

In The Name of God, The Merciful, The Compassionate

New Graduate Course - Information Technology

Multimedia Networks (MMN)

(Advanced Topics in IT-2)

Department of Computer Engineering

Sharif University of Technology

Spring 2011 – CE 40873

Instructors: Hamid R. Rabiee, Ph.D.

Class Hours & Location: Saturdays & Mondays; 10:30 – 12:00 (CE department, #826)

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TAs: (TA Sessions are held on Saturdays 12:00 – 13:15, Room CE-826)

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Course Website: <http://ce.sharif.edu/courses/89-90/2/ce873-1/>
http://dml.ir/?page_id=346

Course Objectives: The course is an advanced graduate level course that covers the concepts and principles that underlie the delivery of multimedia services and contents such as digital audio and video across modern packet-switched computer networks and wireless networks with the required quality of service.

Course Textbooks (References):

Multimedia deals with a variety of different technologies and those technologies advance very quickly. Consequently, no single textbook exist that may cover all the topics we would like to cover in this course. Therefore, the course materials will be drawn from different resources including reference books, Internet, my own research and technical papers. Students are encouraged to study using class handouts, which will be posted on the course website and will cover all the course material needed. Additional material (such as selected articles, recent research papers) will be provided during the course.

Selected chapters from the following text books will be used to complement the course material:

1. “Fundamental of Multimedia”, by ZeNian Li and Mark Drew, Prentice-Hall, 2003.
2. “Computer Networking: A Top-Down Approach (4th edition),” by J. Kurose and K. Ross, Addison-Wesley, 2008.
3. “Quality of Service Control in High-speed Networks”, by H.J. Chao, X. Guo, John Wiley and Sons, 2002.

4. "Multimedia over IP and Wireless Networks: Compression, Networking, and Systems", by M. Van der Schaar, P. Chou, Academic Press, 2007.
5. "Digital Watermarking", by I.J. Cox, M.L. Miller, and J.A. Bloom, Morgan Kauffman Publishers/Academic Publishers, 2002.
6. "Information Hiding: Steganography and Watermarking-Attacks and Countermeasures", N.F. Johnson, Z. Duric, and S. Jajodia, Kluwer Academic Publishers, 2000.
7. "Standard Codecs: Image Compression to Advanced Video Coding" by Mohammed Ghanbari, Institution of Electrical Engineers (IEE), 2003.
8. "Video Processing and Communications" by Yao Wang, Joern Ostermann, and YaQin Zhang, Prentice Hall, 2002.
9. "Introduction To Multimedia Communications" by K. R. Rao, Z. S. Bojkovic, D. A. Milovanovic, WileyInterscience, 2006.
10. "QoS in Packet Networks ," by Kun I. Park, Springer 2005.
11. "Multimedia Communications, Directions and Innovations" by Gerry D. Gibson, Academic Press, 2001.
12. Multimedia Communications: Protocols and Applications, F. Kuo, W. Effelsberg, and J.Garcia-Luna-Aceves, Prentice Hall PTR, 2000.
13. The Art of Computer Systems Performance Analysis, R. Jain, Wiley Interscience, 1991.

Grading: Based on Homework, Quizzes, Critical Reading, Project, Mid-Term and Final Exams. The grade will be determined by (You will learn how to use OpNet for design/simulation assignments: therefore attending the TA sessions is mandatory)

- Homework: 30%
- Quiz: 10%
- Critical Reading & Presentation: 10%
- Mid-Term Exam: 25%
- Final Exam: 25%
- Project: 10%

Prerequisites: Undergraduate courses; Signal and Systems, Multimedia Systems, and Computer Networks, Background in Computer Systems Performance Evaluation (e.g., Simulation, Experimental, or Analytical approaches), experience with Matlab and GNU/Linux.

Course Description: This course is primarily concerned with the problems that arise when carrying audio/video contents over modern communication networks. The course will present an overview of current multimedia applications (e.g., such as video-on-demand, audio-on-demand, and IP TV, etc.) and discuss deployment problems, and study solutions presented in the literature and industry. The course will also examine emerging technologies and open research problems such as quality of service support for networked multimedia applications and streaming in peer-to-peer and wireless networks.

Tentative Course Outline:

Session No	Topic	Readings	HW/Quiz	
1 (89.11.11)	Overview of the course	Why multimedia networks?	Handout	—
2 (89.11.16)	Introduction	Media, Networking principles, IP networks, multimedia networking	Ref#2-Ch#7	—
3 (89.11.18)	Fundamentals of Multimedia (Background	Characteristics of Audio, Image and Video Signals	Ref#1-Ch#5,6	Quiz#1
4 (89.11.23)	Information similar	Audio Compression	Ref#1-Ch#13	HW#1
5 (89.11.25)	to the ones	Image Compression	Ref#1-Ch#9	Quiz#2

Session No	Topic		Readings	HW/Quiz
6 (89.11.30)	covered in the Multimedia Systems)	Video Compression	Ref#1-Ch#10 Ref#4-Part B	—
89.12.02	Holiday			
7 (89.12.07)	Fundamentals of Next Generation Networks	What is NGN?	Handout	HW#2
8 (89.12.09)	Quality of Service	Principles (e.g. Admission Control and Shaping/Policing)	Ref#3-Ch#1,2	Quiz#3
9 (89.12.14)		QoS Architecture (Integrated services; Differentiated services)	Ref#1-Ch#9	—
10 (89.12.16)		Traffic engineering (Fair Scheduling)	Ref#1-Ch#4	Quiz#4
11 (89.12.21)		Flow and congestion control (Buffer Management)	Ref#1-Ch#6,7	HW#3
12 (89.12.23)		Error Correction, Error Concealment	Paper	—
Nourooz Holiday				
13 (90.01.15)	Multimedia over IP	IP multicast	Ref#4-Part B	—
Thursday (90.01.18) – Midterm Exam (Covers up to end of Session 12)				
14 (90.01.20)	Multimedia over IP	IP multicast	Ref#4-Part B	HW#4
15 (90.01.22)	Multimedia over Overlay networks	Application level multicast	Paper	Quiz#5
16 (90.01.27)	Multimedia Applications	Streaming (Real- time)	Ref#2-Ch#7	—
17 (90.01.29)	Multimedia Protocols	Signaling Protocols (SIP, H.323) Streaming (Real- time) Protocols (RTP, RTCP)	Handout (Internet Multimedia Architecture)	Quiz#6
18 (90.02.03)	IP Multimedia Subsystem (IMS)	Emerging Multimedia architecture	Handout	HW#5
19 (90.02.05)	Multimedia over Wireless/ sensor network	Introduction to wireless Networks	Ref#4-Part D, Ref#1-Ch 17	Quiz#7
20 (90.02.10)		Multimedia over Wireless Networks	Ref#4-Part D	—
21 (90.02.12)		Multimedia over Sensor Networks	Paper	Quiz#8
90.02.17	Holiday			
22 (90.02.19)	Multimedia Networking Applications	Digital TV Voice Over IP IPTV Audio/video Conferencing	Handout	Quiz#9
23 (90.02.24)		Interactive Multiplier Games Application-Level Framing Video Servers	Handout	HW#6

Session No	Topic	Readings	HW/Quiz
		Applications Requiring Reliable Multicasting Multimedia Applications in the Web	
24 (90.02.26)	Multimedia Network Security I	Encryption, digital signatures, authentication, IP security	Ref#5 Quiz#12
25 (90.02.31)	Multimedia Network Security II	Digital watermarking security features in multimedia compression standards, secure media streaming	Ref#5 HW#7
26 (90.03.02)	Content Networks	—	Handout Quiz#10
*	Student Presentations I	Outside the class regular hours	—
27 (90.03.07)	Convergence Networks	—	Handout Quiz#13
*	Student Presentations II	Outside the class regular hours	—
28 (90.03.09)	Hot Research Topics	—	Handout Quiz#11
Thursday (90.03.19) – 15:00 PM - Final Exam			
Tuesday (90.04.07) – Projects Due			

Course Regulations

Homework Problems

Homework problems will be handed out on Mondays and will be due two weeks later, before the beginning of lectures. The problems will cover the following week materials so do not expect to cover the whole problem set related materials right after the release. There will be some simple Programming Projects using MATLAB. There will be learning materials and classes on how to use MATLAB for problem solving. Course policy for late submission is mentioned below:

- 50% of the whole point for delivery up to three days after the deadline.
- 20% of the whole point for delivery up to one week after the deadline.
- Do not even think of submission after more than one week delay!

Quizzes and Exams:

Each Saturday there will be a quiz, at the beginning of the lectures. Each quiz will cover the facts discussed in the previous week, so use your Fridays to study!

Attendance:

Attending the class and TA sessions are mandatory.

Statement on Collaboration, Academic Honesty, and Plagiarism

We encourage working together whenever possible on; homework, working problems in tutorials, and discussing and interpreting reading assignments. Talking about the course material is a great way to learn.

Regarding homework, the following is a fruitful (and acceptable) form of collaboration; discuss with your classmates possible approaches to solving the problems, and then have each one fill in the details and write her/his own solution **independently**. An unacceptable form of dealing with homework is to copy a solution that someone else has written.

We discourage, but do not forbid, use of materials from prior terms that students may have access to. Furthermore, at the time that you are actually writing up your solutions, these materials must be set aside; copy-editing from other's work is not acceptable. At the top of each homework you turn in, we expect you to briefly list all sources of information you used, except known course materials like Text Book, Lectures, etc. A brief note such as "Did homework with ABC and ABD in study group" or "Looked at old solution for Problem 4" would be sufficient. Besides the morality issues, it will help TAs on grading your hand outs.

There will be a zero tolerance policy for Cheating/Copying HW's. The first time you are caught, you will receive a zero for the task at hand. If you are caught for a second time, you will fail the course.

In general, we expect students to adhere to basic, common sense concepts of academic honesty. Presenting another's work as if it was your own, or cheating in exams will not be tolerated.