Course  
**TLEN 5440**  
**Multimedia Networking**  
*Spring 2009*

**Time**  
Presentations uploaded to CULearn for viewing: Tuesday & Friday  
No classes: January 19th, and March 23rd -- 27th

**Instructor**  
Timothy Barker  
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Phone: (919) 699-1861  
Office Hours: Tuesday, 5:30PM-6:30PM (EST) Phone Appointment Only

**Location**  
CULearn (Course website) and In-Classroom Sessions

**Topic**  
Technical discussion and analysis of protocols used to transport media (Voice & Video) over a common IP network infrastructure. Technical discussion and analysis of the IP Multimedia Subsystem (IMS) and Next-Generation Network architectures. Key technologies covered are: SIP, RTP, Codec, Compression, Security, quality of service (QOS), and IP Telephony & VOIP Services.

**Goals**  
- **Content:** Develop a basic understanding of Media Transport technologies in a VoIP network and the evolution of networking technologies and protocols to support them. Gain a greater technical, political and economic understanding of the Cellular Industry-wide implementation of the IP Multimedia Subsystem (IMS) Architecture and the Telecommunication Industry-wide implementation of the Next-Generation Network Architecture.
- **Process:** Lecturing, Critical Thinking discussion questions, Team Projects, diverse reading, Research Papers, and Homework Exercises.
- **Skills:** Life skills in learning cutting edge technology (how to effectively aggregate book, academic journal, magazine, trade press, and web research), how to set technology learning in an economic, social, and business context.
**Topical Outline**

1. **Context - Media Transport Protocols**
   1.1 Session Initiation Protocol (SIP)
   1.2 Real-Time Transport Protocol (RTP)
   1.3 Session Description Protocol (SDP)
   1.4 Other Media Transport Protocols

2. **Media - Codec Operation & Selection**
   2.1 Fundamentals: digitization, compression primitives, Operation
   2.2 Audio
   2.3 Speech
   2.5 Video
   2.6 Types of Codecs
   2.7 Bandwidth Adaption

3. **Media Transport – Robustness, Security and Compression**
   3.1 Error Resilient and Concealment
   3.2 Firewalls, NATs
   3.2 IPSEC
   3.3 Secure RTP
   3.4 Header Compression

4. **IP Multimedia Subsystem (IMS) architecture**
   4.1 Standards Bodies, and Requirements
   4.2 IMS IP Core Network Nodes & SIP Protocol modifications
   4.3 Other Key IMS Protocols (DIAMETER, COPS, QOS, etc)
   4.5 IMS Security
   4.6 IMS Services

5. **Next-Generation Network (NGN) Architecture (ETSI TISPAN, Multi-Service Forum, PacketCable/DOCSIS)**
   5.1 Standards Bodies, and Requirements
   5.2 Core Network Nodes & SIP Protocol modifications
   5.3 Other NGN Protocols (MEGACO, MGCP, BICC, DOCSIS etc.)
   5.4 NGN Services

6. **Multimedia Networking Services/Applications/Solutions**
   6.1 Multi-Media Instant Messaging (MMIM)
   6.2 Push-To-Talk (PTT)
   6.3 Presence
   6.4 Video Over IP
   6.5 Fixed-Mobile Convergence (FMC)

**Prerequisites**

TLEN 5330 (Data Communications 1), or consent of instructor.
Grading

10%  Discussion Questions
20%  Assignments
25%  Midterm
30%  Final
15%  In-Classroom Projects (On-Campus)
15%  Distance-Learning Project (CAETE)

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<thead>
<tr>
<th>Grading Scale</th>
<th>100-95</th>
<th>A</th>
<th>76-74</th>
<th>C</th>
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<td>94-90</td>
<td>A-</td>
<td>73-70</td>
<td>C-</td>
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<td>89-87</td>
<td>B+</td>
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<td>D+</td>
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<td>86-84</td>
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<td>83-80</td>
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<td>79-77</td>
<td>C+</td>
<td>59 or &lt; F</td>
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Course Delivery and Management

**On-Line/Distance Learning:**
~90% of the course is taught remotely. The course will be administered entirely by CULearn and email. The professor will record the presentations and post them to the course website on CUAnywhere. Internet and e-mail access is mandatory. Students will access course materials using CULearn. Go to CULearn.colorado.edu for logon information and browser settings.

**In-Classroom Session:**
It will be a scheduled classroom date/time. The classroom session will be administered by SA/TA. The classroom session will be used to conduct Team-oriented activities related to the course topics. It is strongly recommended that students bring Laptops, if you have them. The In-Class activities are designed for team participation/projects, and oral discussion/debate of relevant topics. The In-Classroom grade is based on Team assignment grades, Class participation and In-Classroom Attendance.
Graded Assignments & Activities

A. There are Two (2) types of Assignments:

1) *Homeworks* – These are problem sets that are submitted via CULearn, and count as one assignment each. There are 6-8 homeworks, each count as a single assignment equivalent.

2) *Research Paper* – These are interdisciplinary research paper exercises. Each counts as 2 assignment equivalents.

The Assignments Grade is calculated by:

a) Grading everything submitted
b) Calculate the average grade for all assignment equivalents. This is the Assignments Grade.

B. In-Classroom Graded Activities:

a) On-Campus Students: **MANDATORY**

b) Grade all activities: Assignments, Participation, Attendance

c) Calculate the average grade for all activities & assignments. This is the In-Classroom Grade.

C. Distance Learning Students

a) Distance Learning Students (CAETE): **MANDATORY**

b) All activities and projects are graded. The average of all grades becomes the final grade.

*All TLEN5440 ITP Students*

1. Homework assignments
2. Research Paper: 2 Papers (2 assignment equivalents each)
3. CULearn course website: Discussion Questions (DQ)
4. Exams: Mid-Term and Final
5. Only one (1) graded activity: In-Classroom or Distance-Learning

**Warning:**
A paper with a grade of “C” or below will automatically be included in “top 10 assignment equivalents.”

Late Assignment Policy

Late homework assignments, lab exercises, and papers are penalized 5% for each 24 hour period they are late (as measured by CULearn timestamp), up to a maximum of one week, with the first 5% penalty exacted if they are late by more than 10 minutes. Don’t anticipate any exceptions to the late policy.
Attendance Policy/Grade

Attendance Grades are received by completing the following:

1. Discussion Questions (DQ): Via CULearn Course website. Weekly critical thinking discussion questions related to lecture topic. Count as attendance points. Detail instructions will be provided to explain acceptable responses.

   Each student will select an article (White Paper, trade periodical, technology article, etc.) that is not from a Textbook, but relevant to a course topic. The article should be technical in nature but include other interdisciplinary issues, 3-5 pages, and of creditable research source. The student will create an open-ended critical thinking question that the professor (or SA/TA) will post to the discussion section of the course CULearn website.

   All articles and questions must be approved by the professor. Upon approval and submission to CULearn, the student will get attendance points for the current week. However the student is encouraged to participate in the discussion and assist in the facilitation of continued discussion for the week.

2. In-Classroom Session:
   In addition to the “Discussion Questions (DQ) explained above, the “In-Classroom session for On-Campus students has a graded attendance component.

3. Distance-Learning Project (CAETE Student):
   In addition to the “Discussion Questions (DQ) explained above, the Distance-Learning (CAETE) students will have a project to complete.

Online

Course materials, homework assignments, homework submission, discussion, etc., will be online using CULearn (http://www.colorado.edu/CULearn/).

Midterm and Final

The tests will be focused on mastery of the content of the course with a higher emphasis on relating and organizing the information than on memorizing specific details. Both Midterm and Final exams will be administered Online (CULearn).
Textbooks

- Recommended/Optional:
  - Any other text book specifically focused on the SIP Protocol.
- All Books available at the CU Bookstore or Amazon.com Website

Readings

Reading assignments will be articles from various media content sources (electronic libraries via Chinook http://libraries.colorado.edu/, trade press and other sources on the web) and industry standard specifications. Readings will be posted on the course CULearn website.

Disability

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and http://www.Colorado.EDU/disabilityservices

Disability Services' letters for students with disabilities indicate legally mandated reasonable accommodations. The syllabus statements and answers to Frequently Asked Questions can be found at http://www.colorado.edu/disabilityservices

Religious Observances

Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, assignment and exams due dates will be adjusted (may require ITP administration approval) and late penalty or attendance penalty will not be awarded.

A comprehensive calendar of the religious holidays most commonly observed by CU-Boulder students is at http://www.interfaithcalendar.org/

See full details at http://www.colorado.edu/policies/fac_relig.html http://www.colorado.edu/policies/fac_relig.html
Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

See policies at [http://www.colorado.edu/policies/classbehavior.html](http://www.colorado.edu/policies/classbehavior.html) and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code).

Discrimination and Harassment

The Office of Discrimination and Sexual Harassment recommends the following syllabus statement: The University of Colorado at Boulder policy on Discrimination and Harassment [http://www.colorado.edu/policies/discrimination.html](http://www.colorado.edu/policies/discrimination.html), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at [http://www.colorado.edu/odh](http://www.colorado.edu/odh).

Honor Code

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (mhhonor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at [http://www.colorado.edu/policies/honor.html](http://www.colorado.edu/policies/honor.html) and at [http://www.colorado.edu/academics/honorcode/](http://www.colorado.edu/academics/honorcode/).