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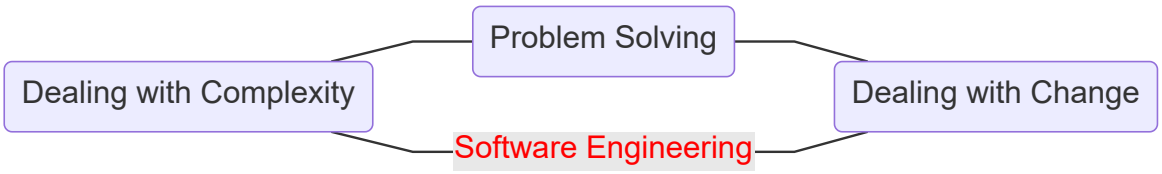
EIST Summary

01 Introduction



Abstraction

> *The 7 ± 2 phenomena*
> *Our short term memory cannot store more than 7 ± 2 pieces at the same time*
> *→ chunking: Group collection of objects to reduce complexity*

- thought process ⟶ **activity**
- result ⟶ **entity**

> *Abstraction as a model of a priorly, currently or not yet existing system.*

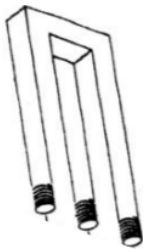
Typical Models

Object Model	**entities**	**structure** of the system?
Functional Model	**use cases**	**functions** of the system?
Dynamic Model	**activities**	system's **reaction to external events**

> *System model: object model + functional model + dynamic model*

Difficulties in software development

- Problem's **ambiguity**

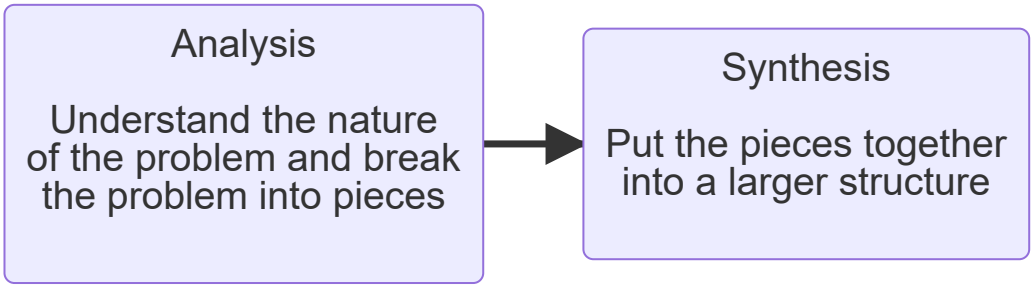


impossible trident

- **Requirements** are usually **unclear** and **change** when they become clearer

- The **problem domain** (also **application domain**) is **complex**, and so is the **solution domain**
- The **development process** is **difficult to manage**
- Software is a **discrete** system
    - Continuous systems have no hidden surprises
    - Discrete systems can have hidden surprises! (Parnas)

Software Engineering as a problem solving activity



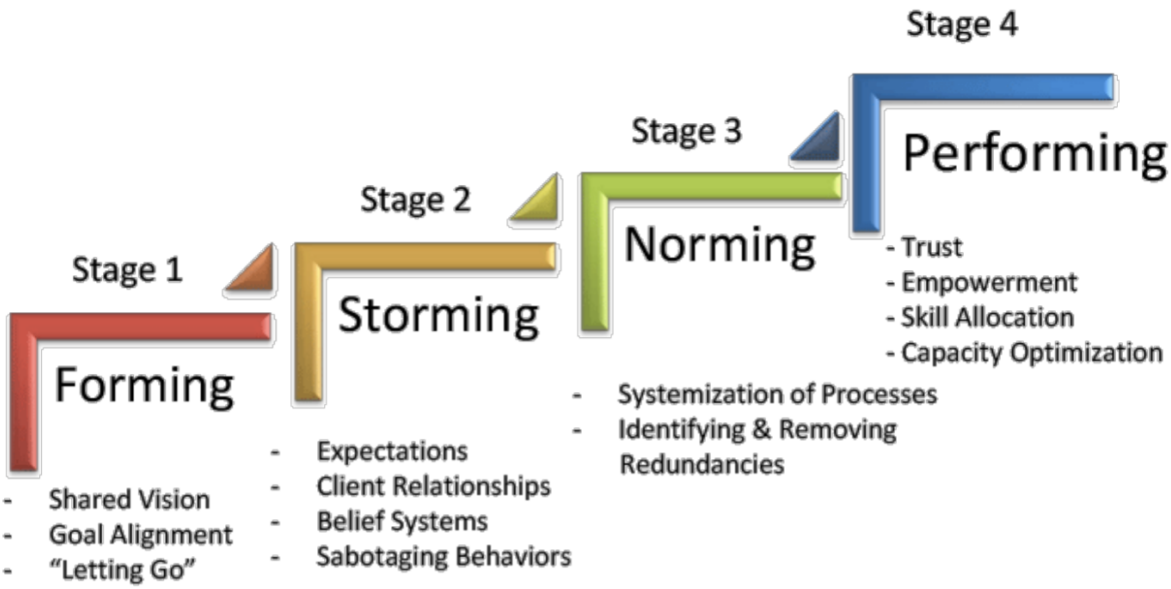
Techniques, methodologies and tools

Techniques	methodologies	tools
Formal procedures for producing results using some **well defined notation**	**Collection of techniques** applied across software development and unified by a philosophical approach	**Instruments or automated systems** to accomplish a technique
recipe, quick sort algorithm	cookbook, object oriented analysis and design, functional decomposition	compiler, editor, debugger, IDE, CASE

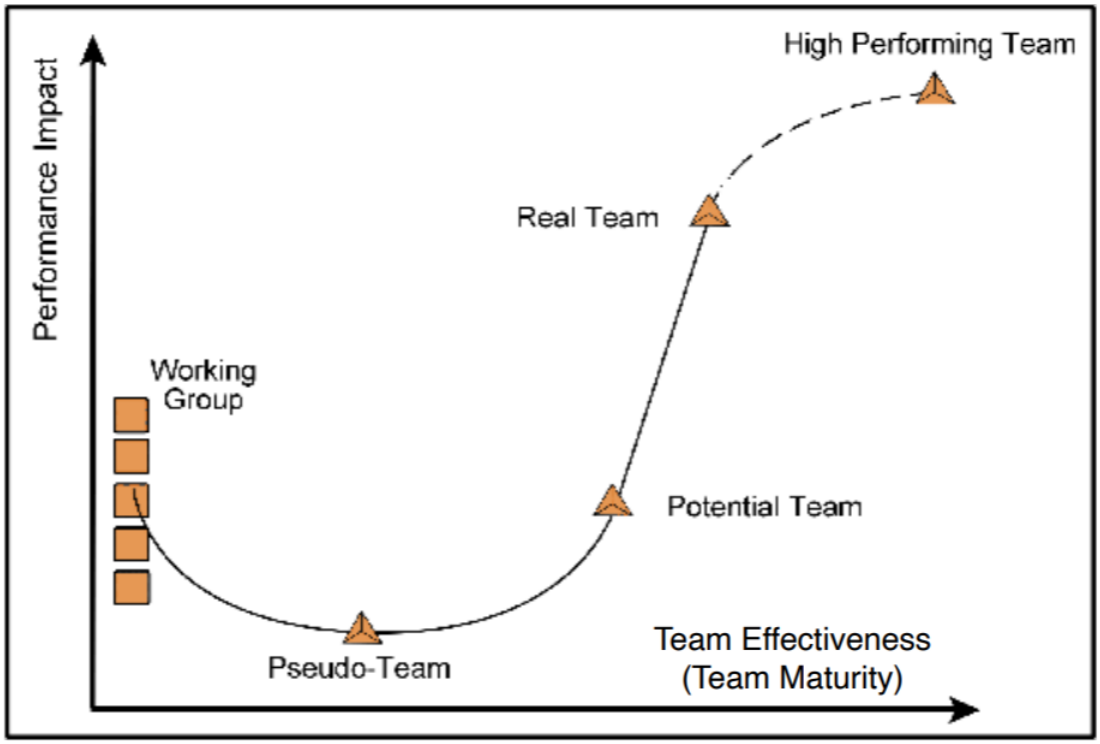
[Team]

I don't know whether that's important for the exam, but it feels like some bs they could ask in a bad mood.

Stages of team development



Team productivity and performance



Forming > Storming > Norming > Performing

Difference between group and team

- Group a number of people that have some relationship to one another
    - Participants are loosely connected
    - Do not focus on specific outcomes or a common purpose
    - Every individual works on his own
- Team any group of people involved in the same activity with a common goal, especially referring to sports and work
    - Participants are strongly connected
    - Focus on a specific outcome, requires coordination of tasks and activities
    - Members need to work together

Phenomenon vs. Concept

Phenomenon
: An **object** in the **world of a domain** as it is **perceived**
This EIST lecture at 9:25 *my black watch*

Concept
: **Common properties** of phenomena
All lectures on software engineering *All black watches*

	A concept is a 3-tuple
Name	The name distinguishes the concept from other concepts
Purpose	Properties that determine if a phenomenon is a member of a concept
Members	Set of phenomena which are part of the concept

> ***Abstraction:*** *classification of phenomena into concepts*
>
> ***Modelling:*** *development of abstractions to answer specific questions about a set of phenomena while ignoring irrelevant details*

Systems, models and views

Systems

- Organized set of communicating parts
  - Natural system: a system whose ultimate purpose is not known
  - Engineered system: designed and built by engineers for a specific purpose
- The parts of the system can be considered as systems again
  - In this case we call them subsystems

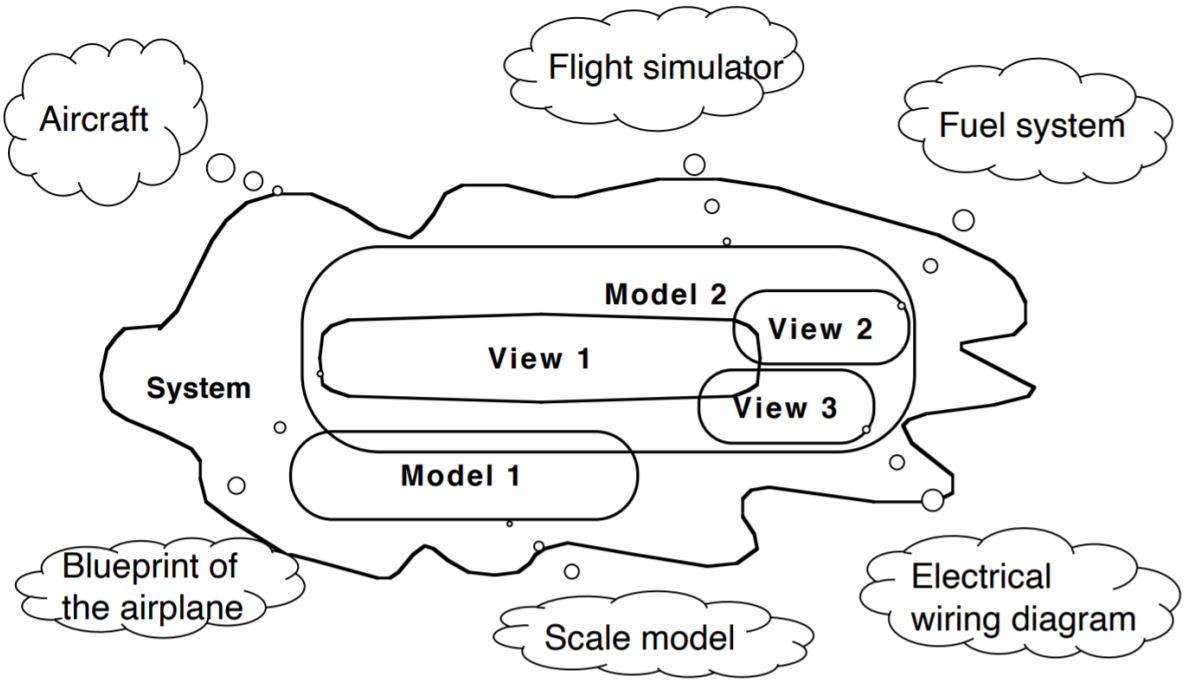
natural systems	**engineered systems**	**subsystems**
universe, earth, ocean	airplane, watch, GPS	jet engine, battery, satellite

Model and View

- Model: Abstraction of a system
- View: Selected aspects of a model
- Notation: Set of Graphical or textual rules for depicting models and views
  - Informal ("napkin design")
  - Formal (UML)

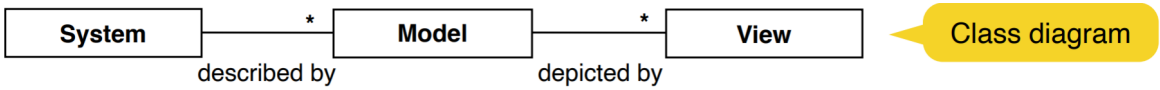
System	Model	View
Airplane	Flight simulator Scale model	Blueprint of the airplane electric wiring diagram an airplane breaking the sound barrier

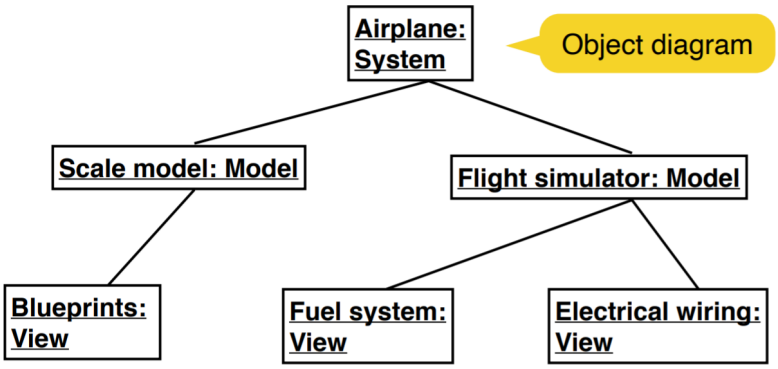
Napkin Notation



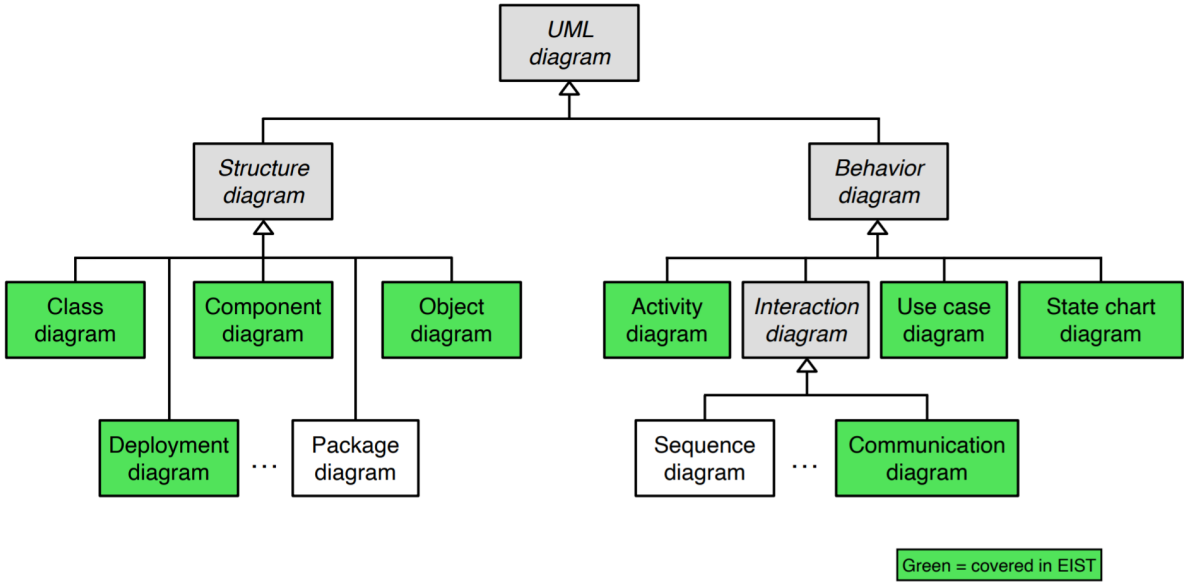
Views and models of a complex system usually overlap

UML Notation





Overview of UML diagrams



OOP principles (some with maybe not so obvious terminology)

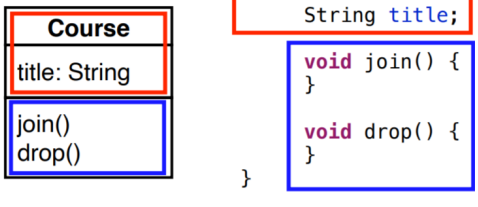
Type & instance

name	purpose	members
int	integral number	$\mathbb{N}_{\text{in memory range}}$
boolean	logical	{true, false}

These relationships are similar

- Type $\longleftrightarrow$ variable
- Concept $\longleftrightarrow$ Phenomenon
- Class $\longleftrightarrow$ Object

Encapsulation

> *Encapsulation means creating classes for such objects to define*
>
> - *Structure / state by using attributes*
> - *Functionality / behavior by providing methods*
>
> Java supports encapsulation by using classes with attributes for structuring and methods for describing functionality
>
> **Problem Statement:** "A course has a title, students can join and drop the course."
>
> 
>
>
> ```
> class Course {
>     String title;
>     void join() {
>     }
>     void drop() {
>     }
> }
> ```

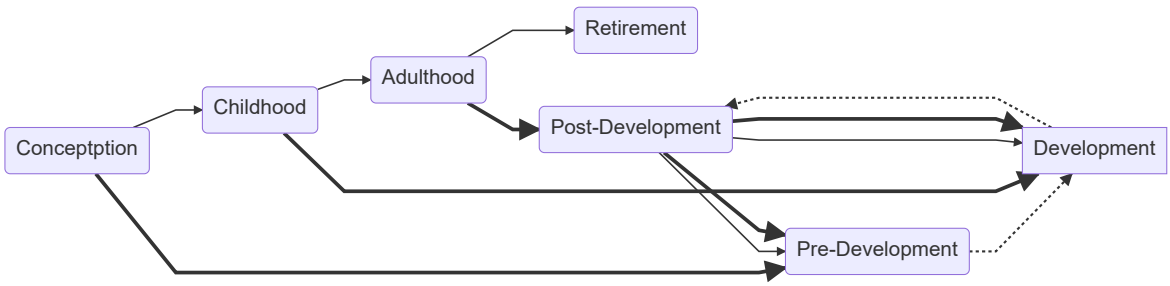
02 Model based Software Engineering

Software Lifecycle

- Set of activities and their relationships to each other to support the development if a software system
- Examples of activities: requirements elicitation, analysis, system design, implementation, testing, configuration management, delivery
- **Software lifecycle model** An abstraction representing the development of software for the purpose of understanding, monitoring or controlling the development of software

Requirements analysis	What is the problem?
System design	What is the solution?
Object design	What are the best mechanisms to implement the solution?
Implementation	How is the solution constructed?
Testing	How is the problem solved?
Delivery	Can the customer use the solution?
Maintenance	Are enhancements needed?

A **lifecycle** is based (loosely) on the metaphor of the life of a person



Tailoring

> *There is no “one size fits all” software lifecycle model that works for all possible software engineering projects*

Tailoring	**adjusting a lifecycle model to fit a project**
naming	adjusting the naming of activities
cutting	removing activities not needed in the project
ordering	defining the order the activities take place in

Controlling software development with a process

organizational maturity (Humphrey '89)	**agility (Schwaber '01)**
Repeatable process Capability Maturity Model Integration (CMMI)	Large parts of the *sd* is empirical in nature they cannot be modelled with a defined process

Defined vs Empirical process

Defined process	**Empirical process**
Planed Follows strict rules Avoids deviations	Not entirely planned inspect and adapt

03 Requirements Analysis

04 System Design I

05 System Design II

06 Object Design I

07 Object Design II

08 Testing

10 Software Configuration Management

11.1 Software Quality Management

11.2 Guest Lecture: Dr. Elmar Jürgens

12 Project Management