ECE 440/CS 485
Introduction to Computer Networks

Overview

Course Catalog Description: Theoretical and practical study of computer networks, including network structure and architectures. Principles of digital communication systems. Network topologies, protocols, and services. TCP/IP protocol suite. Point-to-point networks, broadcast networks, local area networks, routing, error, and flow control techniques.
Prerequisites: C- or better in ECE 330, ECE 337, ECE 340 (co-requisite)
Textbook: J. Kurose, K. Ross, *Computer Networking: A Top-Down Approach (4th Edition)*, Addison-Wesley, 2007
Class Goals: To build on knowledge students have gained from previous programming, data structures, and probability courses and provide a broad-based introduction to modern computer communication networks. To introduce the layered network model and provide a detailed top-down approach of each layer from the application to the link layer. To provide and understanding of the specific functions and associated protocols at each layer and provide relevant examples of existing network architectures, e.g., Internet, telephone, wireless, etc.
Course Coordinator: Prof. Nasir Ghani

Table I: Objectives, Implementation, and Assessment

Objectives		Implementation	Assessment	A	B	C	D	E	F	G	H	I	J	K
O_1	Understand the fundamental network architectures, the roles and responsibilities of protocols at different layers, and various services provided.	9 hrs. lecture in weeks 1-3	Hw 1-2, Exam I	X	X						X	X	X	
O_2	Understand circuit-switching and packet-switching, to be able to define and compute basic network performance characteristics, such as delay and throughput.	3 hrs. lecture in Week 2	Hw 3, Exam I	X	X			X						
O_3	Understand some important application-layer protocols, such as HTTP and DNS.	3 hrs. lecture in Week 4	Hw 3 Exam II	X	X			X					X	
O_4	Understand multiplexing, reliability, and design principles of congestion and flow control.	9 hrs. lecture in weeks 6-12	Hw 4,5 Exam II, III Project	X				X						
O_5	Understand design principle of network routing, addressing, and Internet hierarchy.	Portions of lectures in weeks 9-15,	Hw 5, Exam III, Project	X				X						
O_6	Understand error detection and media access control (such as CSMA), learn design of local area networks.	5 hrs lecture in weeks 11-12	Hw 6, Exam III, Project	X				X						
O_6	Understand basic principles of network security, cryptography, encryption, and authentication	4 hrs lecture in weeks 14-15	Exam III	X				X						

Table II: Expectation and Assessment Outcome
Spring 2009, Dr. N. Ghani

General expectations:
Homework Assignments:
These assignments involve two components:

1. Sharpen/practice/improve skills and understanding of networking concepts taught in class
2. Develop requisite skills to conduct analysis for programming projects (e.g., making sure they are able to compile programs, produce output to computer screen, etc.).

For (1), expect that all of the students will be able to answer at least 70% of the problems assigned. For (2), expect 100% of the students to be able to complete the assignments, otherwise then cannot have success in programming projects.

Class Project:
Project involves selection of a networking-related project and developing associated code to conduct analysis and produce results. Students are required to work in teams of 2-3 each to define a challenging project (approved by instructor), conduct necessary background reading and survey, complete coding design, and present a final project report and in-class presentation.

Exams: Expect 75% of the students to score 70% or better on all exams.

Assessment to be completed by Dr. Ghani for Spring 2009 class

Sample Course Schedule

Week	Date	Lect.	Topic	Assignment
1	22 Jan	1	Introduction & Course Administration	
	24 Jan	2	Networks overview, history, Internet, applications	Ch. 1
2	29 Jan	3	Packet and circuit-switching, delay, throughput, layers	Ch. 1
	31 Jan	4	Network delay, throughput, layering (ISO model)	Ch. 1
3	5 Feb	5	Application layer design and types (client, peer-to-peer)	Ch. 2
	7 Feb	6	Sockets, addressing, TCP/UDP overview web/HTTP	Ch. 2
4	12 Feb	7	Cookies, web proxies/caching, FTP, email	Ch. 2
	14 Feb	8	DNS overview/architecture, DNS caching,	Ch. 2
5	19 Feb	9	Peer-to-peer file distribution, socket programming review	Ch. 2
	21 Feb	10	Transport layer design, multiplexing/de-multiplexing	Ch. 3
6	26 Feb	11	Connectionless vs. connection oriented, UDP, checksums	Ch. 3
	28 Feb	12	ACK/NAK, stop-n-wait, go-back-*N*, selective repeat	Ch. 3
7	4 Mar	13	TCP overview, flow and congestion control, fairness	Ch. 3
	6 Mar	–	**Exam I**	
8	11 Mar	–	*March Break*	
	13 Mar	–	*March Break*	
9	18 Mar	14	Network layer design, routing and forwarding	Ch. 4
	20 Mar	15	VC tables, packet forwarding (longest-prefix match)	Ch. 4
10	25 Mar	16	Router and switch architectures, IP addressing/sub-nets	Ch. 4
	27 Mar	17	DHCP, NAT, IPv6 basics, link-state routing (OSPF)	Ch. 4
11	1 Apr	18	Distance vector routing (BGP),hierarchical Internet routing	Ch. 4
	3 Apr	19	Link layer design, LAN basics, addressing, CRC schemes	Ch. 5
12	8 Apr	20	MAC protocols, ALOHA, CSMA/CD protocols	Ch. 5
	10 Apr	21	LAN addressing (ARP, DHCP), Ethernet overview	Ch. 5
13	15 Apr	–	**Exam II**	
	17 Apr	22	Ethernet bridging vs. switching, switches vs. routers	Ch. 5
14	22 Apr	23	PPP overview, byte-stuffing techniques	Ch. 5
	24 Apr	24	Network security overview, principles of cryptography	Ch. 8
15	29 Apr	25	Cipher techniques, RSA techniques, digital signatures	Ch. 8
	1 May	26	Public keys, authentication protocols, security/encryption	Ch. 8
16	6 May	–	Project presentations	
	8 May	27	Final exam review, course conclusions	
17	15 May	–	**Exam III**	