CMPE 322 - Computer Networks Programming

Istanbul Bilgi University, Department of Computer Engineering, Spring 2014

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Description

The connection of computers in networks, whether local or global, has added a new dimension to the power of computers. This course aims to introduce students to the standards that make this power possible, the theoretical concepts needed to understand it, and approaches for designing networked software systems. Practical element of the course involves writing programs that use the various protocol stacks to carry out network computing tasks.

Subjects covered include layered network architecture, local and wide area network protocols, network topologies, connectivity and delay analysis, network security and communication secrecy, client/server and peer-to-peer communication architectures, programming for high-load web applications.

Project assignments in this course aimse to introduce students, accordint to their choices, to contemporary problems such as peer-to-peer networking, web application protocols and architectures, along with high performance programming techniques and frameworks that form the basis of popular networked applications such as Facebook, Twitter, and Google.

Students who register to this course is expected to have a fair command of object oriented programming and concurrent programming techniques.

Learning Objectives

On successful completion of this course, the student should be able to:

- Develop a robust understanding of digital data transmission, packet switching, and the Internet protocol stack.
- Understand security issues in Internet communication, encryption and hashing techniques, and how to make choices among security measures and apply them using common security tools.

- Understand issues in concurrent network applications in connection-less and connection-oriented infrastructures.
- Understand issues in implementing client/server systems using distributed programming techniques.
- Develop a firm understanding of network topologies and their consequences, and be able to measure performance and monitoring tasks in local area networks.

Learning Outcomes

- Write client and server programs using UDP and TCP protocols.
- Implement protocols for TCP based connection oriented application layers.
- Write distributed network applications using common protocol standards such as XML-RPC and RMI.
- Monitor and constrain network activity on Linux based systems.
- Create, install, maintain, and analyze SSL security certificates for various network services on Linux systems.

Resources

- Brief lecture notes are available at http://mgencer.com
- Data and Computer Communications (seventh edition). William Stallings. Prentice Hall, 2004. There is a book website at http://williamstallings.com/DCC/DCC7e.html
- Java network programming, Elliotte Rusty Harold, 2000. (electronic resource available at Bilgi library)
- The Art of Computer Networking. Russell Bradford. 2007. Prentice Hall.

Assessment

Exams %70, coursework/assignments %30

Tentative weekly outline

The course outline is designed so that students will learn computer networks theory and standards that form the *infrastructure*, up to network *applications* practice.

PART 1: Language of machines

- Alphabet and timing: the physical layer
- Grammar and sentences: the data link layer
- Local addressing: MAC protocol and packet flow
- Global addressing: network layer IP protocol and routing
- Communication secrecy: VPN and cryptography

PART 2: Language of applications

- Packet and stream orientation
- Sockets
- Concurrency in socket processes
- Socket/transport level security: SSL/TLS
- Talk your way: application level protocols

PART 3: Design patterns for performance

- HTTP servers
- Distributed computing: Web-sockets, RPC, Ajax
- Stream servers and multicasting
- Asynchronous servers
- Event driven servers