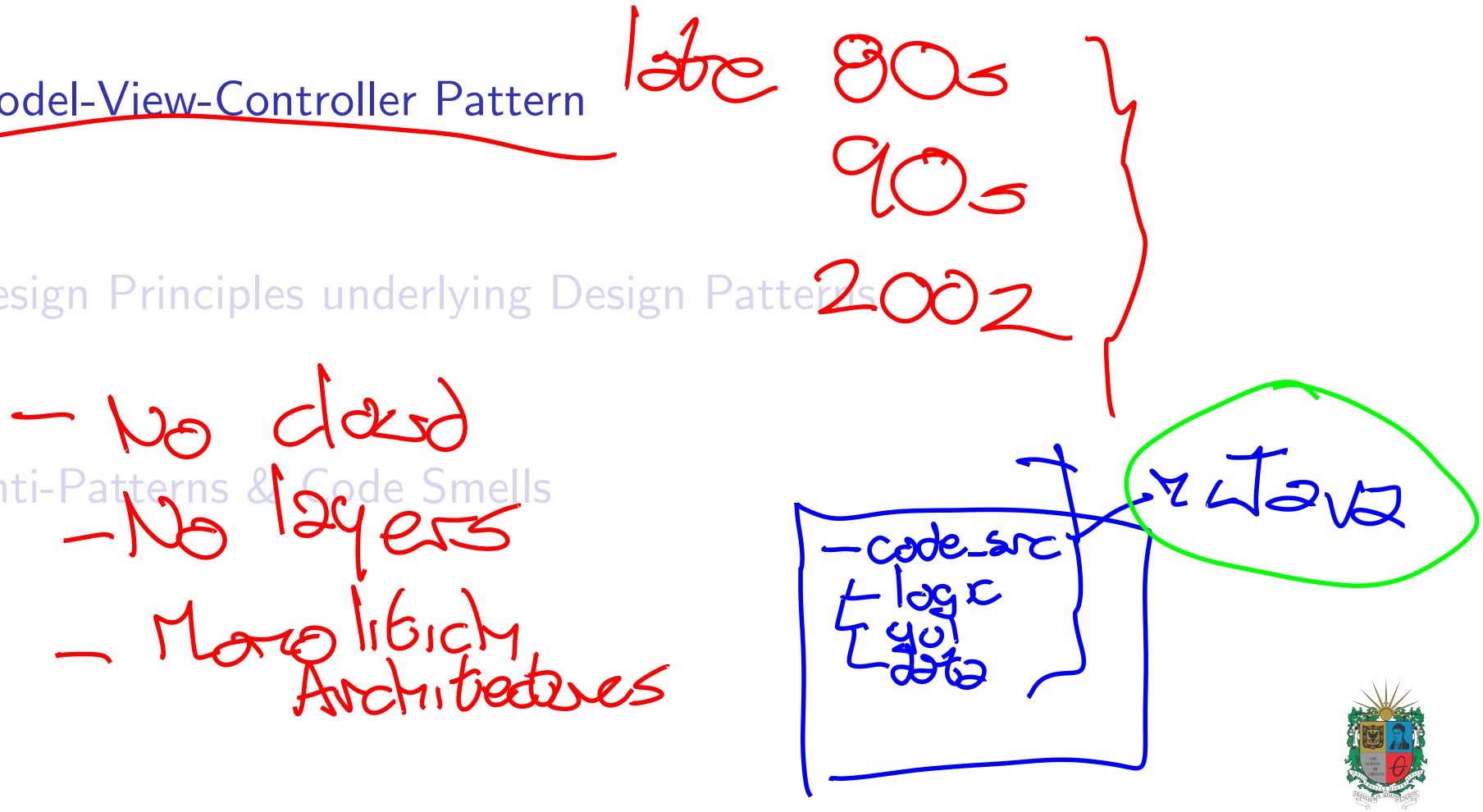
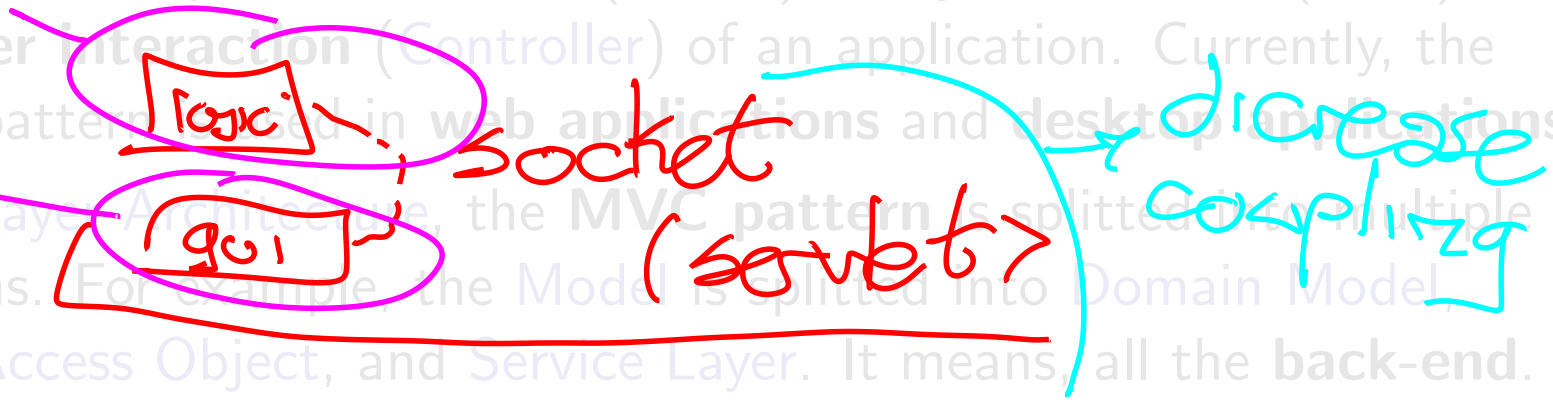


# MVC Pattern

- **Model-View-Controller** is a software design pattern. It is used to separate the concerns of an application. It means, modularize the application with loose coupling.




- It is used to separate the **data** (Model), the **presentation** (View), and the **user interaction** (Controller) of an application. Currently, the MVC pattern is used in **web applications** and **desktop applications**.
- With Layer Architecture, the **MVC pattern** is splitted in multiple patterns. For example, the Model is splitted into Domain Model, Data Access Object, and Service Layer. It means, all the **back-end**.
- The View is splitted into Template View, Composite View, and Transform View. It means, all the **front-end**.
- The Controller is splitted into Front Controller, Application Controller, and Request Dispatcher. It means, all the connection with **back-end**.

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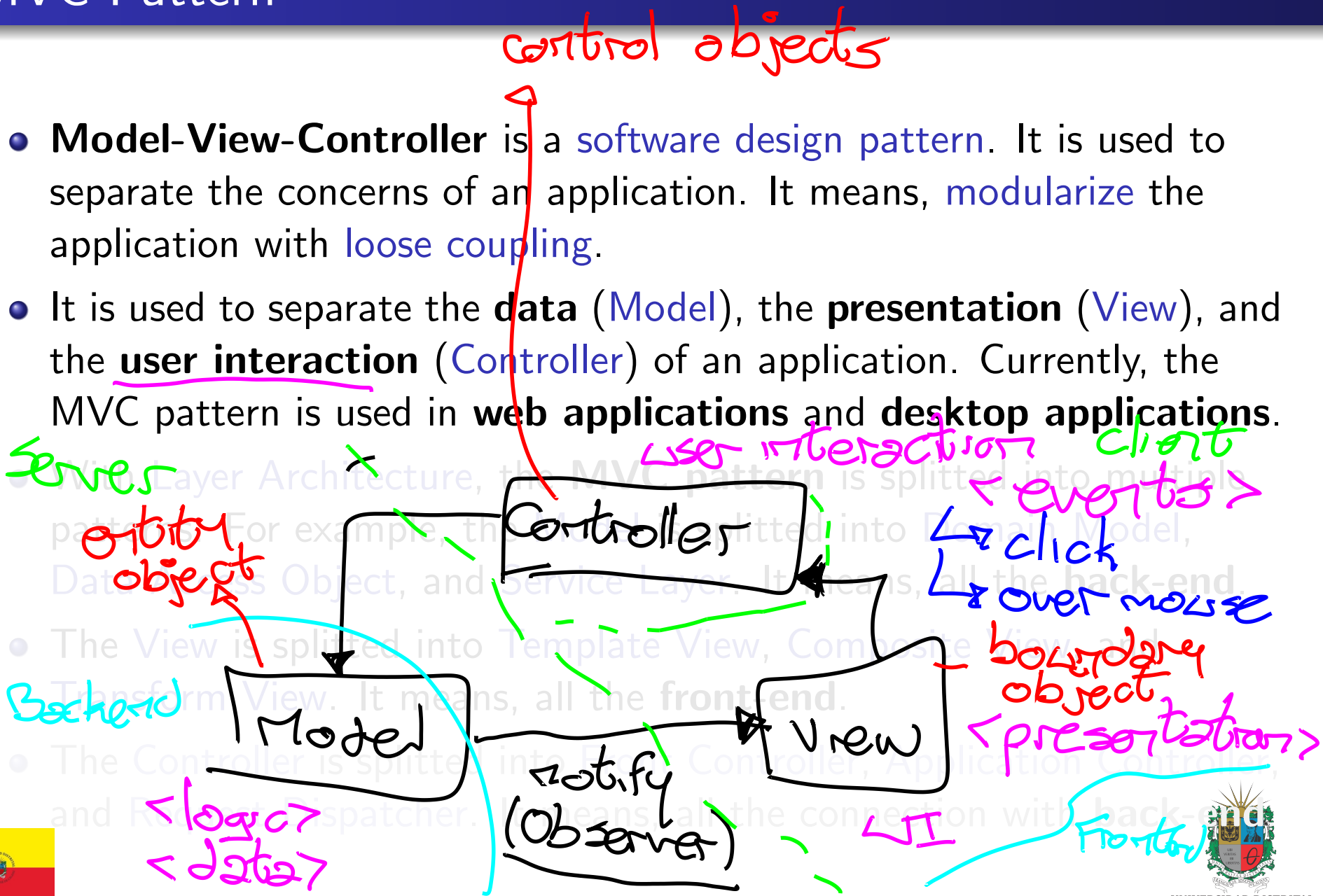

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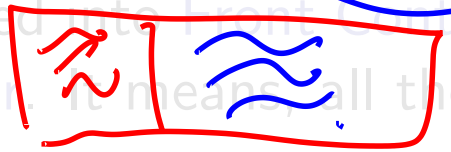

ReactJS
AngularJS

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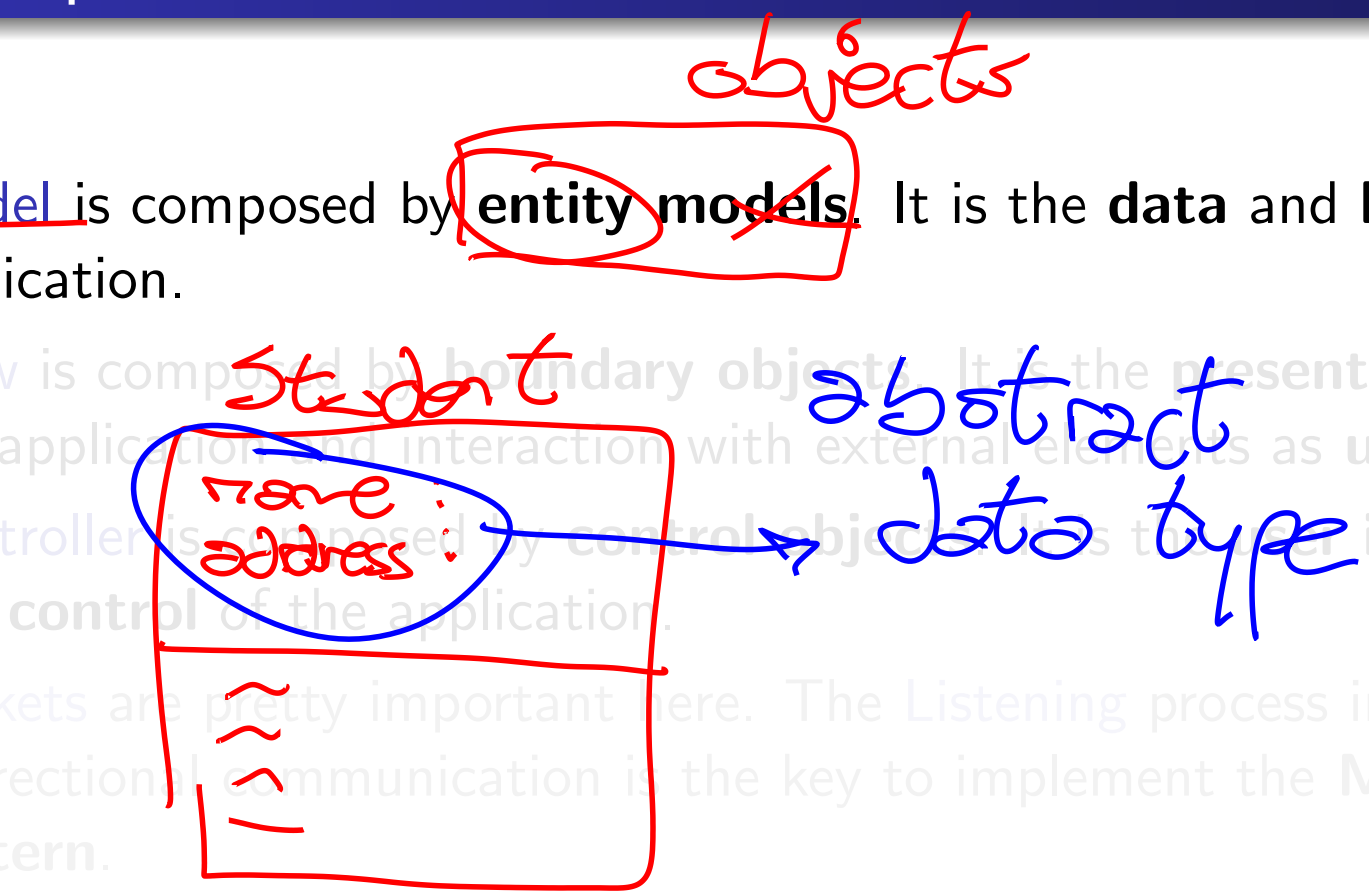
# MVC Implementation

- Model is composed by **entity models**. It is the **data** and **logic** of the application.
- View is composed by **boundary objects**. It is the **presentation** of the application and interaction with external elements as **users**.
- Controller is composed by **control objects**. It is the **interaction** and **control** of the application.
- Sockets are pretty important here. The Listening process in a bidirectional communication is the key to implement the **MVC pattern**.
- The Observer pattern is used to notify the **View** when the **Model** changes.
- The Strategy pattern is used to change the **Controller** behavior.

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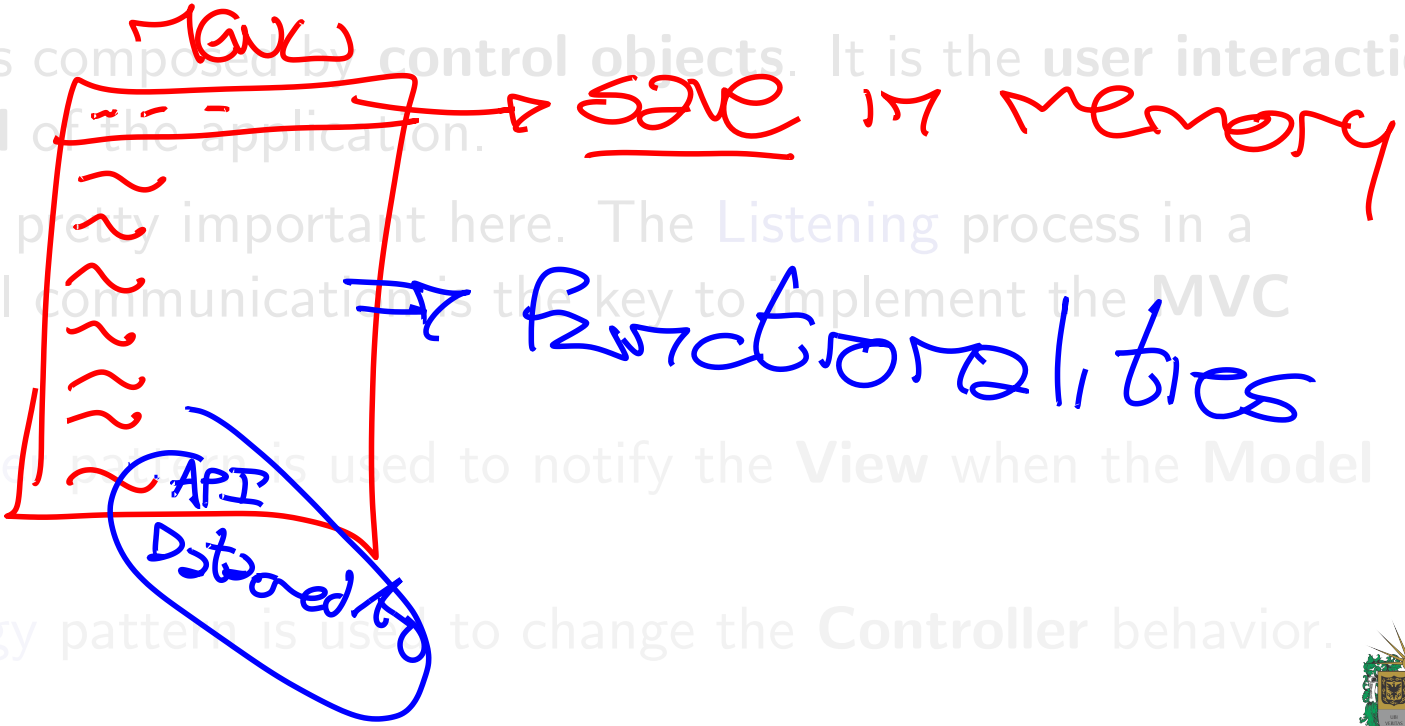


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FastAPI → Pydantic

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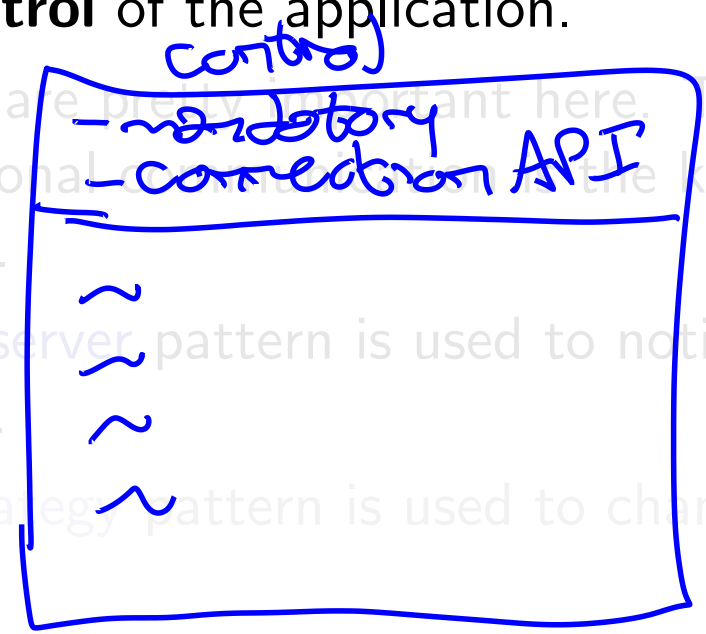


func(input-front)
return output-back
↳ invoke backend

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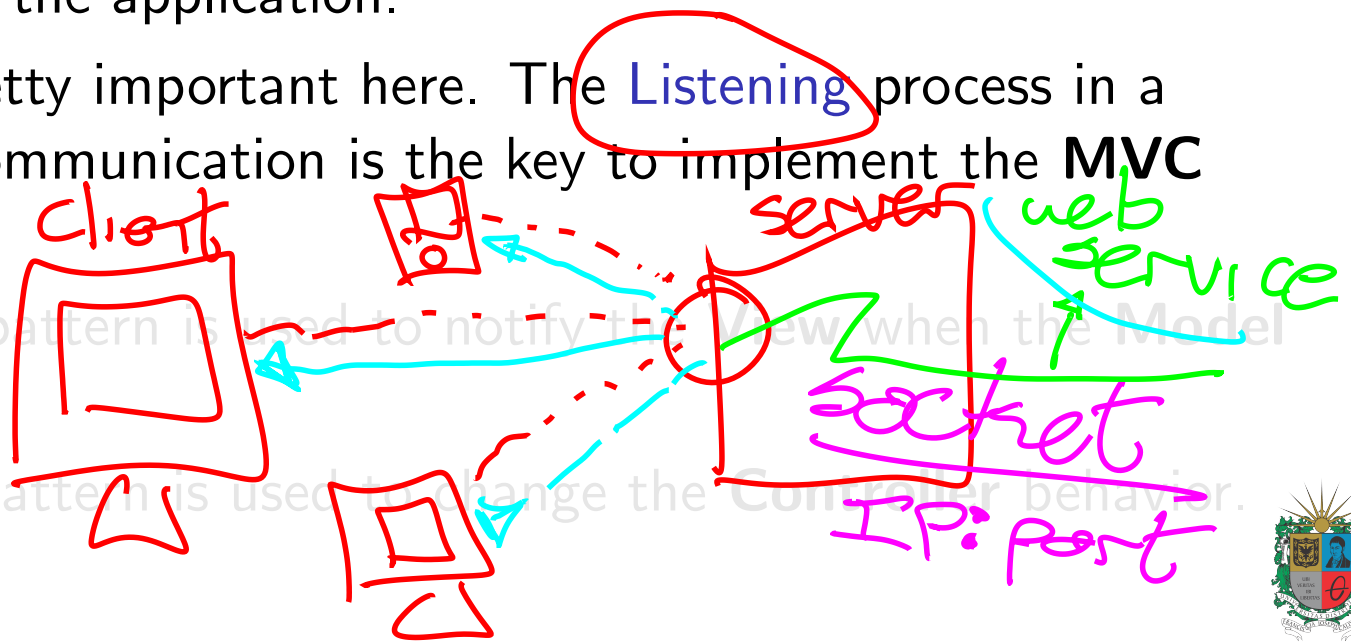




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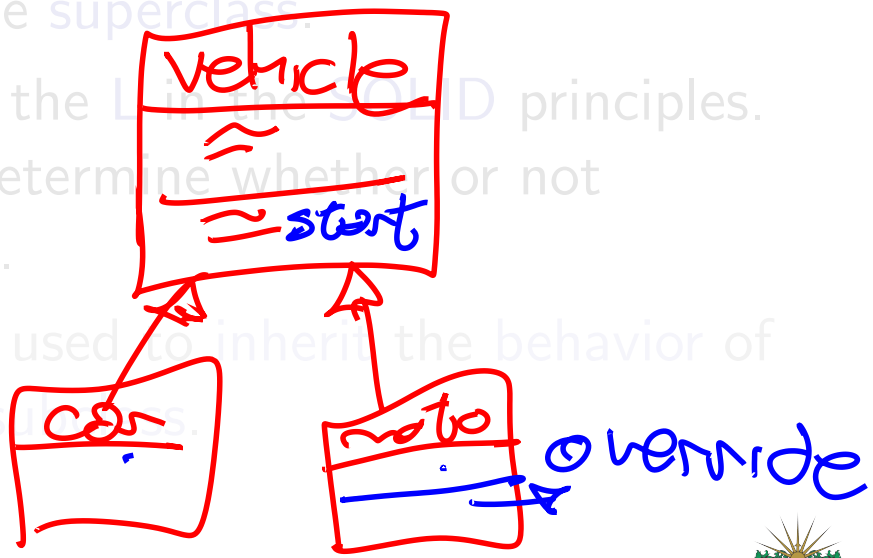
# Liskov Substitution Principle

Functionality ≠ expected output

- **Liskov Substitution Principle** is a design principle that states that objects of a superclass should be replaceable with objects of its subclasses without affecting the functionality of the program.

vehicle.start()

car.start()

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- It means, the subclass should be able to extend the superclass without changing the behavior of the superclass.
- The Liskov Substitution Principle is the L in the SOLID principles. This principle uses substitution to determine whether or not inheritance has been **properly used**.
- The Liskov Substitution Principle is used to inherit the behavior of the superclass and extend it in the subclass.

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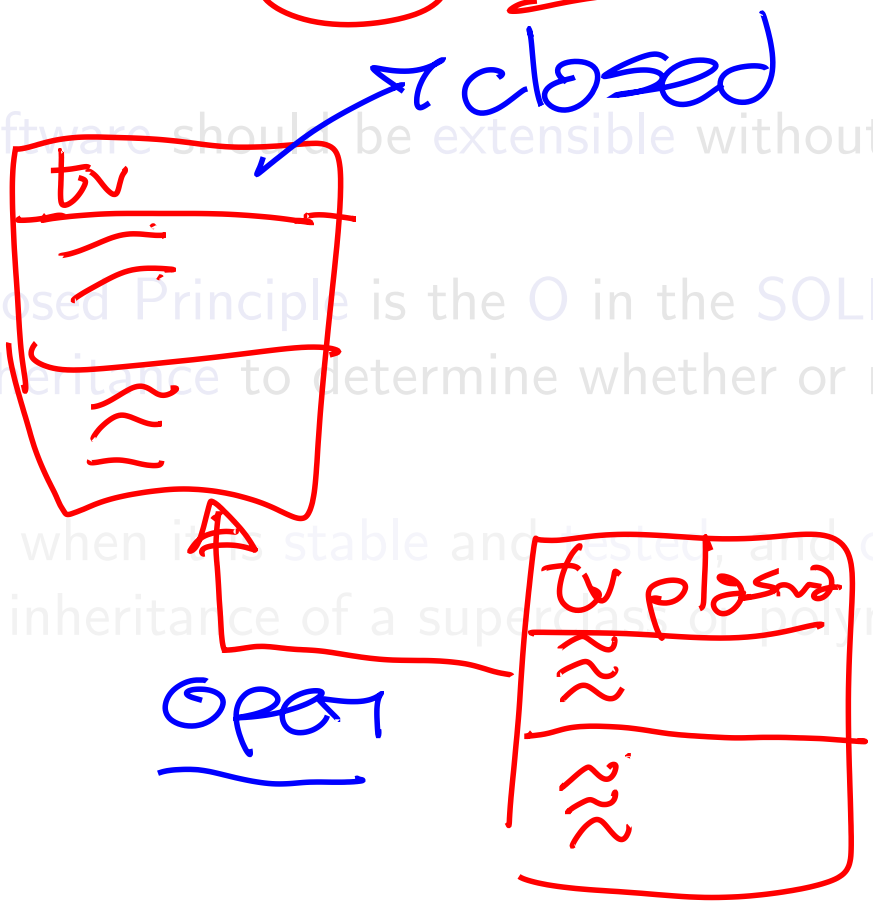
# Open — Closed Principle

- **Open — Closed Principle** is a design principle that states that software entities should be open for extension but closed for modification.
- It means, the software should be extensible without changing the source code.
- The Open — Closed Principle is the O in the SOLID principles. This principle uses inheritance to determine whether or not the software is **extensible**.
- A class is closed when it is stable and tested, and open when it is extensible using inheritance of a superclass or polymorphism from an abstract class.



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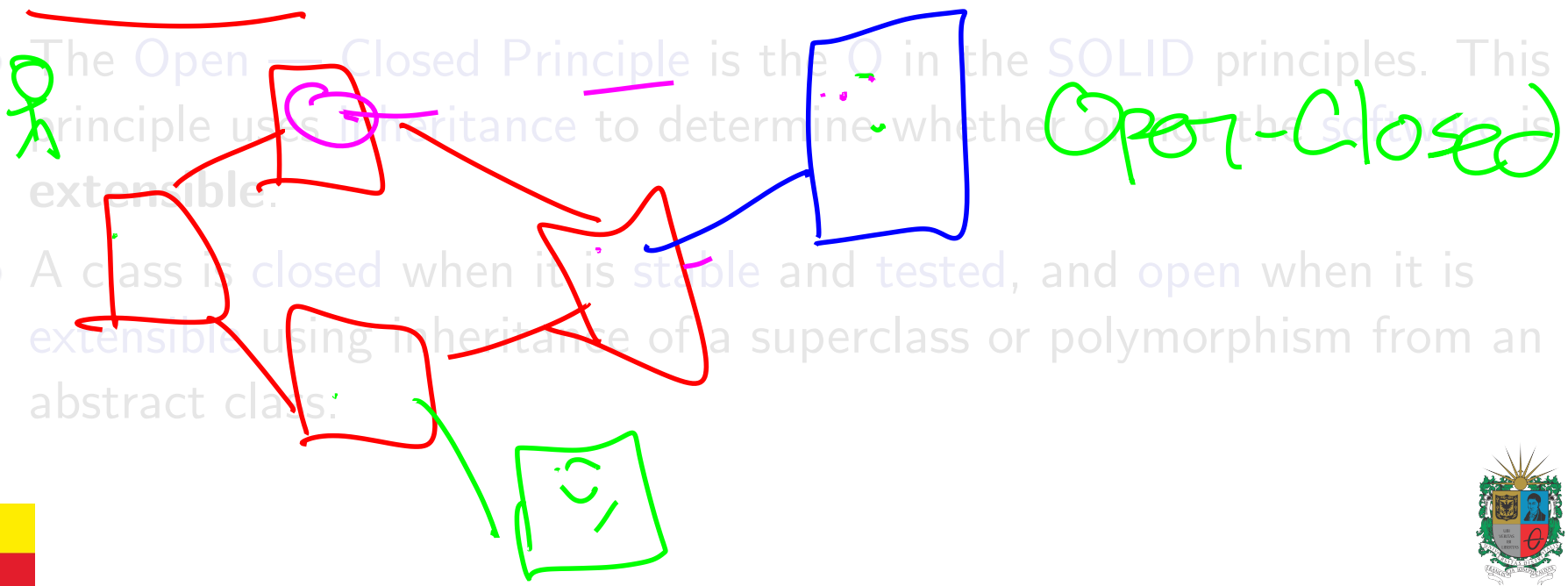


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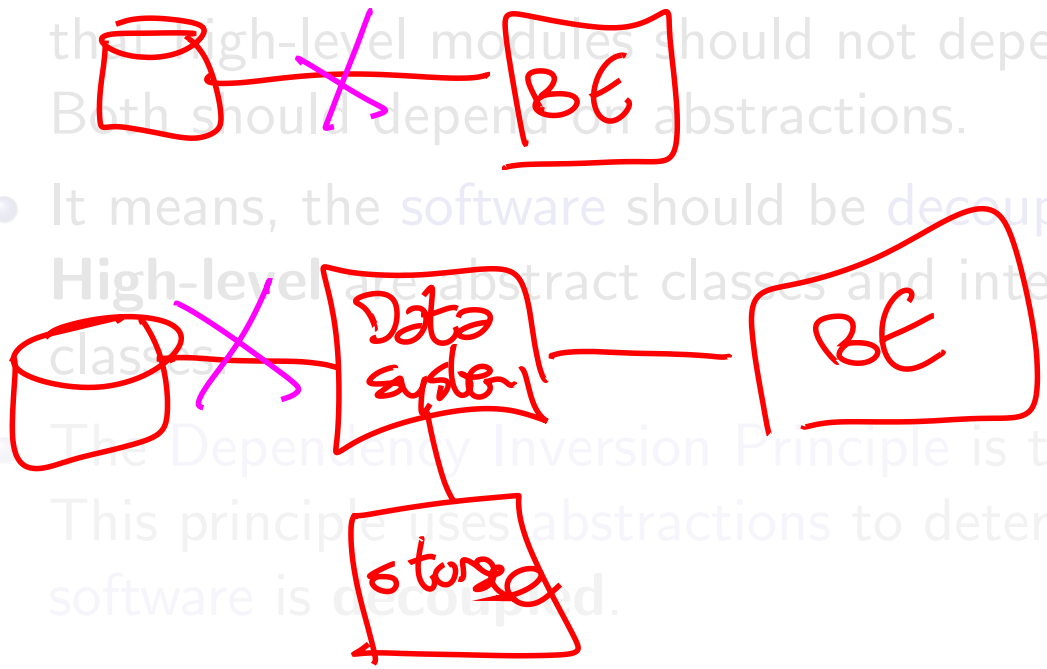
# Dependency Inversion Principle

- A common problem is: *To what degree is my system, or subsystems, dependent on a particular resource?* - Coupling




- **Dependency Inversion Principle** is a design principle that states that high-level modules should not depend on low-level modules. Both should depend on abstractions.
- It means, the software should be decoupled with abstractions. **High-level** are abstract classes and interfaces, **low-level** are concrete classes.
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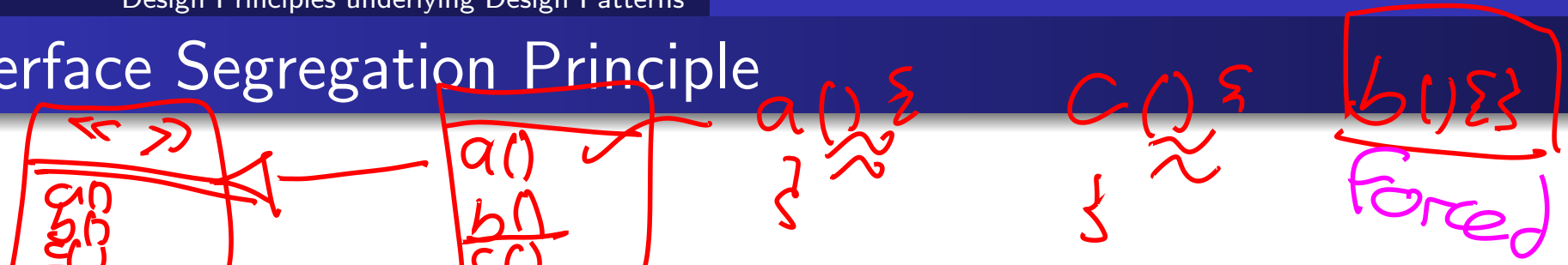
# Composing Objects Principle

- **Composing Objects Principle** is a design principle that states that software entities should be composed of objects.
- It means, the software should be composed of objects to modularize the software.
- The Composing Objects Principle is used to reduce coupling and increase cohesion in the software.
- This principle states that classes should achieve code reuse through composition or aggregation rather than inheritance.
- Design patterns like Composite and Decorator are used to implement the Composing Objects Principle.
- The disavantage of this principle is that it can increase the number of objects in the software. It reduces options of share code.

# Interface Segregation Principle



- **Interface Segregation Principle** is a design principle that states that a client should not be forced to implement an interface that it does not use.
- It means, the software should be composed of interfaces to modularize the software.
- The Interface Segregation Principle is the I in the SOLID principles. This principle uses interfaces to determine whether or not the software is **modularized**.
- This principle states that a class should not be forced to implement interfaces that it does not use. A big interface is split into smaller interfaces.

# Principle of Least Knowledge

- **Principle of Least Knowledge** is a design principle that states that a software entity should not have knowledge of unnecessary details.
- The Principle of Least Knowledge is used to modularize the software with objects.
- The Law of Demeter is a specific case of the Principle of Least Knowledge. It states that a software entity should only have knowledge of its immediate friends.
- Classes should only have knowledge of their attributes and methods. They should not have knowledge of the attributes and methods of other classes.

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# Bad Coding

- **Bad Coding** is a software design problem that states that the code is not well written.
- If the software has bad coding, it is not maintainable and extensible.
- Spaghetti Code is a bad coding that is difficult to understand and maintain.
- **Bad practices** as copy-paste code, hardcoded values, and magic numbers are bad coding.

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# Code Quality

- **Code Quality** is a process to validate that the code is well written.
- Metrics as code coverage, cyclomatic complexity, and code smells are used to measure the code quality.
- Code Review is a process to validate that the code is well written by another developer.
- Unit Testing is a process to validate that a small fragment of code is working as expected

# Anti—Patterns

- **AntiPatterns** are bad practices in software design.
- An AntiPattern is a pattern that is commonly used but is ineffective and counterproductive.
- AntiPatterns are used to identify and fix bad practices in software design.
- Techniques to avoid AntiPatterns are refactoring, code review, and unit testing.

# Identify and Fix Code Smells

- Identify Code Smells is a process to find the bad coding in the software.
- Fix Code Smells is a process to correct the bad coding in the software.
- To *identify* and *fix* code smells, the software should be refactored.
- Refactoring is a process to improve the software without changing the behavior.
- Techniques like code review and unit testing are used to identify and fix code smells.
- Linters and static analysis tools are used to identify and fix code smells.

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# Thanks!

# Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/software-modeling*

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