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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

Who Are you?

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

Cellular Networks and Mobile Computing
(COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing
(COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

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

Cellular Networks and Mobile Computing (COMS 6998-8)

Questions?