EE 543 Telecommunications Switching and Transmission Systems
Fall 2007
Course Outline

3 credits, three lectures per week
Semester taught: Fall

Prerequisites: EE445
Recommended: EE446, EE447, CS 440 or similar course on layered network models

Room and Time: MWF 1:10 – 2:00 PM, 632 Cobleigh Hall

Instructor: Richard S. Wolff, 509 Cobleigh Hall, 994-7172, rwolff@montana.edu

Topics: Circuit and packet networks, switching systems, telecommunication transmission networking and media selection (fiber optics, cable, wireless), network configuration, network technologies, equipment selection, system design examples and project.

Approach: This course will take a systems view of communications, integrating perspectives from computer science, electrical engineering, operations research and economics. Students will learn to consider tele-traffic demands, quality of service, scalability, performance and cost into consideration to develop requirements and architectures. Examples will be drawn from emerging underlying technologies and applications including wireless communications, including mobility, optical communications, wavelength routing, packet networks and the Internet. Students will learn to solve telecommunications problems using modeling and simulation with OPNET IT Guru.

This course will be coordinated with CS 440, Computer Networks, where communication protocols and the TCP/IP protocol suite are addressed.

Texts:

- Required: "Communications Networks: Fundamental Concepts and Key Architectures", Second Edition, Alberto Leon-Garcia and Indra Widjaja, McGraw Hill, 2004.
- Recommended: "Fundamentals of Telecommunications", Second Edition, Roger Freeman, Wiley Interscience, 2005.
- OPNET IT Guru, Academic Edition (available from www.opnet.com)

Requirements and Grading:
Problem sets and labs: 40%
Mid term exam: 35%
Project: 25%

Projects: Each student will define and carry out a project involving a communication system problem. The project report will be written and completed at the end of the

semester. The project will include definition of the problem, analysis of requirements, selection of system architecture including relationships within and between network functions, and design, including selection of technologies, equipment and protocols. The project should address performance, scalability, extensibility and cost. Modeling and simulation will be used to obtain results where appropriate. Before conducting the project, each student will prepare a one page project description and outline for discussion with the instructor and approval. Final project reports are expected to be 10 to 20 pages in length and include discussion of the state of the art, alternative approaches, trade offs and references.

Syllabus:

- Network services and architecture: top down, application-driven view of networks, including a layered approach
- Packet networks, OSI model, packet switching
- Internet protocols, addressing, routing and transport
- Circuit networks, core and access technologies, circuit switching, intelligent networks
- SONET and ATM networks
- Network control and operations, quality of service

Supplemental Reading Material

Communications Systems Principles

- L. W. Couch II, "Digital and Analog Communications Systems", 6th edition, Prentice Hall, 2001. Communications system theory, analog and digital signals.
- B. P. Lathi, "Modern Digital and Analog Communications Systems", 3rd edition, Oxford University Press, 1998.S Signals, modulation, random processes, noise, information theory.
- M. Schwartz, "Telecommunications Networks: Protocols, Modeling and Analysis", Addison Wesley, 1987.Queuing theory, OSI architecture, packet and circuit networks. Examples of networks are dated, but presentation is excellent.
- John C. McDonald, "Fundamentals of Digital Switching", Plenum Press, 1983. Details on digital circuit switch design.
- James D. McCabe, "Network Analysis, Architecture, and Design", 2nd edition, Morgan Kaufmann, 2003. Top down systems approach, with requirements driving architecture and design, technology selection and performance.

Data Networks

- W. Stallings, "Data and Computer Communications", 6th edition, Prentice Hall, 2000.Good overview of communications systems, architectures and protocols.
- A. S. Tanenbaum, "Computer Networks", 2nd edition, Prentice Hall, 1989. Basics of the OSI model, classic text.
- Peterson and Davie, "Computer Networks: A Systems Approach" 3rd edition. Excellent presentation of data networking and the Internet.
- Christian Huitema, "Ipv6: The New Internet Protocol", Prentice Hall, 1996. Discussion of Ipv6 and Internet improvements.

- Martin De Prycker, “Asynchronous Transfer Mode”, Ellis Horwood, 1991. Principles of ATM, early standards.
- Uyless Black, “TCP/IP and Related Protocols”, McGraw Hill, 1992. Nuts and bolts of data networking protocols.
- Daniel C. Lynch and Marshall T. Rose, “Internet System Handbook”, Addison Wesley, 1993. Internet architecture, protocols, operations and early applications. Detailed explanations.
- Michael A. Gallo and William M. Hancock, “Networking Explained”, 2nd edition, Digital Press, 2002. Answers to lots of questions about how data networks work and why…

Wireless

- T. S. Rappaport, “Wireless Communications: Principles and Practice”, Second Edition, Prentice Hall, 2002. Wireless systems, physical and link layers, multiple access, standards
- K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall, 2002. Wireless network design.
- M. S. Gast, “802.11 Wireless Networks: The Definitive Guide”, O’Reilly, 2002. Details on 802.11 standard and WiFI applications. A “how to” guide.
- B. Furht and M. Ilyas, “Wireless Internet Handbook”, CRC Press, 2003. A collection of articles on technologies, architectures, standards and applications.

Optical Networks

- Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, 2nd edition, Morgan Kaufmann, 2002. Good source on optical technology, systems and applications.
- Thomas E. Stern and Krishna Bala, “Multiwavelength Optical Networks: A Layered Approach”, Addison Wesley, 2000. A good guide to wavelength-based networking.