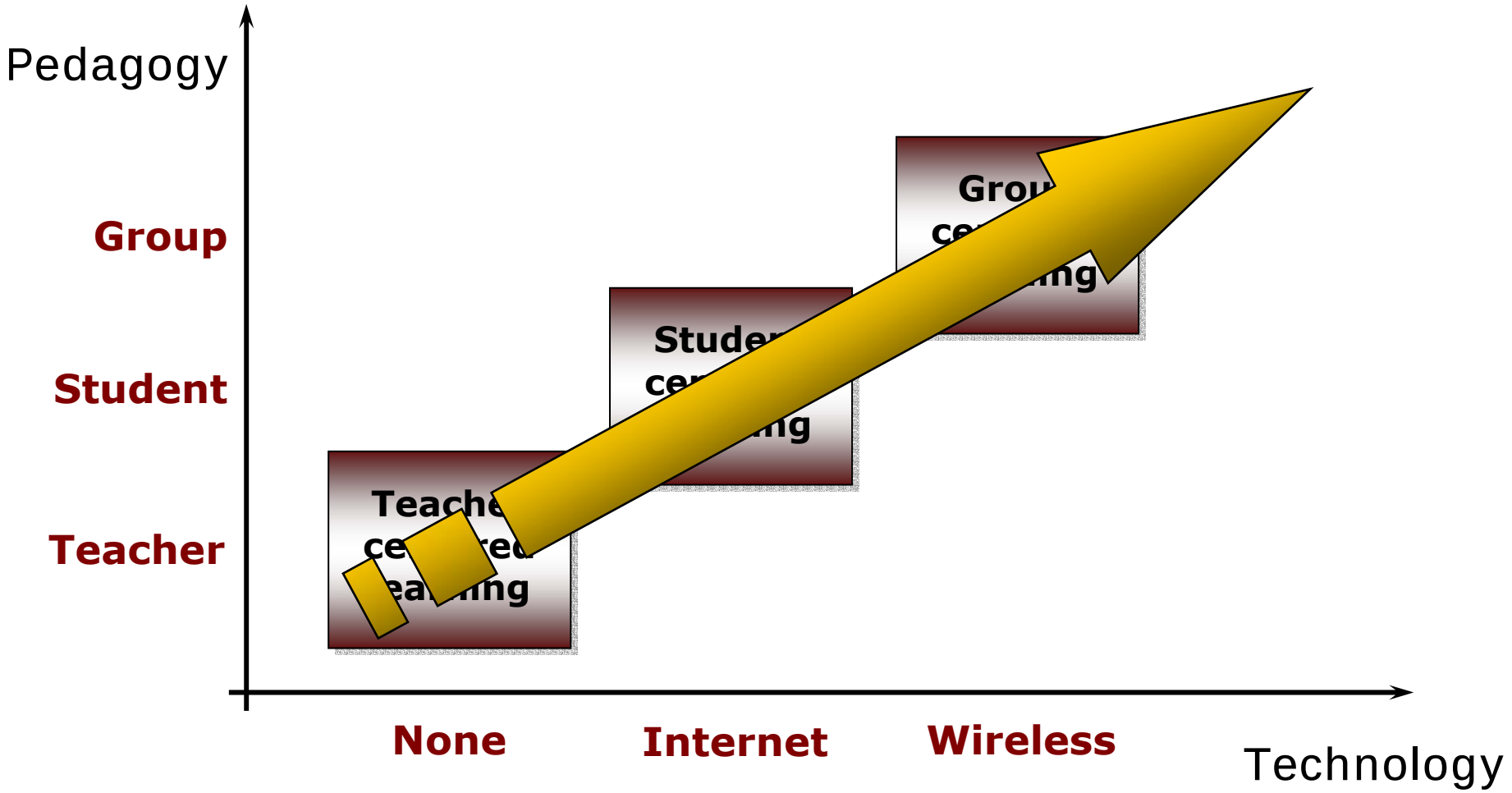
Knowledge Infrastructures for Collaborative Learning

PROJECTS of the Cátedra Telefónica-UPC

Cátedra Telefónica-UPC: Especialización Tecnológica y Sociedad del Conocimiento

Technological Specialization and Knowledge Society



Current staff in the Cátedra Telefónica-UPC

Direction and Coordination

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Current projects in the Cátedra Telefónica-UPC

Changes in the Economic Model	
1.- The new professional competences	**Knowledge Economy and Learning Research Lab**
Knowledge Platform	
2. – Learning space	**Knowledge Infrastructure Lab**
Experiences	
3.- The *Colabora* project	**Collaborative Network LAB**
4.- MIMO - Learning	**MIMO Learning LAB**

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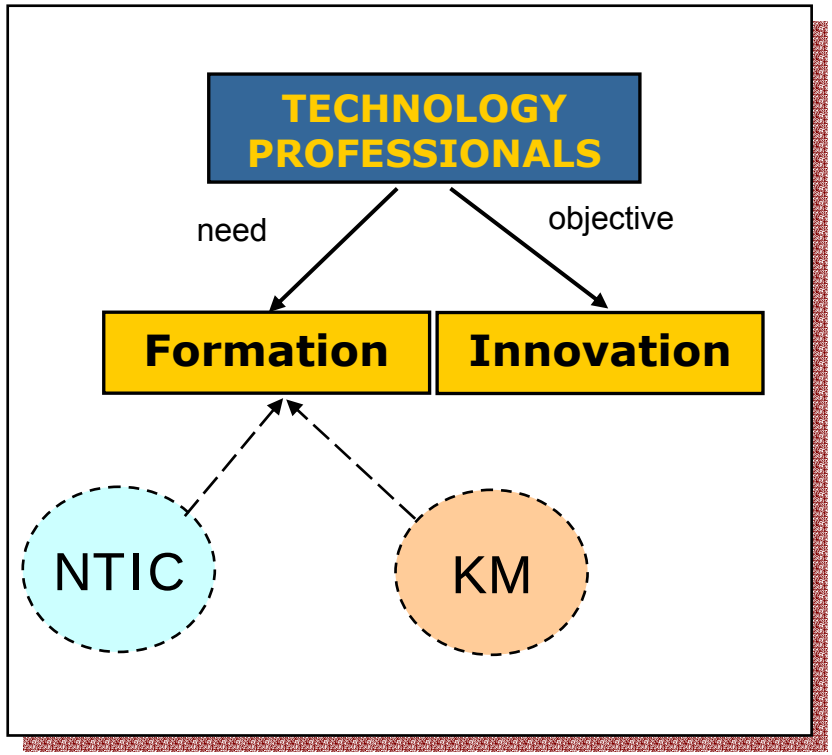
The new Professional's competences

Knowledge Economy and Learning Research Lab

Motivation and objectives

- **New technologies have lead to:**
  - Changes in economy
  - Changes of paradigms
  - Changes in company's management and markets
- **Innovation as key idea:**
  - How does the technology professional innovate?
  - Which competences are needed for innovation?
- **Diagnosis of how the new technology professionals must be:**
  - Which new competences are requested
  - Which profiles companies look for
  - Typologies of the new technology professionals
- **Determine what and how they learn:**
  - At the university: Can NTIC help?
  - At the company: Can Knowledge Management help?

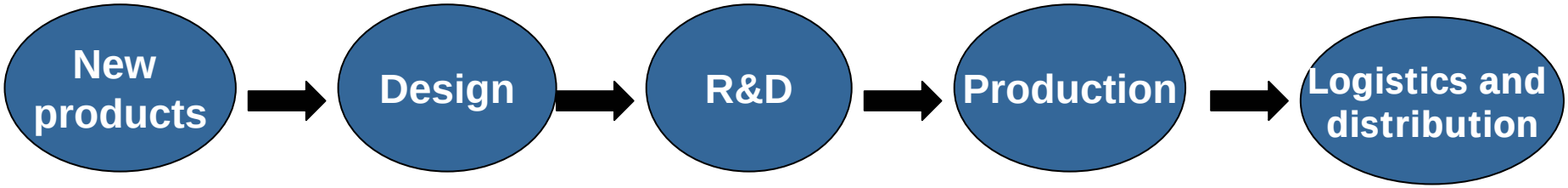
→ **New roles of the technology professionals**



Innovation as the key idea

- **How do they innovate?**
  - Approximation to the process of innovation
  - The phases of innovation
- **The new role of the technology professional**
  - Manager of the sequence of innovation
  - They request the necessary competences to innovate
- **We require a formation**
  - How to instruct for the innovation?
  - How to learn to innovate?
- **Centrality of innovation technology and the human capital**

➢ **Core organizational INNOVATION-TECHNOLOGY**



The protagonists: The technology professionals

- **Which are the new competences requested to the technology professionals? A help:**
  - The accreditation agencies (ABET, QAA)
  - The company's request
- **The competences (ABET)**
  - an ability to apply knowledge of mathematics, science, and engineering
  - an ability to design and conduct experiments, as well as to analyze and interpret data
  - an ability to design a system, component, or process to meet desired needs
  - an ability to function on multi-disciplinary teams
  - an ability to identify, formulate, and solve engineering problems
  - an understanding of professional and ethical responsibility
  - an ability to communicate effectively
  - the broad education necessary to understand the impact of engineering solutions in a global and societal context
  - a recognition of the need for, and an ability to engage in life-long learning
  - a knowledge of contemporary issues
  - an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- **We need a competence and a typology classification for the technology professionals**

Typologies of the technology professionals

- **1st Typology: Intensity and diversity of knowledge**
  - **Generalist:** Extensive diversity, low Intensity
  - **Specialist:** Constrained diversity, high Intensity
- **2nd Typology: Intensity of the scientific basic knowledge, duration and grade of application.**
  - **Higher**
  - **Medium**
- **3rd Typology: Learning model and systems of formation (How).**
  - **Learning model:**
    - Based on the distribution of knowledge (projects formation)
    - Based on the distribution of information (traditional classroom)
  - **Systems of formation:**
    - Intended formation on non-technical competences
    - Unintended formation on non-technical competences
- **4th Typology: Roles within the innovation sequence.**
- **5th Typology: Grades of responsibility within the innovation sequence**

Formation of the technology professionals

Formation objective → Increase the people's knowledge

- When do we instruct ?
  - At the university (individual Engineer)
  - At the company (organization that learns)

- How to teach the competences ?
  - At the university → Project based learning
  - At the company → Knowledge management

- The present-day university situation:
  - A feeling of no adjustment to the present-day company's requirements
  - The university should be at the service of its three main clients:
    - Individuals
    - Society
    - Companies

How to improve competences?: Knowledge Management

- What is it ?
  - Group of processes, organizational structures, applications, technologies and systems that permit that the Intellectual Capital of an organization increases
  - These processes are useful to act quickly and efficiently
  - It can help for innovation and learning
- How do we define it?
  - Establishing a theoretic frame for the definition of the KM through different models.
- KM tools that will be useful for us to form competences and that define the "knowledge space"

KM tools	Competences							
	1	2	3	4	5	6	7	8
Relational database and objects		X						
Motors of information retrieval								X
Groupware and workflow systems			X			X		
Data warehousing	X							

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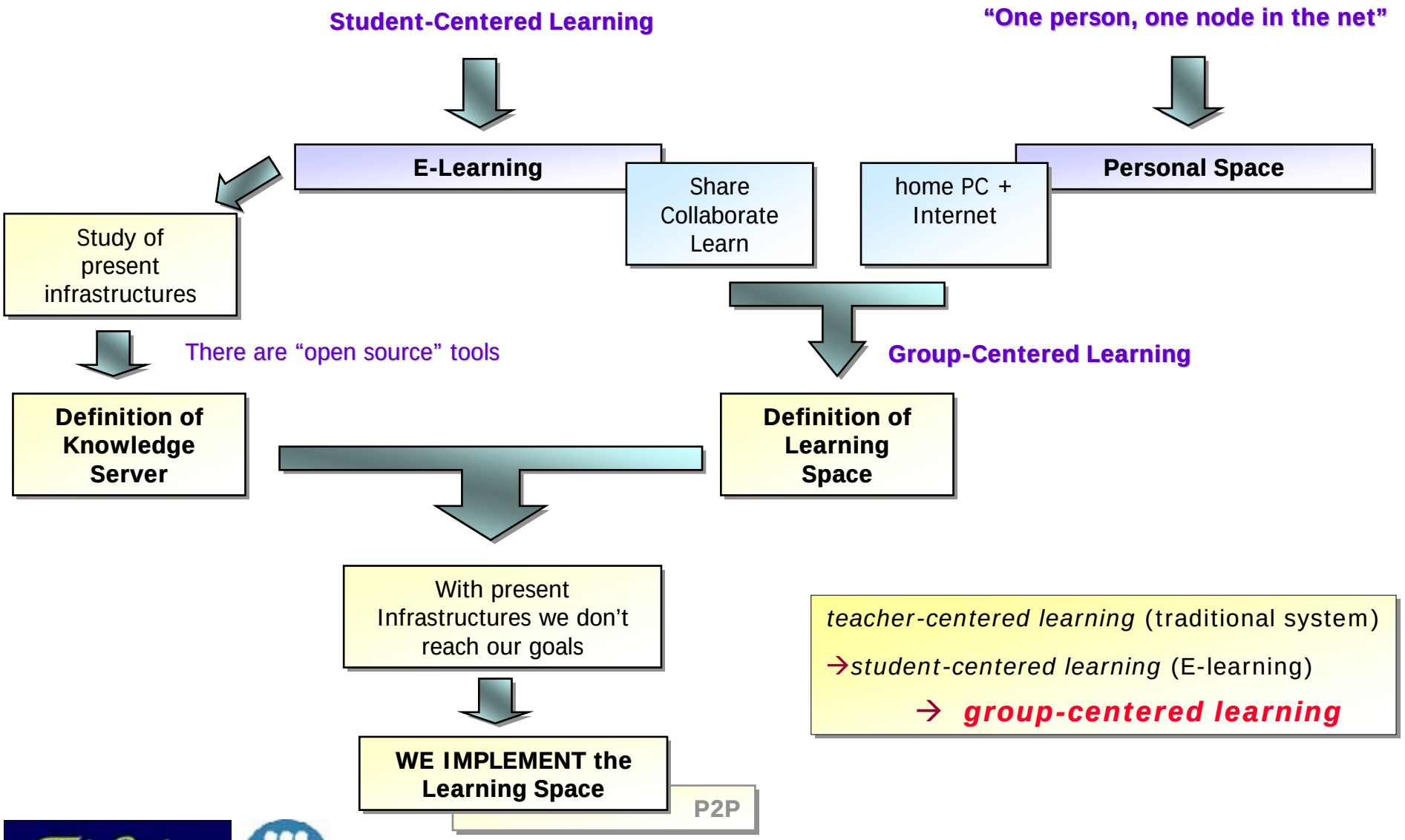
Learning Space
Knowledge Infrastructure LAB

Learning Space



teacher-centered learning (traditional system)

→*student-centered learning* (E-learning)

→ ***group-centered learning***

Learning Space

- **Study the resources and tools** that we need to, if we have

  "One person, one node in the net", reach

  "**N nodes in the net, one learning community**"

  - We define the **"Learning Space"** in the net (Internet) as all the tools and services that a personal space requires to create, manage and share knowledge in the net to allow our own learning.

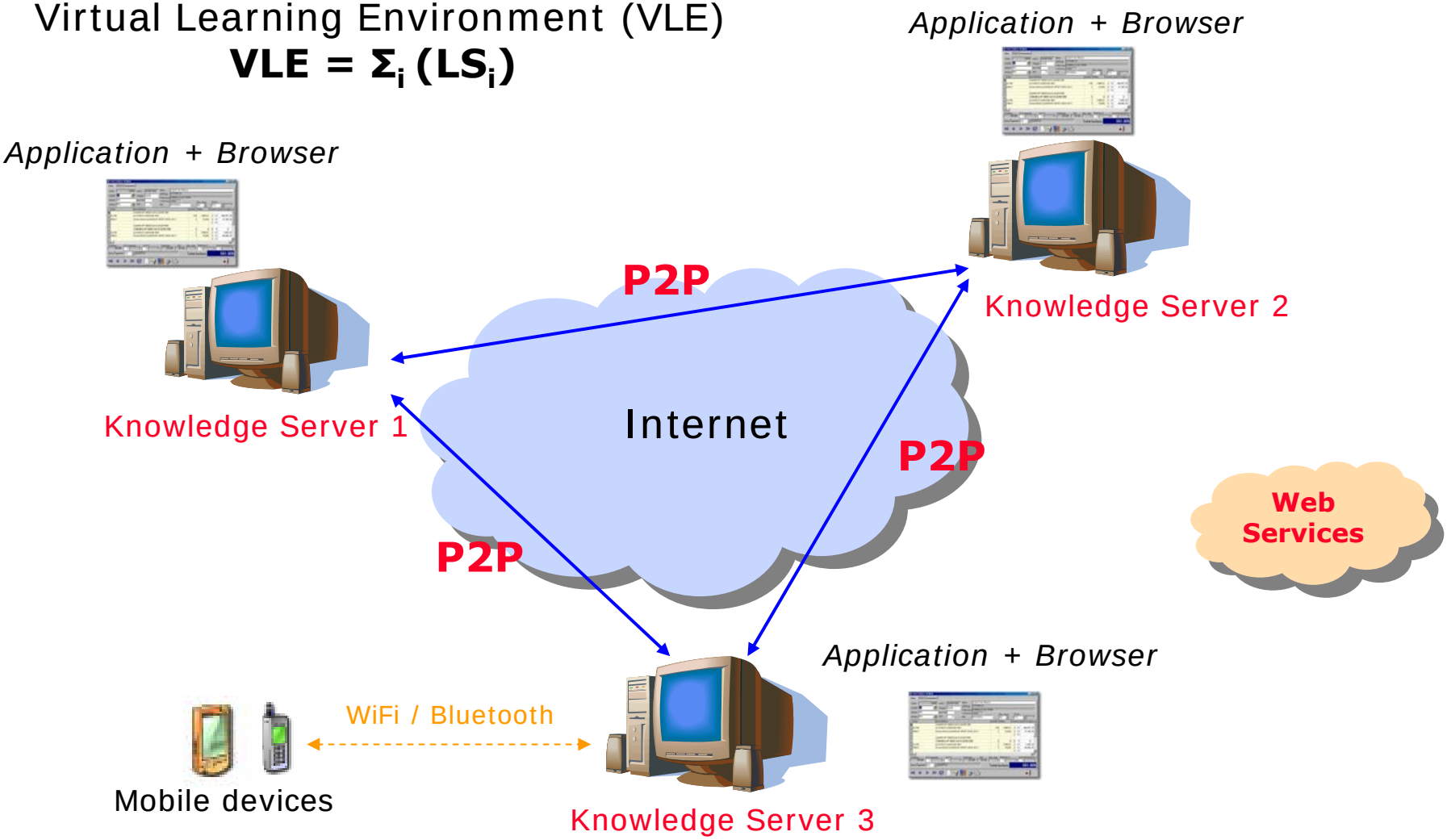
  - We define the concept of **"Knowledge Server"** as a home PC with specific client-server software that allows us to interact with other Knowledge Servers through a **P2P** paradigm.

  - **We implement** a **Learning Space** in a **Knowledge Server**

Learning Community

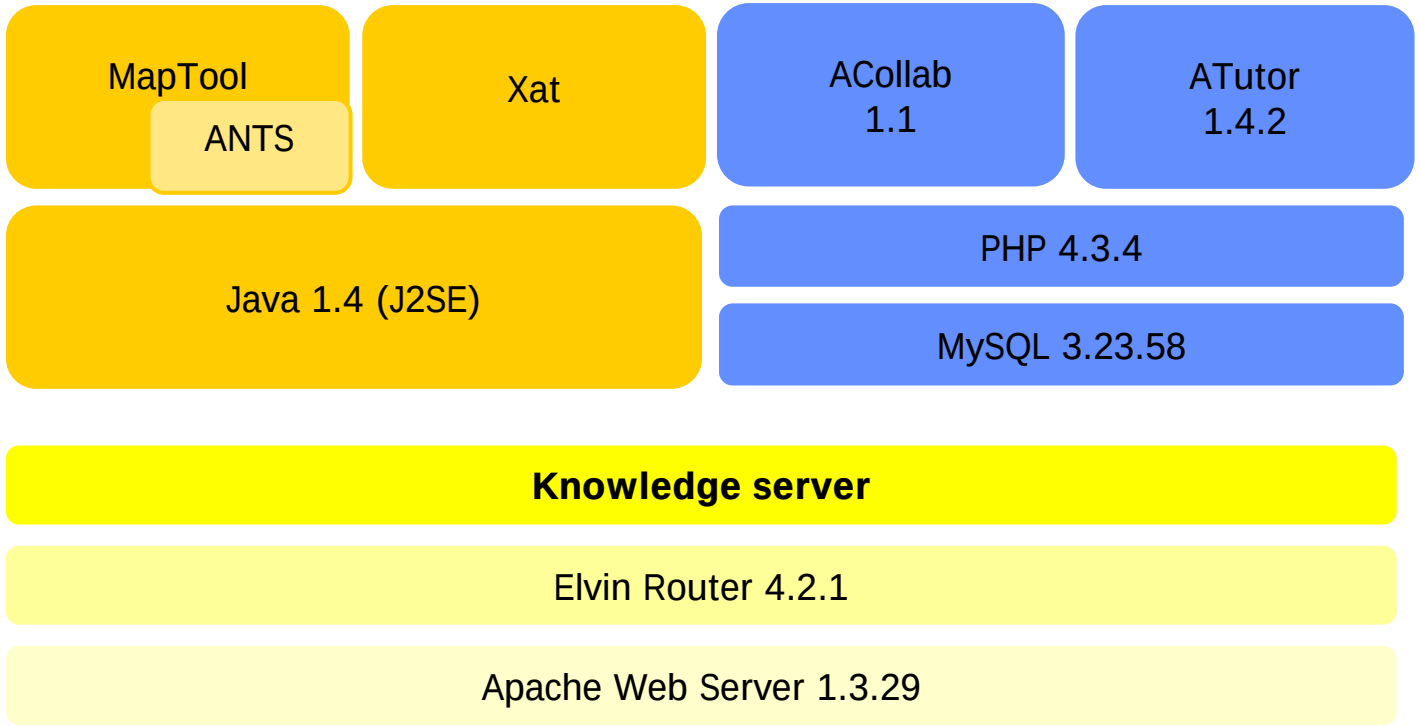
Virtual Learning Environment (VLE)

$$VLE = \Sigma_i (LS_i)$$



Learning Space

- Infrastructure supporting our three basic goals:
  1. Exchange information → ACollab
  2. Exchange knowledge → ATutor
  3. Synchronous communication → Digital Blackboard + Chat



Open Knowledge

- **Open knowledge**: The ideas we have seen lead us to think about a new way to understand the knowledge in the net. It consists of:
  1. **Share with everybody all our knowledge: all the information in our PCs**
  2. **Allow the peers to complement, improve or comment on it**
  3. **It's a local knowledge with global access**

  - **Necessary features to be useful:**
    a. It has to be **well formed.** It means that the format must be recognizable to other Knowledge Servers (representation, structure, organization, etc)
    b. It has to be valid in a specific Knowledge Community.

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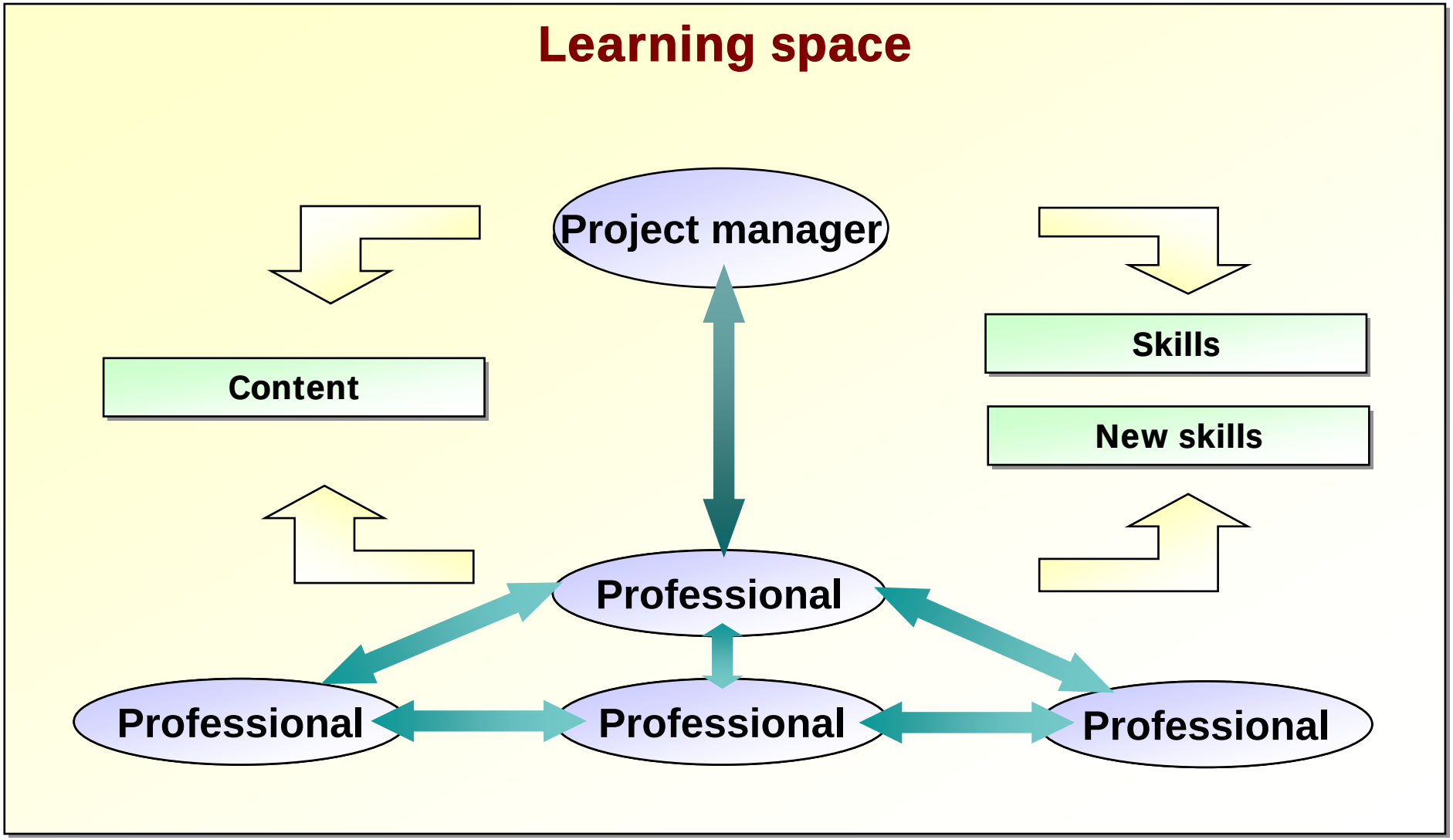
Project Colabora
Collaborative Network LAB

Collaborative Network Lab



Collaborative Network Lab

- OEGP (Open Ended Group Project)
- Increasing student motivation in learning.
- Allowing new 'fast breaking' topics to be explored.
- To develop the ability to deal with non familiar or unpredictable situations.
- Constructivism : to play an active role in the learning process and knowledge sharing
- Goal: to modify the learner behavior after the learning process (Problem Based Learning)

Collaborative Network Lab

Collaborative levels:

- **Horizontal Hierarchy**: we learn with other people and mainly in a informal way, so collaboration between peers in addition to the contents optimize the learning outcomes.

- **Vertical Hierarchy**: collaboration between students and remote teachers will be more and more important as far as companies have headquarters and specialists in different countries.

Collaborative Network Lab

Steps in the trial:

- **Collaboration teacher-teacher**
- **Collaboration learner-teacher**:
  - Learning using *video-based lectures*, animations, presentations and simulations.
  - Assessment of the contents based on tests.
- **Collaboration learner-learner**:
  - Initial task of *decision making* about the work to be done, being an *ice-breaking* phase.
  - Design of an array.
  - Assessment of the projects.
- **Assessment**

Collaborative Network Lab

Assessing the trial's results:

- Quantitatively → through observation of some parameters in the use of the tools (time spent, frequency of use ...)
- Subjectively → based on the answers to open questions made by all the participants involved in the experience
- Comparatively → related to the results of lasts years in the assessment of the same content

4
MIMO Learning LAB

Educational needs: Capabilities

We form people mainly for working in the industry:

- **Team work**:
  - Flat structure (Negotiation):
    Understanding other people's reasoning.
  - Hierarchical structure (Leader):
    Synthesis capability.
  - Hierarchical structure (No leader):
    Capability of working without having all the information.
- **Versatility. Capability of adaptation**:
  - Capability of reaction.
  - Reasoning methodology.
- **Competence in oral communication**:
  - Synthesis capability: Deep understanding.
  - Skills for differentiating the essentials of a topic.

Educational typology

A lecture aiming at the joint creation of contents:

- To exploit the group experience and potential to jointly solve new problems:

  Distributed Model (Multiple Input Multiple Output: MIMO):

  - Multiple realizations of a single problem: Different data.
  - Multiples but partial viewpoints: Optimization from different perspectives.
  - Multiples methodologies of solving: Non-guided problems.
  - Different information sources: Open problems.

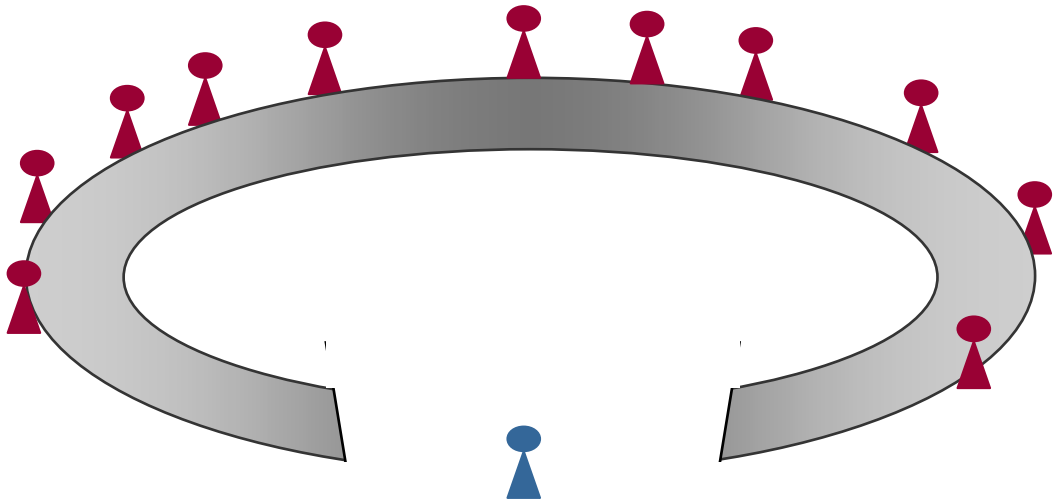
- This multiplicity creates a large amount of information that, in turn, requires a synthesis process to finally create the **Open Contents**:

  - Understand the reasoning methodology.
  - Detect innovative information and innovative reasoning methods.

Lecture methodology (I)

A first part is conducted in the classroom and a second one afterwards:

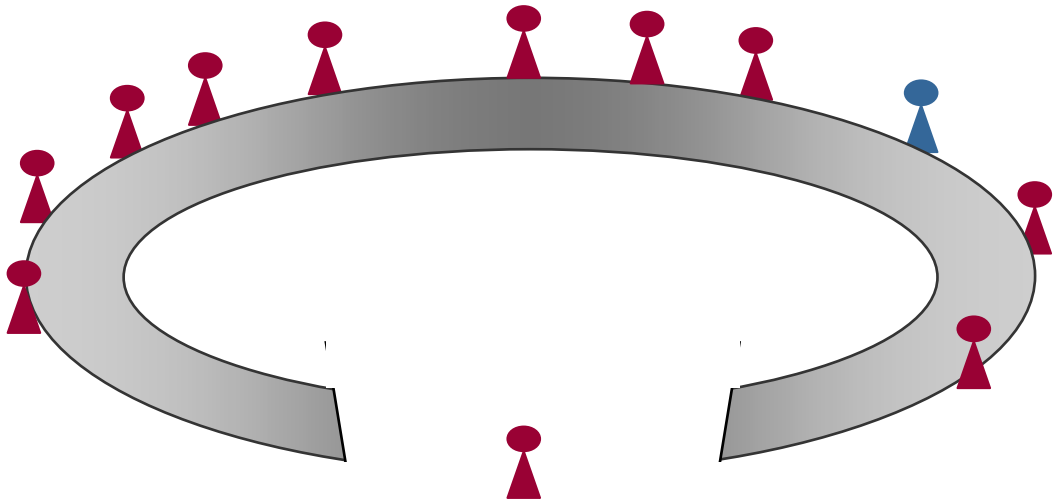
- In the classroom (Synchronous Model):
  - The lecturer exposes the problem.
  - Every student analyses and proposes a solution (as individual or as a team).
    The lecturer as a reference for every student.
    We record every solution and the methodology that has been used.
  - The group discussed a joint solution. The lecturer as a moderator.
    One solution is adopted, although it might not be the best one.



Lecture methodology (II)

A first part is conducted in the classroom and a second one afterwards :

- **Subsequent work (Asynchronous model):**
  - Starting from the records of the various solutions, a global solution combining and synthesizing the previous one is adopted.
    Compare different solutions and methodologies and, if possible, find a new (or previously rejected) better one.
  - Presentation to the group of the obtained solution.
    Analysis of the group dynamics
    Assessment of the open contents.



Framework (I)

Necessary infrastructure for such type of lecturers:

- A classroom where every student has an on-line PC.
  - **Wireless Solution** .
- Lecturer's capability of visualizing every student's screen.
- Lecturer's capability of projecting in every student's screen.
- Storage of the results in the Study Space of the group.
- Remote access to the information created during the lecture:

Current infrastructure:

- **HP Technology for Teaching Grant Initiative -2004**
  - Two classrooms fully equipped
  - 44 laptop PCs (wireless)
  - …

Framework (II)

Type of topic for the development of this type of lectures:

- Master or PhD course.

MERIT: Master of Research on Information Technologies:

- École Polytechnique Fédérale de Lausane (EPFL)
- Politecnico di Torino (PdT)
- Universität Karlsruhe (UKA)
- Université Catolique de Lovaine (UCL)
- Universitat Politècnica de Catalunya (UPC).

Two educative experiences:

- The classroom as a lab:

  Project-based Learning shared by several courses
- The room as a tool:

  MIMO Learning applicable to several courses.

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