

CSS 432: Network Design – Autumn 2008
Class Time: Monday/Wednesday 5:45 – 7:50 PM, UW1-041

Instructor: Dr. Bill Erdly
Office: UW2 Room 308
Office Hours: Monday/Wednesday 4:00 – 5:30 PM (or by appointment)
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Course Objectives:

Welcome to the class! In this course, we will explore the world of computer networks through a combined approach of lectures, group projects, labs, and individual explorations and analyses of real-world problems facing network designers and application specialists. The emphasis of this course is on how to *design* state-of-the-art computer networks that best meet user needs. If you are “born to code” you will have an opportunity to do just that; if you are interested in the systems analysis perspective of network design, you will learn the latest design methodologies and approaches – and have a chance to translate these into practice. Since this is a 400-level course, you will have the opportunity to customize your course learning goals based on your interests. As a baseline, we will explore the following:

- understand the history of networking
- determine network design requirements and quality of service (QoS) specifications
- understand the OSI (Open Systems Interconnect) Reference Model
- gain technical knowledge about the LANs, WANs and telecommunication infrastructure
- identify essential network hardware, software and management policies and procedures based on application needs
- analyze different protocols and routing algorithms
- optimize and troubleshoot existing networks
- create network benchmarking techniques to optimize network performance
- configure routers using a variety of routing protocols
- learn about new trends and advanced topics in networking such as VPN, VoIP, IPv6, DWDM, SONET, network security, wireless protocols, BGP, unified communications

Course Requirements:

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| 1. Homework/Group Assignments | (20 percent) |
| 2. Four Quizzes | (40 percent) |
| 3. Final Exam | (20 percent) |
| 4. Research Project | (20 percent) |

- Homework/Group assignments will include problems intended to enhance critical reading, network analysis, problem solving and router configuration skills -- and also prepare you for upcoming lecture topics. Some of these assignments will be in the form of group activities/reports. Network simulation labs will also be included as part of the homework activities.

- Three in-class quizzes (approximately one hour each), one take home quiz and the Final Exam (two hours) will include a series of short answer questions, networking problems and essay questions which require students to synthesize course lectures, readings and group activities.

- The research project is designed to allow you to focus on a specific aspect of networking that interests you most. It requires approval of a research proposal and may be completed by an individual or a small group. If you choose a group project, responsibilities for each group member must be clearly specified in the proposal.

Course Policy:

All exams, projects, and papers must be completed on the specified date unless prior arrangements are made with the instructor. Make-up exams are discouraged. If necessary, all make-ups must be completed within 10 days of the regularly scheduled exam.

Disability Accommodations:

To request academic accommodations due to a disability, please contact Disabled Student Services (DSS) in the Counseling Center. If you have a documented disability on file with the DSS office, please have your counselor contact me and we can discuss accommodations.

Required Readings:

Comer, Douglas (2006) "Internetworking with TCP/IP: Principles, Protocols, and Architectures" (5th Edition), Prentice-Hall, ISBN 0-13-187671-6.

Doherty, J., Anderson, N. & Maggiora, P. D. (2008) Cisco Networking Simplified. (2nd Edition). Cisco Press, Cisco Press, ISBN-10: 1-58720-199-2.

McCabe, James (2007) Network Analysis, Architecture & Design. (3rd Edition). Morgan Kaufman. ISBN 978-0-12-370480-1

Course Software: (Will be available in the networking lab – or may be purchased and downloaded individually)

CCNA Network Visualizer 6.0 www.routersim.com

Other tools and information can be found at www.cisco.com

Optional Text:(Useful to accompany router simulation software – but not required)

Lammle, S. (2005) " Cisco Certified Network Associate Study Guide – Fifth Edition," Sybex, Inc.

Reading Assignments, Exam and Research Project Schedule

CSS 432: Network Design*

Week 1: “Ubiquitous” Computer Networks – An Applications Perspective

Why have computer networks become so indispensable in a modern business? What are some of the uses of networks? What are the underlying network hardware architectures that we build software upon?

Comer – Chapters 1 & 2, Appendix 1
Maggiora & Doherty –Part III
McCabe – Chapter 1

Week 2: Network Design Approaches & Intro to the OSI/TCP Reference Models

The OSI and TCP (DARPA) reference models are some of the most useful ways of describing network services. We will examine the purpose of each suite, as well as describe how these models influence network design.

Comer – Chapter 10
Doherty, J., Anderson, N. & Maggiora, P. D. – Part I
McCabe – Chapters 2 – 4

Week 3: Network Facilities, Equipment and Cabling Basics

One of the first things people may think of when they think network is the cable to the wall. What lies behind the walls, though? This is an introduction to the physical and data-link layers of the network – and includes discussion of the proper facilities required to house critical infrastructure.

Comer – Chapter 3
Doherty, J., Anderson, N. & Maggiora, P. D. – Parts IV and VI

Week 4: Network Transmission Protocols: How They Work

In the middle of both the OSI and TCP models are layers relating to the transfer of any kind of data. This is an overview of how network and transmission protocols perform their work.

Quiz 1 – Wednesday (October 15)

Comer -- Chapters 4 - 8
Lammle – Pages 246 – 251 (see supplemental materials)

Week 5: Fundamentals of Network Design

We now have enough background to begin to design a functional routed network. What considerations will go into whether to use hubs vs. switches, break your network into subnets using routers, and what must be considered in a WAN environment?

Research Proposal Due – Monday October 20

Doherty, J., Anderson, N. & Maggiora, P. D. – Part II
McCabe – Chapter 5

Week 6: Router Configuration Basics

Methods and techniques for configuring router interfaces; optimizing router configuration files; developing an effective addressing strategy; using NAT, CIDR and other IP conservation techniques, and understanding network operating systems will be covered.

Quiz 2 – Wednesday October 29

Comer – Chapters 9, 13 – 15, 24, 25

McCabe – Chapters 6 – 9

Week 7: Benchmarking and Troubleshooting Networks

Our network is now connected and carrying traffic. Is it performing at its best? What if a portion (or all) of the network fails? We discuss how to measure the performance of a network, as well as diagnosing network failures.

Comer – Chapters 12, 29

Doherty, J., Anderson, N. & Maggiora, P. D. – Part

Week 8: Network Security

Everyone has read about denial of service attacks, hackers breaking in and stealing customer's credit card information, or other failures of security. How do we secure the network against threats, external AND internal?

Comer – Chapters 19, 30

Doherty, J., Anderson, N. & Maggiora, P. D. – Part V

Week 9: Unified Communications – Supporting Complex, Highly-integrated Network Applications

A network is useless if it does not support applications that support the needs of an organization. What are these specialized – and integrated applications – and how do they perform their work? What network design issues and QoS considerations are there to support unified communications?

Quiz 3 - Wednesday (November 19)

Comer – Chapters 20, 22, 23, 26, 27

Doherty, J., Anderson, N. & Maggiora, P. D. – Part VII

Weeks 10 & 11: Implementing Trends in Industry

Where is the industry going? What new network design approaches are available to support complex application and user requirements?

Comer – Chapters 18, 28, 31

McCabe – Chapters 10, 11

Doherty, J., Anderson, N. & Maggiora, P. D. – Parts VIII & IX

Quiz 4 (Take Home) - Assigned December 3 -- Due Monday (December 8)

Research Project Presentations – (Nov 24, Nov 26, Dec 1 in class)

Finals Week: **Final Exam** -- Monday – December 8 (In class – two hours)

**Note: Additional reading materials and handouts will be distributed during class. Also, Network Visualizer assignments will be assigned as part of your homework.*