

From Mobile to Pervasive Learning



IEE:
Informatics Education Europe

Montpellier
9th - 10th November 2006



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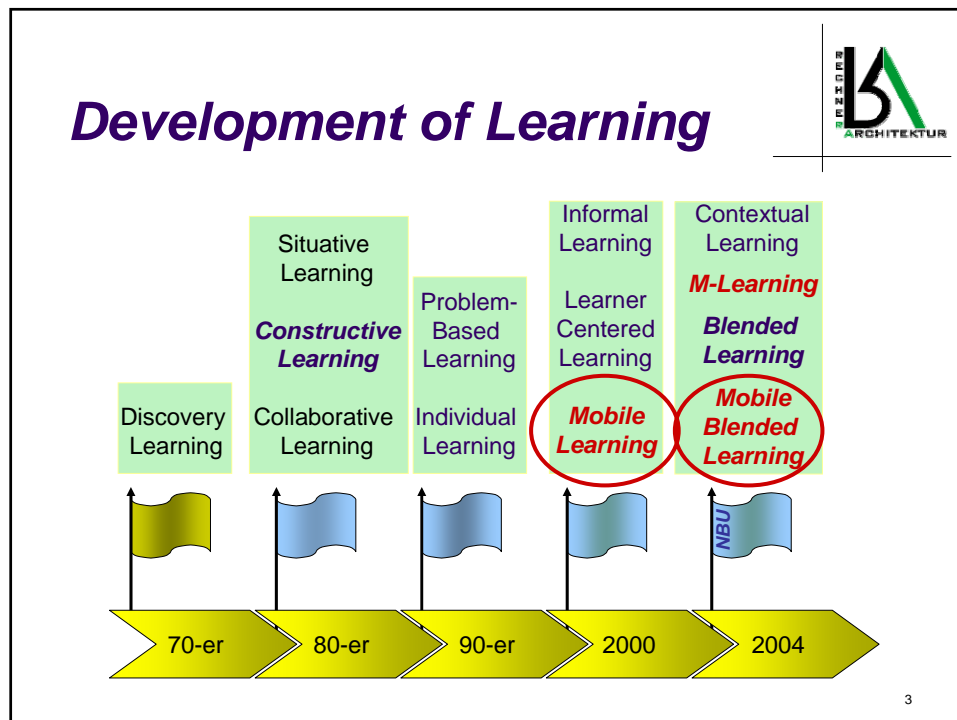
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Content

- Mobility
- Development of Learning
- Mobile Learning
- Architectures for Mobile Learning
- Mobile Learning Projects
- What is Pervasive Learning and why?
- Pervasive Learning, Architectures, Scenarios, Challenges ...
- What will be in the future

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Mobile Learning

- natural evolution of e-learning
- “provision of education and training courses on wireless devices” (Keegan; 2002)
- one component of a complete blended learning solution
- expected by mobile workers
- in combination with session and service mobility as well as device independency just-in-time where you could actually access education and training at the place and time that you need it
- anytime, anywhere, anyone

Logo: RESEARCH ARCHITEKTUR

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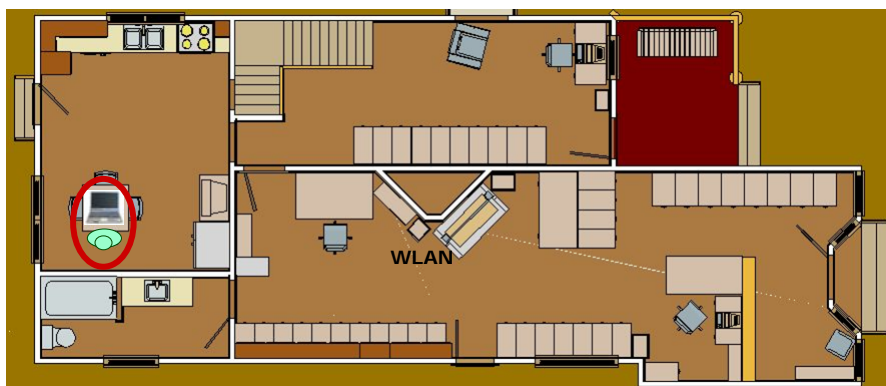
Examples 1



Moving from one place to other with notebook

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Example 2



Moving from one place to other without notebook

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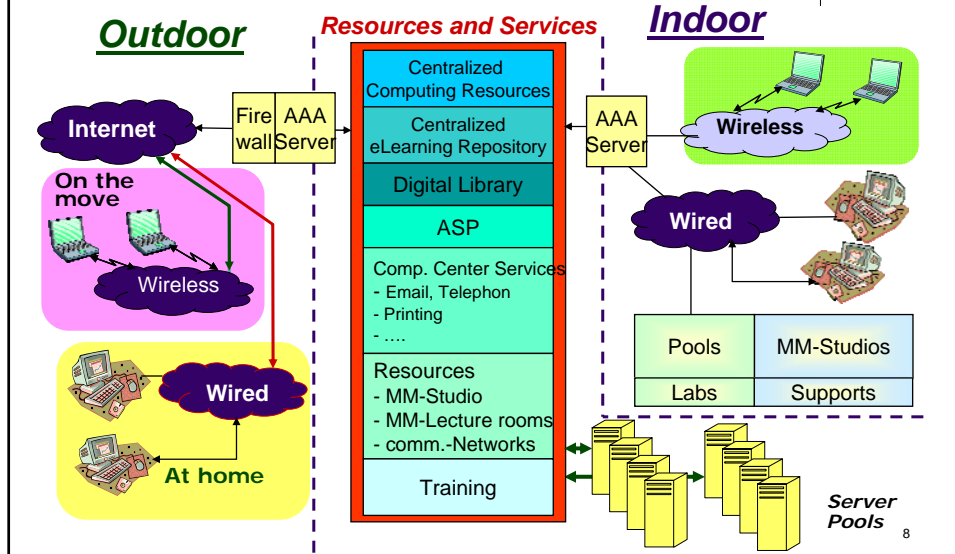


Types of Mobility

- **User Mobility:**
Moving from one place to other
- **Service Mobility:**
Using different services on each computer
- **Device Mobility:**
Using notebooks everywhere
- **Session Mobility:**
Moving the current work from one computer to another

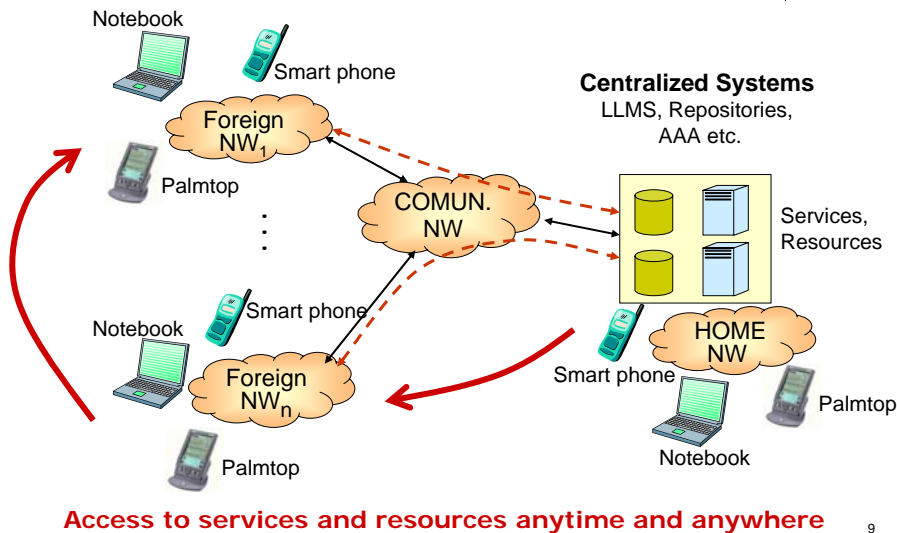
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System Architecture for Mobility



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Organization of the Mobile Process



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Didactics



- constructivist learning environment
building up own knowledge (based on previous one)
while working in a reflexive process directed by the teacher
- learner => active “discoverer” of information
- communication
 - to and from the tutor → feedback on student progress
 - to and from the other students studying the course
- direct access to certain parts of a lecture “on demand” during various phases of learning
- “Pervasive Learning 2.0” based on Web 2.0
(sharing (content) + collaboration)
→ virtual learning community

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Mobile Learning Projects




Local Situation (Rostock) Developments in Europe



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Local Situation (Rostock/Germany)



- **1999**: pilot project **WISS** (Wireless Infrastructure for Students and Staff)
- **2000**: WLAN nearly area-wide available at the University of Rostock
-  precursor in Germany and Europe
- **2001**: implementation of wireless infrastructure in German universities
- **2001**: study “Analysis of using notebooks in teaching and education at universities”
- **2002 - 2004**: project **NUR** (Notebook-University Rostock)

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Germany



<http://www.learnmobile.de/>

<http://www.mobile-education.de>

<http://www.initiated21.de>

www.schule-zukunft-hessen.de/

www.lernen-mit-notebooks.de

http://www.medien-bildung.net/notebook/notebook_9.php

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Developments in Germany



- Support of **42 German universities** by Federal Ministry of Education and Research by a special program to fit the **campuses with WLAN (2003-2004)**
- support of **25 German universities** by the special program "**Notebook-University**" (2004-2005)

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Developments in Europe

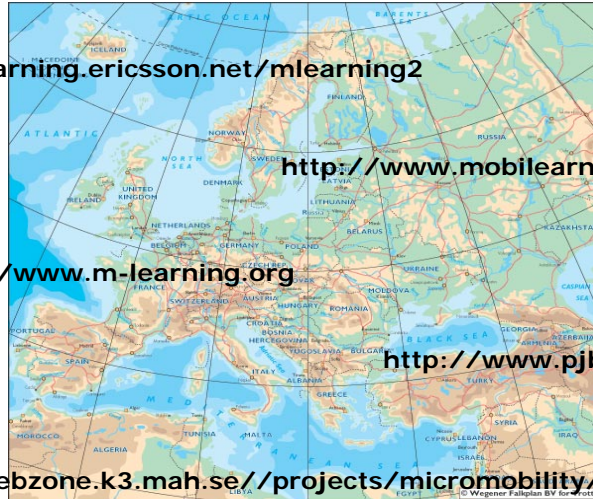
<http://learning.ericsson.net/mlearning2>

<http://www.mobilearn.org>

<http://www.m-learning.org>

<http://www.pjb.co.uk/>

<http://webzone.k3.mah.se//projects/micromobility/>



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MOBIlearn Project

- Worldwide European-led research and development project exploring context-sensitive approaches to informal, problem-based and workplace learning by using key advances in mobile technologies
<http://www.mobilearn.org>
- Partners across Europe, Israel, US, Australia
- Develop technology and services for mobile learning
- Scenarios
 - Art gallery
 - First aid
 - Work-based MBA course

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Other Projects in Europe

- Eriksson - From e-learning to m-learning supported by the Leonardo Da Vinci programme of the European Union
<http://learning.ericsson.net/mlearning2/>
- m-learning project - a pan-European research and development programme supported by the European Commission's Information Society Technologies (IST) programme within the 5th framework (mobile phone) <http://www.m-learning.org>
- European m-learning Forum under the umbrella of pjb Associates
<http://www.pjb.co.uk/>

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Why Mobile Learning is successful?



- Mobile communication devices are provided and offer the following opportunities:
 - for the optimizing of interaction and communication between lecturers and learners,
 - among learners and between members of a community.
- M-Learning enhanced collaborative, co-operative and active learning.
- M-Learning belongs to the contemporary social constructivist paradigm because of its richness in terms of communication and interaction, both synchronously and asynchronously.

Why Mobile Learning is successful?

Mobility Past and Present



Year	1800	2000	Factor
World's Population (bn.)	1	6	X 6
Life expectancy (Years)	35	> 70	X 2
Working hours (per year)	3.000	1.500	X 0,5
Life free time (Hours)	70.000	300.000	X 4
World income (bn.\$)	500	36.000	X 70
Mobility (km/Day)	0,04	40	X 1000

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Beyond Mobile Learning?



How will Mobile Learning environments look like in the future?

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Evolution of Learning



- **E-Learning:**
 - Online and offline learning
- **M-Learning:**
 - natural evolution of e-learning
 - one component of a complete blended learning solution
 - anytime, anywhere, anyone
- **Pervasive Learning, P-Learning:**
 - Is more than mobile learning
 - Based on Pervasive Computing paradigm
 - pervasive support for learning activities in each environment
 - Support of Location Based Services (LBS)

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Pervasive Computing

- **Aim of Pervasive Computing**
 - Is to make easier computing available everywhere it's needed
 - User-centred organization of the services
- **What will be needed:**
Networking and middleware infrastructure,
Service-Oriented Architectures (SOA)
- **Salient features:**
Scalability, mobility, and ubiquity etc.

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Development of Pervasive Computing



- **Pervasive computing** is the **next stage** in information technology
- **Industry analysts** are predicting that Pervasive Computing is the **next paradigm** shift
- **Vendors**, including big IT players, are **investing heavily** in producing the best tools for building applications for pervasive computing
- **Pervasive devices** like mobile phones, PDAs, and pagers **already far outnumber** desktop and laptop computers, and that trend is accelerating
- **Serious computing power and communications** in different embedded systems for all sorts of equipment, such as air conditioning units, oil tanks, car surveillance systems which are being built currently.

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Main Elements of Pervasive Computing



- **Pervasive Community:**
Using selected adjusted methods and tools of Pervasive Computing for a dedicated applications in a closed geographical or application area
- **Pervasive Environment**
Is defined as shorthand for the strongly emerging trend towards:
 - Numerous, casually accessible, often invisible computing devices
 - Frequently mobile or embedded in the environment
 - Connected to an increasingly ubiquitous network structure
- **Pervasive Middleware using**
 - **Overlay communication technologies,**
 - **Location based systems,**
 - **Service-oriented architectures, etc.**

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Technical View of Pervasive Computing?



- Wireless is “big” and mobile devices are “small”
- Better ambient technologies and ambient intelligence
- Powerful ad-hoc networks in closed areas
- User2user, user2machine, machine2machine direct communication
- Always-on wireless connections and ubiquitous computing
- Using wearable mobile technologies

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What is Pervasive Learning?



- In a mobile learning environment the user's mobility is the main focus especially that the user can have access to the resources every where. But the user has to know where the services are!
- In a pervasive learning environment the resources and services will come to the user, or:

The University comes to the student!

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How does Pervasive Learning work?



Example:

- You are in a new area at the university
- You work in a lab and want to print a file of 5 colour pages
- You start the print job on your notebook
- The pervasive environment looks what type of job it is, and tries to find a suitable printer as close as possible to you
- The system offers you a floor plan of the building that displays with the place of the colour printer
- You get the message that your print job was successful
- Finally, you can pickup your documents

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Pervasive University



- Location of the user
- Location of a shared printer

Scenario: print job

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Pervasive University

● Location of the user

Scenario: print job

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More Examples: Pervasive Environment

- Example 2: Where are colour printers?

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More Examples: Process of Pervasive Learning



- **User's question:** I would like to learn about pipeline in processors
- **Principal algorithm:**
 - Search for the available materials, documents and manuscripts
 - If not enough material is available at the local repository, so search on the web
 - Sort the material
 - Find the priority of the documents
 - If necessary combine the documents into one
 - Generate a list of recommended documents
- **Answers of the system:**
 - Please read the first three documents
 - Have a look at the simulation X
 - Have a look at the animation Y
 - See benchmark Z
- **Users action:**
 - Print the documents in question and look at the animation

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Why Pervasive Learning?



- New methods and approaches for learning process
- New methods for collaborated learning with ICT
- Personalized learning with dynamic adaptation of learning resources to individual needs and preferences
- From courseware to performance ware
- Platforms supporting multi-user, context-oriented and interaction on resources, services, and applications

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Our Research Works (PhDs) Regarding to e-Learning Docs



- ***Ulrike Lucke:***
Definition of a document algebra for the description, composition and manipulation of multidimensional learning documents
- ***Marc Röser:***
Metadata for smart generators of learning manuscripts
- ***Deny Voigt:***
<ML>³ a XML-based description language for multidimensional learning documents

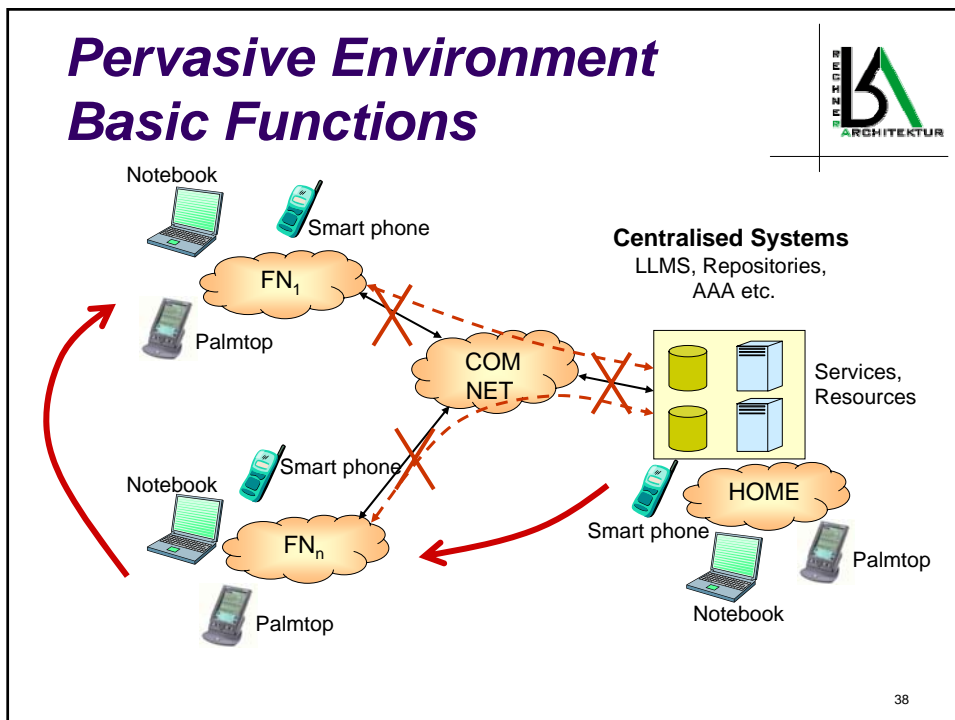
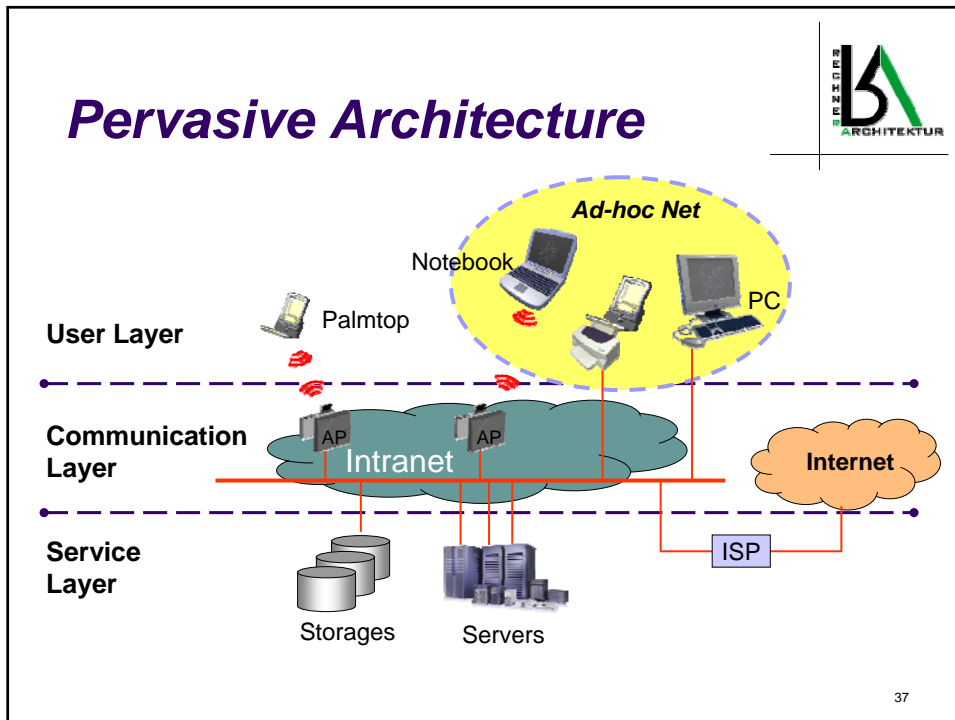
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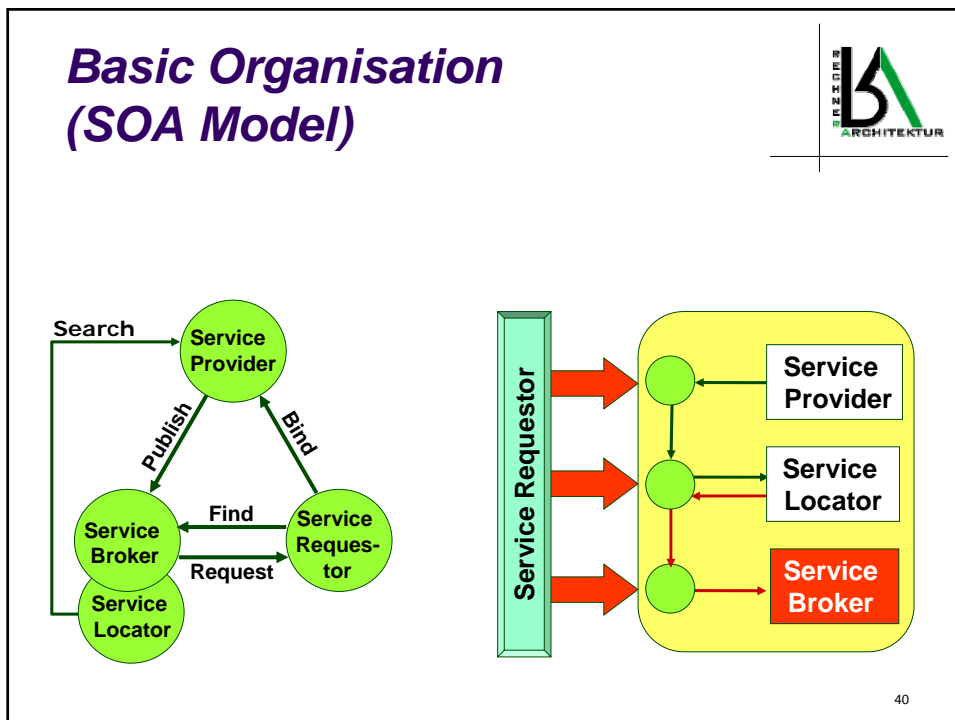
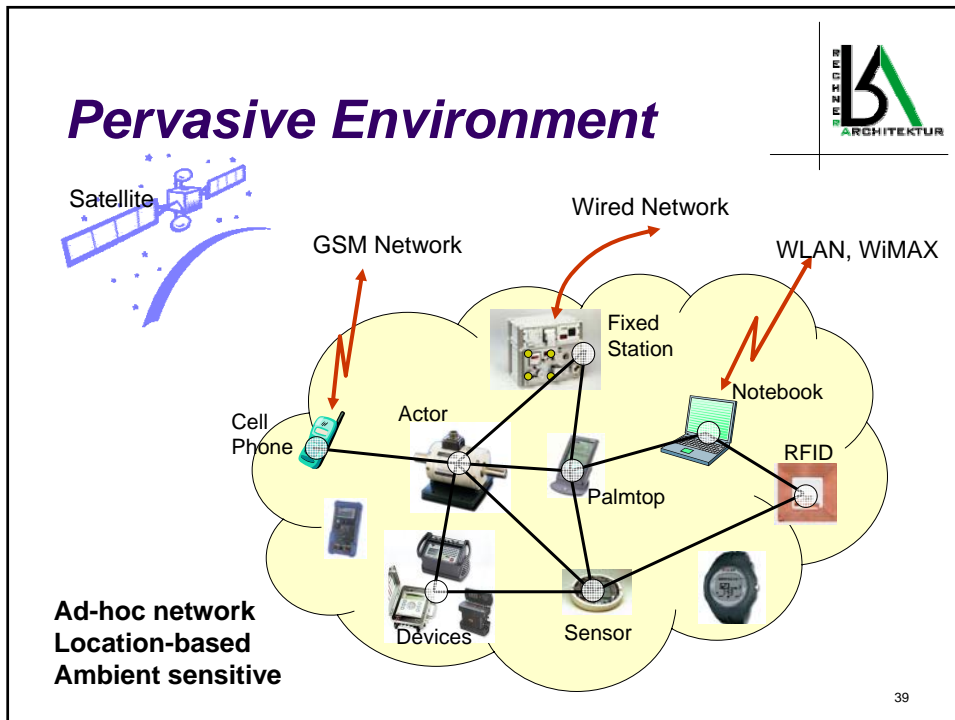
What is Needed?



- Turning training from an event to a process by introducing mobile learning into the systems of daily work.
- Context sensitive systems in users' environment
- Complex Adaptive Systems (CAS) and adaptive targeted training, which relates exactly to what a user is aiming to achieve.
- more widely available and better usable local-based services
- Support for learning activities in each environment at each time, which means:
 - Evolving pervasive learning strategies
 - The need for underlying systems (agents, software probabilistic organisation, etc.)
 - Designing content for pervasive learning
 - Overcoming resistance to the new approach
 - Building workflow learning into the delivery mix (local and global)

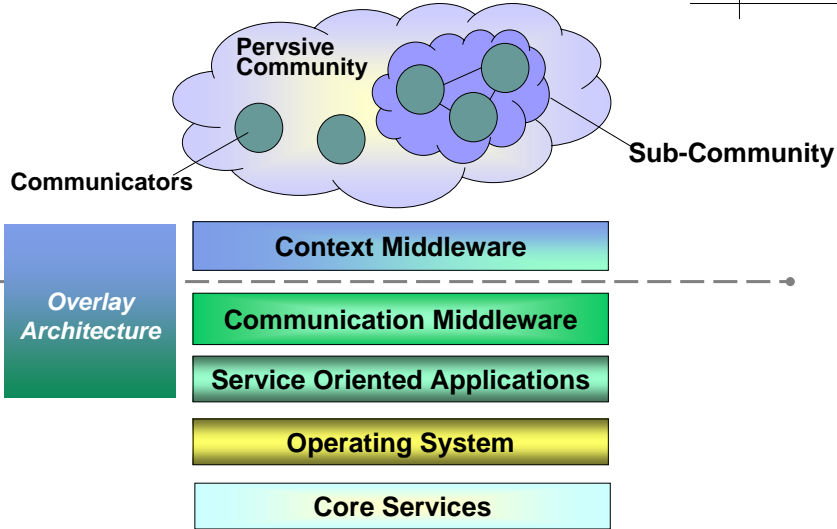
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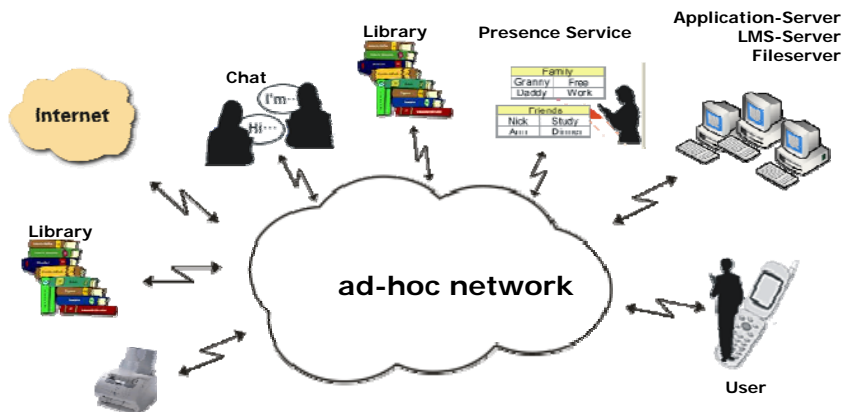
Basic Components



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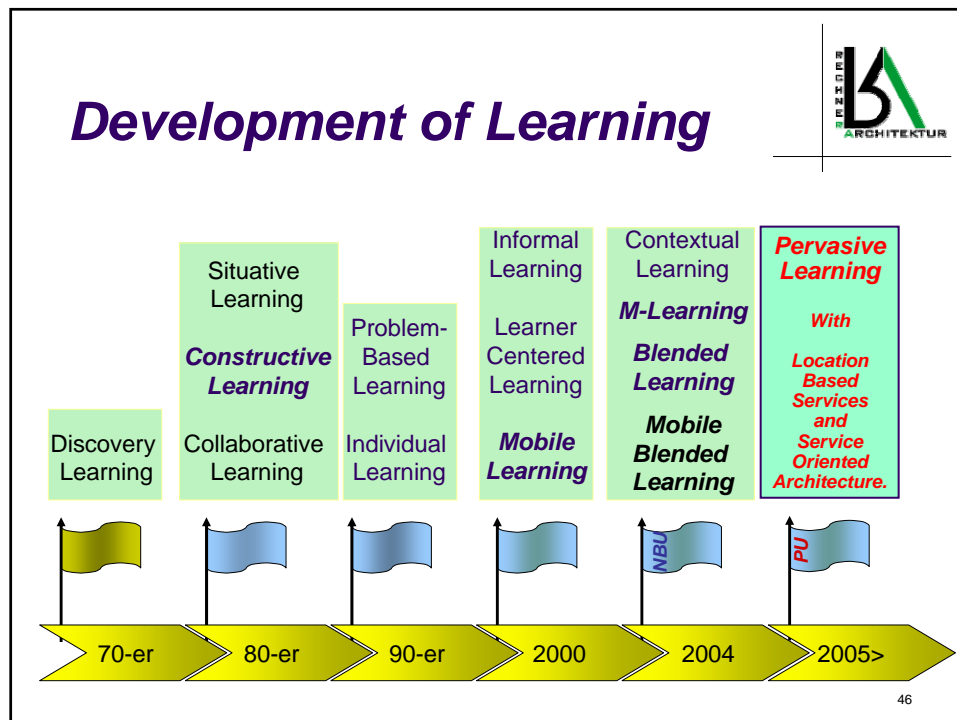


Pervasive University



Merge of pervasive computing with ad-hoc networks as well as context- and location-based resources and services

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Our Research Works (PhDs) Regarding System's Architecture

- **Heiko Kopp**
Self-Organizing Backbone Networks
- **Enrico Dressler**
Overlay Architectures for Sensor Networks
- **Nassim Bahari**
Ad-Hoc Networks in a Pervasive Environment
- **N.N.** (we are looking for a candidate)
Architecture and Organization of a Pervasive Community for e-Learning at Universities

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Conclusion

- Pervasive Learning is
 - learning in a networked world
 - Open learning in response to diversity
- Knowledge and learning in a global context:
 - strategies for the development of the learning environment
 - learning as dialogical process that mediates among diverse learning entities
- Context-oriented environmental support through ambient connectivity to people, services and resources
- Wide range of communication and interaction support

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Conclusions

Changes for Educators



- Teachers, tutors and educators should become the source of
 - HOW to swim in and
 - WHAT to select fromthe ocean of available information and knowledge
- they should become “coaches” within the knowledge era
- they should focus on how to enable learners to find, identify, manipulate and evaluate information and knowledge, in order to incorporate this knowledge into their world of work and life, to solve problems and communicate their knowledge to others

Conclusions

P-Learning Challenge



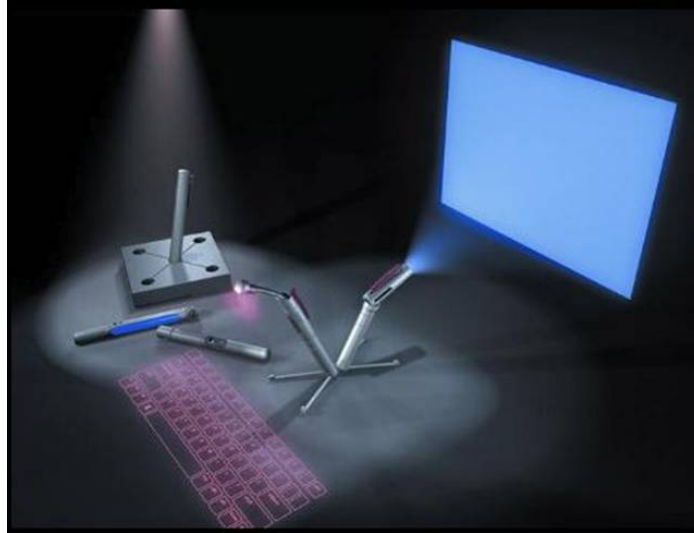
- The design and development process of appropriate learning environments, which are based on suitable didactical principles, is needed to ensure the optimisation of learning in pervasive learning environments
 - Keep abreast of developments in learning theory
 - Identify and anticipate shifts in learning paradigms to be able to adopt and adapt educational technologies that will ensure the optimization of learning in the knowledge era
- 3rd IEEE Workshop Pervasive Learning 2007 in New York
→ <http://wwwra.informatik.uni-rostock.de/perel2007/>

Beyond Pervasive Learning?



How will the Learning environments look like in the future?

Next Device Generations



Visions: University of 2020



Question: I would like to have a poster

Answer: The generated poster as an ePaper is finished and can be picked-up from the room x!

Visions:
The University of 2100



Question: I would like to have 3 print outs of this document and one poster

Answer: Beam the generated ePapers and poster to the user's place

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Thank you for your attention

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