



**ICT MASTER PROGRAMME –
for
Information Security /
Mobile Services**

14.3.2006

Murmansk

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Development Manager

History and Background

- Founded 1969 as an independent department, joined Faculty of Science in 1987
- 1970's emphasis in information systems
- 1980's emphasis in software engineering
- 1990's rapid growth and extension to digital media, software business as well as embedded software and telecommunication
- 2004- master's programme for information security

Basic facts about the Department

- Total number of students around 1500
- New students yearly app. 210-260
- Personnel nearly 140
- Total number of pro gradu theses round 800
- MS degrees 73(2005), 90(2006), increasing till 150
- Ph.D.'s 5-8 (estimated yearly)
- 2004 permanent unit started in
- 2004 office in Petrozavodsk



Specializations areas and general aspects of the studies

<http://www.tol.oulu.fi/english/studies.html>

Orientations:

In Oulu:

- Digital media engineering
- Mobile services
- Software business
- Software engineering
- Information systems

In Kajaani 2004:

- Software
- Software business

Specialization areas

The Digital Media trains experts for the development of digital media content creation and systems. In addition to the development, the students are also familiarized with the use of digital systems in different organizations and in their data management and communication.

Students graduating from this programme can act as go-betweens between coders and customers. They need to master large wholes in a many-sided manner. They have both creative and technical skills in digital media. Communication skills are an essential part of their education and skills. The graduates can become user interface designers, systems designers, software designers, database programmers or project managers.

Specialization areas

- The focus in the **Software Production** is on technical approaches to software. Programming skills are learnt first, followed by the structure, construction and technical possibilities of software.
- Software Production graduates will know how to design, develop and produce software and overall solutions based on them. The design and development of large processes, quite similarly to familiarity with individual software, is the daily grind for them.

Specialization areas

- **Software Business** focuses on the packaging and marketing of software and related services in an international environment.
- All the Software Business students are required to study 35 credits worth of marketing. This programme teaches what software are and how they are made. Packaging, marketing and industrial customer relationships are some of the issues that the students learn to master and develop during their studies. The graduates are sensitive to the needs of companies and other organizations that use software and they know what and how can be done on the software side and how the improvements can be marketed to the appropriate target group.

Specializations areas

- **Information Systems** focuses on the various information systems. Familiarization with information systems involves the areas of development, introduction, use and exploitation. All of these are studied from the viewpoint of practical working life: how information systems can be developed and used in companies and other organizations.
- The programme puts the emphasis on the importance of human interaction and it examines the quality of the systems that are designed. Quality is measured by studying usability and user orientation. The information systems are studied from an anthropocentric point of view. The minor subjects recommended include philosophy, sociology and other subjects concerned with the knowledge of human nature. Those graduating from this programme will be designing various future information systems for the needs of everyday life. The education provides the basis for specialization in various application and management tasks in the IT business.

Specializations areas

- **The Mobile Services** focuses on the tasks faced by the software developer of data communications systems: development methods and tools of communications software, system architectures, programming interfaces, connection protocols, data security and the user interface of service applications.
- The specialization offers the newly graduated software professional an opportunity to find employment in the data communications industry (hardware manufacturers, operators, software companies) and as an expert employed by companies making use of data communications in their business activities.

Re-education

Five re-education programmes:

1. Master's programme for Digital Media 2001-04
2. Master's programme for Software Engineering 2002-05
3. Master's programme for Mobile Services 2003-06
4. Master's programme for Information Security (2005)
5. IT re-education programmes 1998-2002

Information Processing Science in regional education

Master's programmes in 7 localities:

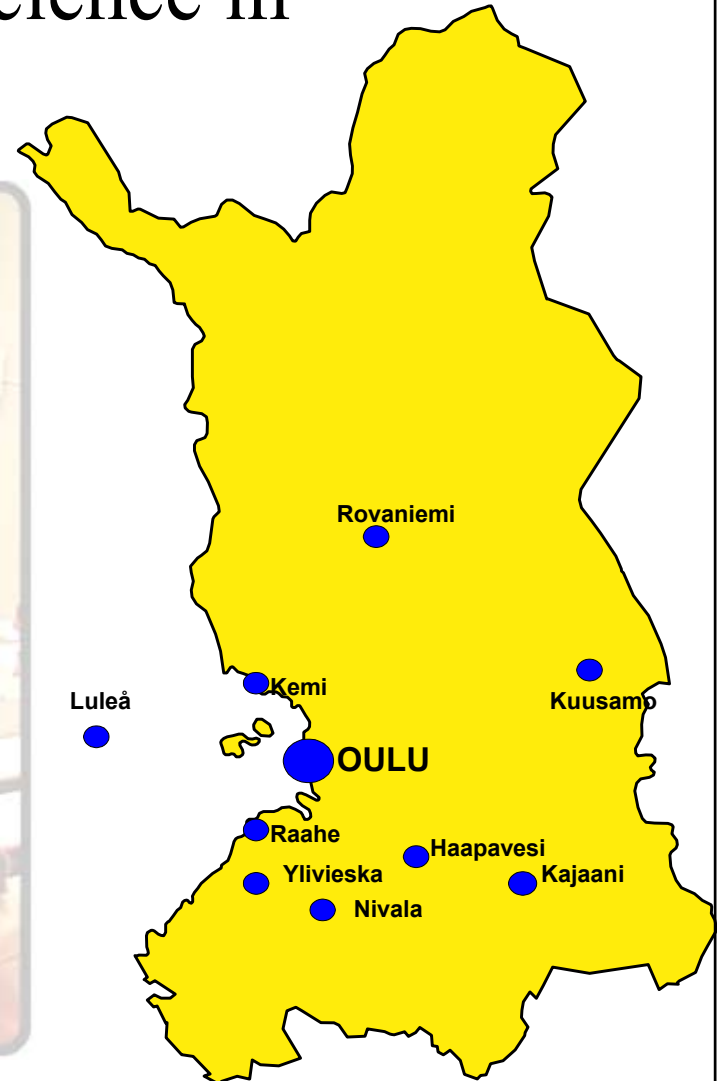
- Digital media
- Software engineering
- Mobile services
- Information security 2005
- International programmes 2006-

IPS in Open university:

- since 1985, now in 9 localities

High school collaboration

2nd grade collaboration



Specialization areas and general aspects of the studies

- ✓ People graduating from the Department of Information Processing Science can work in any job in the information industry.
- ✓ After graduation the student has a practically 100 % opportunity to find employment in an IT company or IT research and development projects.
- ✓ Collaboration with IT companies.
- ✓ The studies put an emphasis on the social skills that are important in working life. The teaching focuses on the importance of teamwork skills and communication. The students can build their expertise within each specialisation area flexibly according to their own interests.

Industry cooperation

- Personnel exchange between companies and the University of Oulu has increased
- Part-time professorship and simultaneous employment in industry (for example 30%/70%)
- Seminars in cooperation with companies
- Recruiting happenings for students (fairs, get-acquainted happenings)
- Direct and intimate cooperation with students as part of the curriculum
- Part of the teaching staff secondarily employed by companies (teaching, software development, consulting)
- Company personnel give guest lectures in courses

Work orientation in teaching

- Several courses in the curriculum include practical parts carried out together with companies:
 - Exercise assignments
 - Seminars
 - Programming and systems work projects
 - Masters theses
- Company staff work as experts in the implementation of some of the courses
- Company representatives partake in directory groups of project-type courses as well as study programs

Work alongside with studies

- Most of the students work alongside with studies, this is emphasized especially in reorientation and masters programs
- Amongst the students there are people changing from one field to another, re-educating themselves and supervising others changing fields
- Requires flexible implementations for education:
 - Evening groups for exercises
 - Versatile utilization of education technology
 - Digital education material in order to reduce time and place dependency of studies
 - Investment in supervision of studies
 - Alternative ways of fulfilling course requirements
- IT companies support students:
 - Partial carry-out of studies during working hours (4-8 h/week)
 - Partaking in study costs (study materials, paying for master theses work)
 - Flexibility in working hours

Regional research directors in IT sector

- Utilization of university know-how in IT education, research and development
- Furthering of competitiveness and expansion possibilities of existing companies and establishment possibilities of new companies in order to create new jobs
- Responding to development needs of the region in the form of the preparation and implementation of a regional research program in cooperation with public and private IT partners in the area
- Responsibility for research, its development and the procurement of additional resources as well as for participation in the planning and implementation of research projects
- Regional cooperative activities in Kajaani, Raahel and Oulu southern area

Most wireless city in the World

In Linnanmaa function the university and its IT units in close cooperation with the Technical Research Centre of Finland (VTT) as well as the first Scandinavian and the largest Finnish technology park (Technopolis Oyj) – born directly under influence of the University of Oulu.

Oulu declared itself the city of technology a little over two decades ago.

Now the city is one of the hottest centres of technology in the world, where it has been recognized mainly for its strong efforts to boost mobile phone technology research and knowledge.

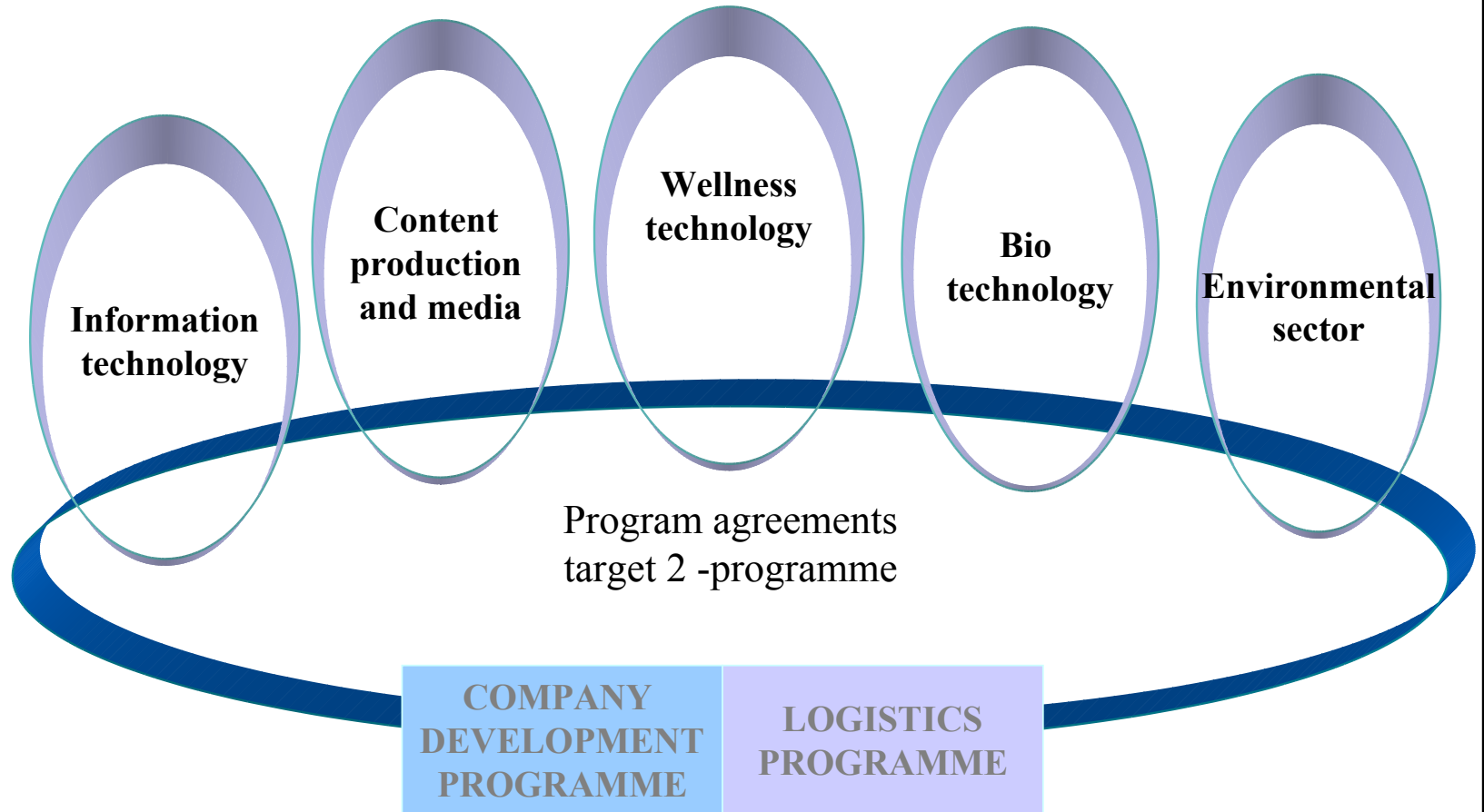
Nowadays almost 60 percent of the jobs and one third of the companies in the Oulu Region operate in the field of information technology - wireless technology in particular in many different application areas.

High technology in the region of Oulu:

- employed about 14,700 people in 780 enterprises
- generated a total turnover of about 3,7 billion euros

Oulu Growth Agreement 2006

CLUSTERS



Oulu Growth Agreement 2006

In February 2002 Growth Agreement 2006 was closed to summon all the Region's resources for a joint effort to make the city of technology even more diverse, capable, competitive and a better place to live in.

Strengthen Oulu's position as an internationally renowned centre of expertise.

Improve the competitiveness of the Oulu Region

Develop and strengthen the growing industries in Oulu

Create opportunities for establishing new jobs and businesses

Diversify high technology in the Oulu Region

By 2006 the agreement will create 150 new businesses and 6000 new jobs

Partner companies in research activities

- Donation professorships, also at our department in software business
- In research projects there are often several national and international university and company partners
- Participation in cooperative research projects is managed with participation fees depending on research financing programs
- Also small IT companies partake with a small monetary contribution
- Research directors and professors have an important role in the implementation of the regional research and education responsibilities of the university

Infotech Oulu

<http://www.infotech.oulu.fi/>

- Research centre founded to promote long-term research in information technology
- Own graduate school (200 students)
- Focal research areas include electronics and measurement technology, software engineering, wireless communication, and information processing
- The department's projects participate in the Mobile Forum, a collaboration programme for research institutions and companies to research and develop mobile information technology products.
<http://www.mobileforum.org/>

Infotech Oulu

- The Department of Information Processing Science is involved in InfoTech Oulu which is an organisation aiming to promote and unite state-of-the-art research on information technology.
- InfoTech includes two research groups managed by the department,
- **INTERACT** (Human Interaction with Advanced Mobile Services and Intelligent Environments)
- **OASIS** (Oulu Advanced Research of Software and Information Systems)

Graduate Schools

- Center and Graduate School of Information Systems,
Software and Digital Economy (CISDE/GISDE)
prof. Harri Oinas-Kukkonen
- Software Engineering Graduate School (SEGS)
prof. Ilkka Tervonen
- INFWEST
prof. Juhani Iivari
- FILOSI (Finnish Linux and Open Source Initiative)
Senior Assistant Henrik Hedberg

Mobile Forum Oulu

<http://www.mobileforum.org/>

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Software Forum Oulu

<http://www.swforum.net/>



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ICT-master programme

Multidisciplinary international cooperation in
Information Security

ICT-master programme₁

Step by step

- Joint understanding and agreement on the cooperation between the partner universities
- Adapting the Bologna process between partner universities
- Necessary administrative actions at collaborating universities
- Description of objectives, topics and contents for cooperation
- Project plan and applying resources for the project
- Developing Joint Pool of courses for collaborative studies
- Student and teaching staff exchange
- Targeting to Dual Degree/Joint degree

ICT-master programme₂

Step by step

The development is divided into seven subtasks:

- 1) Credit system for students' success evaluation
- 2) Development of academic mobility
- 3) Development of courses on English language
- 4) Development of distance education
- 5) Student selections at universities
- 6) Participation at the international education projects related to Bologna Process
- 7) Dissemination of information, knowledge, experience and resources at collaborating universities of Russian Federation and Finland

Information security₁

- Protection of information, services, systems and telecommunication.
- Sufficient level of information security is essential condition in many activities inside society e.g. in industry, public sector and IT –sector.
- Role of information security is increasing at the same time as the use of information technology increases in organizations and people's everyday life.
- Threats to information security, information society, electric transaction, internet services, networking and fast technical development are all factors increasing the importance of information security.

Information security₂

- Threats to information security include breaches of personal privacy, e-mail spam, industrial espionage, private copying, computer viruses, network terrorism and electronic warfare.
- Defective information security has effects on the whole organizations activity.
- Disturbance or even paralysed activity, knowledge leak outs etc. cause credibility problems, extra work and expenses.
- Improvements of information security and privacy increase citizens' and companies' trust in the information society

Curriculum Structure₁

Information Security

- ✓ General structure follows the European Union guidelines (Bologna Agreement)
- ✓ 3+2 years framework, 3 years for bachelor and additional 2 years to master of science degree
- ✓ Specified using the European Credit Transfer System
- ✓ ECTS is approximately 27 student working hours
- ✓ Information Security curricula is started during spring 2005 as piloting project
- ✓ New international Master programme to be planned

Curriculum Structure₂

Bachelor degree

Mandatory Bachelor Studies for Information Processing Science	112	Optional Bachelor Studies for Information Processing Science	68
- General studies	13	-25 ECTS of orientation studies -25 ECTS other orientation	
- Basic studies	40	-Other Information processing science studies or -from other disciplines/ universities	
- Specialization studies	59		

Summary 180 ECTS
(= three years studies)

Curriculum Structure₃

Master's of Science degree

Mandatory Master Courses for Information Security:	56	Optional Master Courses for Information Security:	64
<ul style="list-style-type: none"> - Information Security Management - Methods of Secure Information Systems Design - Computer Security - Network Security - Data Security in Wireless communication - Trends and methods in information security research - Information security and law - etc. 		<ul style="list-style-type: none"> - Internet security - Data protection - Cryptography - Encryption methods - Security certification and evaluation 	
		- etc.	

Summary 120 ECTS

(= two years studies)

Laboratory studies₂

Topics:

- Computer security
- Network security
- Data security in wireless communication.
- Network design, addressing, sub netting, configuration

Subtopics

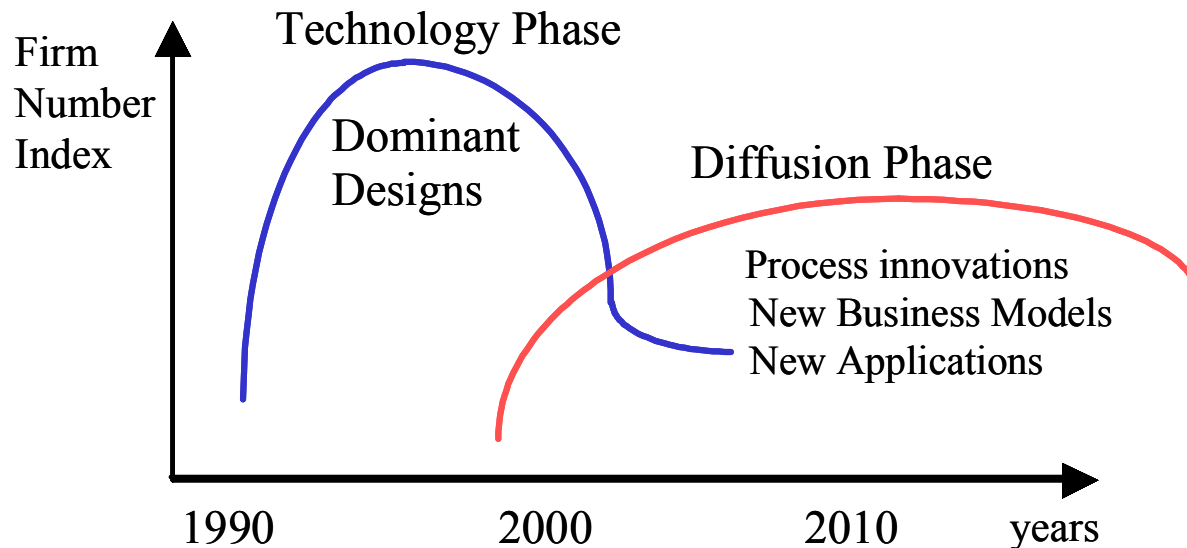
- Routing, switching, tracing, virtual LANs
- Access control
- Authentication
- Traffic analyse
- Network management
- Secure services
- Firewalls
- Viruses etc
- Telecommunications – WAN&VPN
- Security in mobile devices

ICT-master programme

Multidisciplinary international cooperation in
Mobile Services

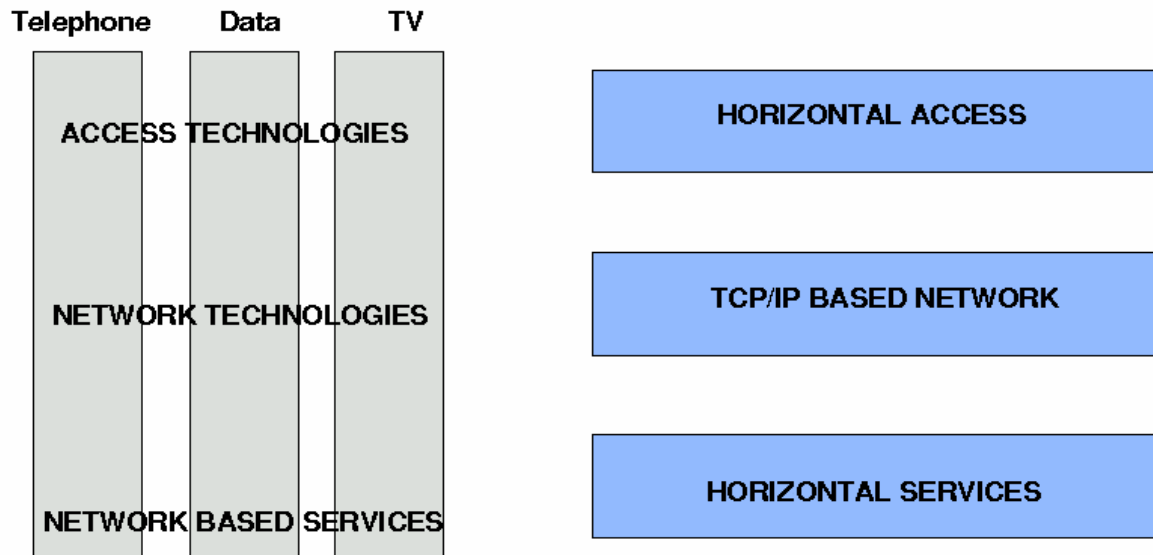
Introduction₁

In fixed and mobile **communications the dominant designs based on Internet and mobile networks have emerged** and we have entered into the diffusion phase with emphasis on applications, processes and business models.



Introduction₂

- ✓ Traditional telecom and content services are vertically integrated. Each service depends on a dedicated network and corresponding terminals.
- ✓ Internet as a dominant design changes the vertical structure to horizontal one: all terminals and services will be Internet compatible.
- ✓ Platform for the integration of various new services and applications is put into the same terminals.



Educational goals₁

- ✓ Changes take place first inside the Information and Communication Technology (ICT) industries.
- ✓ Competitiveness in Europe depend on:
 - Ability to *develop successful mobile services* in Internet economy
 - To apply the *Internet service model* in new mobile applications and services
 - To increase the *productivity* in industrial and public sectors
 - To keep the *high educational standards*

Educational goals₂

Internet and mobile diffusion is related to a large number of elementary technological and industrial issues:

- ✓ New mobile and wireless technologies and their applications
- ✓ Disruptive nature of new technologies and value chains
- ✓ Platforms for mobile and communication service deployment
- ✓ Applications and services involved, their classification
- ✓ Methods and tools for service creation and management
- ✓ The role of standards, dominant designs and industrial alliances

Educational goals₃

- ✓ Intellectual property rights, patents and licensing
- ✓ The competitive environment, competition and co-operation
- ✓ Business models and processes, new processes and process changes
- ✓ Globalization and new emerging markets
- ✓ Models and frameworks explaining the observed phenomena.

Mobile Services Curricula₁

Learning content has been organized as themes (threads):

- ✓ *Software Design and Programming*
- ✓ *Software Production*
- ✓ *Information Systems Design*
- ✓ **Telecommunication Architectures**
- ✓ **Personal communications**
- ✓ **Digital Content Production and Distribution**
- ✓ **Virtual Community Services**
- ✓ **Business Processes**

Mobile Services Curricula₂

- ✓ Trains next generation professionals for the needs of the mobile information society, focusing on the required knowledge and skills for software developers for mobile information systems.
- ✓ Viewpoint for mobile telecommunications is global.
- ✓ Covers besides software and service development also standardization, alliances, intellectual property rights, and relationship between markets and technology.
- ✓ Graduating from this orientation gives the student competence as a software professional for telecommunication industry (manufacturers, vendors, operators, software houses) and as experts in other industries that utilize telecommunications in their business processes.

Curriculum Structure₁

Mobile Services

Bachelor degree

Mandatory Bachelor Studies for Information Processing Science	112	Optional Bachelor Studies for Information Processing Science	68
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Summary at least 180 ECTS
(= three years studies)

Curriculum Structure₂

Mobile Services

Master's of Science degree

Mandatory Master Courses for Mobile Services:	56	Optional Master Courses for Mobile Services:	64
<ul style="list-style-type: none">- Introduction to embedded systems- Software architectures- Real-Time Software Design- Mobile Programming- Mobile Internet Service Architecture- ICT Standardization- Profiles and Personalization- Location and Context Specific Services- Business Processes in Mobile Networks- Mobile Research		<ul style="list-style-type: none">- Platforms for Service Development- Mobile Media- Information Security- Digital Economy- Mobile Work- Tourism/Geographic Information Systems- etc.	

Summary at least 120 ECTS

(= two years studies)

Future directions₁

- ✓ The Information Security curriculum will be developed further on the experiences from the piloting phase in 2005-07
- ✓ It serves also a basis of an international master's programme that is planned with academic partners of EU member states and neighboring countries
- ✓ The idea is that each cooperating university has their own curricula and course structure
- ✓ Provides courses or parts of courses (course modules) on a barter trade exchange principle available to the others.

Future directions₂

- ✓ New funding is used to develop new courses and convert existing course materials suitable for exchange (English language, digital contents, videoconference formats, etc.).
- ✓ Each university benefits from the cooperation because it opens them new opportunities for teaching
- ✓ But does not restrict their freedom or tie up resources except joint planning and coordination.

Future directions₃

- ✓ There will be some changes in the positioning of the whole university institution
- ✓ Work orientation will be more emphasized. Curriculum structure will be changed to the two-tier model. In the renovation professional capabilities of the students will have to be taken into consideration.
- ✓ Software development is very much a human-oriented and resource-oriented process.
- ✓ Due to the nature of software work in the IT education and research even more emphasis will have to be put in communication, cooperation and critical thinking.
- ✓ Instead of automation of software development it is even clearer that now and in the future software work will be human and resource oriented.

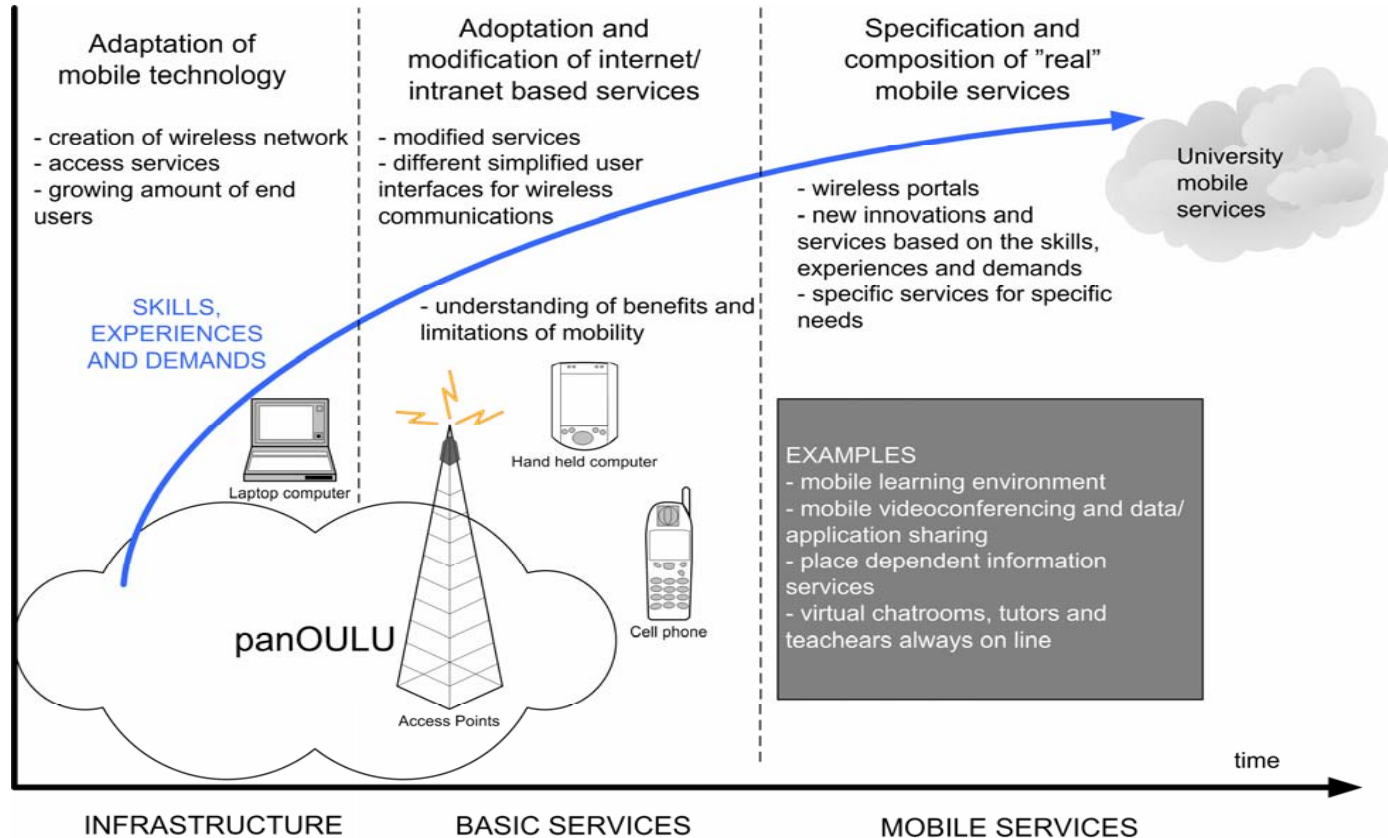
Future directions₄

- More interactive learning situations
- More versatile/efficient use of learning environment
- Digital hypermedia based learning material
- More efficient development and use of learning technology
- Active support for the learner
- Virtual learning environments (rooms), piloted in Master's programmes (national/international)

Virtual Campus

- Multidisciplinary Cooperation in "Mobile Learning" at the University of Oulu and Finnish virtual university

A roadmap to mobile services at the University of Oulu



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