Software & Processes

Systems Analysis

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Outline

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What is Software?

- **Software** is a collection of data or computer instructions that tell the computer how to work.
- This is in contrast to hardware, from which the system is built and actually performs the work.

Software Applications

- **Software Applications** are programs that perform specific tasks for users or for other programs.
- Examples of software applications include `word processors`, `database programs`, `web browsers`, `development tools`, `image editors` and `communication platforms`.
- **Applications** use the computer's operating system (OS) and other supporting programs, typically system software, to function.
- An application requests services from and communicates with other technologies via an `application programming interface (API)`.

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Programming Languages

- **Programming Languages** are used to create software programs, scripts, or other sets of instructions for computers to execute.
- Examples of programming languages include `Java`, `C++`, `Python`, `JavaScript`, `Ruby`, `PHP`, `SQL`, `Swift`, `R`, `Go`, `Rust`, among others.
- **Programming languages** are used to create algorithms that define the *logic* of a program.

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Universal Turing Machine

- The **Universal Turing Machine** is a theoretical machine that can simulate any Turing machine.
- It is a *mathematical model* of a general-purpose computer.
- The **UTM** can read and write symbols on an `infinite tape`, and can execute any algorithm.
- The **UTM** is the foundation of modern computer science.

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Programming Paradigms

- Programming Paradigms are a way to classify programming languages based on their features.
- Examples of programming paradigms include `imperative`, `declarative`, `functional`, `object-oriented`, `procedural`, `logic`, `symbolic`, `concurrent`, among others.
- **Programming paradigms** are used to define the style of a program.
- The choice of **programming paradigm** can affect the structure and performance of a program.

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Programming Paradigms: **Imperative**

Programming Paradigms: **Declarative**

Programming Paradigms: **Object-Oriented**

Software Architectures

- **Software Architectures** are the structures of software systems.
- Examples of software architectures include `monolithic`, `client-server`, `microservices`, `event-driven`, `service-oriented`, `layered`, `peer-to-peer`, `pipe-filter`, among others.
- **Software architectures** are used to define the components and interactions of a system.
- The choice of **software architecture** can affect the scalability and reliability of a system.

Case of Study: **Netflix Technical Infrastructure**

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Process Definition

- A **Process** is a series of steps or actions taken to achieve a particular end.
- Processes are used to **organize** and **manage** work.

Workflows

- A **Workflow** is a series of tasks that are performed in a specific order to achieve a goal.
- **Workflows** are used to automate and optimize business processes.
- **Workflows** can be sequential, parallel, conditional, or repetitive.

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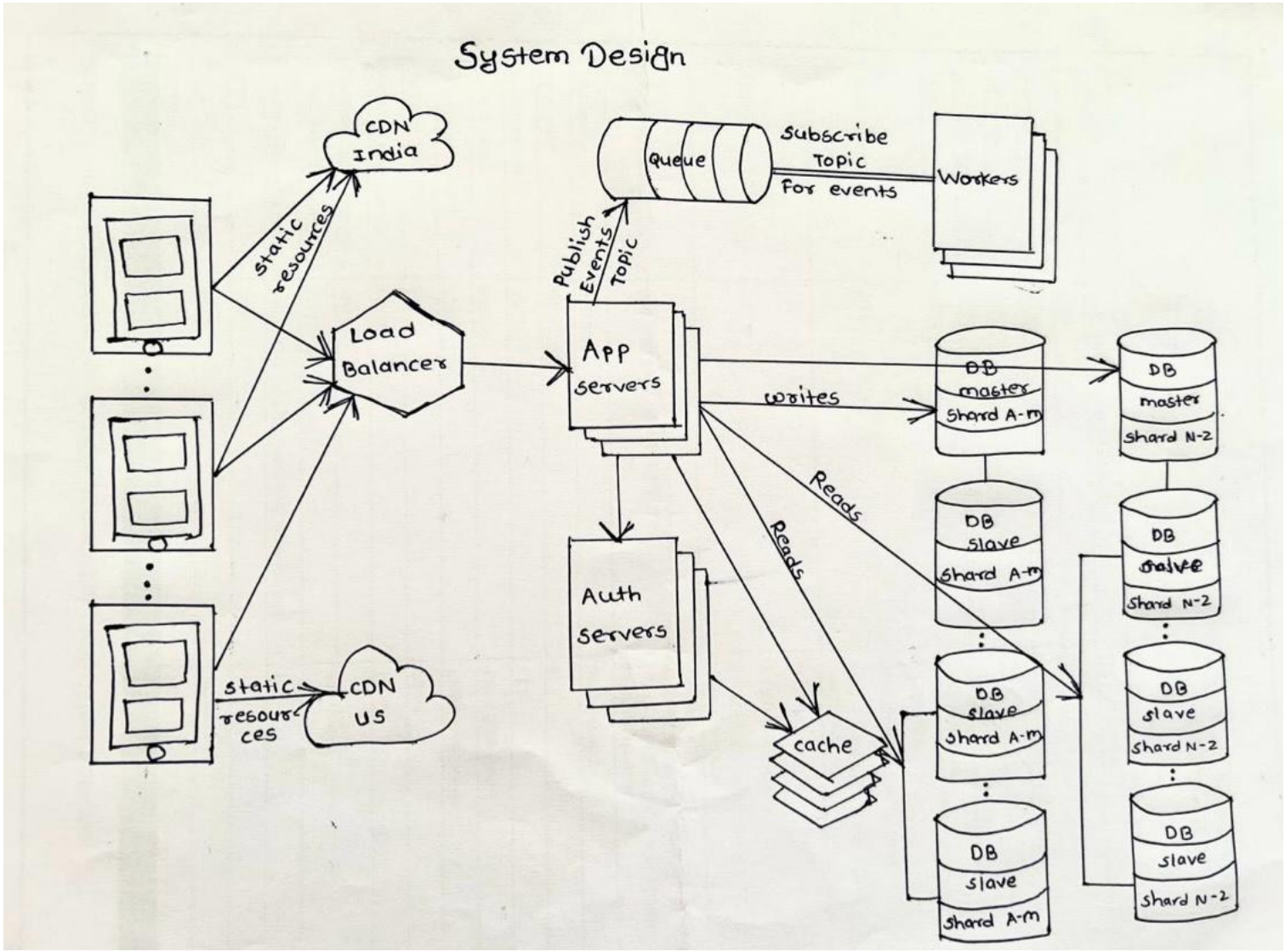
Process Models

- A **Process Model** is a representation of a process that shows the sequence of steps and the relationships between them.
- **Process models** are used to analyze, design, and improve processes.
- Examples of process models include `flowcharts`, `data flow diagrams`, `activity diagrams`, `business process model and notation (BPMN)`, `petri nets`, `state diagrams`, among others.

Business Process Model and Notation (BPMN)

Systems Design applied to Software Architectures



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Information Systems

- An **Information System** is a system that *collects*, *processes*, stores, and disseminates **information**.
- **Information systems** are used to **support** and **manage** business operations.
- Examples of information systems include `transaction processing systems`, `management information systems`, `decision support systems`, `executive information systems`, `expert systems`, `data systems`, among others.
- **Information systems** are used to automate and optimize **business processes**.

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Data Systems

- A **Data System** is a system that *collects*, *processes*, *stores*, and *retrieve* **data**.
- Examples of data systems include `databases`, `data warehouses`, `data lakes`, `data marts`, `data cubes`, `data streams`, `data lakes`, among others.
- **Data systems** are used to store and analyze data.

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Expert Systems

- An **Expert System** is a system that uses knowledge and reasoning to solve problems.
- Examples of expert systems include `diagnostic systems`, `predictive systems`, `prescriptive systems`, `decision support systems`, among others.
- **Expert systems** are used to automate and optimize **decision-making processes**.

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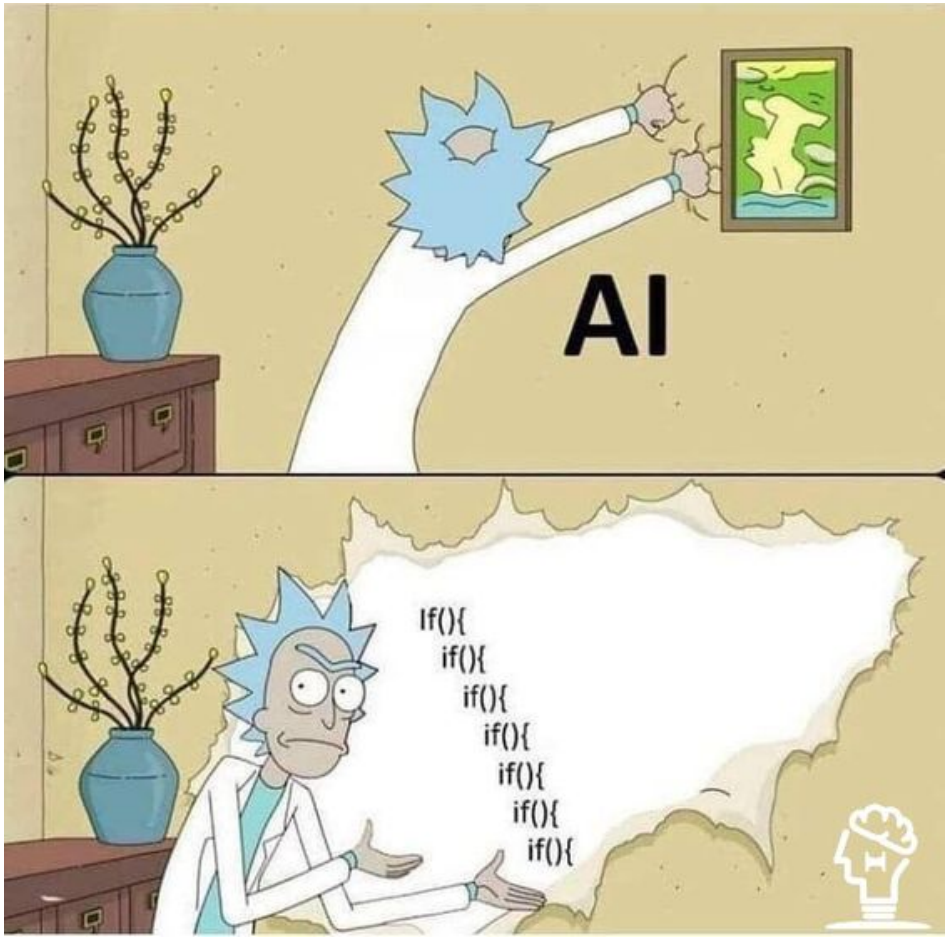
Expert Systems as Classical Artificial Intelligence

Here there is a great example of a diagnostic system.



Risks and Failures in Information

- **Information systems** are subject to risks and failures that can impact **business operations**.
- Examples of risks and failures include security breaches, data loss, system downtime, performance issues, compliance violations, among others.
- **Risks and failures** can be mitigated through security measures, backup systems, disaster recovery plans, monitoring tools, among others.

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Thanks!

Questions?

Repo: *https://github.com/EngAndres/ud-public/tree/main/courses/systems-analysis*

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