Computer Networks

Programme course

6 credits

Datornät

TDTS06

Valid from: 2017 Spring semester

Determined by
Board of Studies for Computer Science
and Media Technology

Date determined
2017-01-25

Main field of study
Information Technology, Computer Science and Engineering, Computer Science

Course level
First cycle

Advancement level
G2X

Course offered for
- Computer Science, Master's Programme
- Computer Science and Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Biomedical Engineering, Master's programme

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Knowledge of C or C++ are required in order to be able to do the laborations in the course. It is an advantage if the student also has knowledge corresponding to Concurrent Programming and Operating Systems, especially know how to explain the resource conflicts that can occur in a computer program and how to solve them. This knowledge can, however, be acquired while doing the laborations in the course. The student is also assumed to know how to construct and test programs in a Unix/Solaris environment.

Intended learning outcomes

After the course, you are expected to be able to:

- Explain, describe, and analyze a typical network architecture, including the importance of network layers and encapsulation
- Explain the different basic types of protocols, communication channels, and network types
- Design, implement, verify, and test your own protocols
- Explain fundamental performance tradeoffs, including showing an understanding of where delays can occur in a network, what different types of delay that exist, the impact of packet losses and jitter on various protocols

Overall, you should have an applied understanding of the network architecture and the protocols associated with the different layers, as well as how they are implemented:

- Describe and analyze the most common application architectures in the Internet, how the most important application-layer protocols work, the service they provide, as well as have the ability to design and implement their own application-layer protocols
- Analyze and explain important design considerations at the transport layer, including hands-on knowledge of how flow control and congestion control works, and how reliable data transfer is implemented
- Motivate and explain how routing and forwarding is implemented on the Internet, including the design and implementation of network-layer protocols
- Describe and explain different link-layer technologies and how they work

In addition, you are expected to build a basic understanding of three example topics:

- Network security: Exemplify how different types of security services can be implemented in different layers with the help of different standards
- Wireless and mobile networks: Analyze and exemplify some of the unique challenges as we are moving towards increasingly mobile users
- Multimedia networking: Explain and discuss the fundamentals of how multimedia services are provided over the Internet

Course content

Protocol terminology, language, and specification. The protocol layering concept. Reference models for network architectures. Application areas for computer networks and examples of commercial network services. Network types and components (router, switch, repeater, hub). Communicaton modes and channels. Access network technology. Different types of MAC protocols. The collision domain concept. The sliding window protocol. Error detection. Local area networks (IEEE 802.3). Wireless networks (Bluetooth, WiFi and WiMax). Extending LANs. Internet and standardisation. The TCP/IP protocol family. Distance vector and link state routing. ICMP. ARP. NAT. Naming, addressing, and routing on the Internet. TCP timers, flow control, and congestion control. TCP reliable delivery. Three-way handshake. IPv6. Mobile IP. QoS network parameters and frameworks. Network performance issues. Internet applications (DNS, e-mail, ftp, the web, filesharing, IP telephony, and SNMP). IP telephony. Network security applications (IPsec, SSL/TLS, PGP). Key management. WPA2. P2P networks. Bittorrent, the DHT data structure and Skype. Internet history. Internet design principles. LAN background. Development trends.

Teaching and working methods

The course consists of lectures and laborations.

Examination

UPG1	Voluntary assignment	0 credits	U, G
LAB1	Laboratory work	3 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses: Advanced Networking, Individual projects

Department

Institutionen för datavetenskap

Director of Studies or equivalent

Patrick Lambrix

Examiner

Andrei Gurtov

Course website and other links

http://www.ida.liu.se/~TDTS06/

Education components

Preliminary scheduled hours: 42 h
Recommended self-study hours: 118 h

Course literature

Additional literature

Books

Kurose, J. F. & Ross, K. W., (2017) *Computer networking: a top-down approach*
Seventh Edition

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.