



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Hardware oriented network operating systems

### Course

Field of study

Year/Semester

Electronics and Telecommunications

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

english

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

Laboratory classes

Other (e.g. online)

15

30

0

Tutorials

Projects/seminars

0

0

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

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Instytut Sieci Telekomunikacyjnych

Wydział Informatyki i Telekomunikacji

### Prerequisites

Student knows how to prepare simple program, student has at least medium knowledge about computer networks (Ethernet, IP, routing protocols). Student also know how to use documents from Internet, software documentation and tutorials

### Course objective

The goal is:

To show to the students how network operating system works, demonstrate example of network operating systems in real network devices, their typical usage and discuss different scenarios, to get them familiar with typical and not typical problems, configurations and usage scenarios.



To show them how procedure are realized in hardware, how protocols are implemented, how they are related with hardware features, how to configure and maintain network nodes, to discuss different case when network applications are used.

To show security mechanisms, how to implement them and what is the risk without them (or with mistakes)

To show risks which are hidden in improper implementation, how to avoid them, how to test and verify network devices.

### Course-related learning outcomes

#### Knowledge

Has in-depth knowledge of the construction and operation of basic telecommunications systems

Has practical knowledge of security systems or methods for ensuring the security of information transmitted in computer networks and radiocommunications.

Has structured knowledge in the field of ICT networks and information-related operations

Has ordered practical knowledge of general IT networks or sound techniques or measuring and embedded systems

#### Skills

Is able to obtain information from literature and databases as well as other sources in Polish or English;

is able to integrate obtained information, interpret it, draw conclusions and justify opinions

#### Social competences

Is aware of the need to expand their competences and is ready to cooperate as part of a team

He knows the limits of his own knowledge and skills, understands the need for further training

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - oral or written exam, 50% to pass

Laboratories - oral or practical exam, 50% to pass

### Programme content

Lecture:

Architecture and functions of networking operating system.

Hardware with typical and extended functionality of network operating systems

Hardware aspects of virtualization of network nodes and hosts

Virtualization of networks



Hardware realization of remote access - Virtual Private Networks;

Performance of network, bottlenecks' analysis

Mechanisms and protocols for communications between network systems;

Hardware realization of security mechanisms,

Hardware support of Software Defined Networks, hardware for OpenFlow;

Example of Network Operating System in hardware network devices (Alcatel-Lucent, Cisco, HP, Juniper Networks);

Demo of preparing own system with usage NetFPGA cards with interfaces 1Gbps and 10Gbps (hardware and software working together).

Hardware realization of network protocols (routing, switching)

During lectures and laboratories students will work on physical Cisco, Huawei, Juniper network devices.

Laboratories:

Building and configuring network of nodes realized on Linux operating system, Alcatel-Lucent, Cisco, Juniper and Huawei routers and L2/L3 switches; working with hardware network devices (in remote Data Center and local laboratory, running and analyzing demo of network prototype device and prepare simple own project

### Teaching methods

Lecture with presentations of real devices and cases; conversation lecture

Laboratories - practical laboratories with real devices

### Bibliography

Basic

1. A. Tanenbaum, Computer Networks. Prentis Hall
2. W. Odom CCNP ROUTE , CCNP SWITCH, Cisco Press
3. T. Adelstein, B. Lubanovic, Linux System Administration, O'Reilly Media

Additional

1. Z. F. Xu Designing and Implementing IP/MPLS-Based Ethernet Layer 2 VPN Services An Advanced Guide for VPLS and VLL, Wiley Publishing
2. D. Hanks, H. Reynolds, Juniper MX Series, O'Reilly Media
3. www: netfpga.pl, netfpga.org



### Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3
Classes requiring direct contact with the teacher	55	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	35	1,0

<sup>1</sup> delete or add other activities as appropriate