CO7213 Networking and Distributed Computing

Credits: *15* **Convenor:** *Prof. Thomas Erlebach* **Semester:** *1st*

Prerequisites:	*Desirable: Java programming*				
Assessment:	*Coursework: 40%*		*Two hour exam in January: 60%*		
Lectures:	*24*	*hours*	**Problem Classes:**	*5*	*hours*
Surgeries:	*5*	*hours*	**Class Tests:**	*3*	*hours*
Laboratories:	*3*	*hours*	**Private Study:**	*72.5*	*hours*

Subject Knowledge

Aims This module teaches the basic concepts of communication networks, the use of algorithms in the design and efficient operation of such networks, and the principles of distributed computing.

Learning Outcomes Students should be able to: describe the layered architecture, routing mechanisms and protocols used in communication networks, in particular the Internet; describe mathematical models of optimisation problems arising in the design and operation of networks; implement simple distributed applications such as peer-to-peer network software.

Methods Class sessions together with course notes, recommended textbooks, worksheets, and some additional hand-outs and web support.

Assessment Marked problem-based worksheets and programming assignments, traditional written problem-based examination.

Skills

Aims To teach students scientific writing, modelling and problem solving skills.

Learning Outcomes Students will be able to: write short, clear, note based, summaries of technical knowledge; solve abstract and concrete problems (both routine seen, and simple unseen), including modelling aspects.

Methods Class sessions together with worksheets.

Assessment Marked problem-based worksheets, class tests, traditional written examination.

Explanation of Prerequisites Basic understanding of discrete mathematics and some programming experience will be helpful.

Course Description In today's world, computers are no longer used in isolation, but are connected via networks. In particular, Internet-based communication is becoming more and more important for our society and economy. This module introduces the basic concepts of networking, discusses problems arising in the design and efficient operation of networks, and explains models and algorithmic techniques in distributed computing. It discusses the different network layers, routing mechanisms, and important protocols, focusing on the Internet but covering also certain aspects of wireless networks. It explains optimisation problems arising in networks, such as those related to routing and fault-tolerance. The design and analysis of algorithms for such problems are covered as well. The module briefly introduces models and basic principles for distributed computing, including architecture and implementation of peer-to-peer networks.

Detailed Syllabus Introduction to basic networking concepts, including discussion of ISO/OSI network model with seven layers and TCP/IP network model with four layers. Basics of the socket programming interface.

Performance analysis including calculations with transmission rates, bandwidth, throughput and latency.

Direct link technologies, transmission of frames (including brief discussion of SONET), error detection, sliding window protocol, Ethernet, 802.11 wireless networks.

Internetworking, basics of the IP protocol, address resolution. Distance-vector routing and link-state routing. Mobile IP and IPv6.

End-to-end protocols, in particular the use of TCP as a basis for reliable transport, and UDP for, e.g., real-time transmissions such as Voice-over-IP.

Introduction to the principles underlying efficient and scalable overlay and peer-to-peer networks (unstructured such as Gnutella, or structured). Implementation of a simple peer-to-peer network using the socket interface.

Reading List

[B] Larry Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach,* 4th Edition, Morgan Kaufmann, 2007, ISBN 1-558-60832-X.

[B] Andrew S. Tanenbaum, *Computer Networks,* 4th Edition, Pearson, 2003, ISBN 0-13-038488-7.

[B] William Stallings, *Data and Computer Communications,* 7th Edition, Pearson, 2004, ISBN 0-13-183311-1.

Resources Course notes, web page, study guide, worksheets, handouts, lecture rooms with OHP and data projector, past examination papers.

Module Evaluation Module questionnaires, course review.