CO7219 Internet and Cloud Computing

Credits: *15*   **Convenor:** *Prof T Erlebach*   **Semester:** *1ˢᵗ*

Prerequisites:	*Desirable: Java programming*				

Lectures:	*28*	*hours*	**Problem Classes:**	*3*	*hours*
Surgeries:	*6*	*hours*	**Class Test Hours:**	*1*	*hours*
Laboratories:	*2*	*hours*	**Independent Study:**	*110*	*hours*

Assessment: *Coursework: 40% + Two hour exam in January: 60%*

Subject Knowledge

Aims   This module teaches the basic concepts and mechanisms underlying the Internet and the principles of Cloud Computing.

Learning Outcomes   At the end of the module students will be able to: discuss the layered architecture, routing mechanisms and main protocols used in the Internet; demonstrate understanding of the principles, components and architecture of cloud computing; discuss issues and solution approaches for questions of privacy and security in the context of cloud computing; demonstrate understanding of mechanisms for enhancing fault-tolerance in cloud computing; discuss scalable approaches to distributed computing on large amounts of data, especially the MapReduce programming model, including application areas such as data analytics, data mining, and information retrieval.

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 problem solving skills relevant to networking and cloud computing.

Learning Outcomes   Students will be able to: perform calculations to predict performance metrics of data transfers in different network scenarios; design and implement scalable computations in Java using the Hadoop framework.

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 in Java will be helpful.

Module Description   Internet-based communication has become essential for our society and economy. Furthermore, the advent of cloud computing has revolutionised the way in which data is stored and processed. The first part of the module covers basic concepts of networking such as the Internet architecture, the sliding window protocol for reliable transfer, routing in the Internet, and end-to-end protocols. Students also learn to carry out calculations to predict network performance. The second part of the module focuses on cloud computing. It covers the principles of cloud computing, the MapReduce programming model for large-scale data processing, the implementation of MapReduce programs using Hadoop, and security considerations relevant to cloud computing.

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.

Overview of Internet architecture and mechanisms for routing and internetworking.

Principles, architecture of cloud computing, including aspects of fault-tolerance, privacy and security.

Scalable distributed computing using the MapReduce programming model, and implementation in Java using the Hadoop framework.

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.

[B]   J. Rosenberg, A. Mateos, *The Cloud at Your Service: The when, how, and why of enterprise cloud computing,* Manning Publications, 2010. ISBN 978-1-935-18252-8.

[B]   Jimmy Lin and Chris Dyer, *Data-Intensive Text Processing with MapReduce,* Morgan & Claypool, 2010, ISBN 978-1-608-45342-9.

[B]   Tom White, *Hadoop: The Definitive Guide,* 3rd Edition, O'Reilly, 2012, ISBN 978-1-449-31152-0.

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.