

SOFTWARE & PROCESSES

Systems Analysis

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Outline

- 1 Software
- 2 Processes
- 3 Information Systems



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1 Software

2 Processes

3 Information Systems



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).



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.



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.



Programming Paradigms: **Imperative**



Programming Paradigms: **Declarative**



Programming Paradigms: **Object-Oriented**

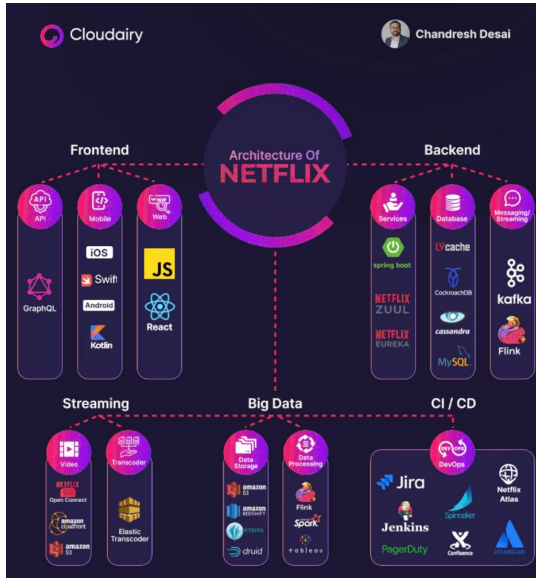


Software Architectures

- **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**.



Process Models

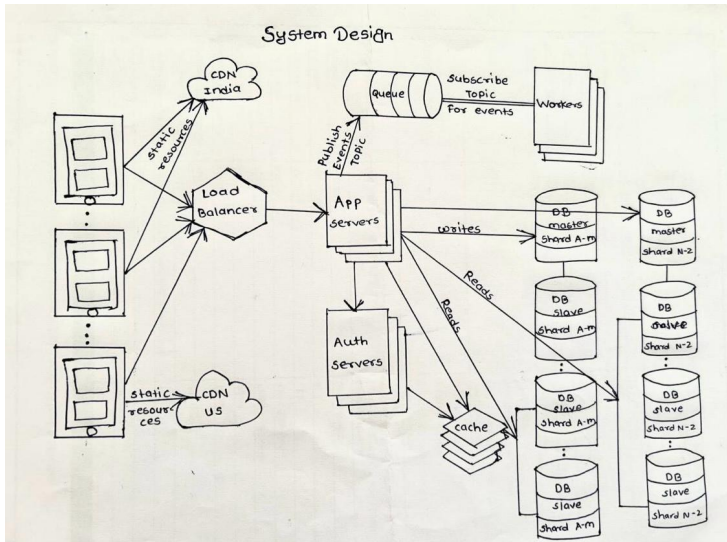
- A **Process Model** is a representation of a **process** that shows the sequence of steps and the **relationships** between them.
- **Process models** are used to **analyze**, **design**, and **improve** processes.
- Examples of **process models** include flowcharts, data flow diagrams, activity diagrams, 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.
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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.



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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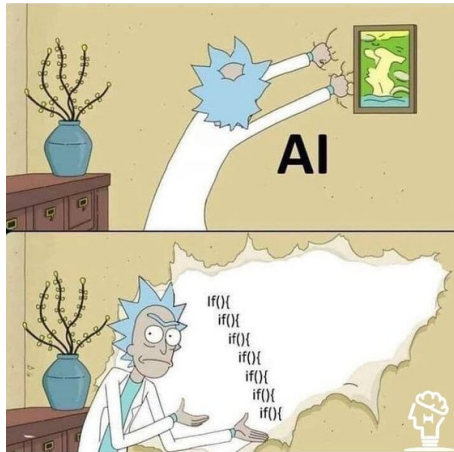
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Expert Systems as Classical Artificial Intelligence

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>

