ADVANCED INTERNET SERVICES (COMS 6181)

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Course overview

- Review of Internet technology
  - wireline and wireless transmission
- Challenges for the modern Internet
- Protocol standardization
- Layer 8: laws, regulation & economics
- Next-generation Internet issues & architectures
  - IPv6
  - from locator-identifier split to content-based networks
- Multimedia networking & protocols
- Practical network security & privacy

Multimedia

- audio and video transmission (RTP)
- quality of service (DiffServ, RVSP, NSIS)
- media on demand (RTSP, FlashVideo)
- content distribution networks
- Internet telephony architecture and protocols (SIP, enum, WebRTC)
- presence, instant messaging (SIMPLE, XMPP)
- location-based services (GEOPRIV)

Course goals

- Descriptive: what's out there
  - deployed, in standardization, research, policy
- skill-oriented: programming projects, semester running project, measurements, …
- critical evaluation: why? how else?
- interactive: discussion + questions in class, on mailing list

How to benefit from this class

- Be prepared (e.g., read assigned materials)
- Expand your mental horizon beyond your discipline
- Participate in class discussion
  - in-class & Piazza!
- Pick an interesting project

How not to benefit

- Catch up on Facebook
- Cat videos!
- Transcribe the class into your notebook
- Flip through the slides
- Voice only popular opinions
- Believe that the instructor is always right
  - on facts or interpretation

Is this the right class for me?

- This course does not address:
  - web services (SOAP)
  - cloud services (mostly)
  - routing
  - ad-hoc & sensor networks
  - Internet of Things
- You should know:
  - general networking concepts (e.g., 4119: Tanenbaum, Kurose/Ross, Bertsekas/Gallagher)
  - C/C++, maybe Java
  - on Linux, MacOS and/or Windows

Course mechanics

- Web page: CourseWorks &
  - http://www.cs.columbia.edu/6181

  - Please note academic honesty policy: http://www.cs.columbia.edu/education/honesty

- 10 written homework assignments, with small programming problems and on-going project

- Project: Internet multimedia radio + telephone, built in stages

- TA: TBA

- Office hours: Thursdays, 4-5 pm, 720 CEPSR
  - please send email to make appointment

- Grading: assignments (including semester-long project) 50%, midterm 20%, final 25%, participation (class + list) 5%

Semester project

- Semester project
  - preferably, groups of 3
  - goal: implementation + report
    - report should be technical report or workshop-paper quality
- Topic
  - from class web page or own
  - related to class topics (i.e., no AI, unless it's networked AI)
  - typically, implementation, experiment (simulation) or measurement
- Project proposal in 1st assignment
  - what are you going to accomplish?
  - what are you going to build on?
  - who is going to do what?
- Updates on progress in each assignment
  - set goals (preferably, measurable – e.g., features)
  - did you meet your goals from last time?
- Report
  - standard workshop or technical report format: abstract, related work, full set of citations (references), labeled graphs, …

Readings and text book

- No text book required
- Will provide references to papers and chapters
- Good (older) background books include:
  - Jon Crowcroft, Mark Handley, Ian Wakeman, *Internetworking Multimedia*, Morgan Kaufman (1999)
  - Kevin Jeffay and Hong Jiang Zhang, *Readings in Multimedia Computing and Networking*, Morgan Kaufman (2001)
  - Alan Johnston, *SIP: Understanding the Session Initiation Protocol*, Artech House, 3rd edition, 2009.
  - Colin Perkins, *RTP: Audio and Video for the Internet*, Addison-Wesley Professional, 2003.

Reference books – general networking

- James F. Kurose and Keith W. Ross, *Computer Networking – A Top-Down Approach Featuring the Internet*, Addison-Wesley, 6th edition, 2012.

- Bruce S. Davie, Larry L. Peterson, *Computer Networks: A Systems Approach*, Morgan Kaufman, 2011, 5th edition.

- W. R. Stevens, *TCP/IP Illustrated*, vol. 1. Reading, Massachusetts: Addison-Wesley, 1994.

- D. E. Comer, *Internetworking with TCP/IP*, vol. 1. Englewood Cliffs, New Jersey: Prentice Hall, 4th ed., 2000.

- D. E. Comer and D. L. Stevens, *Internetworking with TCP/IP – Design, Implementation, and Internals*, vol. 2. Englewood Cliffs, New Jersey: Prentice, Hall, 3rd ed., 1998.

Reference books - multimedia and Internet telephony

- John F. Koegel Buford, Multimedia Systems, Addison Wesley, 1994.

- Borko Furht, *Handbook of Multimedia Computing*, CRC, 1999.

- Ralf Steinmetz and Klara Nahrstedt, *Multimedia: Computing, Communications and Applications*, 1995.

- RTP
  - Colin Perkins, *RTP*, 2003

- SIP and IMS
  - Miika Poikselka, Georg Mayer, Hisham Khartabil, Aki Niemi: *The IMS*, 3rd ed., Wiley, 2009.
  - Gonzalo Camarillo, M. Garcia-Martin, *The 3G IP Multimedia Subsystem (IMS) : Merging the Internet and the Cellular Worlds, 3rd ed.,* Wiley, 2008.
  - Gonzalo Camarillo, SIP Demystified, McGraw-Hill, 2001.
  - Alan B. Johnston, *SIP – Understanding the Session Initiation Protocol*, 3rd ed., Artech House, 2009.

Journals and magazines

- All in ACM or IEEE digital library
- Journals
  - *IEEE/ACM Transactions on Networking* (TON)
  - *Computer Communications Review* (CCR)
  - Computer Communications (COMCOM)
  - *ACM Transactions on Multimedia Computing, Communications, and Applications* (TOMCCAP)
- Magazines
  - *IEEE Communications Magazine* (mix of physical layer & protocols)
  - *IEEE Network Magazine*
  - *IEEE Wireless Communications*
  - *IEEE MultiMedia*
  - *IEEE Pervasive Computing*
- Commercial magazines
  - *Internet Protocol Journal* (http://www.cisco.com/ipj)
  - *Cisco Packet* (http://www.cisco.com/packet)

Related Conferences

- General networking
  - IEEE Infocom
  - ACM Sigcomm & ACM CoNEXT
  - IEEE ICC and Globecom (more VoIP)
  - IEEE ICNP (Int. Conference on Network Protocols)
- Multimedia & VoIP
  - ACM Multimedia
  - ACM NOSSDAV (Network and Operating Support for Digital Audio and Video)
  - IPTComm and IIT-RTC conference (VoIP)
- Other
  - IMC (Internet Measurement Conference)
  - PerCom (Pervasive Computing)

Equipment

- Need headset (headphone & microphone)
- Get early and test compatibility!