

COMM657 Understanding Communication Networks
(Formerly Technology of Communication)
Winter 2010

Lecture: Derby 0029
M/W 11:30 – 1:18

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Last updated: 1/4/10 kg

I. Rationale and objectives

How is sound transmitted over the telephone network? How does data flow across the Internet? What is the difference between a telephone call and a Skype call? Between a television broadcast and a YouTube video? These are a few of the questions that you should be able to answer after completing this course. The focus of the class is on developing a basic understanding of telecommunication technologies, from radio broadcasting and PSTN to streaming audio and HDTV. We will cover a variety of contemporary telecommunication systems, addressing both what they can do and how they work. We will pay particular attention to the similarities and differences between digital and analog technologies.

Specific Learning Objectives:

With these skills, you will be better prepared to

- Read tech news
- Explain technologies to those who are less knowledgeable
- Think critically about key capabilities and limitations of existing and novel telecommunication systems

II. Format and Procedures:

Most class sessions will include a mix of activities, primarily lectures and interactive exercises. We will typically begin with a brief review of the previous lecture's topics, and will end with a preview of what is coming next. My aim is to give you every opportunity to actively participate in the classroom.

III. Course Requirements:

1. Class attendance and participation policy:

Regular class attendance is required. I expect you to have completed the assigned reading and to be prepared to discuss them.

2. Course readings:

(a) A textbook is required:

Goleniewski, Lillian. (2007). *Telecommunications Essentials* (2nd ed.). Upper Saddle River: Addison Wesley. (“Telecom” in schedule)

This book is available at several campus bookstores and through Amazon (about \$35 when I last checked). It is also available through the library as an ebook (see Carmen for link), but the page numbers do not match the syllabus. This makes it almost impossible to use for this class.

(b) We will also make extensive use of two popular web sites: HowStuffWorks and Wikipedia. Links to the relevant entries are included in this syllabus. Unless otherwise noted, you should read all sections of the articles/entries listed. I also encourage you to pursue links within the required entries if there are terms or topics that you do not understand or want to know more about.

Please be aware that although I have reviewed these sources and consider them to be quite reliable, the content can change and the entries may sometimes contain errors. Cross checking the information you find here with the dictionary and lecture is strongly encouraged. (TechWeb’s encyclopedia is also a useful resource.)

(c) An optional dictionary is *strongly* encouraged:

Newton, Harry. (2008). *Newton's Telecom Dictionary* (24th ed.). New York: Flatiron Publishing. (“Newton” in schedule)

This book is available at several campus bookstores and through Amazon (about \$25 when I last checked). As the name suggests, this is a dictionary, not a textbook. It’s a handy reference for keeping up with all the terms and acronyms we will use in this class.

3. Assignments:

(a) *Problem sets*

The point of the problem sets is to help you learn, not to assess what you’ve learned. Because of this, grading might be a little different than you are used to so *please read this section*

carefully! There will be eight problem sets and each one will be completed in two stages. In the first stage, you'll have one week to answer the questions on your own. This work must be turned in via CARMEN by the due date. At the end of that week, I will provide a solution set and you will have another week to correct your answers. A printed copy of your corrected problem set should be turned in at the start of class.

When correcting your assignment, do not just copy answers from the solution set; instead, you must explain your mistake. To get credit for the revision, you should:

- Leave your original answer. Indicate errors by crossing out or circling the mistake.
- Describe the problem with the original answer and explain how the new answer fixes this problem.

Each assignment has a maximum score of 3 point.

- You get one point for turning in the completed assignment by the first due date. If you do not turn it in, you will receive a 0 for the assignment.
- You get the second point for identifying and correcting the errors you made in your first attempt and turning these in by the due date.
- You get the third point for correcting and explaining all your mistakes.

(b) *In-class exercises*

There will be a variety of in-class exercises. Like the problem sets, the goal of these is to help you improve your understanding of the class material. Many of the exercises will be completed in small groups, but unless I say otherwise, each individual is expected to turn in their own attempt at documenting the solution.

Note concerning attendance while having flu-like symptoms: Students should NOT attend class while ill with influenza. Students with flu symptoms will be asked to leave class. The illness and self-isolation period will usually be about a week. It is very important that individuals avoid spreading the flu to others.

Most students should be able to complete a successful quarter despite a flu-induced absence. If you are absent due to the flu, you will be provided with a reasonable opportunity to make up missed work. The opportunity to complete all assignments and exams supports the university's desire to enable students to make responsible situational decisions, including the decision to avoid spreading a contagious virus to other students, staff, and faculty, without endangering their academic work.

Students with the flu do not need to provide a physician's certification of illness. However, ill students should inform me (but not through personal contact in which there is a risk of exposing others to the virus) as soon as possible that they are absent because of the flu.

(c) Exams

There will be a midterm and final exam. The midterm will encompass all material covered in the class prior to the exam. The final will be a comprehensive exam, covering all the topics of the course. You should be prepared to answer multiple-choice and short-answer questions on both exams. I will provide more information about the exams later in the quarter.

IV. Grading Procedures: Grades will be based on:

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| In-class exercises | 15% |
| Problem sets | 30% |
| Midterm | 25% |
| Final | 30% |

V. Academic Integrity

Each student in this course is expected to demonstrate academic integrity and to abide by the Code of Student Conduct (http://studentaffairs.osu.edu/resource_csc.asp). The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Academic misconduct on any assignment will result minimally in receiving a zero on that assignment and may also lead to further disciplinary action. Penalty for violation of the Code of Student Conduct can also be extended to include failure of the course and University disciplinary action.

Collaboration is required throughout this course and cooperation is *strongly* encouraged, but any work submitted by a student for academic credit must be the student's own work. You are encouraged to study together and to discuss information and concepts covered in lecture with other students. You can give "consulting" help to or receive "consulting" help from such students. However, cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment, a diskette, or a hard copy.

VI. Accommodations for students with disabilities

I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. You can also contact the office for disability services at 292-3307 in room 150 Pomerene Hall to help coordinate reasonable accommodations (telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>).

VII. Tentative Course Schedule

| Date | Topics | Readings | Assignment |
|--------|---|---|---|
| M 1/4 | Introduction: Syllabus & Overview | TELECOM: Introduction xxix-lviii | [Get started on problem set 1] |
| W 1/6 | Waves and signals | TELECOM: 11 (start at spectrum) - 15 (stop before bandwidth) and see figure 1.8 http://science.howstuffworks.com/humans-hear-in-space1.htm http://videos.howstuffworks.com/hsw/6052-exploring-sound-sound-waves-video.htm http://en.wikipedia.org/wiki/Waveform http://en.wikipedia.org/wiki/Frequency http://en.wikipedia.org/wiki/Modulation (stop before "digital modulation methods") <i>Recommended:</i> Newton - electromagnetic wave, waveform, wavelength, frequency, hertz, phase, sound, sound waves, signal, signal level, modulation, Fourier's theorem, filter | |
| M 1/11 | Modulation and spectrum | TELECOM: 15-18, 550 (start at history) - 557 (stop before phased-array) http://en.wikipedia.org/wiki/Amplitude_modulation (just introduction and figure 1) http://en.wikipedia.org/wiki/Frequency_modulation (Introduction, "radio", and associated figures) http://electronics.howstuffworks.com/radio-spectrum.htm (first three pages of entry) http://www.ntia.doc.gov/osmhome/allochrt.html (follow link to "U.S. Frequency Allocation Chart") http://en.wikipedia.org/wiki/Bandwidth_(signal_processing) (just introduction) <i>Recommended:</i> Newton - amplitude modulation, frequency modulation, bandwidth (definition #1), noise, spectrum, spectrum designation of frequency, spectrum management | Problem set 1 |
| W 1/13 | Transmission Basics | TELECOM: 1-11, 23-26 (stop before TDM), 41-81 (Ch2) http://en.wikipedia.org/wiki/Multiplexing (introduction and FDM) <i>Recommended:</i> Newton - radio, signal converter, noise (defn 1), circuit, FDM, propagation delay | |
| M 1/18 | No class | Martin Luther King Day | |
| W 1/20 | Digital basics | TELECOM: 20-23 (esp. table 1.1), 160-162 (coding schemes) http://computer.howstuffworks.com/bytes.htm (first four pages of entry) http://electronics.howstuffworks.com/analog-digital.htm (first four pages of entry) <i>Recommended:</i> Newton - analog, analog transmission, digital, digital transmission, binary number system, binary, bit, PCM, CODEC, sampling, sampling rate, quantization, encoding | Problem set 1 corrections & Problem set 2 |

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|--------|---|---|---|
| M 1/25 | Advanced topics in digital representation | TELECOM: 375 (start with encryption) - 381,390-396 http://computer.howstuffworks.com/file-compression.htm http://computer.howstuffworks.com/encryption.htm (first four pages of entry) <i>Recommended:</i> Newton - pixel, raster graphics, bitmap, vector images, compression, encryption, RSA | |
| W 1/27 | Digital data transmission | TELECOM: 26-27 (TDM), 83-87,92-94 (packet switching), 173-187 (stop before LAN interconnection), 215-219 http://en.wikipedia.org/wiki/Circuit_switching (introduction) http://en.wikipedia.org/wiki/Packet_switching (Stop at X.25 vs. Frame Relay packet switching) <i>Recommended:</i> Newton - Time Division Multiplexing, network, LAN, hub, router, Ethernet, packet switching, connection oriented, connectionless | Problem set 2 corrections & Problem set 3 |
| M 2/1 | Digital network performance | TELECOM: 154-156, 159-160, 661-664, 388-390 (stop before digital video), 621-622 and Table 15.3 http://computer.howstuffworks.com/cable-modem.htm (All) http://electronics.howstuffworks.com/dsl.htm (All) http://computer.howstuffworks.com/wimax.htm http://en.wikipedia.org/wiki/Bitrate (first section only) http://streaming1.osu.edu/ramgen/media2/comm657au07/bitrate.rm http://streaming1.osu.edu/ramgen/media2/comm657au07/prop.r http://streaming1.osu.edu/ramgen/media2/comm657au07/latency.rm <i>Recommended:</i> Newton - modem, 802.11b, Bluetooth, infrared, WiMAX, propagation delay, cache (defn 2) | |
| W 2/3 | Midterm | Covering material through 2/1 | |
| M 2/8 | The Internet: protocol stack, IP | TELECOM: 165-171, 245-256 (stop before TCP) http://streaming1.osu.edu/ramgen/media2/comm657au07/warriors.rm http://computer.howstuffworks.com/internet-infrastructure.htm http://computer.howstuffworks.com/osi.htm http://en.wikipedia.org/wiki/Internet_Protocol <i>Recommended:</i> Newton - Internet, protocol, protocol stack, OSI, OSI standards, IP defn #1, Internet address | |
| W 2/10 | Digital networks: TCP, UDP, firewall | TELECOM: 256-257 (TCP and UDP), 264-275 (stop before IPv6) http://en.wikipedia.org/wiki/Transmission_Control_Protocol (introduction, "significance" and "applicability") http://en.wikipedia.org/wiki/User_Datagram_Protocol (just introduction) http://compnetworking.about.com/od/networkprotocols/l/aa071200b.htm <i>Recommended:</i> Newton - TCP/IP, TCP defn#1, UDP, firewall | Problem set 3 corrections & Problem set 4 |

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| M 2/15 | Digital networks: DNS, and HTTP | TELECOM: 280 (DNS) - 289 (stop before Internet challenges) http://www.perfect.com/articles/http.shtml http://en.wikipedia.org/wiki/Http http://www.iana.org/gtld/gtld.htm http://www.networksolutions.com/whois/results.jsp?domain=osu.edu <i>Recommended:</i> Newton - DNS, HTTP | |
| W 2/17 | Advanced Internet topics: Cookies, SSL, Email, web programming | http://computer.howstuffworks.com/cookie.htm (all pages) http://computer.howstuffworks.com/encryption4.htm (just fifth page of entry) http://computer.howstuffworks.com/question369.htm http://communication.howstuffworks.com/email.htm <i>Recommended:</i> Newton - electronic text mail, IMAP, POP3 | Problem set 4 corrections & Problem set 5 |
| M 2/22 | Telephony: PSTN | TELECOM: 103-113, 129 - 135 http://electronics.howstuffworks.com/telephone.htm http://en.wikipedia.org/wiki/Local_exchange_carrier Newton: telephone, telephony, circuit switching, circuit switched network, PSTN, POTS, LEC, IXC | |
| W 2/24 | Voice Over IP | TELECOM: 140-142, 306 (SIP telephony), 334 (start at SIP) - 342 (stop before IPTV) http://electronics.howstuffworks.com/ip-telephony.htm http://www.oreilly.com/catalog/sound/chapter/ch05.html (stop at Streaming media formats) <i>Recommended:</i> Newton - telephony, Voice over IP, Skype, Vonage, SIP (defn 3), and http://electronics.howstuffworks.com/skype-vonage.htm | Problem set 5 corrections & Problem set 6 |
| M 3/1 | Mobile Telephony | TELECOM: 529, 579-614 http://reviews.cnet.com/4520-11288_7-5664933-1.html http://en.wikipedia.org/wiki/WiMAX (Introduction, "Uses", "Mobile handset applications", and Table labeled "Comparison of Mobile Internet Access Methods") <i>Recommended:</i> Newton - cell phone, ESN, MTSO, SIM, 3G, 4G, WiMax | |
| W 3/3 | Audio broadcasting | http://electronics.howstuffworks.com/radio8.htm (this page only - - this is review) http://electronics.howstuffworks.com/question323.htm http://electronics.howstuffworks.com/hd-radio.htm http://electronics.howstuffworks.com/satellite-radio.htm http://www.howstuffworks.com/internet-radio.htm <i>Recommended:</i> Newton - XM, streaming media, internet radio | Problem set 6 corrections & Problem set 7 |

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| M 3/8 | Video broadcasting | TELECOM: 342-344 and fig 9.8, 390-409 http://electronics.howstuffworks.com/tv.htm http://www.howstuffworks.com/dtv.htm http://electronics.howstuffworks.com/cable-tv.htm http://www.howstuffworks.com/satellite-tv.htm http://en.wikipedia.org/wiki/Internet_television <i>Recommended:</i> Newton - DTV, HDTV, Digital cable set top box, Video on demand | |
| W 3/10 | Storage media Exam review | http://www.howstuffworks.com/cassette.htm http://electronics.howstuffworks.com/vcr.htm http://electronics.howstuffworks.com/cd.htm http://www.howstuffworks.com/dvd.htm http://electronics.howstuffworks.com/blu-ray.htm http://electronics.howstuffworks.com/dvr.htm http://entertainment.howstuffworks.com/movie-download.htm <i>Recommended:</i> Newton - CD, DVD, Blu-ray, blue laser, PVR, hard drive, flash memory, flash RAM | Problem set 7 corrections & Problem set 8 |
| 3/15 | Final exam | 11:30 – 1:18 – Comprehensive final exam | |