

Optimization of Computer Networks

Course Syllabus

This course contributes to the requirements for the Degree of MSc in Computer Science

Title of the Academic Program	Master's Degree Programs in English “Digital intelligent control systems”
Type of the course	elective
Course period	1 semester from October, the 1st to February, the 1st (18 weeks)
Study credits	3 ECTS credits
Duration	108 hours
Language of instruction	English
Academic requirements	<ul style="list-style-type: none">– BSc degree in Computer Science or equivalent (transcript of records),– good command of English (certificate or another official document) Prerequisites: <ul style="list-style-type: none">– basic PC user skills

Course Description

«Optimization of Computer Networks» is an elective course.

The course will introduce students to computer network fundamentals. The most widespread link-layer and network technologies, Ethernet and IP are considered.

Students will learn network design, operation and testing, network equipment configuration, network performance measurement and optimization.

The course will use Cisco 2960, Cisco 3750 multi-layer switches (with wired network infrastructure and control-plane network).

Special Features of the Course

The course provides an opportunity for students to work personally using electronic and test equipment. The student will be able to build network using modern production-grade equipment.

The aim of the course is to provide students with knowledge and skills for network design, operation and testing, equipment configuration, performance optimization.

Course Objectives

- to familiarize students with network fundamentals;
- to study the most widespread data-link and network technologies: Ethernet and IP.
- to teach students to use real network equipment.

Learning Outcomes of the Course

By the end of the course, students will know:

- network fundamentals
- network performance indicators
- network optimization features

By the end of the course, students will be able to:

- build an Ethernet/IP-based network
- configure Cisco network equipment
- perform network performance measurement

By the end of the course, students will possess:

- the necessary skills to design, configure and operate production-grade Ethernet/IP network.

Course (module) Structure

Learning Activities	Hours
Lectures	18
Practice sessions / Seminars,	18
Self-study Assignments	72
Total study hours	108

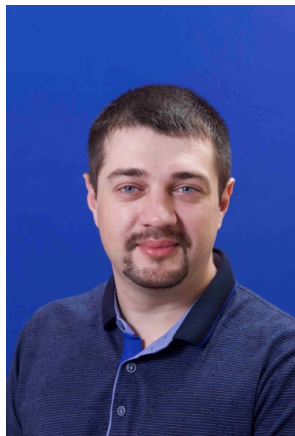
Detailed Schedule

Week	Lectures	Seminars/ Assignments	Hours Lec/Lab/HA
Semester 1			
1-2	Course introduction, computer network introduction. Network components. Multi-layer network model, OSI model.	Introduction to lab equipment. Cisco routers and switches management.	2/2/8
3-4	Data link layer. Link types: point-to-point, multi-access. Ethernet and PPP protocols.	Simple Ethernet-based network design.	2/2/8

5-6	Internet Protocol (IP). IP addressing. Introduction to routing. ICMP control protocol.	IP-based network design.	2/2/8
7-8	Transport layer, TCP and UDP protocols.	Transport-layer protocol operation.	2/2/8
9-10	Static routing, dynamic routing.	Implementing routing in IP-based network	2/2/8
11-12	Network key performance indicators (KPI). Bandwidth, latency, jitter, convergence time. KPI measurement.	Exploring high-loaded IP network. KPI measurement.	2/2/8
13-14	Optimization of network bandwidth. Load sharing and load balancing. Routing protocol tweaking. Forwarding detection (BFD).	Optimization of bandwidth and convergence/recovery time in IP network.	2/2/8
15-16	Optimization of network latency. Packet queueing, packet scheduling. Quality-of-service (QoS) features.	Optimization of network latency and jitter.	2/2/8
17-18	KPI measurement automation. Optimization of computer networks using IP SLA feature.	Optimization of lab network using IP SLA feature.	2/2/8
	18	18	18/18/72

Course Instructor(s) and Tutor(s), Contact information

Kirill V. Korshun



Current Position: Associate Professor of Computer Science Dept, School of Space and Information Technologies.

Research Interests: Network OS and Network Administration, Wireless networks, Networks and telecommunications, Fundamentals of information security in computer networks, Design and deployment of computer networks, Internet routing and transmission protocols.

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Personal webpage <https://structure.sfu-kras.ru/node/3416>

Scopus

<https://www.scopus.com/authid/detail.uri?authorId=56142031200>

Elibrary

https://elibrary.ru/author_items.asp?authorid=846654&pubrole=100&show refs=1&show_option=0

Google Scholar

<https://scholar.google.com/citations?user=V2JGwmsAAAAJ&hl=ru&oi=sra>

Profile on another site(s) <http://vt.ikit.sfu-kras.ru/people/Korshun.html>

Assessment

Assessment strategy	Points, max	Evaluation criteria
Tests	40	Test questions for lectures and self-study assignments in the e-course
Seminar works	60	Working lab example demonstration and/or lab report

Grading policy for final assessment is:

- A (excellent work) 100 points
- B (above average) 90–99 points
- C (average) 80–89 points
- D (below average) 60–79 points
- F (failed) < 60 points

Attendance Policy

Students are expected to attend classes regularly. In case of missing a seminar activity a student should perform additional self-study work and provide a report to the instructor within a week after a class was missed.

Web page of the course

Course materials and required reading materials are available on the e-course: <https://e.sfu-kras.ru/course/view.php?id=32822>, SibFU E-learning portal, www.e.sfu-kras.ru. You must be logged in to access this course.

Core reading

1. Catalyst 3750 Switch Software Configuration Guide. Copyright © 2004–2006 Cisco Systems, Inc. All rights reserved. URL: https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst3750/software/release/12-2/35_se/configuration/guide/scg.pdf
2. Lammle Todd «CCNA Routing and Switching Complete Study Guide», John Wiley & Sons, Inc., Indianapolis, Indiana, 2016. URL: <https://www.yottabytetechnologies.com/Todd%20Lammle%20-%20CCNA%20Routing%20and%20Switching%20Complete%20Study%20Guide.pdf>
3. A, Jesin Packet Tracer Network Simulator (Professional Expertise Distilled) ISBN 13: 9781782170426, Packt Publishing, 2014.

Facilities, Equipment and Software

Software:

PuTTY SSH/telnet client (free).
Cisco Packet Tracer (free)

Laboratory equipment:

Cisco 2960, cisco 3750 ethernet multi-layer switches.
Ethernet/IP-capable personal device (PC, laptop).