Object-Oriented Modelling

Object-Oriented Programming

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Outline

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Design Before Code

- **Design** should come before coding.
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business vocabulary

Design Based on the Problem

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- Focus on what needs to be solved, *not just* how to implement it.
- Use the **problem statement** to identify key objects and their *relationships*.

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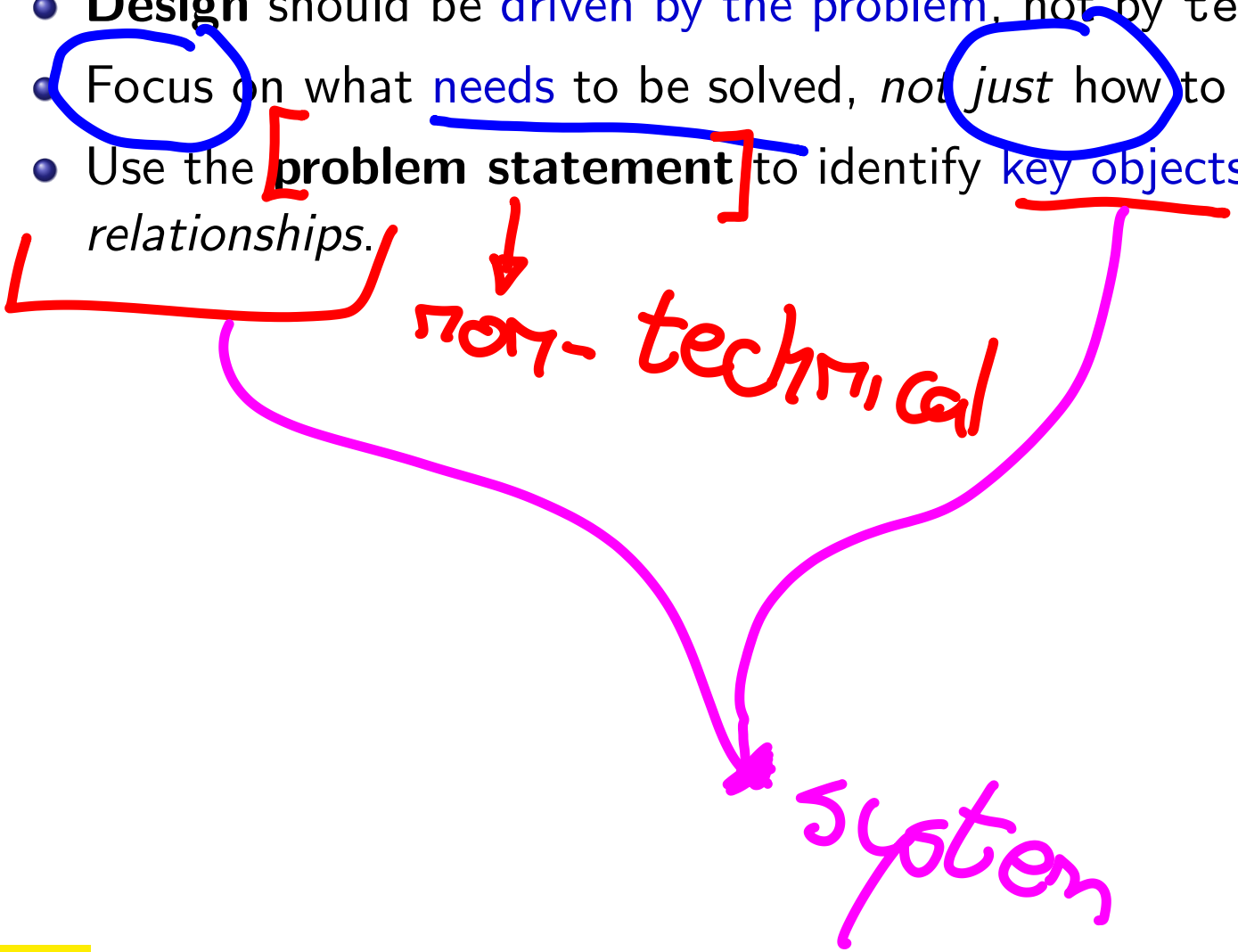


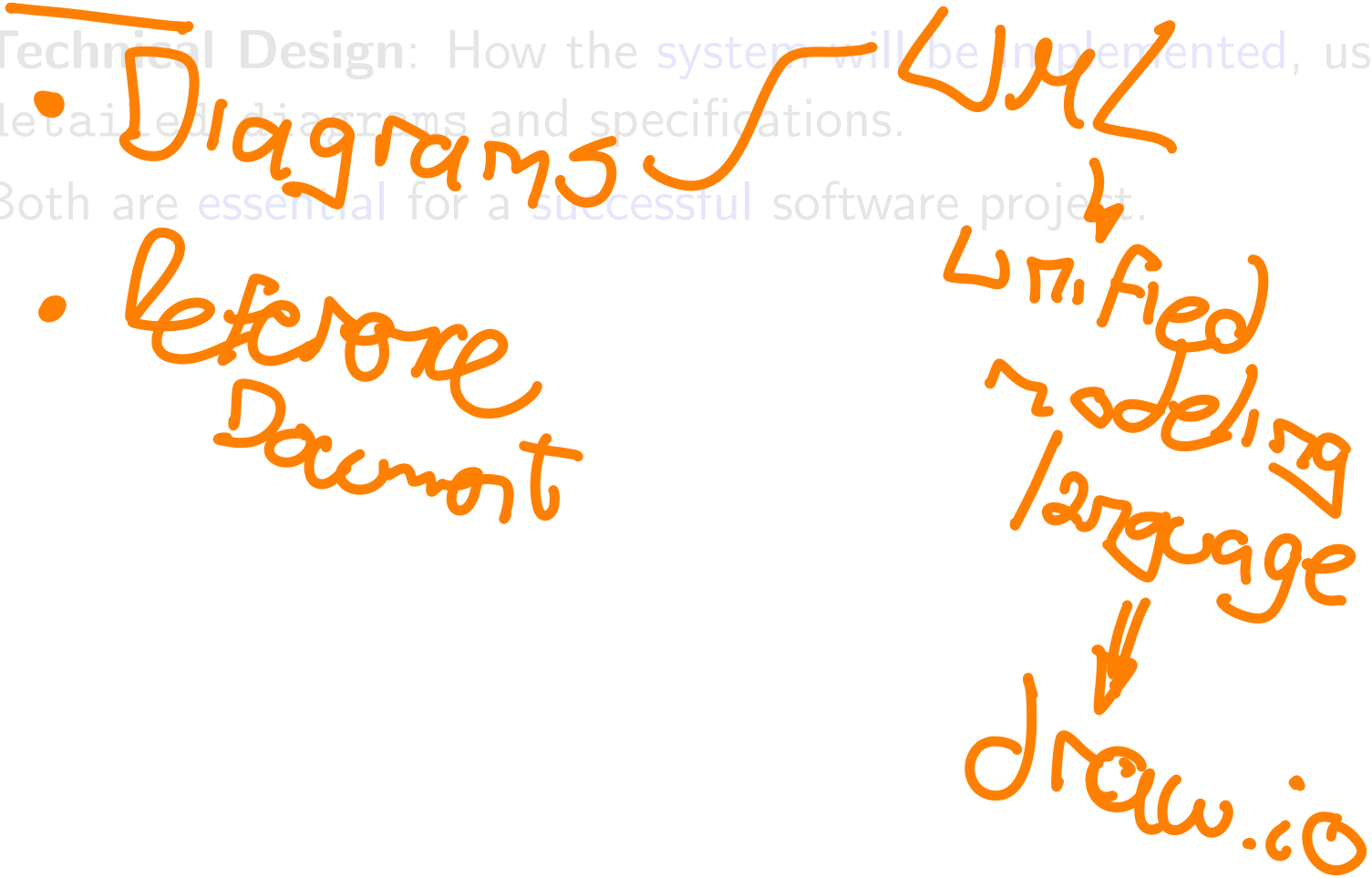
Object-Oriented Approach

- The **object-oriented approach** models the system as a collection of interacting objects.
- Each `object` represents a real-world entity or concept.
- **Objects** encapsulate data and behavior.

objects ← elements
relations

Conceptual Design and Technical Design

- **Conceptual Design**: What the system should do, using `high-level models`.
- **Technical Design**: How the system will be implemented, using detailed diagrams and specifications.
- Both are essential for a successful software project.



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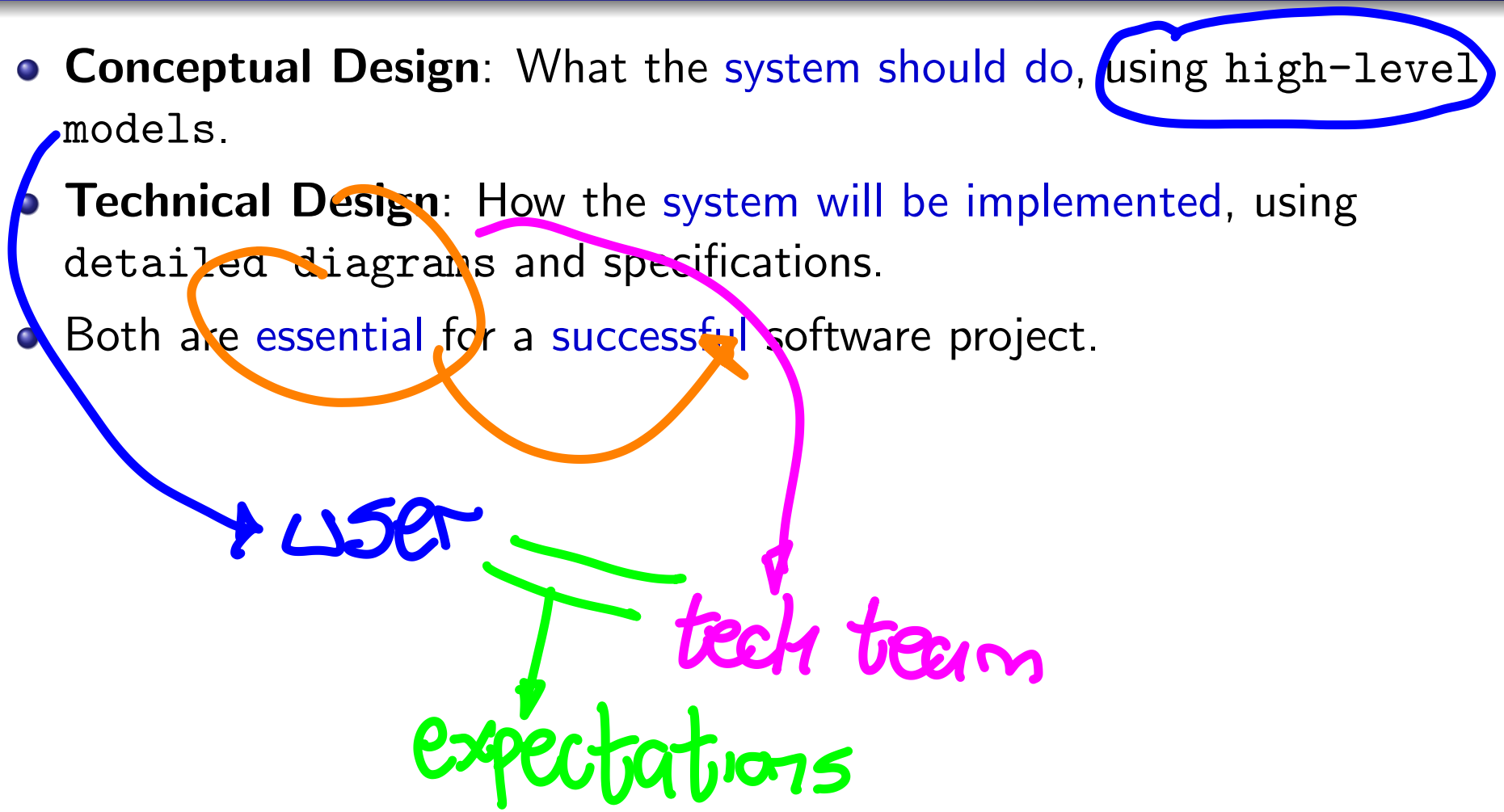

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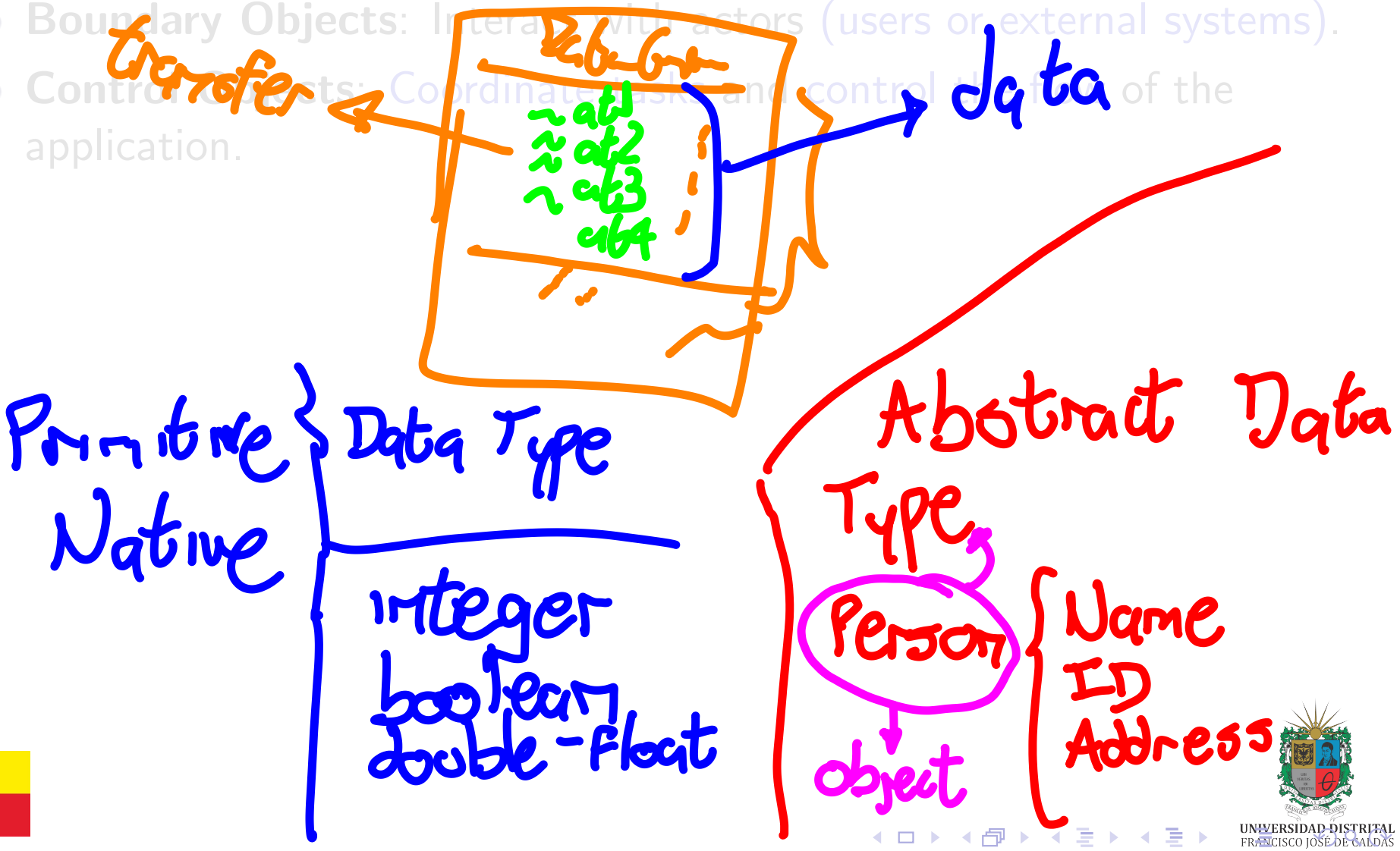
Categories of Objects

- **Entity Objects**: Represent information and data.
- **Boundary Objects**: Interact with actors (users or external systems).
- **Control Objects**: Coordinate tasks and control data flow of the application.



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Talk with Machines: Programming Paradigms

- **Programming languages** are tools to communicate with machines.
- **Paradigms**: Imperative, Procedural, Object-Oriented, Functional, Logic.
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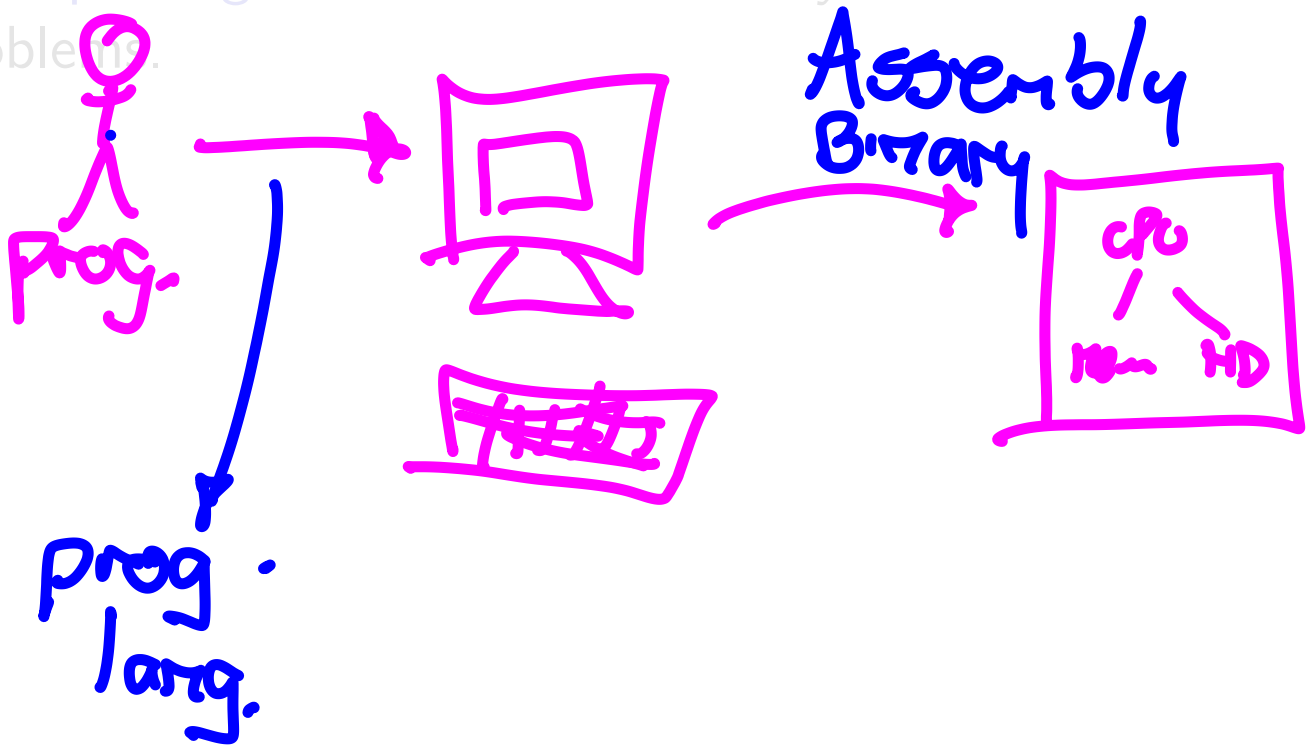

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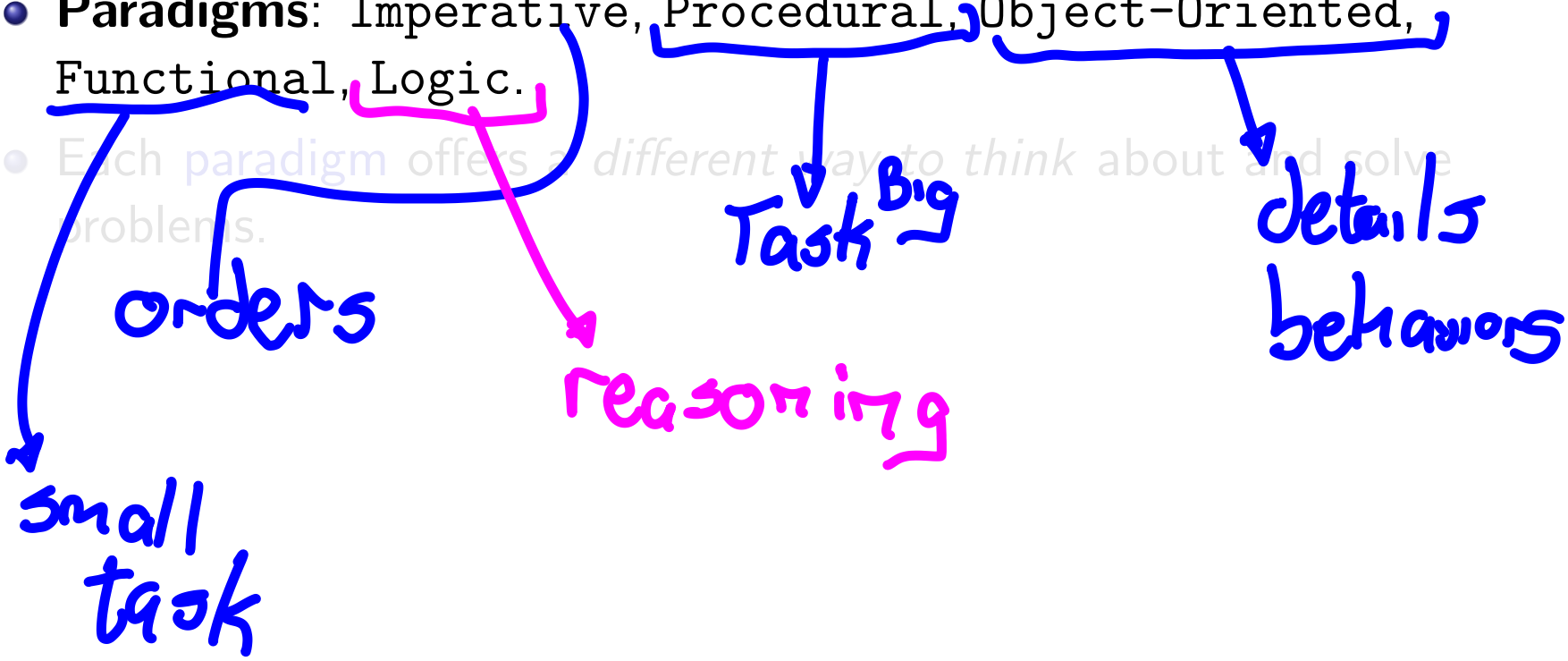

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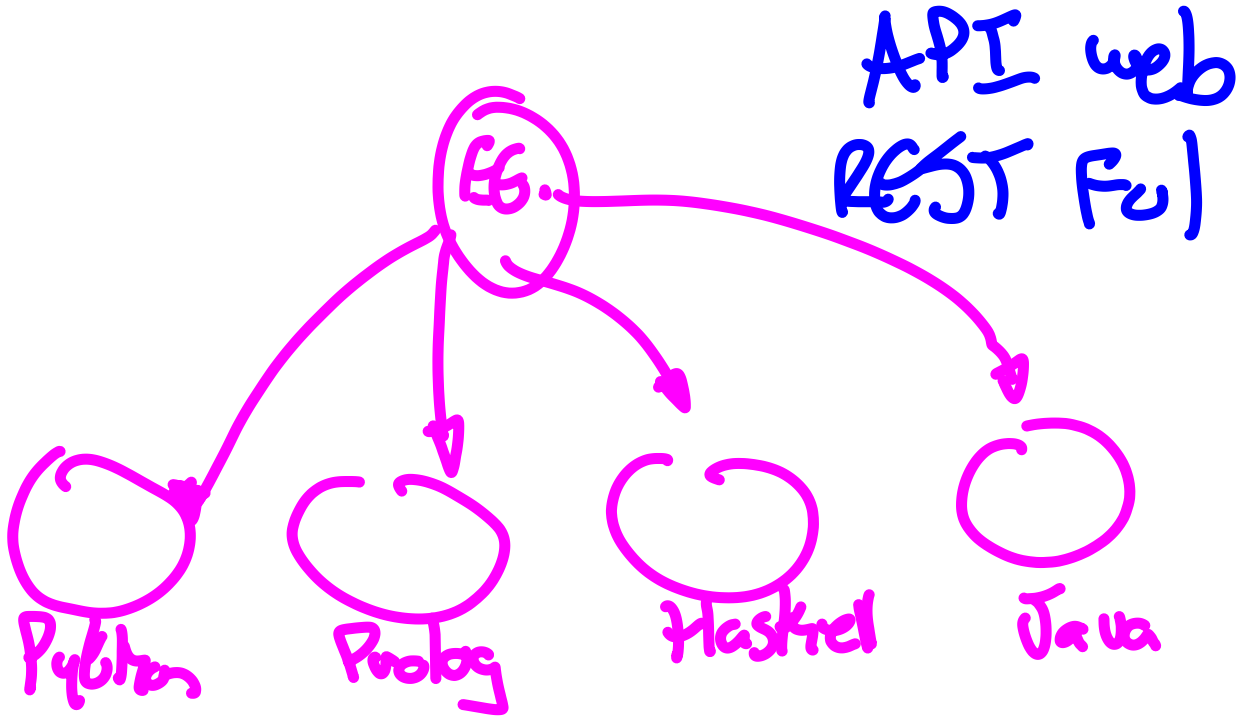
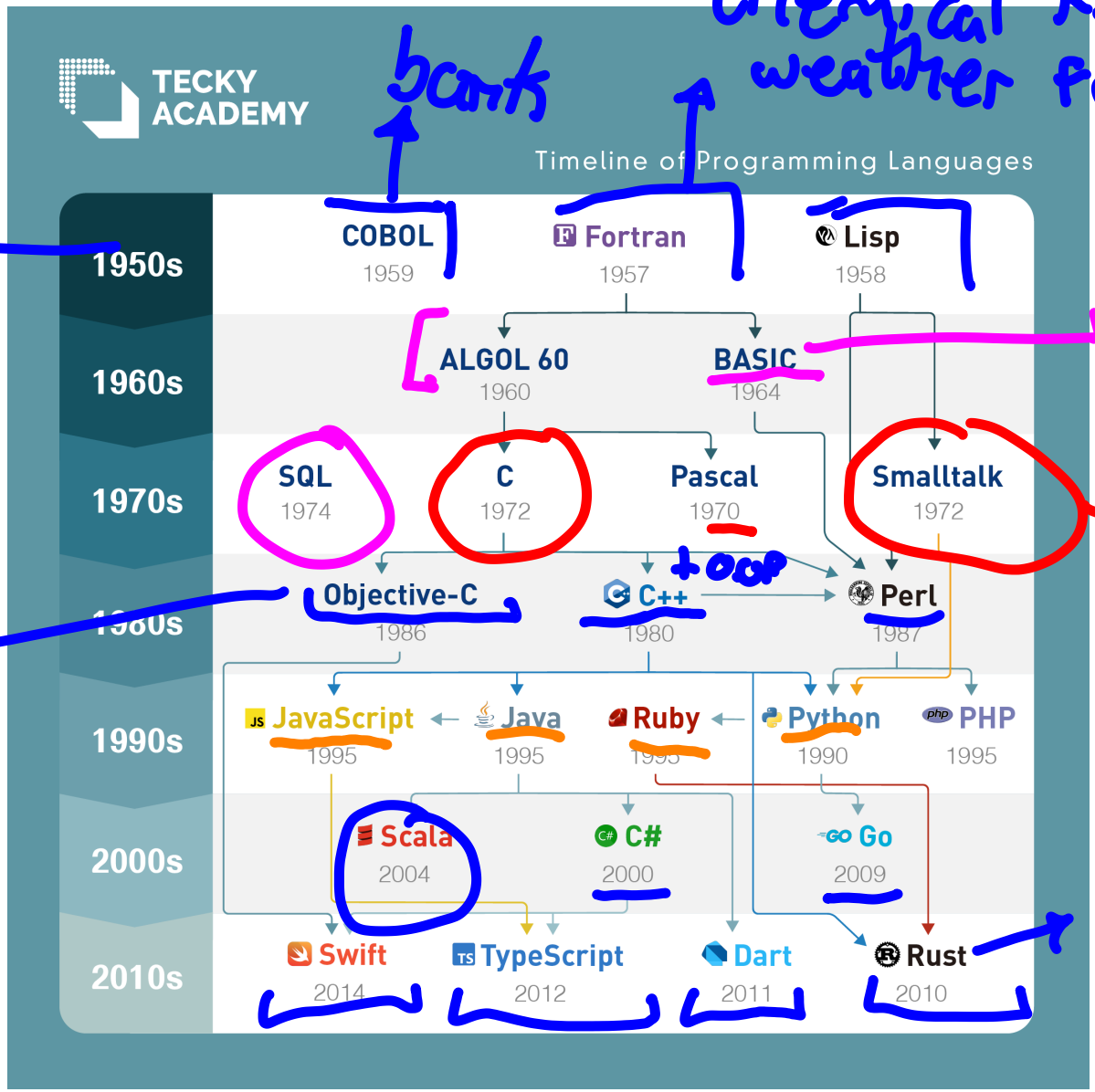


History of Programming Languages



Strategies to Solve Problems

- **Top-Down**: Start from the big picture and break it down into smaller parts.
- **Bottom-Up**: Start from small, well-defined components and integrate them into a complete system.
- Both strategies are useful and often *combined* in `software design`.

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Object-Oriented Design and Contracts

- **Object-Oriented Design (OOD)** organizes software as a collection of objects.
- **Contracts**: Define responsibilities and expectations between objects.
- **Contracts** help ensure correctness and robustness.

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UML Diagrams

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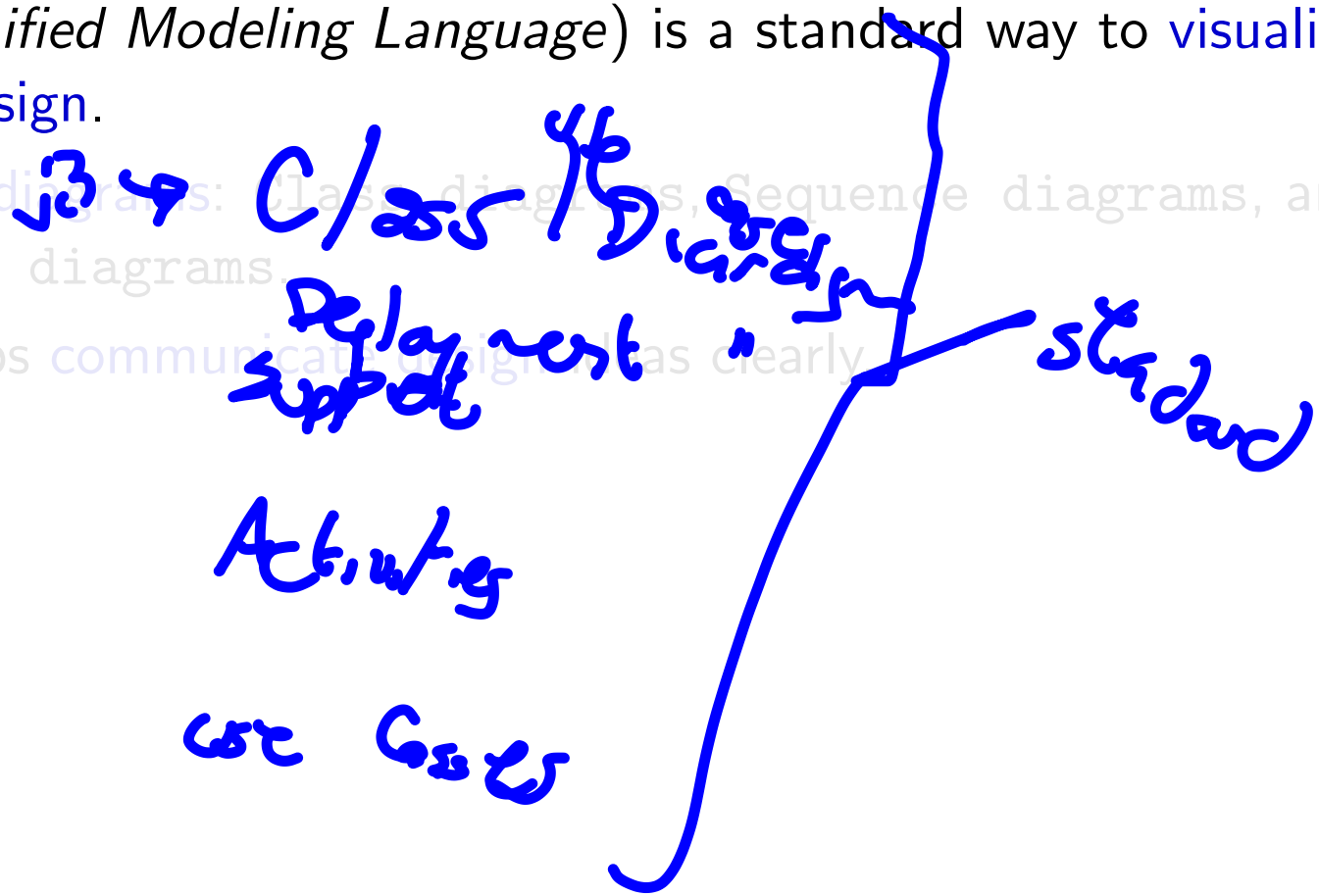
- Common diagrams: Class diagrams, Sequence diagrams, and Use case diagrams.
- **UML** helps communicate designs as clearly as possible.



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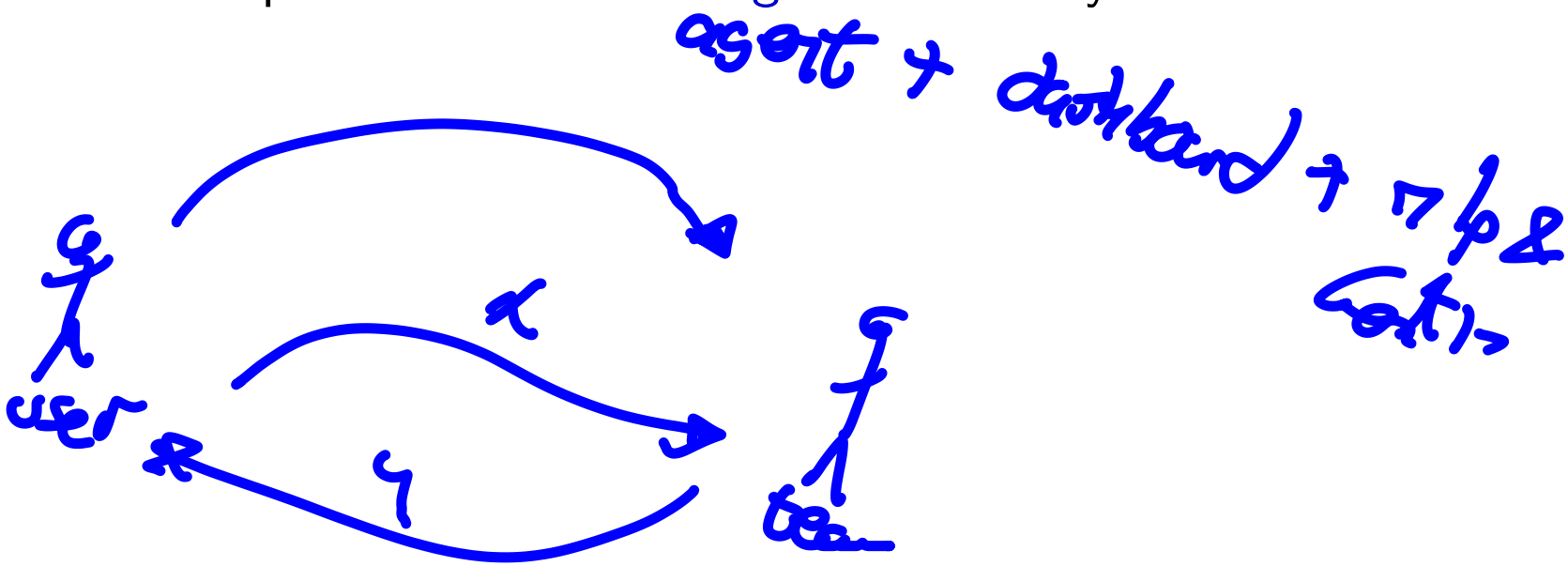

Class Diagrams

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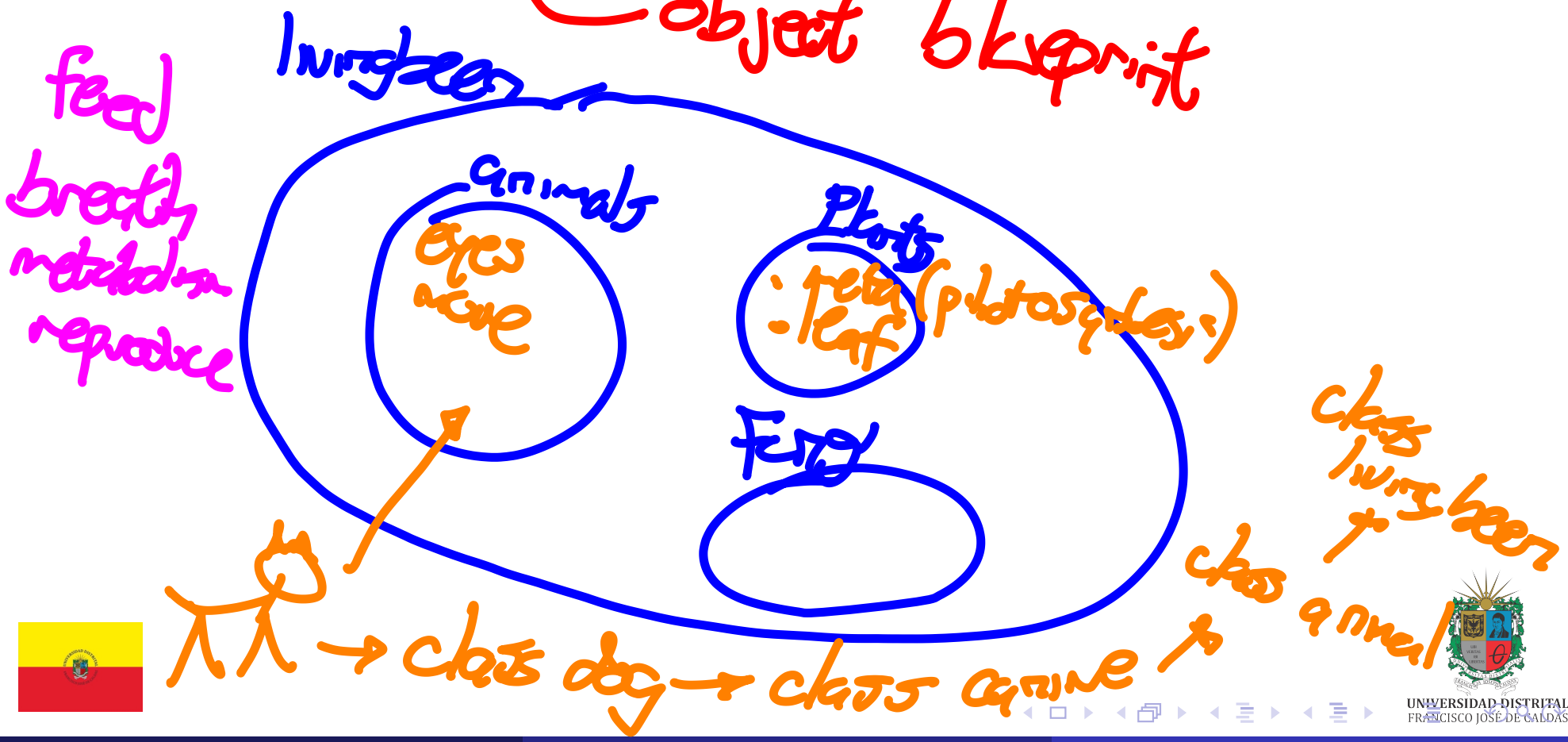
- They display **classes**, their attributes, methods, and relationships.
- Useful for both conceptual and technical design.



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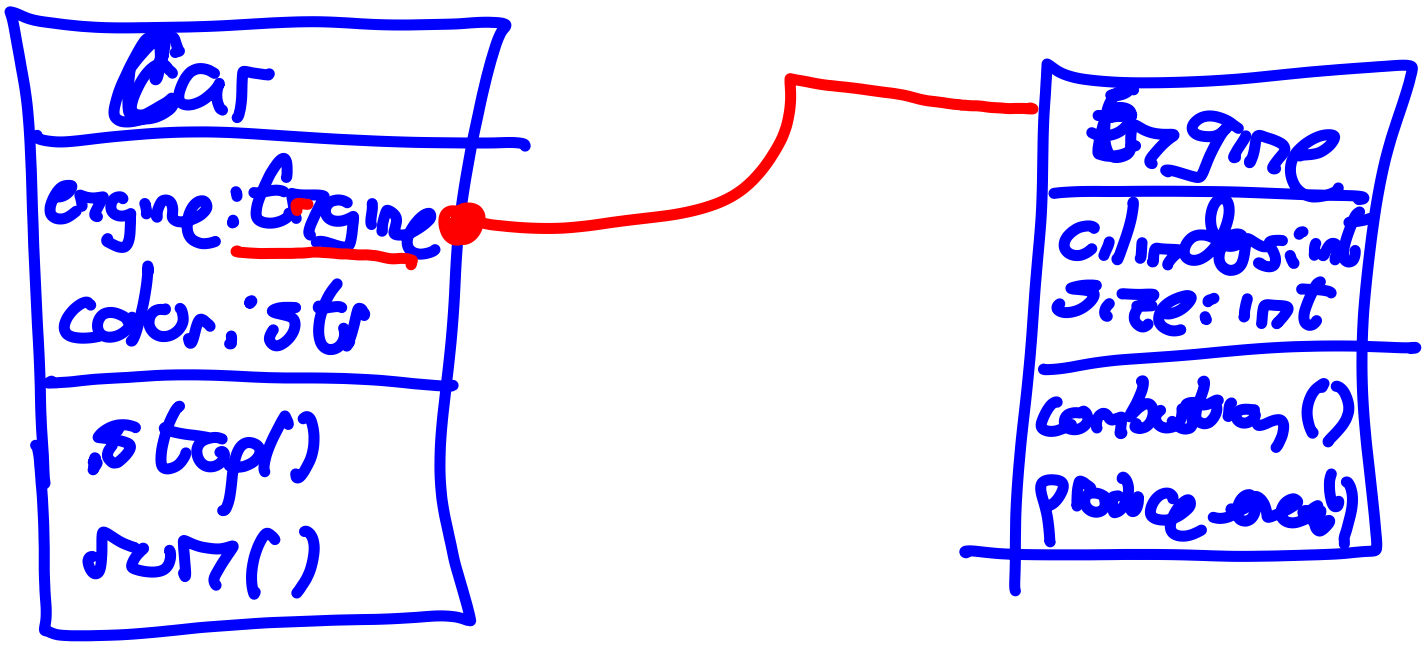

Abstraction

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- **Rule of Least Astonishment**: Design so users are not surprised by behavior.
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Abstraction & CRC Cards

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- **Encapsulation** bundles attributes and methods together.
- Expose only what is necessary (*access levels*: `public`, `private`, `protected`).
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Encapsulation & UML

Black Box Thinking

- **Objects communicate** through well-defined interfaces.
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- **Black box**: Focus on what an object does, not how it does it.

Demo time!

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- They help maintain data integrity by controlling how attributes are accessed and modified.
- Use them to enforce validation rules and business logic.

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Decomposition Example: Kitchen in a House

Association

A **relationship** between two classes where one class uses or interacts with another class.

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Aggregation

An **aggregation** is a **whole-part relationship** where one class is a part of another class, but can exist independently.

Demo time!

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Generalization

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- **D.R.Y. Principle**: Don't Repeat Yourself.
- `Behaviors` can be generalized using **inheritance**, interface inheritance, and abstract classes.
- **Polymorphism**: Objects can be treated as instances of their parent class.
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Inheritance & UML

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- **Open/Closed Principle (OCP)**: A class should be open for `extension`, but closed for `modification`.
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Good Practices

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Thanks!

Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/object-oriented-programming*

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