Syllabus CS 536 Data Communication and Computer Networks Fall 2004

Instructor : Kihong Park
Class : MWF 1:30–2:20pm (CS G66)
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Course Content : Graduate-level introductory course to computer networks and data communication; covers principles (∼60%) and implementation (∼40%).

Prerequisites : Operating systems (CS 413); solid background in C and UNIX (experience with medium-to-large projects); sound undergraduate-level mathematical preparation (calculus, probability and statistics, linear algebra, etc.).

Text Books : Required: *Computer Networks: A Systems Approach*. Peterson & Davie. Morgan Kaufmann Publ., latest edition (3rd). The textbook should be viewed as reference material; the lectures are the main source of information. Although the overall flow will be the same, the material covered in the lectures will deviate from the textbook in sequence, presentation, and treatment at various places. Attendance is crucial for the successful completion of the course.

Work Load and Grading Policy : Homework assignments (35%), midterm (25%), final (25%), project (15%). Homework assignments, on average, are bi-weekly. They will be posted on the course homepage. Discussion of initial ideas and approaches regarding homework assignments is fine. *Collaboration* on homeworks (i.e., jointly exploring the specifics of a solution), however, is not allowed. Academic dishonesty is a serious matter and is dealt with in accordance with University policy. Project: list of topics distributed after midterm; submit project plan; feedback provided; execution and submit report. Current events: round-robin presentation & discussion of networking trends; each Friday 10–15 minutes.

Lab Space : Our main programming and implementation platform will be the cluster of PCs in the Xinu Lab (CS 257) of the Computer Science Building running UNIX (Solaris). Lab times have been set aside for CS 536 (consult your schedules). There are also open times (posted in the Lab) during which the machines can be shared with other users. The lab machines can be accessed remotely using `ssh`; `telnet` is disabled for security reasons. The relevant hostnames are: `xinu1.cs.purdue.edu`, ... which are Intel x86 machines, and `xinuserver.cs.purdue.edu` which is the fileserver for the cluster. A typical homework will involve writing network programs running on a number of `xinu*.cs.purdue.edu` machines communicating with each other. Accounts are automatically created for you based on registration. For account-related questions, please consult Candace Walters (`clw@cs.purdue.edu`, 4–9206, CS 210).

Goal of the Course :

The primary goal of the course lies in the mastery of fundamental networking concepts—architecture, algorithms, and implementations. Computer networks is a rapidly evolving field, with new standards and improvements in data communication technology occurring, literally, as we speak. This makes the field both exciting and rewarding; however, for those not firmly grounded in its fundamentals, it can also be a confusing and overwhelming subject matter. Fortunately, the fundamentals required in understanding and keeping on top of ongoing developments vary at a much slower pace, and it is these fundamentals that will form the skeleton of the course, with technological advances providing further grounding and context. This course is a modern introduction to computer networks, stressing the logical organization of the three networking features: architecture, algorithms, and implementations. Special emphasis will be given to *performance* issues which will be a recurring and, to some extent, unifying theme of the course. Ultimately, architecture, algorithm, and implemention are geared toward facilitating performance. We will learn about the technology and control mechanisms underlying local area and wide area networks including wireless networks, the fundamentals of information transmission and coding which underlies all intelligible communication, the protocols that allow diverse networks to interoperate so that messages are seemlessly forwarded (internetworking), the role of data buffering and why, in spite of that, data is sometimes lost on its route from source to destination (aka queueing). We will learn how to control the path and flow of data such that network performance is enhanced (routing and congestion control), special problems arising in high bandwidth networks, what Internet traffic actually looks like, key issues surrounding multimedia communication (voice/audio/video), and their support (quality of service), high-level transparent network services including domain name system (DNS), hypertext transfer protocol (HTTP), caching and content distribution networks (CDNs). We will conclude with a discussion of network security issues.

Course Outline :

- Introduction
- Fundamentals of information transmission and coding
- Direct link communication I: wired media
- Direct link communication II: wireless media
- End-to-end communication: packet switching and circuit switching
- Socket programming and network communication
- Internetworking with TCP/IP: structure
- ——*Midterm*——
- Internetworking with TCP/IP: functionality
- Congestion control
- Routing
- Internet traffic: data and multimedia payloads
- Multimedia communication and QoS
- Transparent network services: DNS, HTTP, web server design, caching and CDNs
- Network security: "CIA," denial-of-service attack, worm attack
- ——*Final*——

§ *The lecture notes will be made available on-line on the course homepage.*