Object-Oriented Modelling

Object-Oriented Programming

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Outline

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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.

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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.
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- Includes requirements, design diagrams, user manuals, and code comments.
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Talk with Machines: Programming Paradigms

- **Programming languages** are tools to communicate with machines.
- **Paradigms**: `Imperative`, `Procedural`, `Object-Oriented`, `Functional`, `Logic`.
- Each paradigm offers a *different way to think* about and solve problems.

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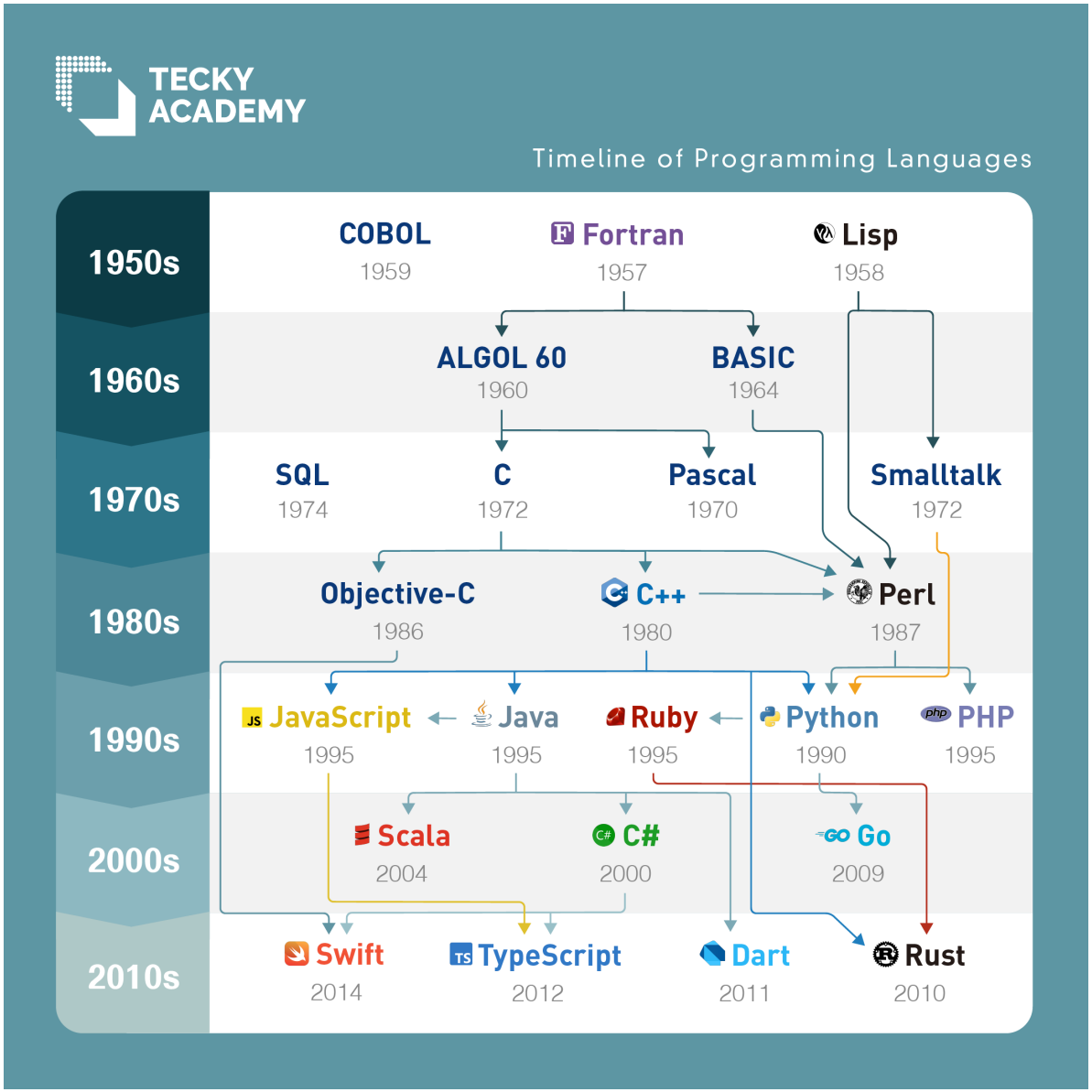
History of Programming Languages



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

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- **Contracts**: Define responsibilities and expectations between objects.
- **Contracts** help ensure correctness and robustness.

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- Common diagrams: `Class diagrams`, `Sequence diagrams`, and `Use case diagrams`.
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- **Rule of Least Astonishment**: Design so users are not surprised by behavior.
- Consider context, basic attributes, and basic behaviors when *designing abstractions*.

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Abstraction & CRC Cards

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Encapsulation

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- Expose only what is necessary (*access levels*: `public`, `private`, `protected`).
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Data Integritry: Getters and Setters

Encapsulation & UML

Decomposition

- **Decomposition**: Divide and conquer by breaking the system into smaller parts.
- **Separation of Concerns**: Each part should have a clear responsibility.
- Consider **object** lifetime, association, aggregation, and composition.

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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.

Aggregation

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

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Composition

A **stronger whole-part relationship** where one class is a part of another class and cannot exist independently.

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Generalization

- **Generalization** eliminates redundancy by extracting common features.
- **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.
- **Types of inheritance**: `single`, `multiple`, `interface-based`.

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Inheritance & UML

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Thanks!

Questions?

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

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