Networked Wireless Systems (CS 5070)

Bheemarjuna Reddy Tamma

Dept. of CSE, IIT Hyderabad

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Note: Some of the slides are derived from Sachin Katti's course on Wireless Networking at Stanford University.

Goal of the course

1. To become familiar with the field of wireless networking *research*: Architectures, protocols and systems.

2. To get some practice in the art of reading research papers and presenting them.

3. To get started on doing wireless systems research

It's a big field, so we will focus
on just a few topics.

Tentative Syllabus

- Basics of Wireless Communication Networks
- MAC Protocols
- IEEE 802.11
- Cellular Systems: 2G/3G/4G Architectures
  - Channel allocation problem
  - Handoff techniques
  - QoS
  - FemtoCells
- 802.21 MIH
  - Seamless handoff between Wi-FI and 3G systems
- TCP in Wireless Networks
- Power Management (Green communication)
- Mobility Management
- Security in Wireless Networks?

Outline
First 4 Weeks

Lectures

- Teaching basics of Wireless Communication Networks
- Medium Access Control (MAC) Protocols
- IEEE 802.11 MAC
- Architecture and MAC of GSM Cellular System

Your work

- Homework assignments
- Wi-Fi trace collection and analysis: trace from Live expt with single board computers
- Tutorial(s)
- Choosing topic for term project

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Outline

Lectures for rest of the semester

– Each class we will discuss 1 or 2 research papers.

– You <u>must</u> read these papers before class

– Most of the time will be spent on discussion

– 10% of your grade comes from in-class participation

– 15% from scribing and paper evaluations

Grade

- Homework & Lab Assignments, Tutorials: 25%
- 1-page Paper Evaluations and Scribing 1 or 2 class room discussions of papers: 15%
- In-class Participation: 10%
- 1-Paper Presentation and Term Project work presentation: 10%

- Term Project work: 40%
  - Quality of Work Done (25%)
  - Project Report and Software Artifact (15%)

Logistics

1-Page Paper Evaluations

Each student need to read all papers to be discussed in the class
(except the one who assigned scribing duty)

List of papers along with discussion timings will be posted on the class web page

1-Page Evaluation should include:
- Summary of each "Read deep" paper
- What is the major contribution of the paper?
- What are the paper's strengths?
- What are the paper's weaknesses?
- What unanswered questions does the paper leave, or what would you do to extend the work?

Evaluations are due at the beginning of class lecture on those papers.
(Late submissions are strictly not allowed)

1-Paper Presentation

- One of the research papers is assigned for presentation
- A group of two students present it together
- Duration of presentation: 25 mts
- Choose from the list (TBA). Assignment is FCFS

In-class participation

- Come prepared to summarize the paper and discuss the main ideas

- We will all learn from each other

- Attendance is a necessary but not sufficient condition for "participation"

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Scribe

Each student will do 1 or 2 scribes

200 words summary of each "Read deep" paper,
200-400 words summary of in-class discussion
1 paragraph critique/opinion of each paper

Scribe assignments: TBD

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Term Project

Research project (accounts for 45% of grade)

Individual projects preferred, teams maybe allowed if scope is very big

We will post a set of suggested topics by Aug 15th, but you are encouraged to come up with your own by the end of first 4 weeks

Logistics

Project Milestones

1 page abstract: Aug 29

Define the problem, why it is relevant

3 page Interim Report: Oct 3

Clarify the original problem statement, exact statement of the deliverables

15 minute class presentation: Nov 3rd Week

Short talk on your project

10-15 page project report: Nov 28

Conference/Journal style paper using LaTex

Hints on reading a paper
[Keshav]

Three stage approach

1. Read quickly in 5-10minutes

2. Read with greater care; ignore proofs

3. Deconstruct paper; question all assumptions

Stage 1: 5-10 minute read

Read title, abstract, introduction, section headings, conclusion, reference list.

Look for "5 C's"

Category: What type of paper is it?

Context: Where does it fit in?

Correctness: Do assumptions make sense?

Contributions: What are the main ones?

Clarity: Is it well-written?

Stage 2: Read with care

- Spend an hour re-reading paper in detail
- Try to understand the "story"
- Summarize the main thrust
- Identify main supporting evidence

Stage 3: Deconstruct the paper

- This can take one or more hours
- Understand every proof
- Question every assumption
- Identify missing references
- Why was the paper written this way?
- How else could the paper have been written?

Contact

Class webpage:
  www.iith.ac.in/~tbr/teaching/CS5070.html

Faculty: tbr@iith.ac.in

TAs: CS10P003@iith.ac.in (Tejaswini), cs10m04@iith.ac.in (Prerana Tiwari), bala@iith.ac.in

Paper details, assignments, etc posted on web page

To summarize

- Wireless "networking" is a young field, unlike wireless communications

- Explosion of interest in recent years due to the shift to mobile Internet

- Many unanswered questions on how to architect these networks: theory, design and systems

Reference Books

1.   Wireless Communications & Networking by Vijay Garg, Morgan Kaufmann
Series in Networking, 1st edition, 2007

2.   Mobile Communications by Jochen Schiller, 2nd edition, 2003, Addison-Wesley

3.   Wireless Networking by Anurag Kumar, D. Manjunath, and Joy Kuri, Morgan Kaufmann Series in Networking, 1st edition, 2008