



TNK087 Data Communications and the Internet

(4 credits / 6 ECTS credits)

Fall 2007

Aim

Most of today's data communication uses the Internet. New applications appear constantly. The course deals with how the Internet works, and how new communication solutions can be formed using the Internet as the infrastructure. The course is aimed at providing the participants with comprehensive knowledge in data communications, focusing on the IP protocol, the data link layer, quality of service, and performance analysis (in particular for wireless networks). Moreover, the course is intended to enable the participants to gain practical skills in setting up computer networks.

After the course, the participants should be able to

- Identify the connections between the course subjects and their study program, and thereby justify the learning of these subjects.
- Identify the most important components in constructing wired and wireless networks.
- Describe the functions of the layers in the TCP/IP model.
- Describe the differences between various routing protocols and algorithms.
- Compare and explain application areas of various protocols at the data link layer.
- Associate networking concepts, components, techniques, and functions with TCP/IP layers.
- Describe the impact of wireless links on the protocols used by the Internet.
- Explain the underlying concepts and current solutions for dealing with service quality.
- Explain the possibilities and limitations of the Internet for real-time communications.
- Design and configure networks, and assess network performance.
- Analyze and evaluate data communication solutions based on in-depth knowledge in TCP/IP protocols and the Internet.

Prerequisites

TNK040 Telecommunication Systems and TNK037 Applied Data Communications, or equivalent.

Organization and Time Plan

The course consists of lectures and lab assignments.

- Nine lectures, two hours each (18 hours in total).
- Six assignments, two hours for each of the first five assignments, and four hours for the last assignment (14 hours in total).

Literature

- Textbook 1 (K+R): J. Kurose and K. Ross, Computer Networking – A Top Down Approach Featuring the Internet, 3rd or 4th edition
- Textbook 2 (H+J): Mahbub Hassan and Raj Jain, High Performance TCP/IP Networking, Concepts, Issues, and Solutions, 2004.
- Lecture notes and the lab assignments will be uploaded at the course homepage, located at www.itn.liu.se/~diyua (The material are compressed using a password, which will be given by the examiner at the start of the course)
- Supplement material, if needed for covering the content of a lecture, will be specified or handed out



- On-line material for preparation of the lab assignments, located at <https://athena.itn.liu.se/cnap> (user name and password will be given by the examiner at the start of the course)

Examination and Grading

Course examination consists of two parts.

- Three written tests (2 credits / 3 ETCS credits)

The written tests (in Swedish: kontrollskrivningar) are scheduled during the fall semester. Possible grades are 5, 4, 3, and fail. The grade is based on the total number of received points in relation to the total number of possible points (over all three tests), as specified below.

0 - 59% = fail
60% - 74% = 3
75% - 89% = 4
90% - 100% = 5

- Lab assignments (2 credits / 3 ETCS credits)

The lab assignments are used for building up practical skills in networking hardware configuration, network implementation, and network performance evaluation. To pass a lab assignment, the course participants must show their work and results to the course staff. Note that the last assignment requires a written report. Possible grades are pass and fail.

Re-examination

Re-examination will be offered during examination periods (omtentamensperioder) only, that is, January 2008, April 2008, and August 2008.

Re-examination of the written tests takes places in form of a single written test, of which the entire scope of the course is subject to the test. The aforementioned thresholds will be used for grading.

Course contents

Communication architecture. The TCP/IP model. IP: Datagram format, addressing, special addresses, subnet, supernät, CIDR, IP fragmentation. RARP, BOOTP and DHCP. ICMP. Traceroute. ICMP. Router components. Basics of router configuration. Routing protocols: IGP and EGP, RIP, OSPF, BGP. Multicast routing. Functions of the data link layer. Addressing at the data link layer. ARP. Error detection. LAN and Ethernet. PPP. VLAN. ATM. MPLS. ACL and ACL configuration. TCP in wireless networks. WAP 1.0/2.0. Bluetooth. SMS. MMS. GPRS. WLAN. Concepts related to service quality. Service quality parameters RSVP. IEEE 802.11e.

Course staff

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Lecture Contents

Lecture	Content	Literature
1. Introduction	Course information, repetition of basic knowledge of TCP/IP	K+R: Chapter 1 H+J: Chapter 2
2. IP	IP addressing, subnet, CIDR, ICMP, NAT	K+R: Section 4.4 Lecture notes
3. Router and routing	Router components, routing basics, static routing	K+R: Section 4.3 Lecture notes On-line material
4. Routing protocols	RIP, OSPF, BGP, multicast	K+R: Section 4.5-4.7 Lecture notes
5. The link layer, part I	Functions of the link layer, addressing, ARP, error detection, LAN and Ethernet, PPP	K+R: Sections 5.1-5.7
6. The link layer, part II; ACL	VLAN, ATM, MPLS; ACL and ACL configuration	K+R: Section 5.8 Lecture notes On-line material
7. Performance measurements	Performance measurement tools, performance metrics	H+J: Chapter 3 Lecture notes Supplement material
8. Quality of service	TCP/IP QoS, including metrics, protocols, queuing disciplines, and discard policies	H+J: Chapter 3 K+R 3rd edition: Section 7.3, 7.6, and 7.9 K+R 4th edition: Section 7.3, 7.5, and 7.6 Lecture notes Supplement material
9. TCP performance in various environments	TCP performance in wireless networks and asymmetric environment	H+J: Chapters 6 and 10
