

European Study Programme for Advanced Networking Technologies

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Introduction

In this article authors present main objectives and progress of the EU ERASMUS CD project: European Study Programme for Advanced Networking Technologies (ESPANT). Participants from Belgium, Spain, Finland, Portugal and Slovenia are involved in this project. There is a need for well-educated, internationally oriented, dynamic computer professionals in Europe. Companies own large computer networks covering a large region, which could stretch over different European countries. However, there is a lack of a common professional education in the area of Networking Technologies. Despite the scarcity on the European labour market, a growing demand is recorded for these high educated employees.

ESPANT addresses a one year postgraduate study programme of 60 European Credit Transfer System (ECTS) credits [1, 2]. The curriculum is tailored on students who obtained a bachelor degree in an IT related subject – computer science, multimedia, information engineering, telecommunication, etc. It is our aim to implement a bachelor level training programme that lies on operational objectives rather than on design and research topics.

To give students the competences to integrate different networking technologies, an innovative teaching approach is needed, providing i) real world examples and case studies, ii) training have to take place in a realistic environment rather than an artificial lab setup, iii) operational competences, and iv) detached units, in which the different areas in the study field are integrated in case studies and lab projects.

At the end of the project, in September 2010, it is expected that Institutions across Europe joined ESPANT being able to copy and implement one or more units from the study programme. This enlarges the recruiting space and the flexibility of the study programme.

The proposal concerns a one year postgraduate study programme of 60 ECTS credits. The target group for the ESPANT Study Programme are students who passed a study programme of minimally 180 ECTS credits. The curriculum is tailored on students who obtained a bachelor degree in an IT related subject – computer science, multimedia, information engineering, telecommunication, etc. It is our aim to implement a bachelor level training programme. This means that the emphasis lies on operational objectives rather than on design and research topics.

After finishing the project the programme in advanced networking technologies will be implemented. The different units are described in ECTS files, which outline the study programme. Besides the ECTS files, competence cards for each teaching activity in the units will be produced, which will be based on existing competence profiles. The study material will be uniformly conceived in English. In a trial period, the units mentioned earlier will be taught using a test audience. The outcomes of this trial will be used to adapt the course material to the objectives of the units.

Aims and Objectives

The main goal of this project is to develop an international curriculum as flexible and dynamic as

possible. The curriculum allows students to develop the necessary competences for the labor market, which enhances their employability. This is guaranteed by working together with experts from large industrial partners who help defining the competences, which should be addressed during the study programme.

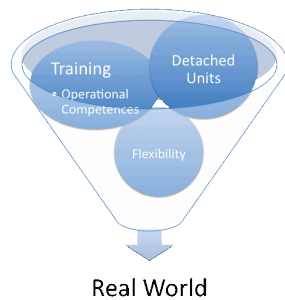


Fig. 1. Aims and objectives

The goal of the consortium to integrate different state-of-the-art networking technologies using real world case studies and practical training, which are executed in a real and professional environment, Figure 1 summarizes this fact. In this way the students sharpen their competences to cover difficulties, which are encountered in real world networking configurations.

By making students more mobile they learn the large opportunities that the European Union brings along. The European Study Programme for Advanced Networking Technologies is built around six units, which the students have to complete to finish the study programme successfully. This brings students at a short period in contact with different social and cultural environments. Also the group they work in changes within each unit, which sharpens their interpersonal and intercultural competences

Course Units

The ESPANT programme is built around six units.

1. System management.
2. Implementing real-time media.
3. Integrated security.
4. Mobile and wireless communication techniques.
5. Integrated network storage.
6. Networking infrastructure.

Each unit requests 5 ECTS and takes around four weeks in which students get practical training about the subject of the unit. Each institution in the consortium implements one, two or three units, which implies that students have to travel around to finish the complete study programme. This enhances the international and intercultural competences of the participants. Because not every institution has all the necessary expertise and peripherals to educate all the different units, an extra effort of the teaching staff is expected. Different solutions are possible using distance learning, video conferencing or teachers' exchange.

After the end of the ESPANT project, the partner consortium will continue to offer this international course as a postgraduate modular course, and it will be included as such in the institutions' course catalogues and study

offer. The course will consist of a 60 ECTS credit programme leading to a postgraduate certificate, which will be a joint certificate signed by the legal representatives of each partner institution. It will be explored when the programme is running if it can be expanded to a joint degree programme. The programme will be open to students from institutions out of the consortium, and the website will continue to exist after the programme to be able to act as an information and recruitment instrument. The impact of this study programme will be to deliver the well educated employees with the necessary competences wanted by the industry.

Competences

In the design of the European Study Programme for Advanced Networking Technologies (ESPANT), we adopted student-centred learning approach. This approach to education focuses on the needs of the students and has many implications for the design of curriculum, and for course content. A curriculum has to be based on competence hierarchies rather than on traditional knowledge hierarchies [3, 4].

Competency based learning is a method of study that focuses on what a person can actually do as a result of training. It places concrete emphasis on the acquisition of competences during the learning process by matching competences to assignments [5–7]. In the design of the ESPANT study programme, the competence files for each particular course were created in a workgroup of experts delivered by the participating institutions and refined by suggestions of the resonance groups, consisting of potential employers, students and alumni.

Our design is based on the result of the Tuning project [8] where a distinction was made between generic competences (transferable skills) and subject-related one. Although it is accepted that key outcomes of university programmes will be subject related competences. Employers, graduates and academic staff are in broad agreement about which generic competences are the most relevant. Their importance is widely understood. The true importance lies in the implications of competence-based approach for teaching and learning, i.e., which are appropriate modes of teaching and which learning activities can best foster competences in terms of knowledge, understanding and skills.

General Competences of ESPANT:

- Capacity for applying knowledge in practice.
- Basic general knowledge in the field of study.
- Grounding in basic knowledge of the profession in practice.
- Capacity to learn.
- Information management skills.
- Capacity for analysis and synthesis.
- Planning and time management.
- An ability to analyse, synthesise and anticipate solutions and consequences.
- To gain the mastery over development methods, procedures and processes.
- Communicational-skills development; particularly in international environment.

- Cooperativity, team work (in international environment).
- Ability to communicate with non-experts (in the field).
- Project design and management.
- Critical and self-critical abilities.

Syllabi

The competences and a structures list of topics are essential for creation of syllabi (often called also ECTS files). Syllabus is a core document specifying all important information about each particular course for students.

1A Network Infrastructure: Technologies. Specific competences:

- Ability to understand networking terminology.
- Ability to determine the difference between the fundamental network technologies and principles.
- Ability to understand and configuration of network devices.

Contents:

- Main Concepts and types of networks.
- Data communications.
- Circuit Switching and Packet Switching.
- Quality of Service and Label based switching.

1B Network Infrastructures Internet. Specific competences:

- Ability to understand internetworking terminology.
- Ability to determine the difference between the TCP-IP and the OSI stack principles.
- Ability to understand Quality of Service concepts and their solutions based on new Internet protocols.

Contents:

- Internet protocol basics.
- Internet Protocol (IP) layer.
- Transmission Control (TCP) layer.
- Internet basic services.
- Basic network management.

2 A. Networking Security Techniques. Specific competences:

- Identify, classify and present defense against particular examples of attacks.
- Identify points of vulnerability in simple networks.
- Compare and contrast symmetric, asymmetric and hybrid encryption systems.
- Understand the concepts of data integrity.
- Describe methods of providing assurances about data integrity.

Contents:

- Concepts and definitions of security.
- Threats to communication networks.
- Principles of encryption.
- Access control.

2 B. Practical Networking Security Techniques. Specific competences:

- Discuss the effectiveness of passwords in access control and the influence of human behavior.
- Apply and explain simple filtering rules based on IP and TCP header information.
- Understand and apply authentication concepts and techniques.
- Identify security problems of distributed protocols, applications and systems.
- Apply tools and techniques to prevent, identify and handle malware.

Contents:

- Implementing encryption in networks.
- AAA – Authentication, authorization, accounting.
- Specific security issues.
- Protection of Networked Systems.

3 A. Wireless Technologies. Specific competences:

- Understand the concepts of wireless data transmission.
- Understand and use advanced techniques and technologies for secure, reliable, and efficient radio transmission of voice and data.
- Understand the concepts of communication protocols for wireless networks.
- Understand the concepts of mobile communication systems.
- Plan and carry out network operation and maintenance activities.

Contents:

- Basics of wireless communications.
- Mobile communication systems.
- Wireless LAN systems.
- Fixed wireless broadband access.

3B Wireless Services and Applications. Scientific competences:

- Understand the concepts of GSM, UMTS and other mobile services.
- Design and maintain local computer networks based on wireless technologies.
- Compare and evaluate different networking solutions.
- Plan, design and maintain services and applications in WLAN.
- Identify, classify and present defense against misuse.
- Communicate with network users.

Contents:

- Service provisioning.
- Local wireless services and applications.
- Cellular network based services and applications.

4A Storage Server Techniques. Specific competences:

- Capacity for applying knowledge in practice, basic general knowledge in the field of study, problem solving.

Contents

- Understand principals of ITL frameworks.
- iSCSI, SCSI, Fiber Channel.
- Network Attached Storage, Direct Attached Storage (DAS), Networked Attached Storage (SAN).
- Concept of database storage.
- Quality handling in NAS environment.
- Benchmarking, site optimization.

4 B Advanced Storage Server Techniques. Specific Competences:

- Problem solving in IT Quality Issues.

Contents:

- Performance issues in databases.
- General IT Quality issues and related to storage networks.
- Concept of content switching.
- Monitor and detect performance issues.

5 A Multimedia Compression, Standards and Tools.

Specific competences:

- Ability to understand digital transmission.

Contents:

- Video streaming protocols, systems architectures and technologies.
- DVB-H system architecture.
- Speech main standards and applications.

5.B Real-Time Multimedia Delivery. Specific competences:

- Capacity to set-up a streaming server, problem sorting capability related to DVB-H.

Contents:

- Servers and protocols used for streaming video/audio content.
- Main protocols (RTP, TRSP, RTCP etc.) and their usage.
- Multimedia formats and main transmission parameters used in internationally in these systems.
- System architectures and technologies used, e.g., modulation, error correction.
- Main protocols in IP-TV systems.
- VoIP system architecture and applications.

6 A Systems Management. Specific competences:

- Being able to install information and communication systems and make these operational.

Contents:

- Windows server administration.
- Linux Server Administration.
- Integrated environments (Linux/Windows).

6 B Practical Systems Management. Specific

competences:

- Ability to assist in the development, testing and trying of information and communication systems.

Contents:

- Concepts of virtualization.
- High availability.
- Disaster recovery.

Conclusions

The EU ERASMUS CD project: European Study Programme for Advanced Networking Technologies (ESPANT) has been introduced. Its main objectives have been summarized as well as the methodology to carry out the involved tasks. A set of generic and subject specific competences has been defined by the project expert team for each particular course in the curricula of the study program. These competences were refined by employers, graduates, and academic staff and have been used to define

a structured list of topics. Afterwards, learning and teaching activities, appropriate for active and blended learning, have been developed and proper assessment techniques have been defined. All these specifications are supposed to be a basis for the next phase in the project, i.e., implementation of the courses.

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In this article authors present main objectives and progress of the EU ERASMUS CD project: European Study Programme for Advanced Networking Technologies (ESPANT). Participants from Belgium, Spain, Finland, Portugal and Slovenia are involved in this project. Major novelties in the development of one year study programme curriculum - long lifelong learning oriented - are presented. In ESPANT a professional competences approach is addressed, therefore Syllabus contents and activities are practical oriented. Their structure and didactic units description are also described. The comments from a resonance group (formed by academia and industry members) are also summarized as a crucial methodology to develop ESPANT. III. 1, bibl. 8 (in English; abstracts in English, Russian and Lithuanian).

Ц. Ваз де Царвахло, Ю. Салонен, К. Бьюорн, С. Кноцкаерт, Р. Ван Стеенбергхе, Л. Шоофс, С. Ругелю, Ю. Л. Марзо. Программы европейских студий на основе сетевых технологий // Электроника и электротехника. – Каунас: Технология, 2010. – № 6(102). – С. 31–34.

Описываются результаты Бельгии, Испании, Финляндии, Португалии и Словении, полученные по программе ES ERASMUS CD на основе применения современных сетевых технологий, обсуждаются требования, предлагаемые группой ученых и представителей промышленности. Полученные результаты направлены на обучение на всю жизнь. Ил. 1, библи. 8 (на английском языке; рефераты на английском, русском и литовском яз.).

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Pristatytas pagrindinis ES ERASMUS CD projekto „Europos studijų programa taikant pažangias tinklines technologijas“ tikslas. Projekte dalyvauja Belgija, Ispanija, Suomija, Portugalija ir Slovėnija. Pateikti vienu metų studijų programos esminiai pokyčiai, orientuoti į mokymąsi visą gyvenimą. Daug dėmesio skiriama profesinei kompetencijai, veiklai, orientuotai į praktinį pritaikymą. Apibendrinti iš mokslininkų ir pramonininkų sudarytų grupių veiklos komentarai. Il. 1, bibl. 8 (anglų kalba; santraukos anglų, rusų ir lietuvių k.)