Introduction to Systems Engineering

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SE : An Introduction

- Systems Engineering I
- Systems Engineering II
- Systems Engineering Standards : EIA 632
- Requirements management I
- Requirements managements II : Traceability
- Verification and Validation (V&V)
- Case studies

Seminar goals

- 1. Grasp the importance of SE
- 2. Knowledge about the context and SE Framework
- 3. Stimulus for further SE Knowledge acquisition

What is the systems engineering : **produce an impression** or ***create a rabbit***

Systems engineering is also an art without magicic

System Engineering: Definition (Incose)

ystems Engineering is an **interdisciplinary** approach and means to nable the realization of successful systems. It focuses on defining ustomer needs and required functionality early in the development ycle, documenting requirements, then proceeding with design synthesis nd system validation while considering the **complete problem**:

- Operations
- Performance
- Test
- Manufacturing
- Cost & Schedule
- Training & Support
- Disposal

System Engineering: Definition (Incose)

Systems Engineering integrates

- All the disciplines and
- specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation.

Systems Engineering considers both

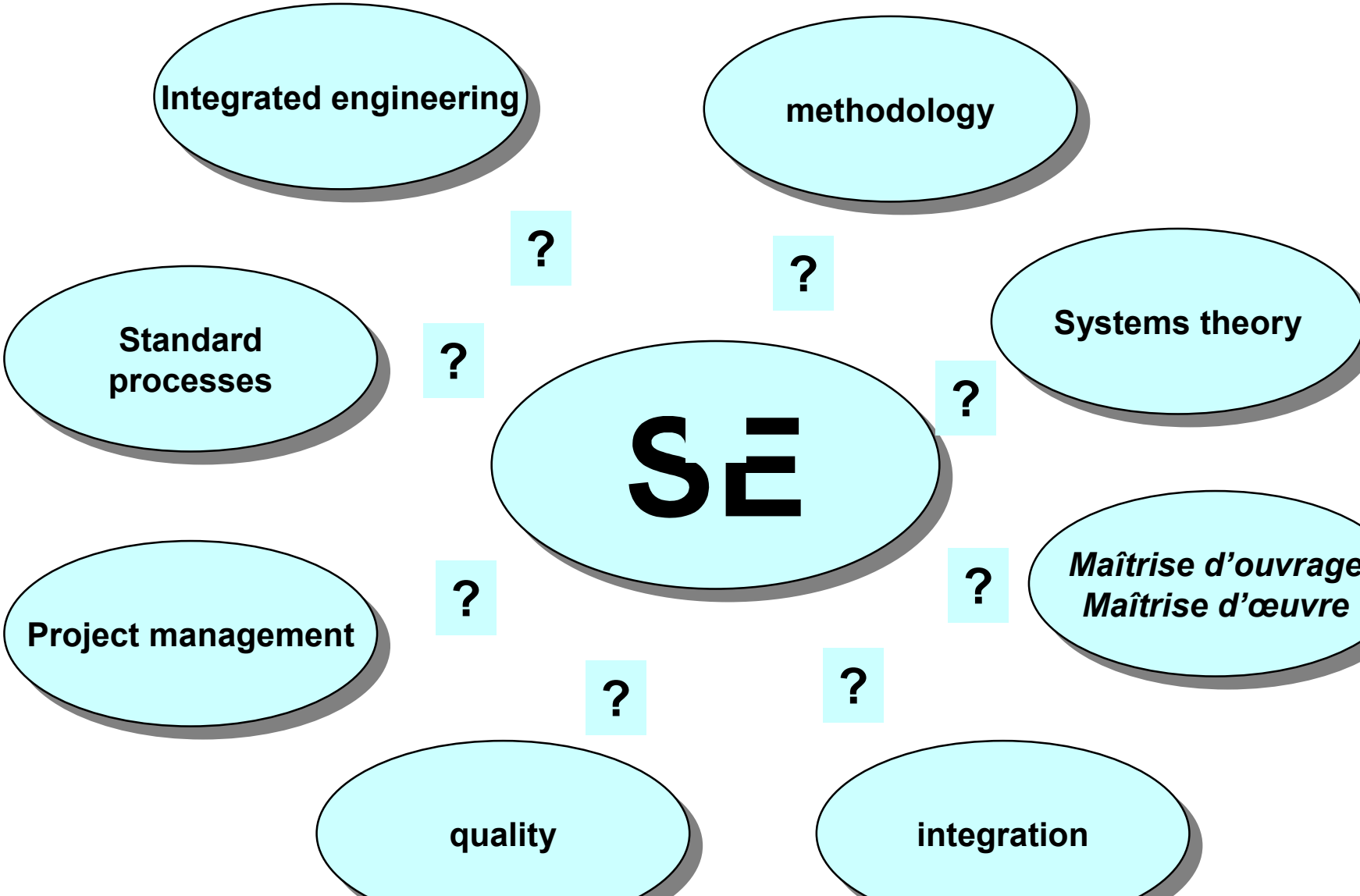
- The **business** and
- The **technical needs** of all customers with the goal of providing a quality product that **meets the user needs**.

A simple example : A pen

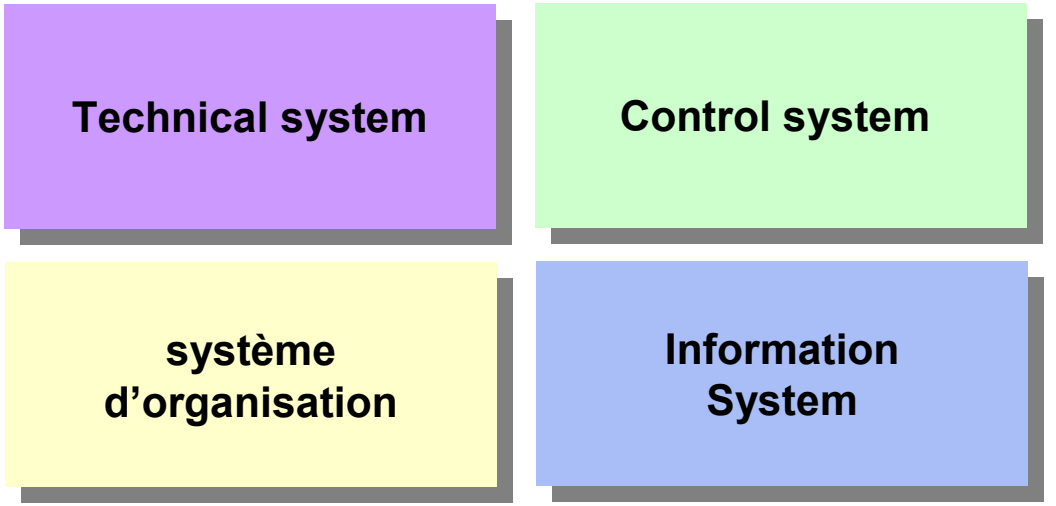
We need : why a new pen

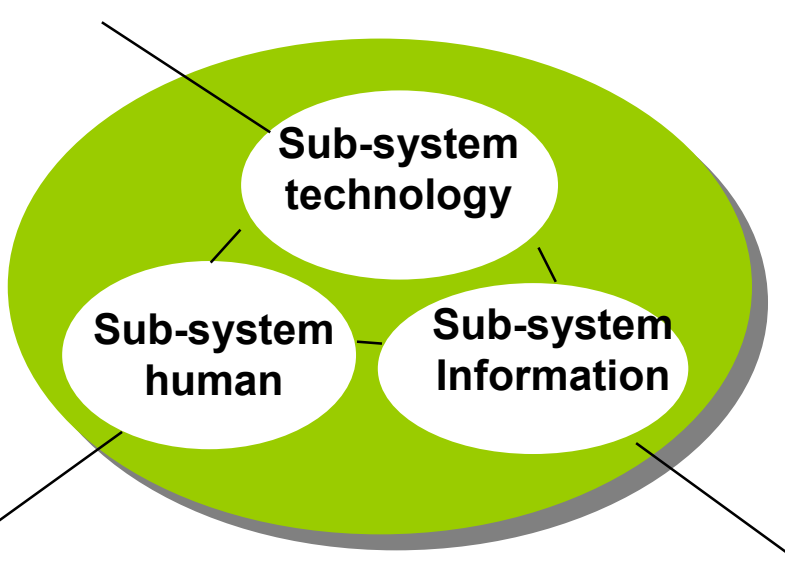
- Its primary function
- The stakeholders : writers, designers, salesman, …
- Cost constraints and related data (market)
- Accumulated knowledge (the writing have been with for centuries ..)
- More detailled requirements
- related discipline
    - Chemistry (Ink)
    - Mechanics/metallurgy, manufacturing

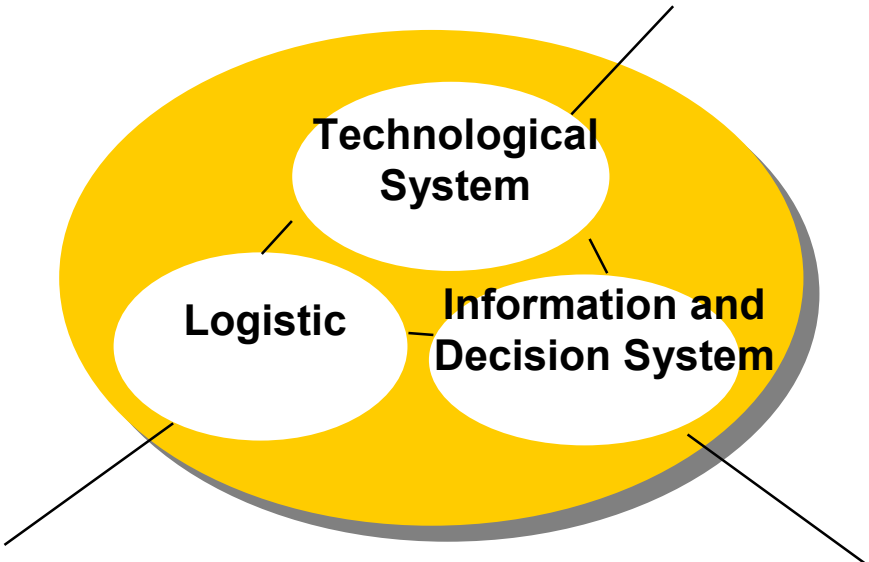
System Engineering and System integration



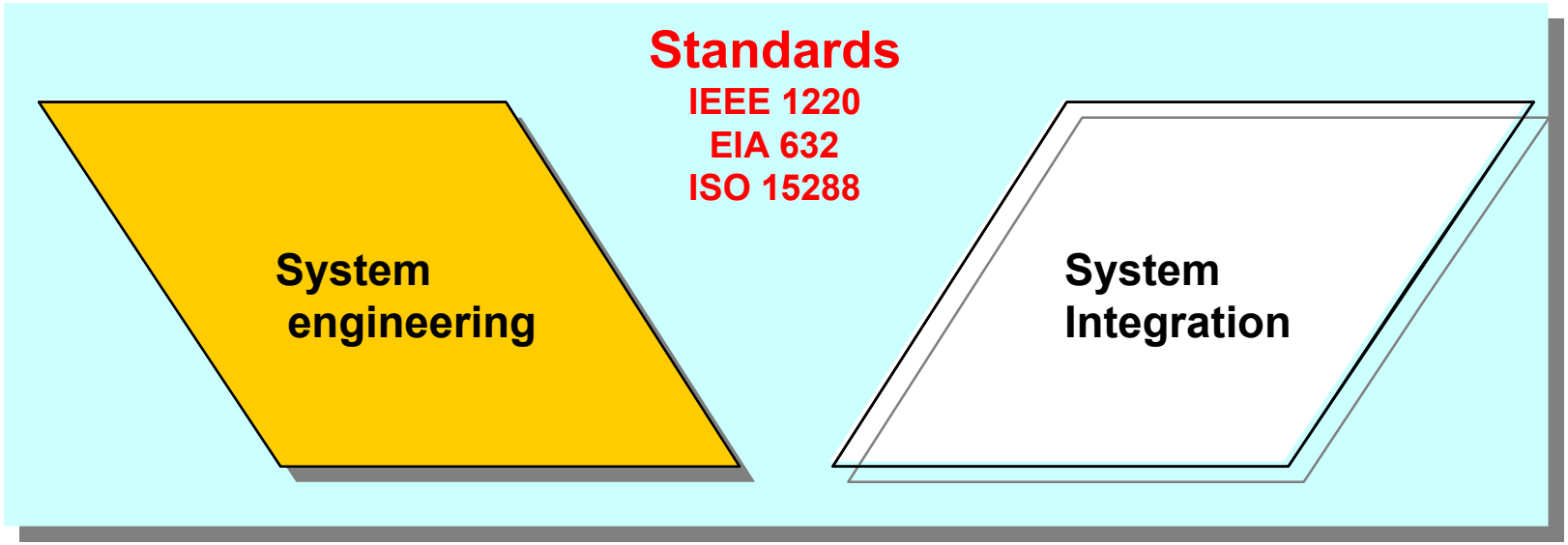
Integration

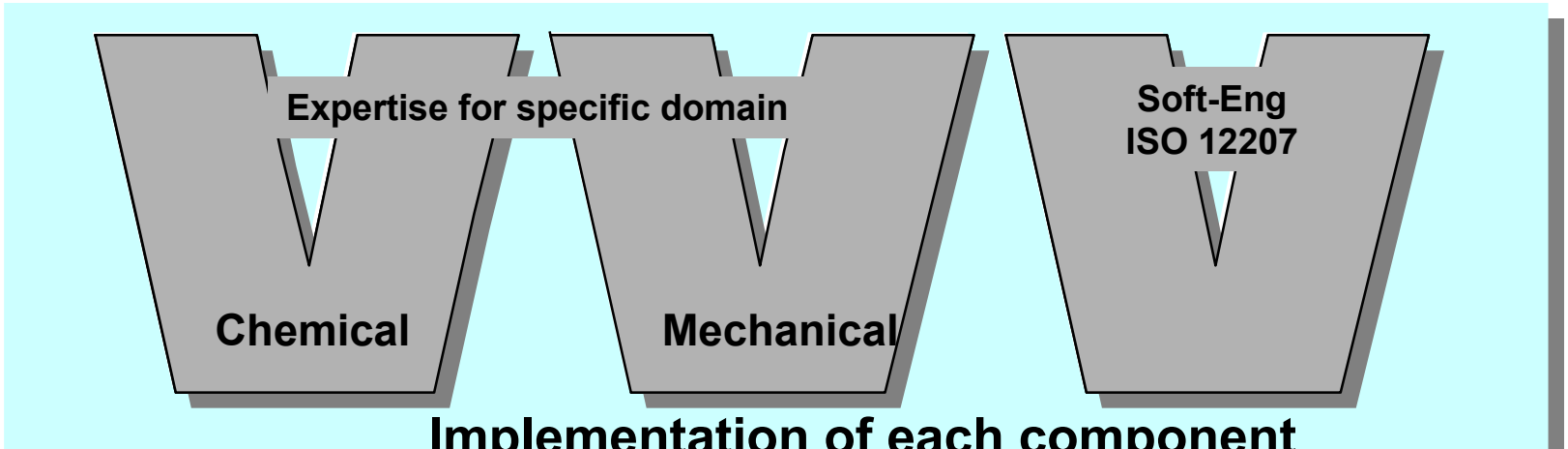




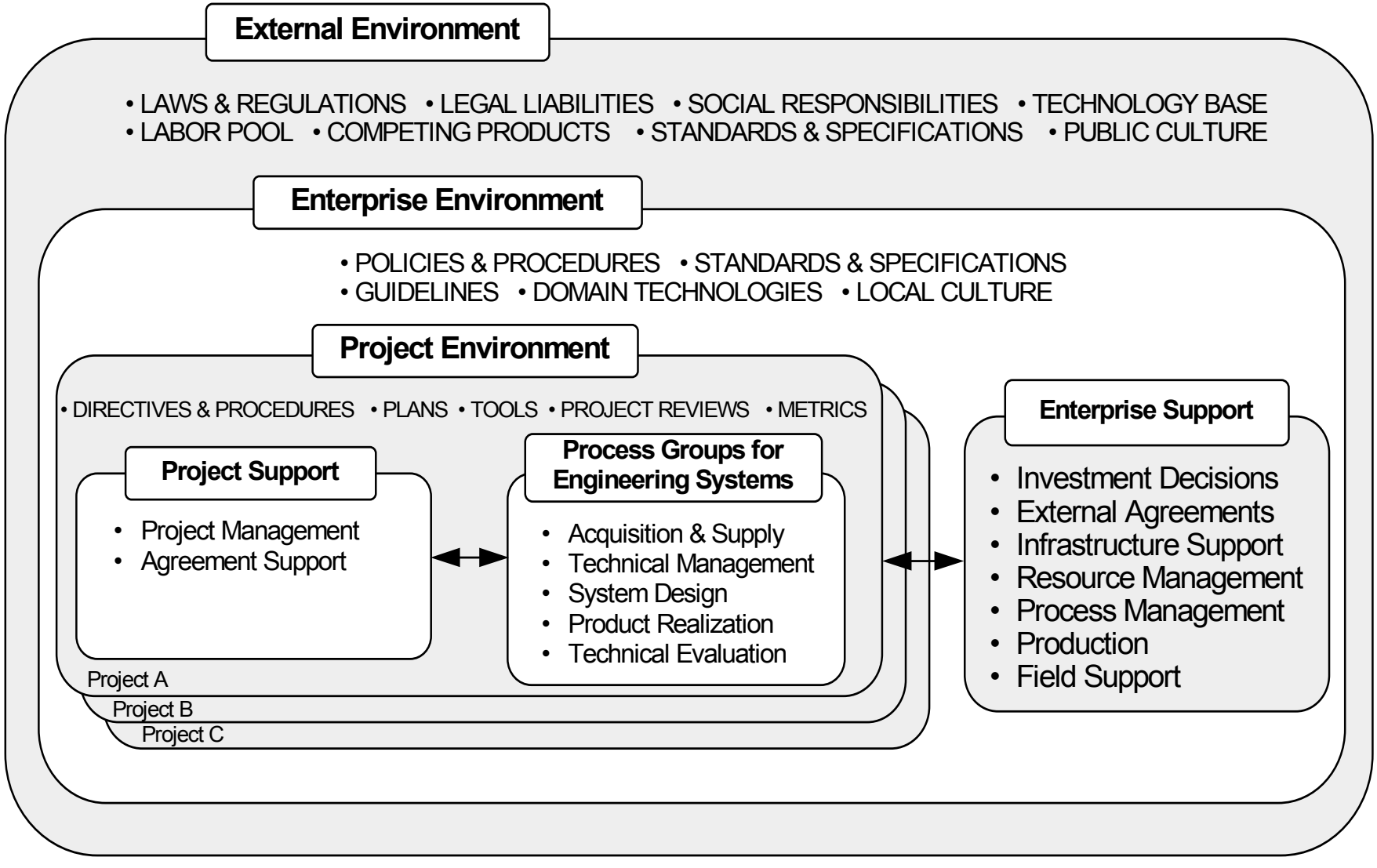


Integration versus specific domains

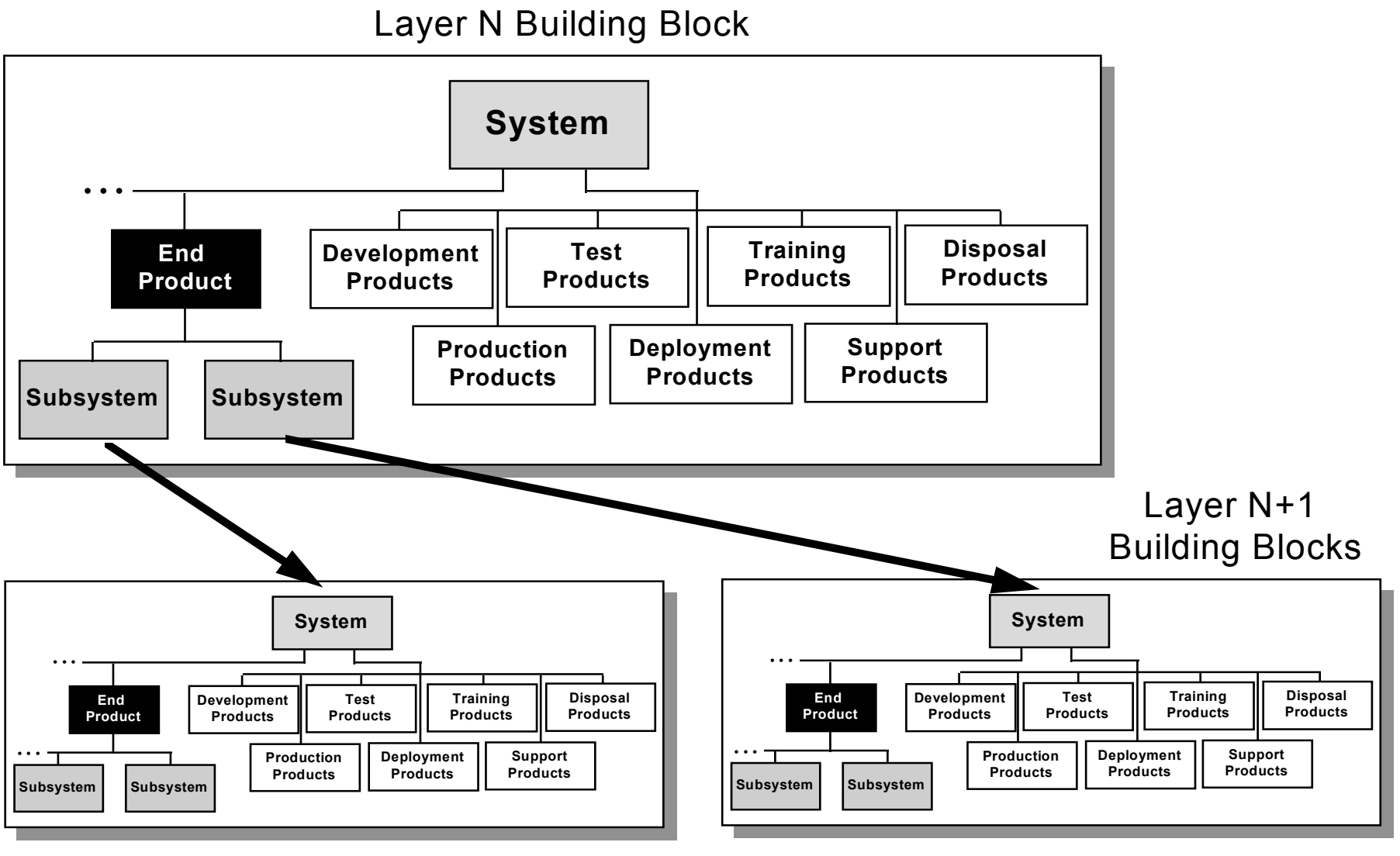




The SE context



System layering



Elicitation and ... *Acquisition* ...

- Elicitation versus acquisition
- Main issues about elicitation : ethno and sociological

Requirement elicitation is a team effort

Requirements management

- What do we manage
- Managing to objective
- Traceability
- Requirements prioritisation
- Problems with metrics

Manage your Requirements

=> Manage your time

Requirement expression

- Maturity levels for expression
- Standard languages and methods
- Dedicated methods
- Others

Intended message and perceived message :
That´s all about semantics !!

Pragmatics and Syntactic issues have a role

Requirements exchange

- The exchange process
- The rationale behind

Exchange is a must : Easiness of requirement validation statement

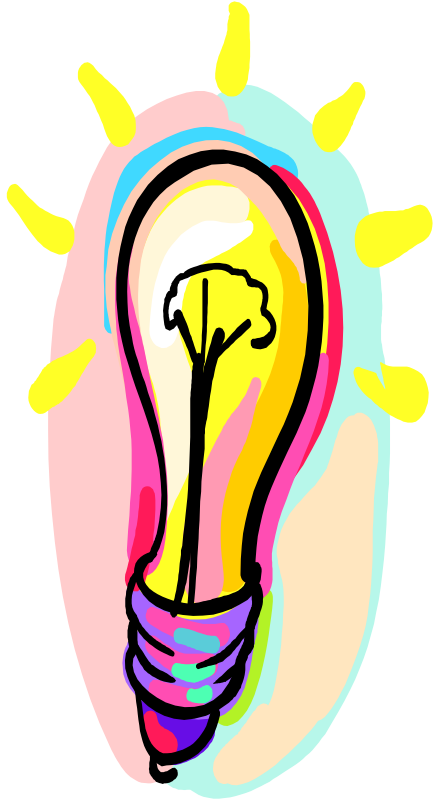
Where do you come from ?

Do you mean which country or which University I come from ?

No I mean which place have you been before !!

Requirement validation

- Importance of Validation
- V&V Techniques
- Case studies



***Eureka**, It Works !!*

It means it corresponds to

What You requested ,

What You required

What You needed

Standards

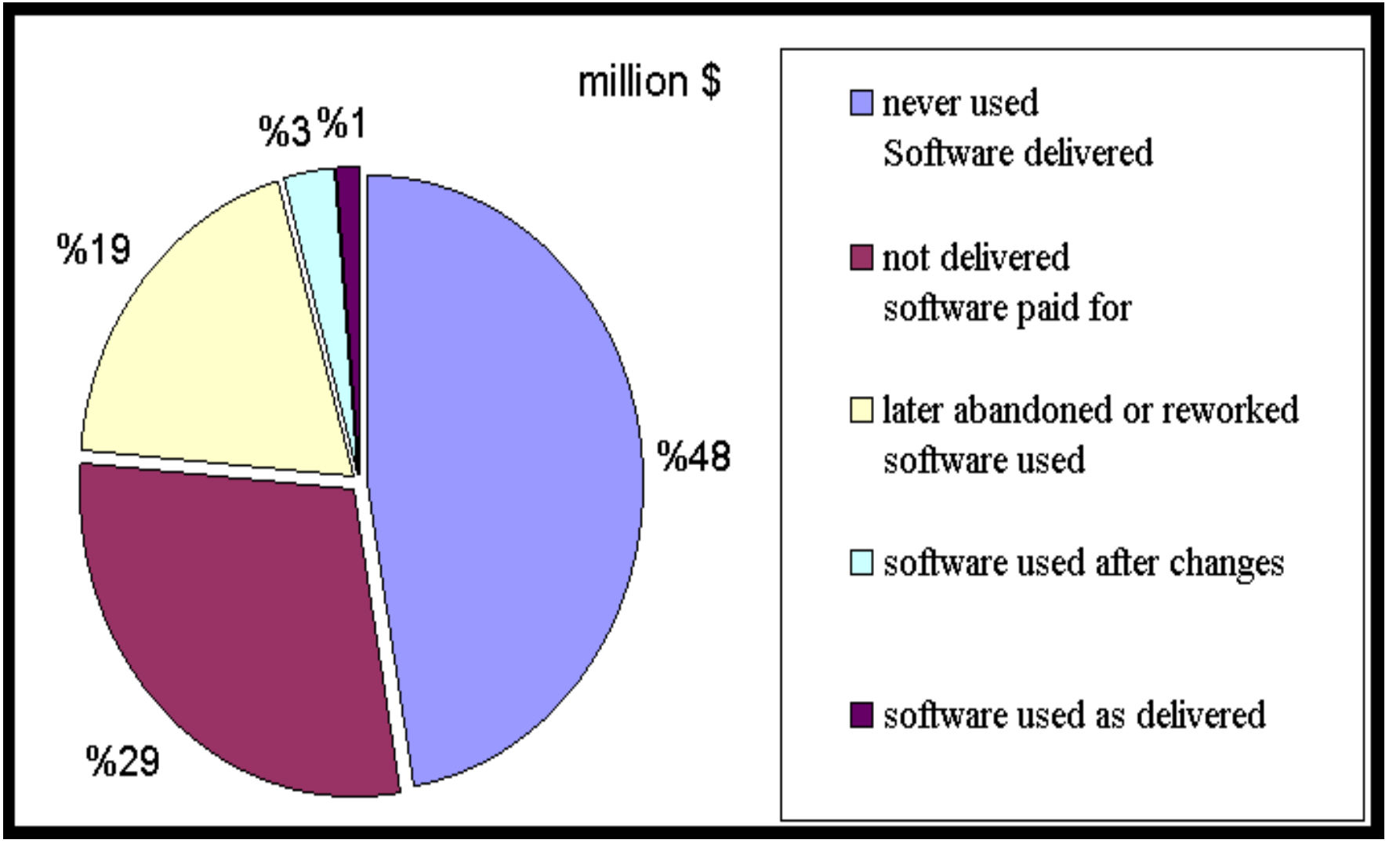
- IEEE-1220
- INCOSE/EIA-632
- ISO 15288
- Specific : aeronautic . ARP and space ECSS-E10

Standard are guideline for common understanding and Good Practice

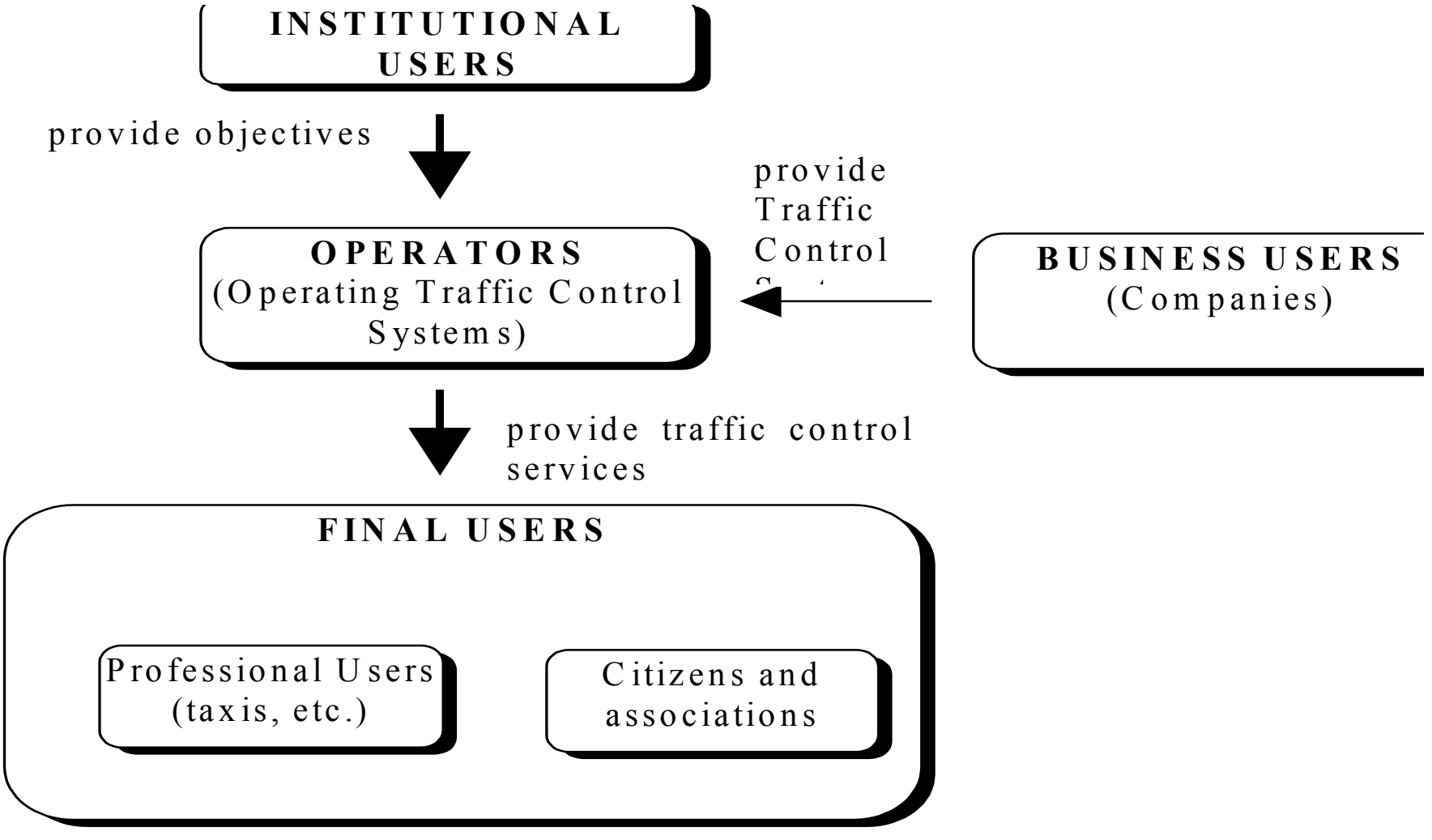
Case Studies

- Requirements expression case with Statemate (Lab)
- Traceability issues with RTM (Lab)

Why SE? A Bad Experiences with SoftEng
(source NASA)

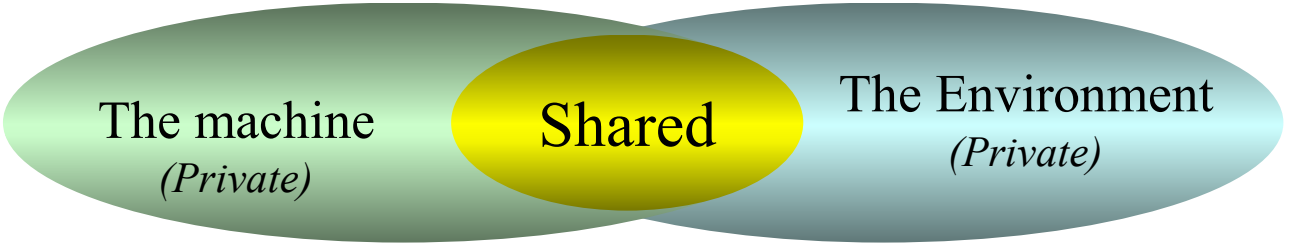


Experiences with transport(4)



Main Orientations (2) : The Jackson View

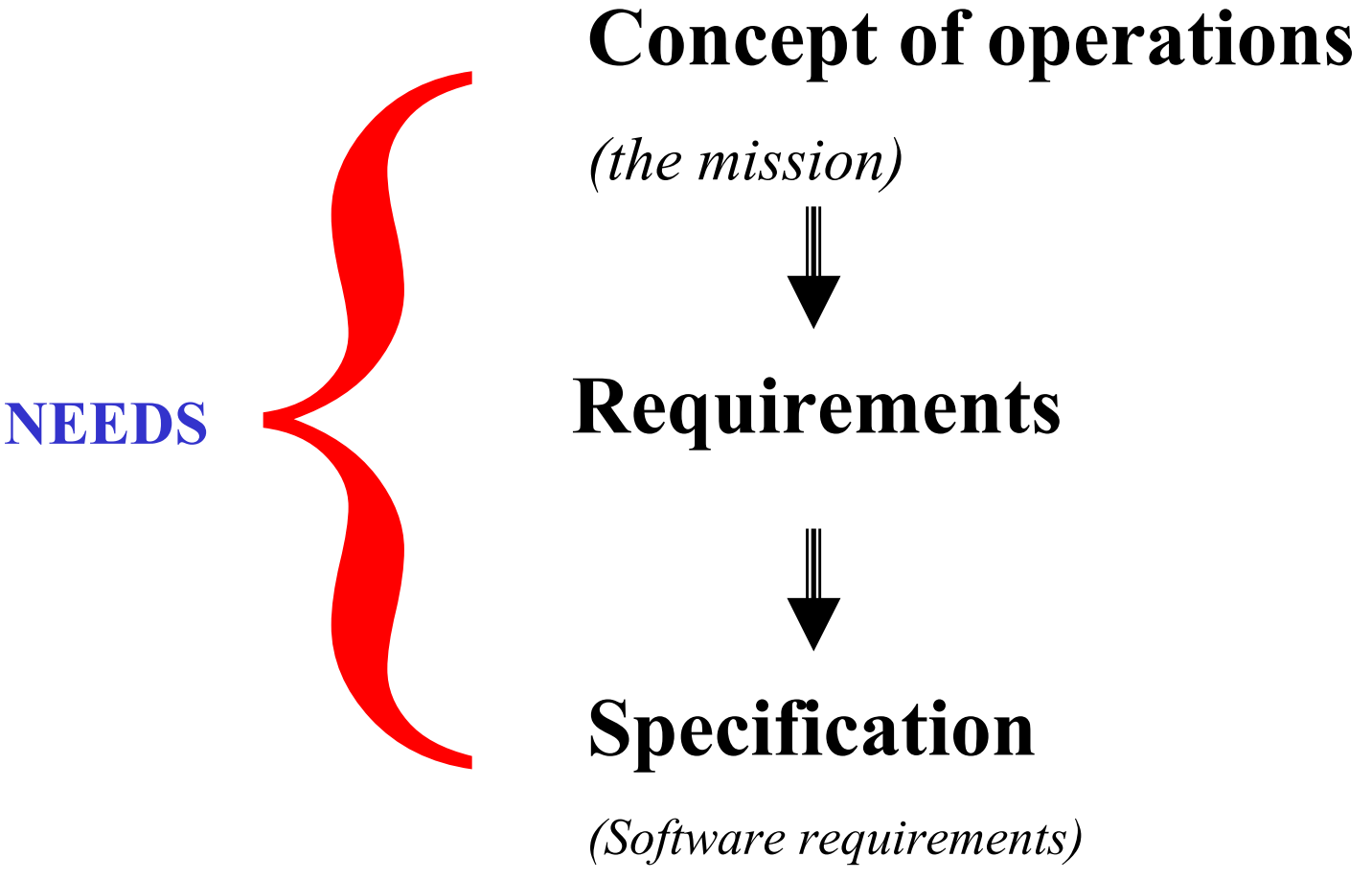
- A View based on environment and context
  - A machine (system) to be developped
  - Machine interacts with environment
  - User needs make abstraction on system internal
  - The environment exist; the machine to be developped
  - Shared phenomen :



Requirement and concept of operation (3)

- *The concept of operations (ConOps) document is a bridge between the operational requirements (events occurring over time) and the technical requirements (static, hierarchical description). It is written in narrative prose that is in the user's language. It states priorities, it uses visual images and leads to sofware requirements.*
- *IEEE Standard 1362, IEEE Guide for Concept of Operations Document, 1998.*

Needs, requirement and specification



Challenges in SE

- A System View : Global View
- An interdisplinary
- Comparative methodologies
- From In House to General approach

Next lecture : Keypoints