EE 6364 Advanced Data Networks

Fall, 2014

Instructor: Dr. David C. Wang
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Office-Hour: by appointment
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Course web site: http://www-ee.uta.edu/online/wang
Class Time: Monday 6:00-8:50PM
Classroom: NH 105

Required Textbooks:

J. Kurose and K. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet, 6th ed*., Addison Wesley, 2013.

Course Description:

Presentations and detailed analysis of computer/data networking technologies. Topics include ISO OSI layers 2 and above networking technologies, such as asynchronous transfer mode (ATM), frame relay, Ethernet networks, multi-protocol label switching (MPLS), and Internet protocol technologies, and their applications. Network architectures, protocol stacks, routing algorithms, quality of service (QoS), flow control and traffic management techniques, router/switch design, and data network applications/services will be studied. Students will use Wireshark to examine the various protocols.

Pre-requisites:

- EE5360 "Data Communication Engineering" or EE5363 "Modern Telecommunications".
- Probability course, such as EE3330 "Probability and Random Signals."
- Some knowledge of queuing theory.

Course Learning Goals/Objectives:

Upon completing this course, students are expected to have comprehensive understanding of
- current data networking technologies and trend;
- various data network architectures;
- various data networking protocols and their applications.

Students should also be able to compare different data networks and to perform high level design of data networks. Students are expected to be able to read protocol specifications.

Attendance and Drop Policy:

Students are expected to attend classes regularly. For drop policy, follow school guidelines.

Student Evaluation of Teaching

Students will be asked to complete instructor/course evaluation forms at the end of the semester

Americans with Disabilities Act:

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 93112—The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitled Americans with Disabilities Act – (ADA), pursuant to section 504 of The Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens.

As a faculty member, I am required by law to provide **"reasonable accommodation"** to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with **informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels**.

Academic Dishonesty

It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University.

"Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22).

ANY CHEATING WILL RESULT IN SEVERE PENALTIES.

Course Requirements:

- Examinations: One mid-term exam (3 hours), one final exam (3 hours) and one network design quiz (1 hour)
- Homeworks

All exams are open book exams, and cover the material discussed in the class and assigned reading material.

Unless specifically instructed, homeworks are due in one week after the assignment is posted.

Email Account:

Each student is expected to have his/her own e-mail address.

Final Grade:

First Mid Term Exam	40%
Final Exam	40%
Network Design Quiz	10%
Homework	10%

Course Content/Tentative Lectures:

I. Introduction

1. **Introduction** (K-1)
   - Examples of data networks: network elements, protocols, and applications
   - Protocols: OSI reference model
   - Physical Layer and Access Network Technologies: SONET, DSL, cable, PON

II. Link Layer

2. **ATM Protocols and Services** (K-4.1, K-4.2, and reading assignment)
   - Physical, ATM, and AAL layers: functions and PDU formats
   - ATM services
3. **Local Area Networks** (K-5.3, K-5.4, and reading assignment)
   - Ethernet, Fast Ethernet, Switched Ethernet, Gigabit Ethernet
   - Access control protocol
   - Performance analysis
4. **Frame Relay** (Reading assignment)
   - Frame format and functions, congestion control
5. **Point-to-Point Protocol (**Reading assignment)
   - PPP format and operations
   - Packet over SONET
6. **Generic Framing Procedure** (Reading assignment)
7. **Multi-Protocol Label switching** (K-5.5; Reading assignment)
   - MPLS protocol, forwarding and control components
   - MPLS fast-reroute
   - Pseudo-wire emulation

III. Network, Transport and Higher Layers

7. **Internet Protocol Suite** (K-2, K-3, K-4.4, K-7, K-9 and reading assignment)
   - Protocol model
   - Network layer protocols: IPv4, IPv6, ICMP
   - Transport layer protocols: TCP, UDP, RTP
   - Application protocols: Telnet, DNS, FTP, RTSP, HTTP, SNMP

IV. Routing

8. **Internet Routing (**K-4.1 - 4.3, K-4.5 - 4.7, K-5.7 and reading assignment)
   - Unicast routing protocols: RIP, OSPF, IS-IS, BGP
   - Multicast routing protocols: DVMRP, MOSPF, CBT, PIM
9. **Router/Switch Design** (K-4.3, Reading assignment)
   - Architectures: single stage, multi-interconnect network
   - Performance analysis: queuing delay and cell loss ratio

V. QoS and Traffic Management

10. QOS (K-3.6-3.7, K-7.3, K-7.5- 7.6, and reading assignment)
- QOS Protocols: IntServ/RSVP, DiffServ, MPLS, SBM
- Queuing and scheduling disciplines
- Congestion control techniques

11. Traffic Management (K-3.6, K-7.5, and Reading assignment)
- Network dimensioning, Call admission control
- Usage parameter control/ Network parameter control
- MPLS- Traffic engineering

12. Network Performance (Reading assignment)
- Network performance analysis

VI. Applications

13. Voice over IP (K-7.3, Reading assignment)
- Codecs
- Network architecture & protocols

14. P2P Network (K-2.6, Reading assignment)
- Network architecture & protocols

Legend:
K-n.y: Kurose book, chapter n, section y

References:

- D. Bertsekas and R. Gallager, *Data Networks, 2nd Ed.*, Prentice Hall, 1992.
- H. Chao and X. Guo, *Quality of Service Control in High-Speed Networks*, Wiley, 2002.
- D. Comer, *Interworking with TCP/IP: Principles, Protocols, and Architectures*, 6th *ed*., Addison-Wesley, 2014.
- D. Comer, *Computer Networks and Internet*, Pearson, 2008.
- J. Davidson et. al., *Voice over IP Fundamentals, 2nd ed*, Cisco Press, 2007.
- Srinivasan Keshav, *Mathematical Foundations of Computer Networking*, Addison-Wesley, 2012.
- J. Matthews, *Computer Networking: Protocols in Action*, Wiley, 2005.
- N. F. Mir, *Computer and Communication Networks*, Prentice Hall, 2007.
- H. G. Perros, *Connection-Oriented Networks*, Wiley, 2005.
- L. L. Peterson and B. S. Davie, *Computer Networks: A Systems Approach*, *4th ed*., Morgan Kaufmann, 2007.
- W. Stallings, *High-Speed Networks and Internets: Performance and Quality of Service, 2nd ed*, Prentice-Hall, 2002.
- H. Sinnreich and A. Johnston, *Internet Communications using SIP*, Wiley, 2006.
- A.S. Tenenbaum, *Computer Networks,* 5*th ed*., Prentice Hall, 2010.
- J. Walrand and P. Varaiya, *High-Performance Communication Networks*, *2nd ed*., Morgan Kaufmann, 2000.