Computer Networks and Networks Technologies

Course Syllabus

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ISMA University
Riga, Latvia

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Contact Information

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Course duration, hours: 4h x 16 = 64h, 4 points

Course additional website https://net.academy.lv/ contains:
- LS - lecture slides,
- LV - lesson videos,
- PW - trainings and practice work assignments,
- LW - lab work assignments,
- SW - online tools and software,
- BK – reading books, links to the frequently websites,
- QZ - tests and quizzes.

Objectives

The objectives of this course are to introduce the fundamental concepts, structure and components of computer networking, to overview selected protocols associated with the Application, Transport, Network, Link, and Physical Layers of the OSI Reference Model and to show how these protocols are organized to produce computer networks.

Prerequisites and Required Skills

The course does not assume prior knowledge of networking. However, the course will move relatively fast.

Expected Skills: The course is not suited for students without basic mathematic & computing skills.

Teachings Philosophy

- Emphasis on building stuff that works: Practical skills.
- Lateness policy is designed to encourage success rather than timeliness, but we have to find a balance.
- Grading is mostly on functionality, though there is a role for clarity, modularity, efficiency and style.
- Readings are important to make our class time more effective and to gain confidence about learning from tutorials, references and so forth.
- Classwork gives you a chance to make mistakes with support
- LW & PW Assignments integrate several skills and go beyond Classwork

Reading supports Classwork which supports PW Assignments which supports the LW Assignments.

Honor Code

Unless otherwise instructed, feel free to discuss problem sets with other students and exchange ideas about how to solve them. However, there is a thin line between collaboration and plagiarizing the work of others. Therefore, I *require that you must compose your own solution* to each assignment. In particular, while you may discuss problems with your classmates, *you must always write up your own solutions from scratch*.

Reading Books

BK-01EN. IBM RedBooks. TCP/IP Tutorial and Technical Overview. 2006 [PDF], [Online], [EPUB], [Google Books].

BK-02EN. Forouzan. Data Communication and Networking, 5th.ed. 2012 [PDF], [Online].

Optional Books

BK-03EN. Tanenbaum. Computer Networks 5th.ed. 2011 [PDF], [Online].

BK-03RU. Таненбаум. Компьютерные сети, 5-е изд. 2012 [PDF]

BK-04RU. Олифер. Компьютерные сети. Принципы, технологии, протоколы, 4-е изд. 2010 [PDF]

BK-05RU. Семёнов. Телекоммуникационные технологии. [Online]

Глоссарий сетевых терминов. (RU) BiLiM System Ltd. [PDF]

Network Acronyms. (EN) [PDF]

Road Map
Lectures, Lab Works Schedule and Reading Topics

Weeks	Chapters	Slides	Topics	Reading	Labs, Practices, Quizzes (*Optional)
1	I. Overview OSI/RM & TCP/IP	LS-01	Introduction Networking Standards and the OSI Model.	IBM Redbook, Chapter 1	PW-01. Bin/Hex/Dec System Conversion.
2		LS-02	Review of Important Networking Concepts.		LW-01. Wireshark. Introduction.
3	II. Physical Layer and Media	LS-03	Network Classification. Topology, Hardware, Transmission Media.	IBM Redbook, Chapter 2.1	*LW-02. Make an Ethernet Cable for Twisted Pair Cat5 & Cat6.
4		LS-04a LS-04b	Data Communications. Line Coding. Block Coding. Scrambling.	IBM Redbook, Chapter 2.4	LW-03. Line & Block Coding Schemes.
5	III. Data Link Layer	LS-05	Introduction, Services. Error Detection & Correction.		*LW-04. Internet Backbone, ISP Tiers and DC Tiers. Excursion to DC.
6		LS-06 LS-07	Multiple Access. EUI/MAC, ARP, Ethernet, VLAN.		
7	IV. Network Layer I	LS-08	IP - Internet Protocol.	IBM Redbook, Chapter 3.4	
8		LS-09	IP Addressing. Subnetting, Supernetting. IPv6 Addressing.	IBM Redbook, Chapter 3.1	PW-02. Basic Sub/Super-netting Practice. LW-05. IPv4 Sub/Super-netting (Classes, CIDR, VLSM).
9		LS-10	ICMP - Internet Control Message Protocol.	IBM Redbook, Chapter 3.2	
10	V. Transport Layer	LS-11	TCP and UDP.	IBM Redbook, Chapter 5.1, 5.2	*QZ-01. Midterm Quiz: standards, OSI/RM, hardware, communications, Multiple Access, MAC, ARP.
11	VI. Network Layer II	LS-12	IP Forwarding. AS. Static Routing.	IBM Redbook, Chapter 4.1	LW-06. Wireshark. Network Traffic Capture and Analyse.
12		LS-13	Dynamic Routing DVA. RIP.	IBM Redbook, Chapter 4.3	
13		LS-14	Dynamic Routing LSA. OSPF, AS, BGP.	IBM Redbook, Chapter 4.4	LW-09. Dynamic Routing LSA.
14		LS-15	IP Multicasting. IGMP, PIM.		
15	VII. Application Layer	LS-16 LS-17 LS-18	DNS. FTP. SMTP, POP, IMAP.		*QZ-02. Finish Quiz: IP Addressing, ICMP, TCP, UDP, Routing, Application Layer.
16	VIII. TCP/IP Administration & Security	LS-19 LS-20 LS-21	Monitoring & Diagnostic. SNMP, MIB, OIDs. Spam and Phishing. TCP/IP Security		*LW-07. Network Diagnostic and Monitoring Tools.
*	IX. Modern Networks Solutions	LS-22	Internet of Things.		
	X. Final Subject Grade	All bellow	Exam	All below Chapter	All below assignments Reports

Course Grading Policy

Course activity:	Cost, %
Interactive participation in Classroom or via Zoom	10%
Lab Works Reports	60-70%

> LW1=10%,
> *LW2=05%,
> LW3=10%,
> *LW4=05%,
> LW5=10%,
> LW6=10%,
> *LW7=10%,
> LW9=10%
>
> ___
> * Optional LW

Final Exam	30-20%
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Final Grade SUM	100%

Your Skills after Course

Concept of Layering

- Basics of Computer Networks,
- Concept of Layering

Flow & Error Control

- Flow and error control techniques,
- Switching

LAN

- LAN technologies,
- Ethernet, WiFi

IP Addressing

- Classful Ip Addressing,
- Classless Ip Addressing,
- Subnetting,
- Supernetting,
- IPv4 and IPv6
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TCP and UDP

- TCP, UDP and sockets, congestion control

Routing Algorithms

- IP Forwarding. AS. Static Routing,
- Routers and routing algorithms (distance vector, link state)
- RIP, OSPF, BGP,
- Multicast

Application Layer Protocols

- Application layer protocols (DNS, SMTP, POP, FTP, HTTP)

Network Security

- authentication,
- basics of public key and private key cryptography,
- digital signatures and certificates,
- firewalls.

Network Administration

- Diagnostic & Monitoring (SNMP, MIB, OIDs)