Cellular Networks and Mobile Computing
COMS 6998-8, Spring 2012

Instructor: Li Erran Li
(lel2139@columbia.edu)

http://www.cs.columbia.edu/~coms6998-8/

1/23/2012: Class Introduction
Outline

• Introduction
• Course content
• Course goals and structure
• Example projects
Introduction

• Researcher at Bell Labs, Alcatel-Lucent
• Ph.D. from Dept. of CS, Cornell, 2001
• Research interest: cellular networks, mobile computing, cloud computing
• Research Goal: improve our mobile user experience through innovation in cellular network architecture, network services, and mobile cloud computing
Introduction (Cont’d)

• Current research projects:
  – cPlane: a cellular information plane for mobile applications and network management
  – mCloud: mobile cloud computing
  – Software-defined cellular networks
  – LAWN: scaling up cellular networks using a large number of antennas
Who Are you?

• Please briefly introduce yourself
  – Name
  – Program and year at Columbia
  – What do you want to learn from this course?
Course Content

• Why study cellular networks and mobile computing together?
  – Mobile apps with no knowledge of cellular networks can perform poorly
    • Pandora consumes 46% radio energy on periodic transfers of 0.2% received user data
  – Cellular networks with no knowledge of mobile apps can perform poorly, e.g. poor traffic planning, high latency for delay sensitive traffic
Course Content (Cont’d)

• This course has three themes revolving around improving mobile user experience
  – Understand current cellular networks and their interaction with mobile apps through measurements
  – Improve the interplay of cellular networks and mobile computing through new cellular network services (e.g. proxy, caching), cellular aware mobile app design, redesign of cellular networks
  – Improve mobile apps through cloud computing such as novel cloud platform services (e.g. iCloud, Amazon Silk Split Browser, push notification server)
Course Goals and Structure

• **Basics**: brief overview of cellular networks and mobile OS and development platforms

• **Recent literature**: review recent research on cellular network measurements, and mobile computing
  – Paper presentation, summary, and discussion

• **Learn by doing**: work on a research project
Recent Literature

- Will read about 22 papers that identify or address challenges in cellular networks and mobile computing
- Papers covered will be in networking, systems and security; topics include
  - Understanding the interplay of cellular networks and mobile computing through measurements
  - Mobile application aware cellular networks
  - Cellular aware mobile application design
  - Mobile cloud computing
  - Future cellular network trends
Recent Literature (Cont’d)

• Your duties:
  – Read all assigned papers before class
  – Participate in class discussions
  – Present and summarize 1 or 2 papers
Research Project

• Topic
  – Choose from a list of topics
  – Come up with your own topic
  – Must be related to cellular networks or mobile computing
  – Must contain some research element
• Teams of 2 to 3 students
• Final deliverables
  – Project report (research paper format, 10 to 12 pages)
  – Project presentation and demo
Research Project (Cont’d)

• Precisely define the project
• Understand related work
• Propose novel techniques or systems
  – Creativity will be evaluated
• System implementation
  – Client side: iOS or Android
  – Server side: Google AppEngine or Amazon EC2
  – Networking component: measurement, modeling
Research Project (Cont’d)

• Evaluate your solution, e.g. performance, scalability
  – Thoroughness will be evaluated
• Write up and present your projects
  – Evaluated using professional paper review criterions

• Project timelines
  – Feb. 6: Form final project team
  – Feb. 13: project description
  – March 5: progress report
  – April 2: preliminary project report
  – April 30: final presentation and demo
  – May 2: final project report
• I will meet with you regularly
Grading

• Project reports: 50%
• Project presentation and demo: 20%
• Paper presentation and summary: 15%
• Class discussion participation: 15%
Class Resources

• Web page: schedule, project timelines, list of potential projects, etc

• For any questions or concerns: email me at lel2139@columbia.edu
Example projects

• Ideal project criterions
  – Solves a real problem in cellular networks and mobile computing
  – Has a research component, e.g. scalable system design, novel inference algorithm of cellular network properties
  – Real implementation at client side running iOS or Android, and at server side using public cloud platforms such as Google AppEngine or Amazon EC2
Example project 1: cPlane

• Goal: build a cellular information plane for mobile apps
• Research: scalable probing, inference, system architecture
• Implementation: client side probing agent, server side inference, data store and query processing engine
Example project 2: data locker for mobile devices

- Goal: p2p file sharing running on mobile devices consume lots of resources; the goal is to serve the files from in-network data locker
- Research: scalable design of data lockers
- Implementation: client side IETF DECADE protocol, server DECADE protocol and data locker management
Questions?