ECE4110 Internetworking Programming
Version 1/6/2006

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Class Hours: T/Th 12:05-1:55 p.m.
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TAs:
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Class Web site: http://www.csc.gatech.edu/copeland/jac/4110/
Fall 2005 Web site: http://users.ece.gatech.edu/~owen/Academic/academic.htm

Class Laboratory: COC 311
Lab Hours: See Schedule on door. It is an "open" lab; Lab T.A.s for this class post hours also. It is during these hours you may obtain help and or get signed off for completing a lab assignment.

You will work in "groups of two" on the labs. It is OK to talk to others and help each other in the lab.

3 hours of class per week, approximately 3 hours of lab per week, 4 hours of credit

This class covers how the Internet works and includes hands on practical networking exercises for the laboratory. Both Internet hardware (equipment) and software (both sockets programming and TCP/IP protocol implementation) are included in this class. Students use routers, network test equipment, hardware as well as software traffic generators, etc in the laboratory. The class also covers some aspects of network security. Using the Linux operating system, students examine the networking portions of the operating system in order to perform modifications to the computer's TCP/IP implementation. The laboratory consists of C programming on computers running Linux and working with computer network equipment such as routers and switches. Laboratory work is done in teams in an "open" laboratory in COC311which has class TA support during limited hours.

Last Semester Student reviews of Class and Instructor:
Available on line at class web site http://users.ece.gatech.edu/~owen/Academic/academic.htm under last semester's class info.

Policy on Commenting Software:
Fully commenting code, even code that you were given as a starting point is mandatory. This is one of the instructor's pet peeves. You must fully comment all code you turn in and must include comments to explain all of the code you turn in. (Even those parts of the code you did not write but were given as a starting point). You must include in the comments an explanation of what the purpose of the code is, the date the code was originally written, the date the code was last modified, your lab team member names and your group number must be in the comments. The last date modified must be correct and in the comments.

Policy on Handouts:
If you miss class you may obtain the class handouts from outside COC 360 on the bookshelves in a box labeled ECE4110. Class Web site also has assignments but not the lectures:
http://users.ece.gatech.edu/~owen/Academic/academic.htm

Prerequisites: ECE3076 Or CS3251 Or ISYE 3770 Or MATH 3770 Or CEE 3770 Or ISYE 2027 and only CMPE ECE EE CS; some previous C Programming (or Java) experience

Text Books
This class really does need three textbooks! We cover lots of really good material and no one textbook has it all. These

are excellent references and will serve you well in future jobs or research projects.

Text One: UNIX Network Programming Networking APIs: Sockets and XTI, Volume 1, Third EDITION, by Richard Stevens, Bill Fenner, Andrew Rudoff, ISBN 0-13-141155-1 (This text will be used for the first 4 weeks or so. It is an excellent reference book for Internet Programming in C.)

Text Two: TCP/IP Illustrated Volume 1, Richard Stevens, ISBN 0-201-63346-9 (This book contains the detailed FTP sessions we will trace packet by packet so as to understand exactly what happens in an FTP session. Additionally this book contains the details of TCP/IP.)

Text Three: TCP/IP Protocol Suite by Forouzan (SECOND EDITION not first!) ISBN 0-07-246060-1 MCGraw Hill (The majority of the class lectures originate from this material.)

References:

TCP/IP and Internets in General:

IP Fundamentals, by Thomas Maufer ISBN 0-13-975483-0)

Internet Core Protocols, Eric Hall and Vint Cerf, O'Reilly, ISBN 1-56592-572-6

TCP/IP Illustrated The Implementation, Volume 2, Gary R. Wright and Richard W. Stevens

LINUX Internet Implementation:

TCP/IP and Linux Protocol Implementation, John Crowcroft and Ian Phillips, Wiley, ISBN 0-471-40882-4

Linux IP Stacks Commentary," Coriolis Open Press, By Maxwell , ISBN 1576104702

Linux Core Kernel Commentary," Second Edition, Coriolis Open Press, By Maxwell, ISBN 1588801497

Internet Programming:

The Pocket Guide to TCP/IP Sockets, C Version, Donahoo and Calvert, Morgan Kaufman, ISBN 1-55860-686-6

Beginning LINUX Programming, by Neil Matthew and Richard Stones, WROX Press,ISBN1-874416-68-0

UNIX Network Programming Interprocess Communications, Volume 2, SECOND EDITION, by Richard Stevens

Internetworking with TCP/IP Client-Server Programming and Applications, Volume III, by Douglas E. Comer and David L. Stevens

Interprocess Communications in UNIX, Second Edition, by John Shapley Gray

Intrusion Detection:

Intrusion Signatures and Analysis, Northcutt, Cooper, Fearnow and Frederick, New Riders, ISBN 0-7357-1063-5

Network Intrusion Detection An Analyst's Handbook, Second Edition, New Riders, ISBN 0-7357-1008-2

Old Tests
Old exams are online on Henry Owen's Web site.

Grading:

Test 1	25%
Test 2	25%
Labs	20%
Final	30%

If you miss a test without prior approval, you will receive a grade of zero for that test. If you do not complete 2 or more of the labs/homeworks in a "timely manner" (within a week of the due date), the highest grade you can get in the class is a B. If you do not complete 4 or more labs in a timely manner, the highest grade you can get in the class is a C. Labs not signed off by the due date will be penalized.

Exams are **open notes** and **closed old exams** (but open text books). You are not allowed to bring in old exams during tests. You may use any books, including the class texts during the exam. Thus, reading the class textbooks and knowing where the info you need is located is important. You should always bring a calculator to all exams in this class. You may not use the in class computer during the exams. Cell phones must be turned off and should not be placed on your desk. You are not allowed to use the classroom computer during an exam or a network connection.

For maximal class benefit read the reading assignments prior to the class lectures on the subject.

The laboratory consists of the following labs (**subject to change**):

Installing the Linux Operating System on a Computer and configuring Networking. Install the Stevens book Sockets code and run examples from the Stevens text.

Modify a sockets program to send TCP traffic to a destination. At the receiver, measure the throughput and report it to the screen. Measure the throughput.

Modify a sockets program to send UDP traffic to a destination and at the destination measure the throughput and report it to the screen. When this program is used in conjunction with the LAB 2 UDP traffic generator, throughput measurements with conflicting traffic on the same Ethernet segment may be made. The TCP traffic generator will slow down as it encounters congestion. Examine how UDP and TCP act differently in a bottleneck situation.

Use a Network Sniffer to examine packet contents.

Configure a Linux box to act as a router. Examination of the routing tables and interface configuration.

Modify the Linux Kernel to print some messages from the Kernel. Build a priority queue that gives priority to a protocol. Run this with TCP receiving priority and then later with UDP receiving priority while using the traffic generators.

Configuring an internetwork from scratch using Cisco routers and switches

RIP Router Lab. Use Cisco Routers to demonstrate Routing Information Protocol (RIP).

OSPF Router Lab. Use Cisco Routers to demonstrate Open Shortest Path First (OSPF) Routing Protocol.

ECE4110 Internetwork Programming Schedule (Version 4/28/2006)

Tu Jan 10	Goals and Objectives, Class Administration DetailsDHCP and DNS Read Forouzan Chapters 16, 17
Th Jan 12	TCP/IP Protocol Architecture, Header Bit assignment Details, TCP/IP Forouzan Chapters 8, 11, and pp. 783-786.
Tu Jan 17	TCP/IP Continued; Client and Servers, Example sockets programs, Elementary TCP Sockets (Chapters 1,2,3, and 4 Stevens Unix)
Th Jan19	Elementary TCP Sockets (Chapter 4 Stevens Unix)
Tu Jan 24	TCP Client Server Examples (Chapter 5 Stevens Unix) **LAB 1 DUE: Installing Linux and Installing the Stevens book code**
Th Jan 26	Elementary UDP Sockets (Chapter 8 Stevens Unix); Lab 2 Code discussed in detail
Tu Jan 31	Address Classes, Physical Addresses, IP Routing, Subnet Addressing, Subnet Masks (Read Chapter 4 Forouzan) **LAB 2 TCP Traffic Generator Due**
Th Feb 2	Subnetworks with Variable Length Masks, Subnet Example Network; (Read Chapter 5 in Forouzan) Supernetting, CIDR
Tu Feb 7	Network Address Translation, IP Forwarding; Routing Versus Switching (Read Chapter 6 and Chapter 7 in Forouzan) **LAB 3 UDP Traffic Generator Due**
Th Feb 9	Linux Networking Kernel Code
Tu Feb 14	Linux Networking Kernel Code **LAB 4 Ethereal Packet Sniffer**
Th Feb 16	Ethernet (Read Forouzan Ethernet pages 43-49)
Tu Feb 21	Test 1
Th Feb 23	Test 1 Solutions
Tu Feb 28	Configuring Routers: VLANs
Th Mar 2	TCP Bulk Data Flow (Chapters 17, 18 Stevens TCP/IP Illustrated Vol. 1 and Read Chapter 12 in Forouzan)
Tu Mar 7	TCP/IP Details, Bandwidth-Delay Product (Chapters 19, 20 Stevens TCP/IP) **Lab 5 Configuring a Linux Machine as a router and Kernel Modification**
Th Mar 9	TCP/IP Details, slow start, Timeout and Retransmission (Chapters 21, 22 Stevens TCP/IP)
Tu Mar 14	TCP Congestion Avoidance, Fast Retransmission
Th Mar 16	Routing Protocols, RIP Read Forouzan Chapter 14 **Lab 6 Setting up a Network Using Cisco Routers, Switched and VLAN Technology**
Tu Mar 21	School Holiday
Th Mar 23	School Holiday
Tu Mar 28	Open Shortest Path First (OSPF) Routing
Th Mar 30	BGP and Dissimilar Routing Domains Interconnection Techniques
Tu Apr 4	File Transfer Protocol and HTTP Forouzan Chapters 19, and 22 **Lab 7 Setting up Burdell Inc network using multiple switches and Access Control Lists**
Th Apr 6	Test 2
Tu Apr 11	Test 2 Solutions
Th Apr 13	DHCP and DNS Read Forouzan Chapters 16, 17 **LAB 8 RIP Lab Due**
Tu Apr 18	Network Security Read Forouzan Chapter 28
Th Apr 20	Network Security
Tu Apr 25	**LAB 9 OSPF Lab and Fixing a Broken Network Lab Due**
Th Apr 27	No class
Fr May 7	Final Exam 8:00 a.m.