

# SYSTEMS DESIGN

## Systems Analysis & Design

Author: Eng. Carlos Andrés Sierra, M.Sc.  
[cavirguezs@udistrital.edu.co](mailto:cavirguezs@udistrital.edu.co)

Full-time Adjunct Professor  
Computer Engineering Program  
School of Engineering  
Universidad Distrital Francisco José de Caldas

2025-III



# Outline

1 Requirements Engineering



2 Design & Process



# Outline

## 1 Requirements Engineering

## 2 Design & Process



# Stakeholders Vs . Shareholders

- Stakeholders are individuals or groups who have an interest in the success of a project.  
devs.
- Stakeholders can be internal or external to a company. For example, customers, employees, suppliers, and regulators are external stakeholders.  
sales  
legal
- Shareholders are individuals or groups who have an ownership interest in a company.  
devs
- Shareholders are internal to a company. For example, investors, owners, and sponsors are internal stakeholders.  
sponsors  
final users



# Stakeholders Vs . Shareholders

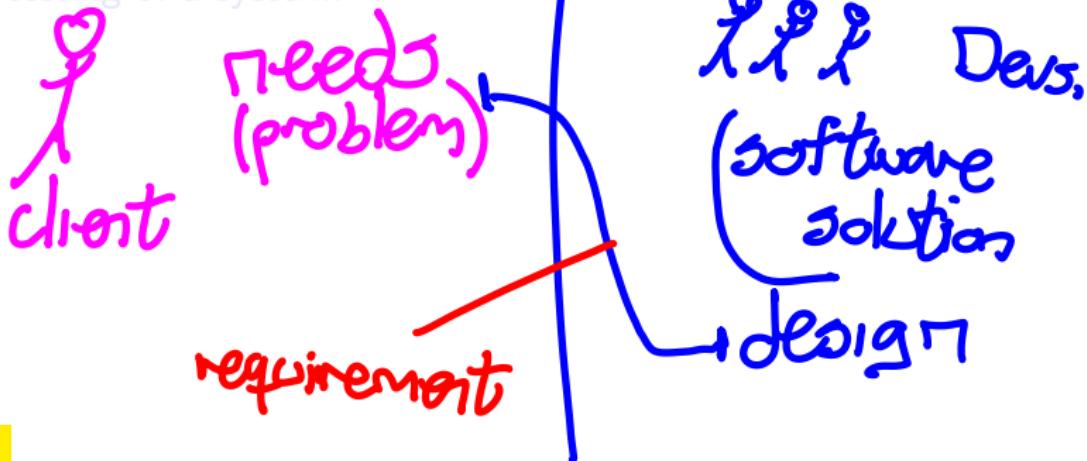
- **Stakeholders** are individuals or groups who have an interest in the success of a project.
- **Stakeholders** can be internal or external to a company. For example, customers, employees, suppliers, and regulators are external stakeholders.
- **Shareholders** are individuals or groups who have an ownership interest in a company. *Jav.*
- **Shareholders** are internal to a company. For example, investors, owners, and managers are internal stakeholders.



# Requirements

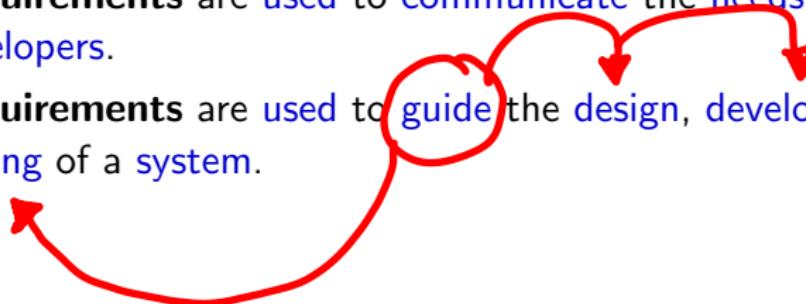
clear

- Requirements are statements that describe the features, functions, and constraints of a system.
- Requirements are used to communicate the needs of stakeholders to developers.
- Requirements are used to guide the design, development, and testing of a system.



# Requirements

- **Requirements** are statements that describe the features, functions, and constraints of a system.
- **Requirements** are used to communicate the needs of stakeholders to developers.
- **Requirements** are used to guide the design, development, and testing of a system.



T. D.P.  
Test-driven Development

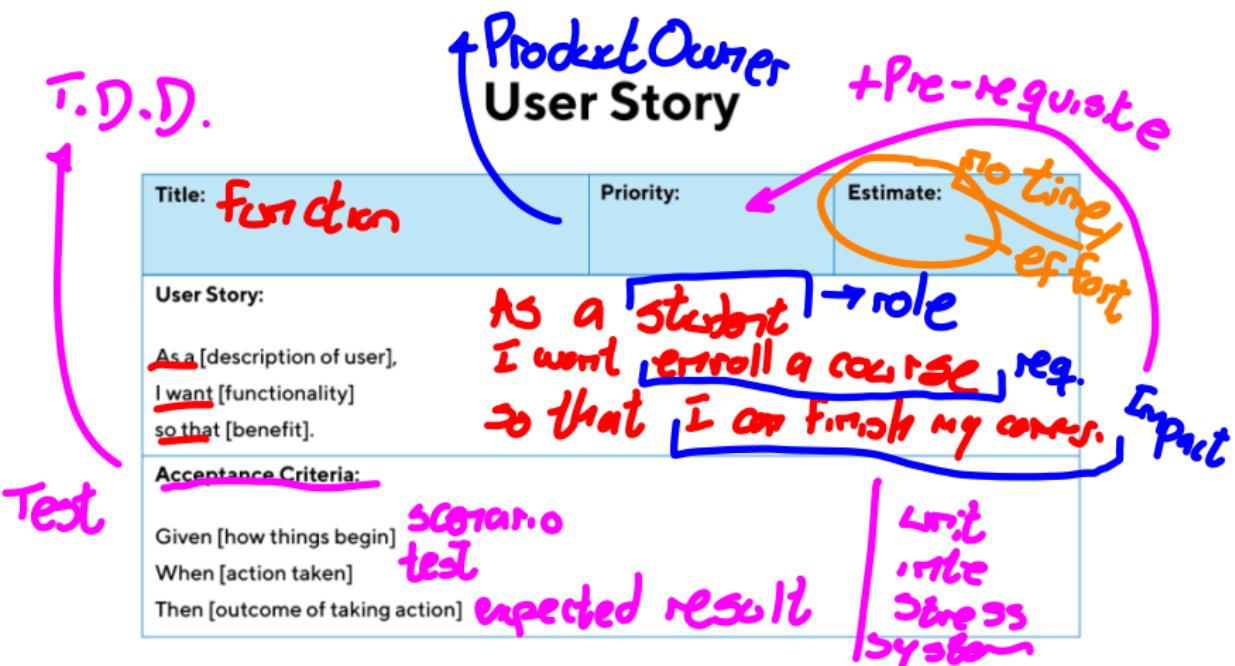


# User Stories → *not-technical*

- User stories are short, simple descriptions of a feature or function of a system.
- They are written from the perspective of the user and describe what the user wants to achieve.
- They are used to capture the requirements of a system in a simple and understandable way.



# User Stories: Format Example



ProductPlan



# What is Requirements Engineering?

Step

- Requirements engineering is the process of eliciting, analyzing, specifying, validating, and managing the requirements of a system.
- It is a critical activity in the systems development lifecycle that ensures that the system meets the needs of its users.
- It is a collaborative process that involves stakeholders from different backgrounds and perspectives.

solve → problem



# What is Requirements Engineering?

- Requirements engineering is the process of eliciting, analyzing, specifying, validating, and managing the requirements of a system.
- It is a critical activity in the systems development lifecycle that ensures that the system meets the needs of its users.
- It is a collaborative process that involves stakeholders from different backgrounds and perspectives.



# User-Centered Design (UCD)

- User-centered design (UCD) is an iterative design process that focuses on understanding the needs, preferences, and behaviors of users.
- UCD is a collaborative process that involves users in the design and development of a system.
- UCD is used to create systems that are usable, efficient, and satisfying to users.

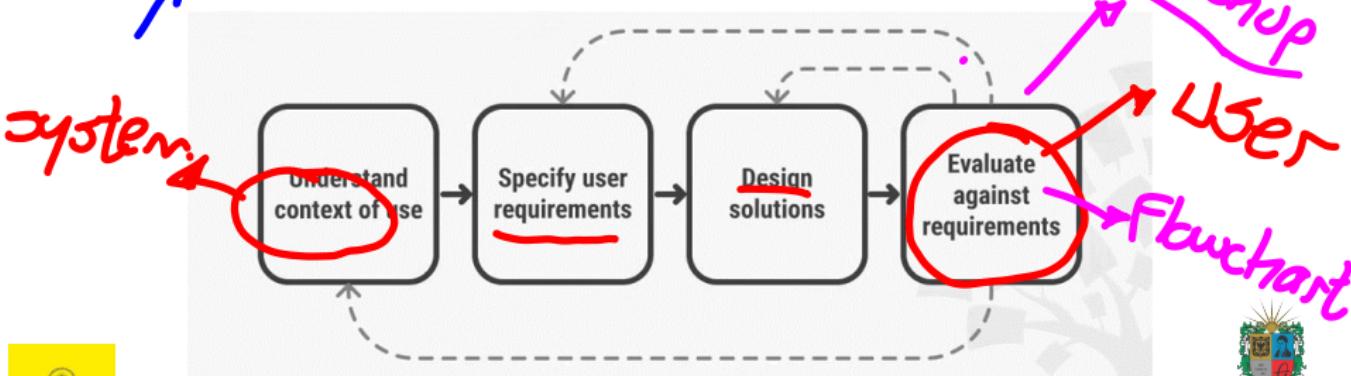
agile

T-hard

mockup

User

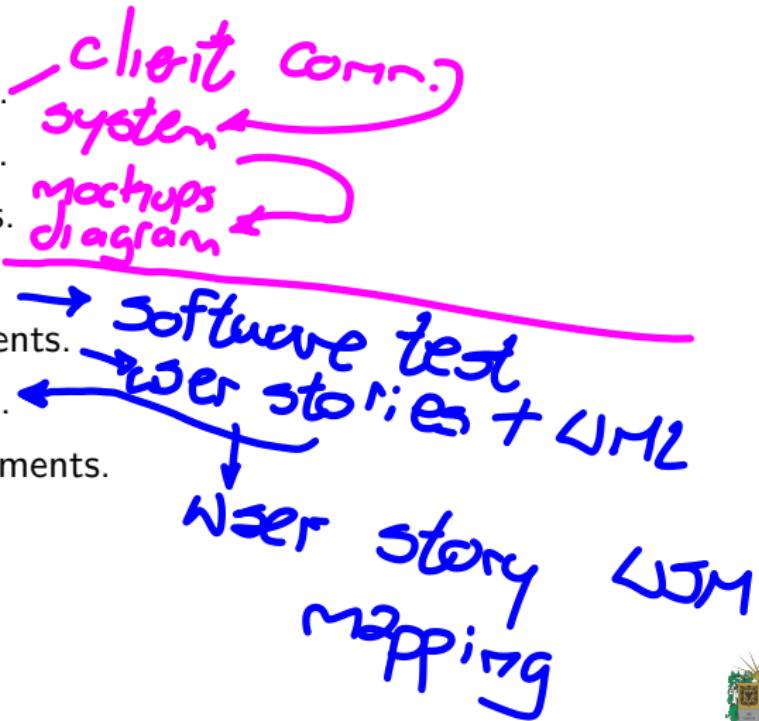
Flowchart



# Requirements Engineering Process

The **requirements engineering** process consists of the following activities:

- Gathering requirements.
- Analyzing requirements.
- Validating requirements.
- Verifying requirements.
- Documenting requirements.
- Managing requirements.
- Communicating requirements.



# Gathering Requirements

- **Gathering** requirements is the process of **collecting** and **documenting** the **needs** of stakeholders.
- It involves interviewing stakeholders, conducting surveys, and observing users to understand **problem(s)**.
- It is a collaborative process that involves stakeholders from different backgrounds and perspectives.

**root**



# Gathering Requirements

- Gathering requirements is the process of collecting and documenting the needs of stakeholders.
- It involves interviewing stakeholders, conducting surveys, and observing users to understand their requirements.
- It is a collaborative process that involves stakeholders from different backgrounds and perspectives.

Flexible  
↓  
take time

final users  
events  
relations

Fast stats  
↓  
non-flexible



# Gathering Requirements

- **Gathering** requirements is the process of **collecting** and **documenting** the **needs** of stakeholders.
- It involves **interviewing** stakeholders, **conducting** surveys, and **observing** users to understand their **requirements**.
- It is a **collaborative process** that **involves** stakeholders from **different backgrounds and perspectives**.



# Clients are not always right

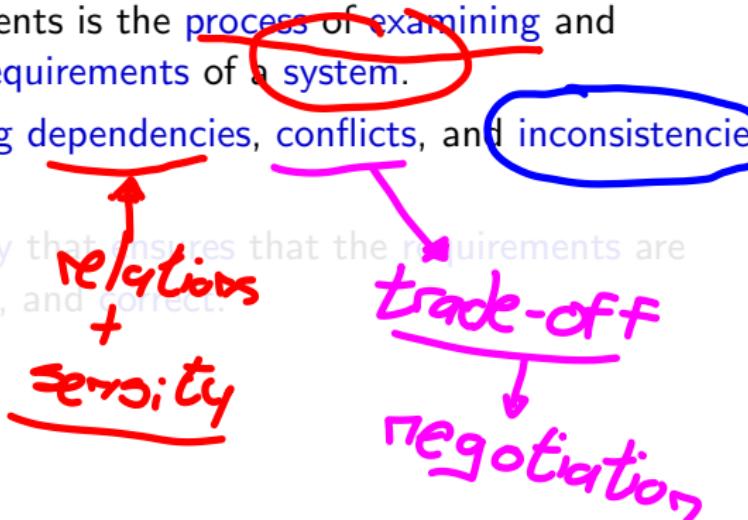
Dear Santa  
How are you? I'm good.  
Here is what I want for  
Christmas.

A <https://www.amazon.com/gp/product/B00032HF60>  
Mref=59\_hps\_bw\_g21\_ir03?pf\_rd\_m=ATVPDKIKXODER&pf\_rd\_s=center-3&pf\_rd\_d=IXWY42FH2KO3Y78MWQNM8P&pf\_rd\_t=101&pf\_rd\_p=1328901542&pf\_rd\_i=16579



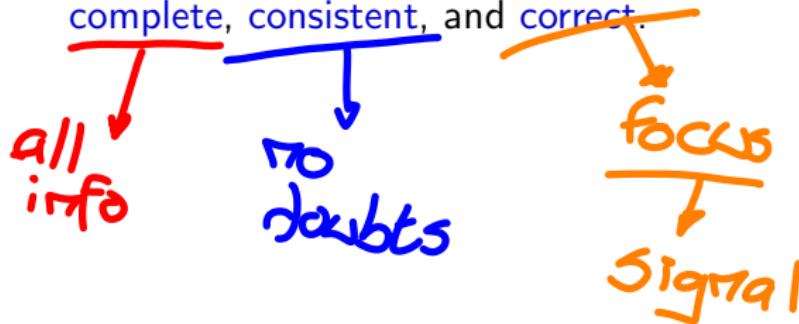
# Analyzing Requirements

- **Analyzing** requirements is the process of examining and understanding the requirements of a system.
- It involves identifying dependencies, conflicts, and inconsistencies in the requirements.
- It is a critical activity that ensures that the requirements are complete, consistent, and correct.



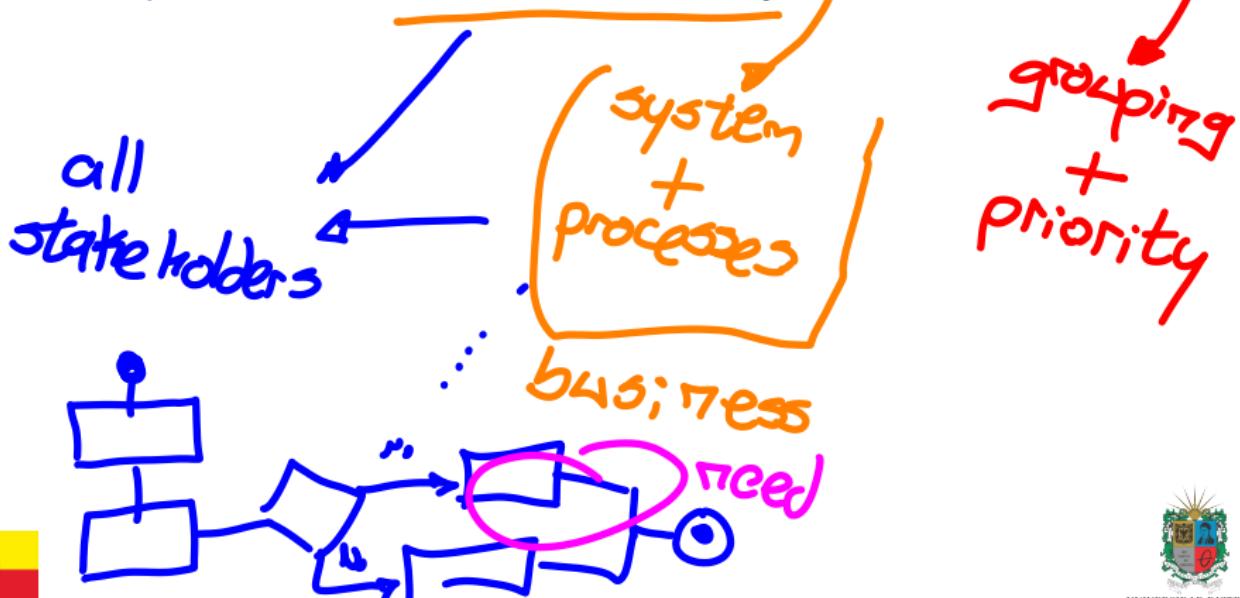
# Analyzing Requirements

- **Analyzing** requirements is the process of examining and understanding the requirements of a system.
- It involves identifying dependencies, conflicts, and inconsistencies in the requirements.
- It is a critical activity that ensures that the requirements are complete, consistent, and correct.



# Documenting Requirements

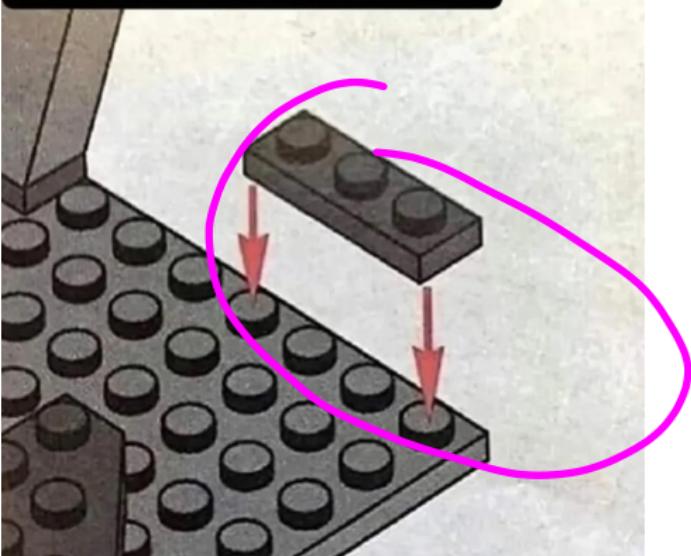
- Documenting requirements is the process of writing and organizing the requirements of a system.
- It involves creating documents, diagrams, and models that describe the requirements in a clear and concise way.



Everyone hates to write Documentation

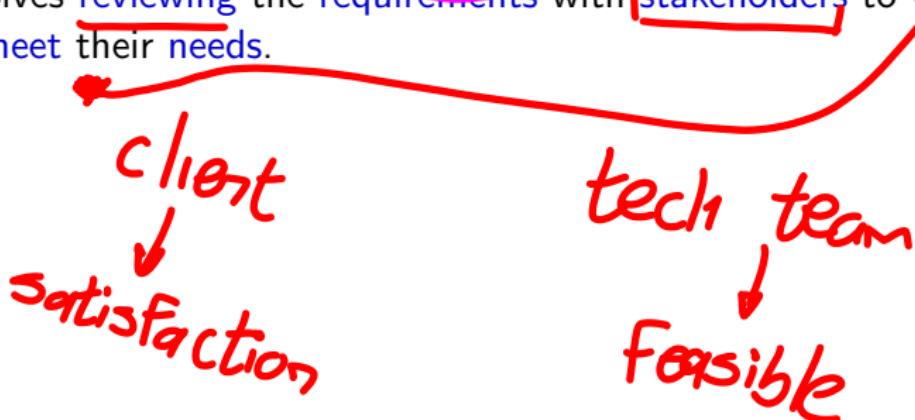
**En la documentación  
está todo bien explicado**

**La documentación:**



# Validating Requirements

- **Validating** requirements is the process of ensuring that the requirements are **correct** and **complete**.
- It involves **reviewing** the requirements with **stakeholders** to **verify** that they **meet** their needs.



# NOT Clear Understanding of Requirements



Dad Jokes

@Dadsaysjokes

[ My dad told me his password is:  
MickeyMinnieGoofyDonaldPlutoHuey  
LouieDeweyDublin.]

Because he was told his password  
had to contain 8 characters and at  
least one Capital.

To understanding

example  
training



# Verifying Requirements

- **Verifying** requirements is the process of **ensuring** that the requirements are correctly implemented in the system.
- It involves **testing** the system to verify that it meets the requirements.
- It is a critical activity that ensures that the system meets the needs of its users.

product  $\Rightarrow$  testing  
engineering

- check functionalities
- quality



# Verifying Requirements

- **Verifying** requirements is the **process** of **ensuring** that the requirements are correctly implemented in the **system**.
- It involves **testing** the **system** to verify that it **meets** the **requirements**.
- It is a critical activity that **ensures** that the **system** meets the **needs** of its **users**.

unit  
integration  
stress  
system  
acceptance

solve  
the problem

QA-area  
testing  
org-area / ROI



# Typical Mistakes when Testing

Disturbing Chinese calorie app...

70-Case X



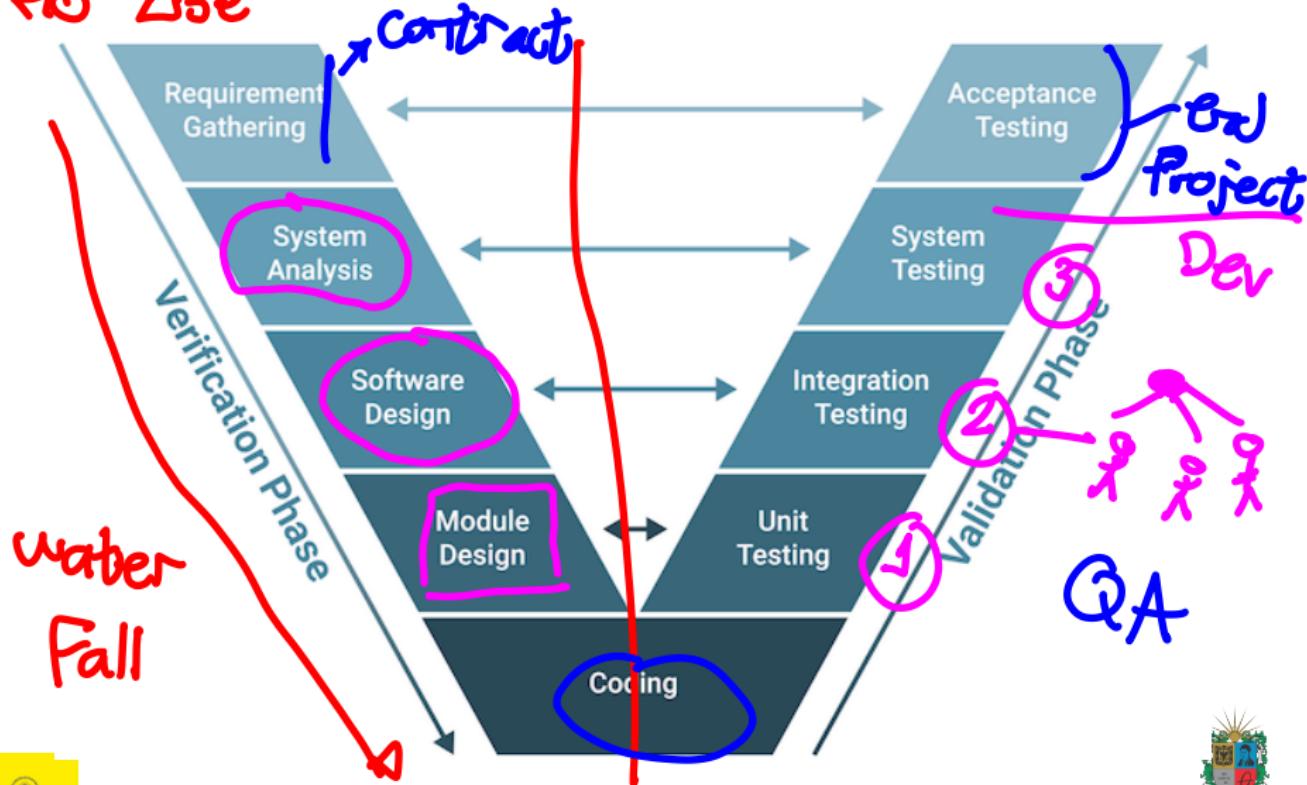
カシューナッツ	(cashew)	1粒	9 kcal
ジャムパン	(Pomeranian)	1個	327 kcal



## V-Model in SDLC

70s - 80s

to use



# Outline

1 Requirements Engineering

2 Design & Process



# Conceptual Design

*tech-less*

- Once the initial set of **requirements** is defined, the next step is to create a **conceptual design** of the system.
- Conceptual Design** is a **high-level design** that defines the **structure** and behavior of the system. It is achieved by the recognition of the appropriate **components**, **connections**, and **responsibilities**.
- The conceptual design is used to communicate the vision of the system to stakeholders and to guide the development of the system.

*Understand*

*Problem as a system*



# Conceptual Design

- Once the initial set of **requirements** is defined, the next step is to create a **conceptual design** of the system.
- Conceptual Design** is a **high-level design** that defines the **structure** and **behavior** of the system. It is achieved by the recognition of the appropriate **components**, **connections**, and **responsibilities**.
- The **conceptual design** is used to **communicate** the **vision** of the system to **stakeholders** and to **guide** the **development** of the system.

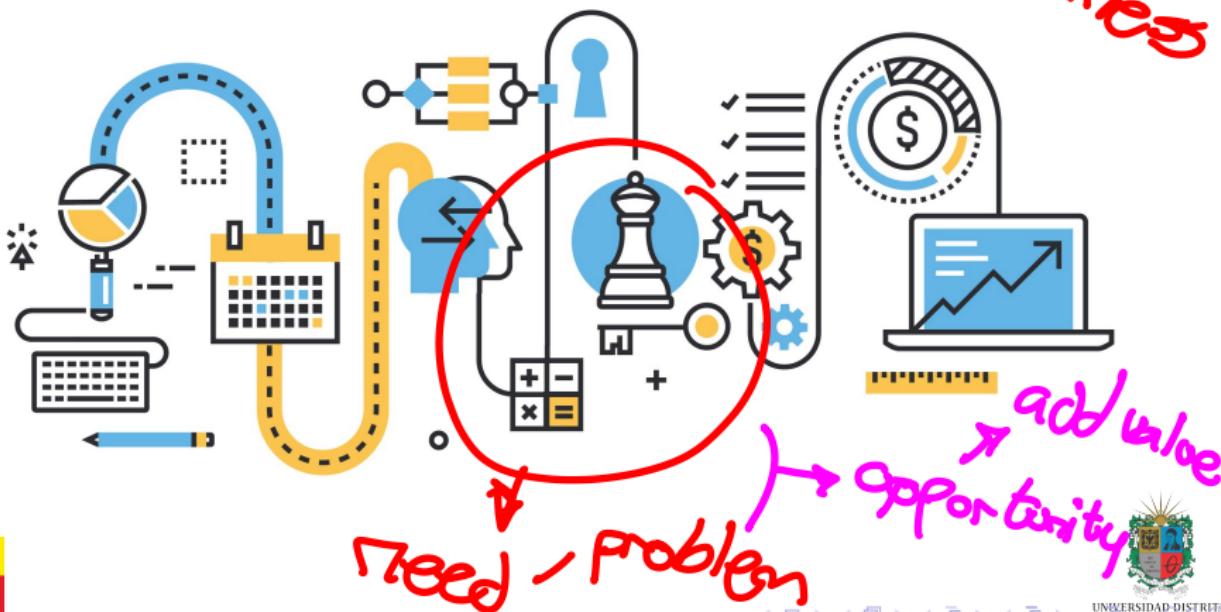


# Process Definition

*Algorithm → Coding*

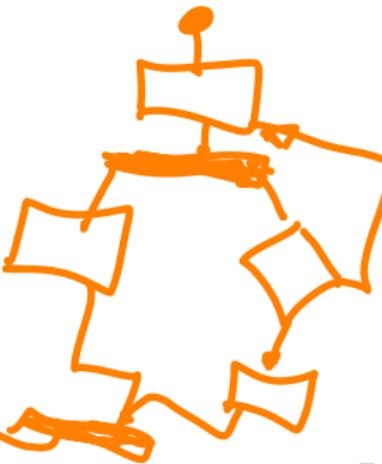
- A **Process** is a **series** of steps or actions taken to achieve a particular end.
- Processes are used to **organize** and **manage** work.

*Business*



# Workflows → Pipelines → automation

- 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.



② quality  
① speed

Flowchart



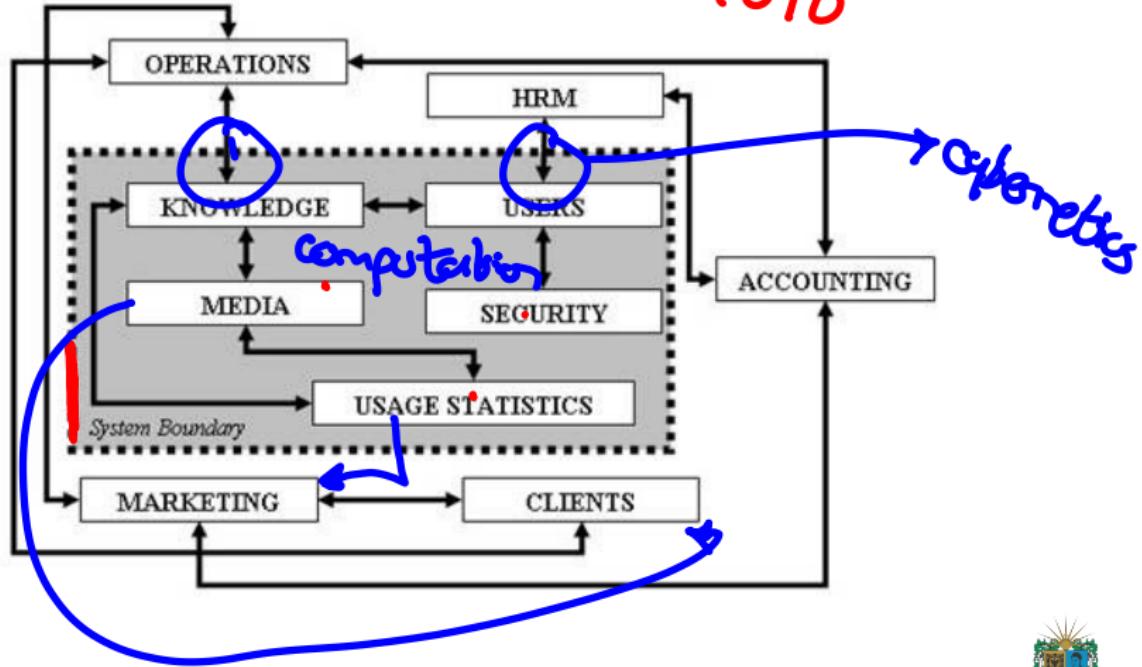
# Process Models

- 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.



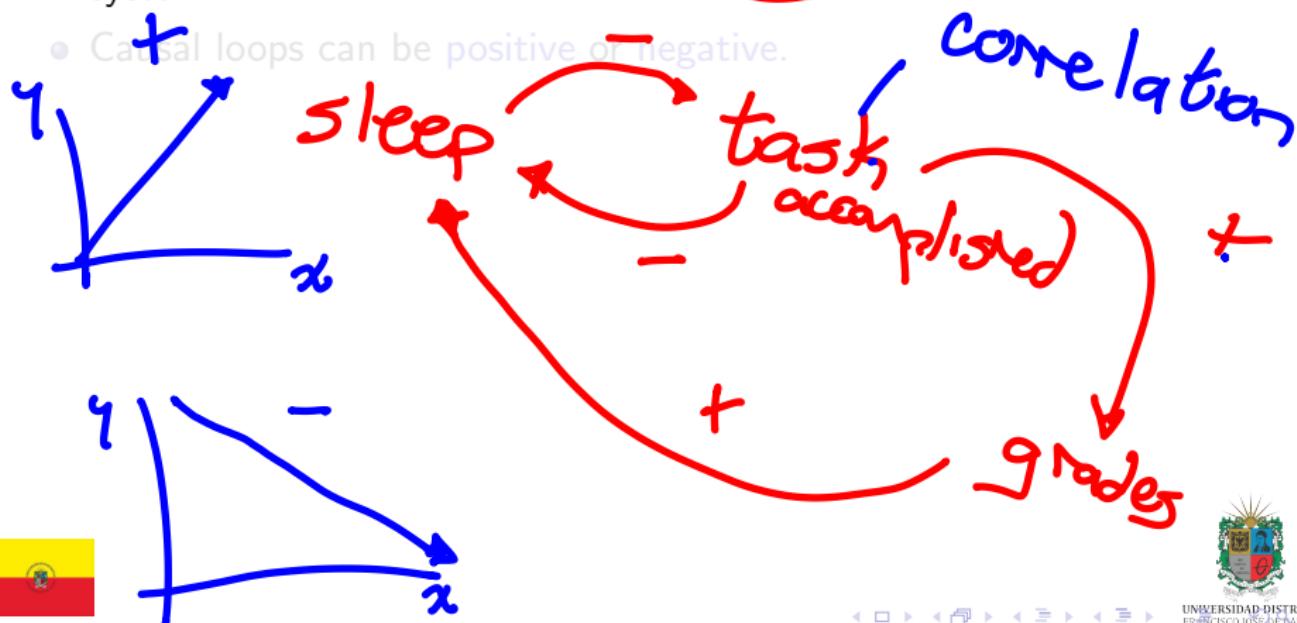
# System Schema Example: Company Structure

*Environment*



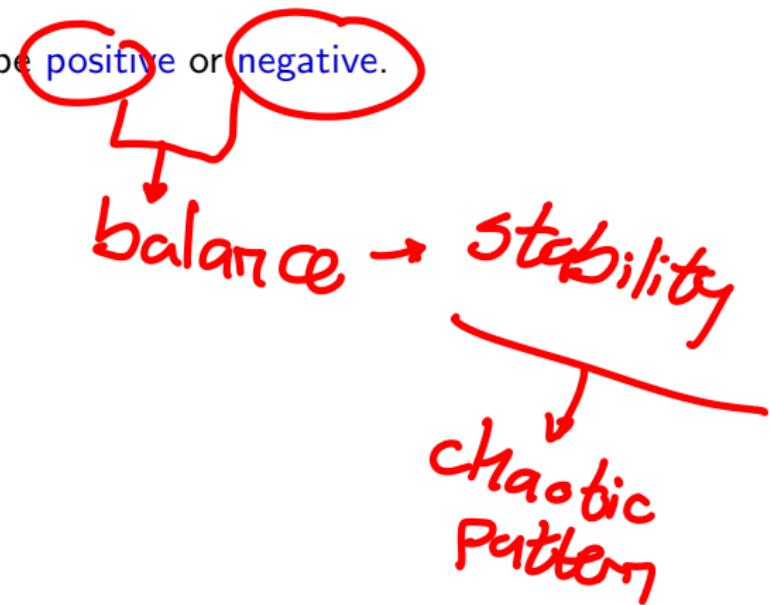
# Causal Loops

- A **Causal Loop** is a **diagram** that shows the **relationships** between different variables in a system.
- Causal loops are used to **analyze** and **understand** the **dynamics** of a system.
- Causal loops can be positive or negative.

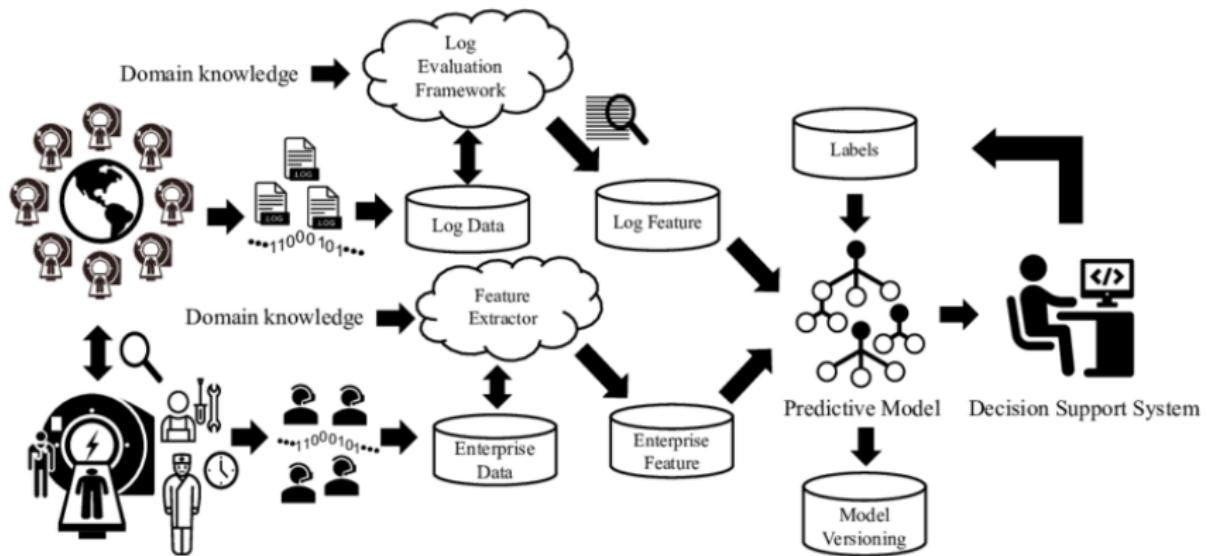


# Causal Loops

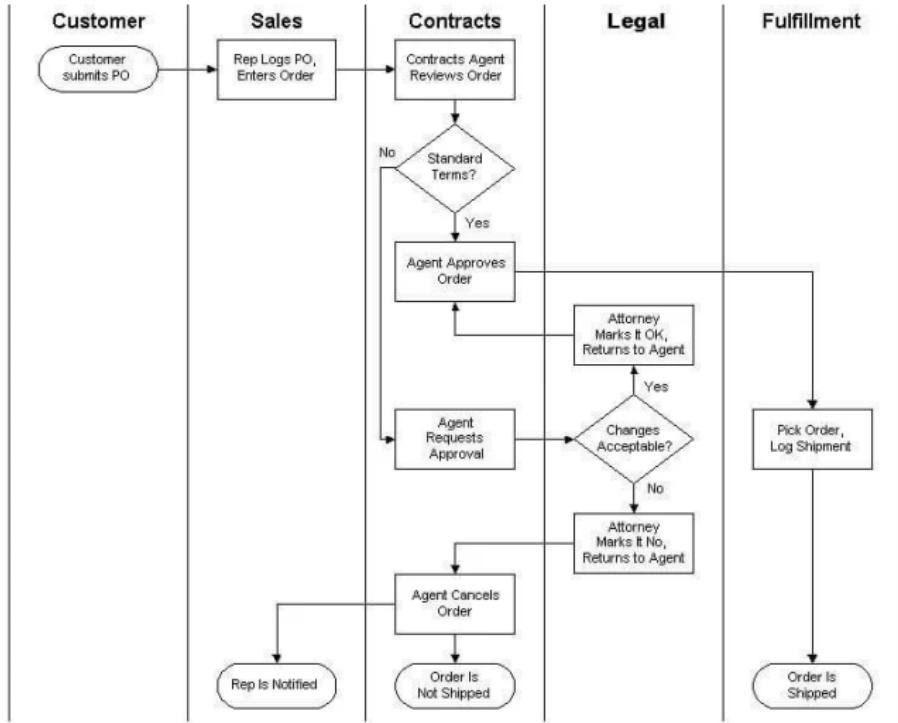
- A **Causal Loop** is a **diagram** that shows the **relationships** between different variables in a system.
- Causal loops are used to **analyze** and **understand** the **dynamics** of a system.
- Causal loops can be **positive** or **negative**.



## System Schema Example: Processing Pipeline



# Business Process Model and Notation (BPMN)



# Technical Design

- Once the **conceptual design** of the system is defined, the next step is to create a **technical design** of the system.
- Technical Design** is a **detailed design** that defines the architecture, components, and interfaces of the system.
- The **technical design** is used to guide the **development** of the system and to communicate the implementation details to developers.

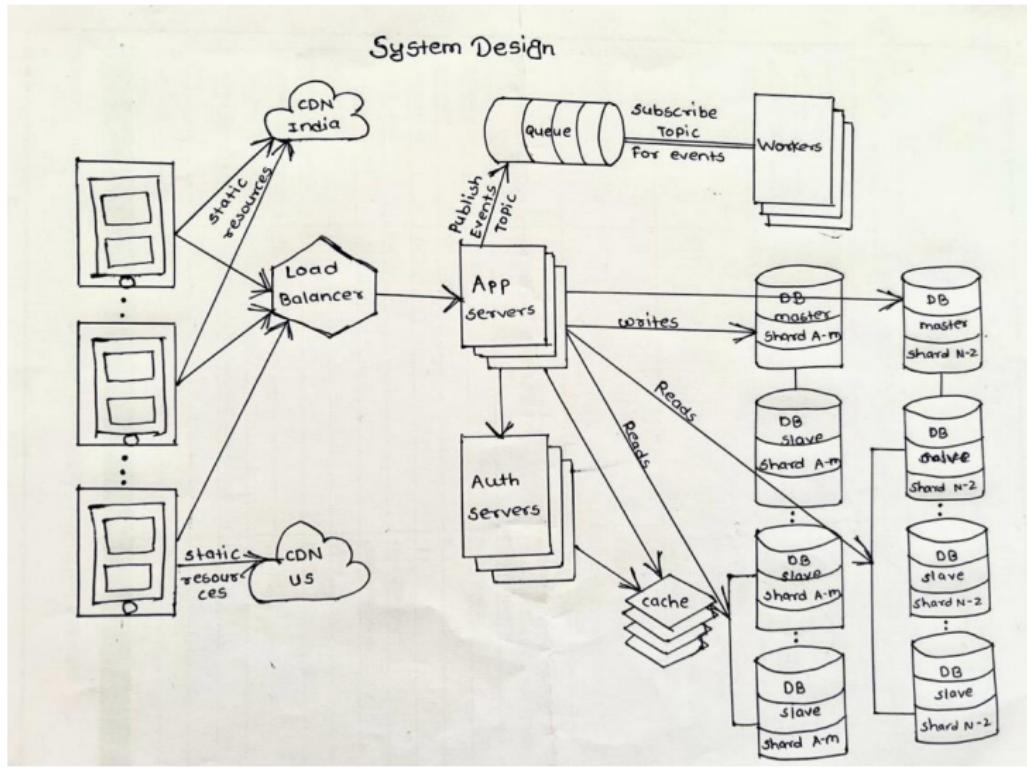


# Technical Design

- Once the **conceptual design** of the system is defined, the next step is to create a **technical design** of the system.
- Technical Design** is a **detailed design** that defines the architecture, components, and interfaces of the system.
- The **technical design** is used to **guide the development** of the system and to **communicate** the **implementation** details to developers.



Systems Design applied to Software Architectures



# Outline

1 Requirements Engineering

2 Design & Process



# Thanks!

## Questions?



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

