

King Fahd University of Petroleum & Minerals
College of Computer Sciences and Engineering

ICS 570: Advanced Computer Networking (3-0-3)

Spring Semester 2007-2008 (072)

Syllabus

Instructor: Dr. EL-SAYED EL-ALFY

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Schedule:

Class Time & Venue: UT @ 6:30pm-7:45pm - Room: 22-119

Office Hours: UT @ 7:45pm-8:30pm or by appointment

Description:

This is a graduate level course that covers a wide spectrum of advanced networking topics to equip students with the necessary knowledge, tools and skills to engage in research work in the area of computer networks. Students will be introduced to fundamental networking problems, concepts, mechanisms, protocols and models for their analysis and design. Examples of topics to be discussed include contemporary concepts, practices, implementations, and design trade-offs of modern computer networks; architecture; switching, multiplexing and routing; flow and congestion control; quality of service; access protocols; traffic modeling and engineering; scheduling and resource allocation; security management; modeling and analysis of data networks: queueing theory, Little's law, single queues, and Jackson networks. **Note:** This course is equivalent to COE 540 or EE 674.

Pre-requisites: It is assumed that students have already taken undergraduate level courses on computer networks and operating systems (e.g. ICS 343 and ICS431 or equivalents). Basic background on probability and algorithms is recommended.

Learning Outcomes

Upon completion of the course, you should be able to:

1. Explain the operation of a wide range of network applications such as email, web, P2P file sharing.
2. Describe various network and application architectures and related underlying design principles.
3. Identify and discuss major design trade-offs for essential functions needed for modern computer networks.
4. Model and evaluate the performance for basic network operations, e.g. multiplexing, routing, flow and congestion control, access control, scheduling, load balancing and resource allocation.
5. Identify research topics and engage in the design, analysis, control, and optimization of networks, protocols and applications.

Required Material

- J. Kurose & K. Ross. *Computer Networking: A Top-Down Approach Featuring the Internet, 4/e*, Addison Wesley, 2008. http://wps.aw.com/aw_kurose_network_4/
- Selected papers will be assigned as supplementary reading materials.

Some Recommended References

- H. Jonathan Chao & B. Liu. *High Performance Switches and Routers*, John Wiley and Sons, 2007.
- D. Bertsekas and R. Gallager. *Data Networks*, 2/e, Prentice Hall, 1992. citations:
<http://portal.acm.org/citation.cfm?id=121104>
- L. Peterson, B. Davie. *Computer Networks: A Systems Approach*, 4/e, Morgan Kaufmann Publishers, 2007.
- *Data Communications and Networking*, 4/e. B. Forouzan, McGraw-Hill Higher Education 2007.

Grading Policy

Practice Homework	0%
Quizzes and paper reviews	10%
Midterm (End of Week#9)	20%
Semi-Comprehensive Final Exam (TBA)	30%
Term Paper	40%

Tentative Major Topics

- Review of basic networking concepts (~2week)
 - Key concepts, components, network services and applications, layered models, switching paradigms
 - Applications architectures and systems (C/S, P2P and hybrid)
- Modeling and analysis of networks (~3week)
 - Simulation
 - Basic queuing theory: Little's law, single queues, and Jackson networks
 - Applications including scheduling, multiplexing, probabilistic routing, load balancing and resource allocation
- Routing (~4week)
 - Spanning tree protocol, minimum weight routing
 - Link state routing, distance vector routing
 - Admission control and traffic shaping (Leaky Bucket)
 - Router architecture, packet classification and lookup matching
- Transport (~3week)
 - FSM and design of reliable data transfer
 - Flow and congestion control
 - Quality of service and differentiated services
 - TCP fairness and delay modeling
- Wireless networks (~1week)
- Security management (~1week)

Additional Notes

- **Term paper:** As a major part of this course is enhancing your skills to be a self-learner and conduct independent research with little guidance, the project component will give you a chance to work with the instructor on a real research problem. It is required to pick up a topic related to networking, study it, write a term paper of published quality, and give a 20-minute presentation. You first need to perform a pre-study to identify a set of topics and potential research objectives. Then discuss them with the instructor to select only one. Examples of problems include (but not limited to) Internet QoS, traffic modeling, load balancing, web caching, traffic engineering, performance evaluation of specific protocols or algorithms, etc. A typical example term paper will be distributed in the class to give you a close feeling of what you

are expected to produce. There are three tasks: (1) proposing a topic you want to study, (2) conducting the research study and writing a paper on the topic, (3) giving a 20-minute presentation. More information will be discussed incrementally later.

- **Class participation:** Students are expected to be active and collaborative in the discussion of the topics. Some papers of relevant material will be assigned and students are expected to read them and submit a one-page review report summarizing the paper contribution, strengths and weaknesses, possible improvements, etc.
- Check the **WebCT** frequently for course material updates and all communication items.
- **Make-up:** No make-up assignments or exams will be given
- **Attendance:** It is very important to attend all the classes. If there is a real need to be absent, contact the instructor beforehand. Attendance will be checked at the beginning of each class. More than 6 absences will result in a DN grade. To avoid being considered as absent, an official excuse must be shown within one week of return to classes.
- **Academic Dishonesty:** Students are expected to abide by all the university regulations on academic honesty. Cheating will be reported to the Department Chairman and will be severely penalized. Although collaboration and sharing knowledge is highly encouraged, copying others' work without proper citation, either in part or full, is considered plagiarism. Whenever in doubt, review the university guidelines or consult the instructor.
- **Courtesy.** Students are expected to put their cell phones on silent mode during the class and turn them off during exams.

☺☺☺ **Best of luck!!** ☺☺☺

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syllabus
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Networks (041)
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Author: .
Keywords:
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