Assignment:

Read Chapter 1 of Kurose-Ross
Revolutions in Communications

- Telegraph (1830s)
- Telephone (1870s)
- Radio (1890s)
- Television (1930s, 40s)
  - Satellites (1960s, 70s)
  - Cable Television (1970s, 80s)
- Cellular Telephone (1980s, 90s)
- Commercialization of the Internet (1990s)

Revolutions can happen **FAST**

For example, in 1978 there was:

- No Facebook
- No YouTube, No Twitter
- No Google
- No World Wide Web
- No DVDs or even CDs
- No Sprint, no Verizon
- No cell phones (Aghhh!)
- Larry Page, Google co-founder, was 5 years old, in kindergarten in East Lansing.
- Microsoft had 11 (!) employees.
Internet Growth

- The Internet began in the late 1960s with the ARPANET, a U.S. DoD project
  - Development of TCP/IP protocols and some rudimentary applications (email, ftp)
- By the 1980s the network was used by
  - academia, some industry and the U.S. DoD orgs
  - but NOT by the general public
- Domain Name System not widely deployed until late 1980s. Before that???
- First dedicated transatlantic connection only in 1990!
- But then...

The World-Wide Web!

- 1989: Tim Berners-Lee (CERN - Switzerland) develops HTML, HTTP and the first (non-graphical) browser
- 1993: Marc Andreesen and Eric Bina (UIUC) develop the graphical Mosaic browser
- And the rest, as they say, is history...
  - 1993: Internet carries 1% of all telecommunications traffic in the world
  - By 2007, the Internet carries 97% (!!) of all telecom traffic in the world
The Internet Revolution

- How does the Internet Revolution differ from other technological revolutions, such as the Industrial Revolution?

Internet - the “8th Continent”

- How does the Internet Revolution differ from past revolutions in communications?
Social and Legal Issues

My Background

- Grew up in a (very) small town in the 1950s/1960s.
- After earning BS and MS degrees from MSU, worked at Digital Equipment Corporation
  - Hardware Design/Performance Evaluation
  - High Availability Systems
  - Network and Communications
- Earned MS degree in education from Tufts, 1990
- Operations Director, DoD Contractor
- Started PhD at MSU, 2009
Past Research

- Wireless Sensor Networks
- Residential Power Monitoring
- Seismic Monitoring - Real-time Volcano Imaging

Supero

Light and acoustic sensors

Smart meter

Light + acoustic captures
90% power consumption

Base station

Event-Appliance Association

Event clustering

Event Correlation (remove false alarm)

Light/acoustic event Power reading

100W
Supero

TelosB (light)
Iris (acoustic)

System
- TelosB/Iris + TED5000 + KAW ground truth meters

Five deployments
- Three apartments (40~150 m²), two houses
- 9 ~ 22 sensors

Real-Time Volcano Imaging
Seismic Monitoring

- 1992 Mount St Helens study
  - 27.5 km by 21 km target area model
  - 5454 Local seismic events from 39 stations
  - 35,475 rays
  - 10 years of seismic data

Increasing station density, decreases the number of events needed

22 stations, 600/2400 Events

48 stations, 600/2400 Events

System Architecture

Three Tier Architecture

- Tier 1 - Sensor Node
  - Sensor Sampling
  - Event Detection
- Tier 2 - Base Station
  - Event correlation
  - Hypocenter computation
  - Remote communication
- Tier 3 - Remote Server
  - Model generation/storage
  - Visualization
Deployments

- Deployment 1 – Tungurahua Volcano, Banos Ecuador, June 2013
  - Test use of low cost hardware to detect local seismic events
  - Detected event 20Km from Tungurahua Volcano
- Deployment 2 – Llaima Volcano, Melipeuco, Chile, January/March 2015
  - 16 nodes plus base station
  - 26 traditional stations
  - Environmental test of hardware in actual field setting
  - Validate network communication

Back to CSE 422

In this class, we will:

- Learn the fundamentals of computer networking
- Understand how these fundamentals are applied in real networks, in particular, the Internet
- Understand the relationship between theory and practical design
- Understand network services and layers
- Learn how distributed applications access the network
- Learn that, by their nature, networks comprise many individual solutions that must (somehow) work together and continually integrate new solutions.
Course Web Site

- https://www.cse.msu.edu/~cse422
- Handin - https://handin.cse.msu.edu