Lecture 1a

About the Class

+ What is INFSCI 1072?

- The "one course" to take in Wireless Networks
  - Deals with most of the wireless technologies of interest today

- Provide understanding of the structure, system aspects, and protocols of wireless networks
  - Wireless WANs, LANs, and PANs

- Attempt at a *unified approach*
  - Rather than looking at technologies one-by-one, treat them as examples

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+ Prerequisites

- INFSCI 1070/TELCOM 2000: Introduction to Telecommunications
  - Qualitative idea of telecommunication networks and protocols – circuit Vs packet switching, the OSI stack, LANs vs WANs, what TCP/IP is, etc.

- Good to have knowledge of
  - Some calculus and trigonometry
  - Probability, PDF, CDF, etc.

+ Broad overview of course contents

- Wireless Systems
  - Wireless Wide Area Networks (WWANs)
    - 1G, GSM, CDMA, LTE
  - Wireless Local Area Networks (WLANs)
    - WiFi = 802.11
  - Wireless Personal Area Networks (WPANs)
    - Bluetooth, Zigbee

  Beware of Acronyms!

- Lower Layers
  - Physical Layer (PHY)
    - Radio Propagation
    - Modulation
  - Access layer (MAC)
  - Deployment
  - Traffic Engineering

- Higher Layers
  - Radio Resource Management (RRM)
  - Mobility Management (MM)
  - Location Based Services (LBS)
  - Security

Course Objectives

- Learn architectural differences between various wireless systems
  - Example: How is 4G different from 2G?

- Examine how the PHY layer impacts wireless systems – coverage Vs. data rates
  - New physical layer techniques are becoming prevalent
  - The physical layer impacts mobility and radio resource management, etc.)

- Uncover network operation, deployment, and application issues

Textbook and references

- Textbook
  - No Required Textbook

- Other references
  - Papers from journals and magazines
  - Principles of Wireless Access and Localization – Kaveh Pahlavan and Prashant Krishnamurthy, John Wiley & Sons

- Required: Matlab, R (open source)
  - Some exercises for homework
 - Matlab available in Pitt computer labs

Contact

- Prashant Krishnamurthy

- Location
  - 718, IS Building

- E-mail: prashk@pitt.edu

- Web: www.pitt.edu/~prashk/tel2700

- Office Hours:
  - Tuesdays & Thursdays after class till noon
  - Mondays 11.00 – 12.00 p.m. (or by appointment)

- GSA: Maryam Karimi (mak322@pitt.edu)

Grading

- Homework 15%

- Bi/Weekly Quiz 15%
  - Around 5-8 in number
  - Based on reading and previous classes

- Midterm 20%

- Project 20%

- Final 30%

Pie chart:
- Project 20%
- HW 15%
- Quiz 15%
- Midterm 20%
- Final 30%
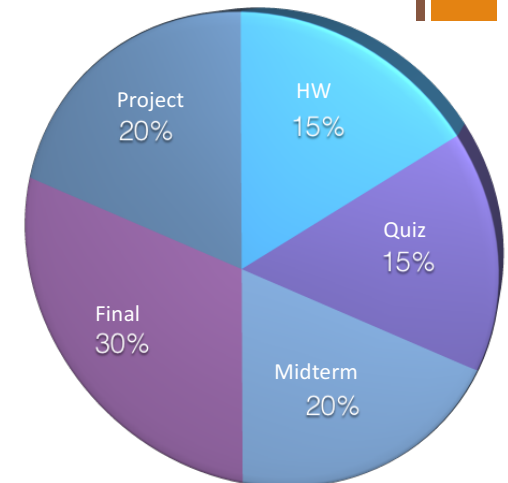
+ Project

- Groups are allowed
  - Group size should be commensurate with workload
  - One report per group
- Possible project thrusts
  - Thorough literature reviews
  - Experimental work
  - Topics not covered in sufficient detail in class
  - Emerging topics

- Examples
  - LTE Advanced
  - LTE Unlicensed
  - VoLTE
  - Gigabit wireless LANs
  - Economics of dynamic spectrum access
  - Ad hoc extensions of cellular networks for disaster/fault recovery
  - Health issues of wireless technology
  - Operation of multi-homed wireless devices

Data Source: RootMetrics/CNN (2014)
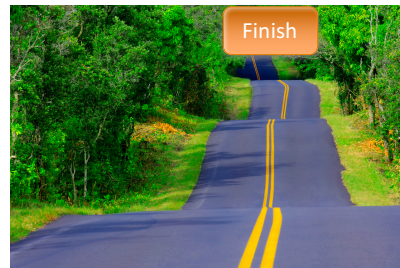
+ Example: 4G Data Rates in US Airports

Verizon, ATT, Sprint, T-Mobile
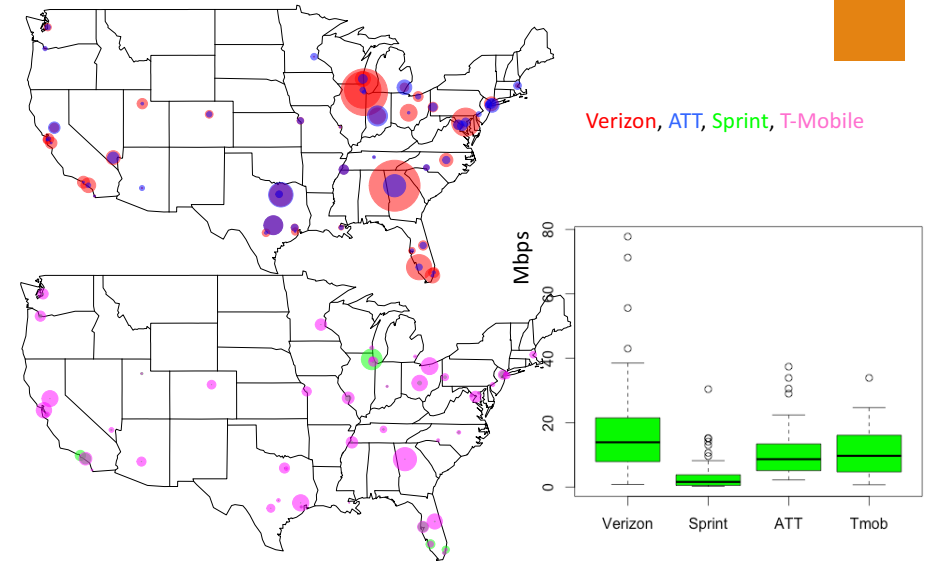
+ Project Milestones

- **Short Proposal Due**
  - September 22nd, 2015

- **Intermediate Progress Report Due**
  - October 27th, 2014

- **Final Report Due**
  - November 24th, 2014
  - Why?

Finish

+ Policies

- No laptops, mp3players, tablets, or cellphones, in class

- Your work MUST be your own
  - Zero tolerance for cheating
  - You get an F for the course if you cheat in anything

- Homework is due a week after it is assigned
  - Late assignments will NOT be accepted
  - The GSA is responsible for homework

- General grading policy
  - There will be no credit for vague answers or unclear steps
  - I should be able to understand what you were trying to do without your verbal explanation later

- Check webpage for everything!
  - You are responsible for checking the webpage for updates

Clarity and Legibility are Very Important

Rhymes with Orange – by Hilary Price

- There will be no credit for vague answers or unclear steps
- I should be able to understand what you were trying to do without your verbal explanation later

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Course Outline – Subject to Change

- Week 1: Introduction to the class
- Week 2: Overview of wireless systems
  - Channel, bandwidth, and spectrum efficiency
- Weeks 3-4: Basics of Transmission
  - dB scale, antennas, modulation
- Week 5: Radio Propagation – Large Scale Fading
- Week 6: Radio propagation – Small Scale Fading
- Week 7: Spread Spectrum and OFDM

Course Outline (2)

- Week 8: Midterm
- Week 9: Medium Access
  - Fixed and Random Access
- Week 10: Deployment and Traffic Engineering
  - Frequency reuse, Call blocking
- Week 11-12: Network Operations
  - Cell search, RRM, MM, and Security

Course Outline (3)

- Weeks 13: WiFi
- Week 14: LTE
- Week 15: Final