A Wireless Seismic Sensor Array

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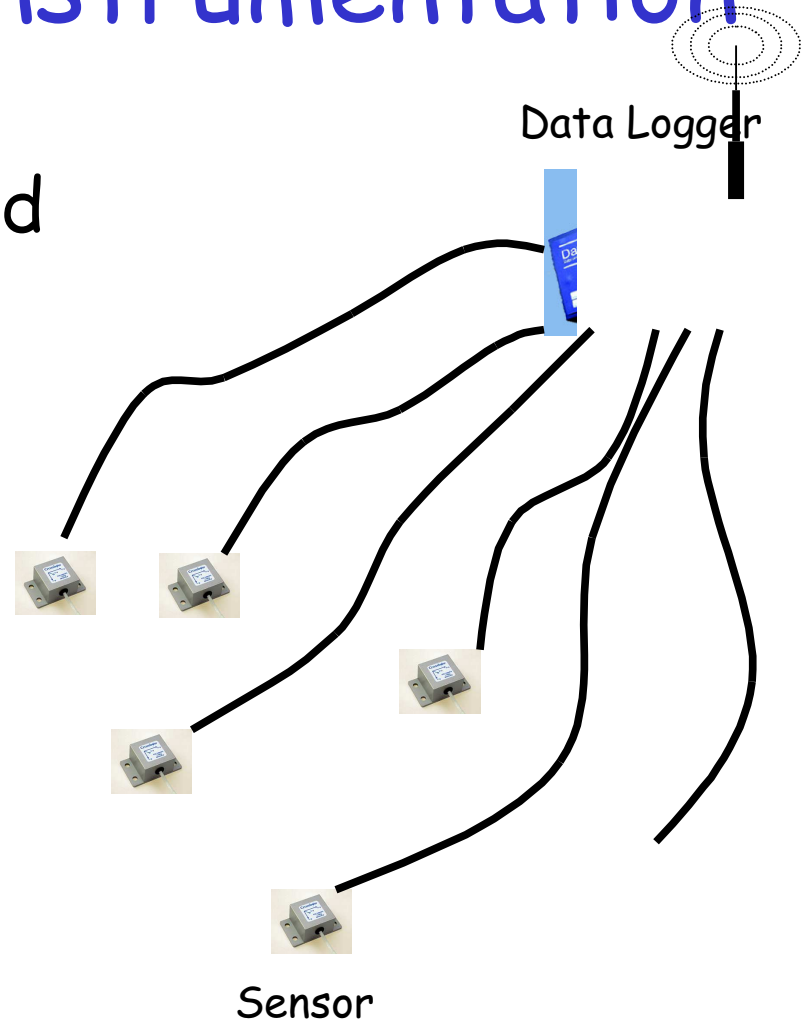
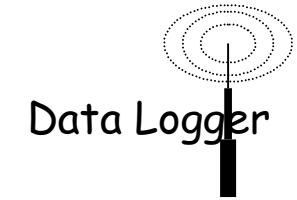
(Joint work with Ning Xu and Sumit Rangwala)

Existing Instrumentation

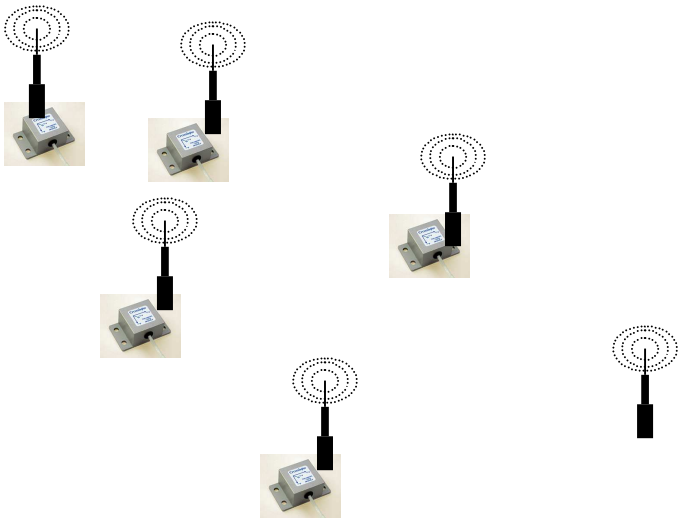
- Sensors connected by cables to data logger
- Data logger wirelessly transmits sensor readings to base station



Our Experiment

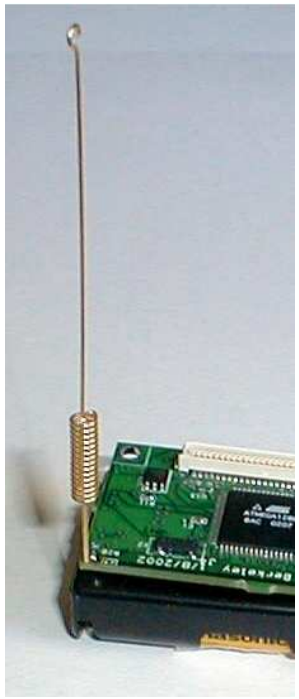


- Sensor nodes with
  - On-board computation
  - Wireless communication
- Can we build a (possibly multi-hop) wireless seismic sensor array?
  - Can greatly simplify deployment



The Technology

- Mica-2 motes from Crossbow
  - Atmel processor
  - Chipcon CC1000 transceiver
- Vibration daughter card (under development)
  - 16-bit, up to 100 Ksps, on board processor and sample memory



The Challenges

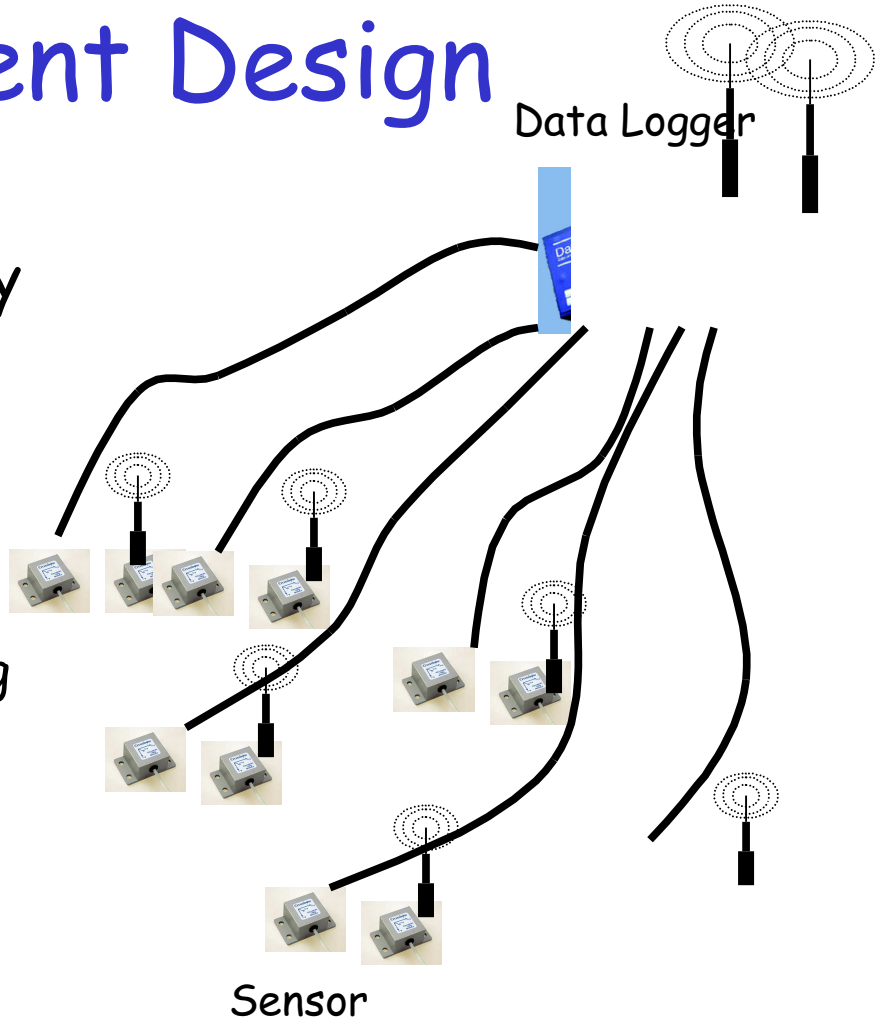
- Wireless communication
  - Relatively low bandwidths
  - Unreliable transmissions
- Time Synchronization
  - May not be able to use GPS
  - Need other ways to synchronize the samples

Where We Are

- In the laboratory, we've been able to
  - obtain one channel of 16-bit accel data from each of 15 motes at 128 sps
- Careful software design
  - Silence suppression
  - Rate-limited transmission
  - Hop-by-hop reliability of transmissions
- Other pieces of software already available
  - Time synchronization between nodes (UCLA, Berkeley)

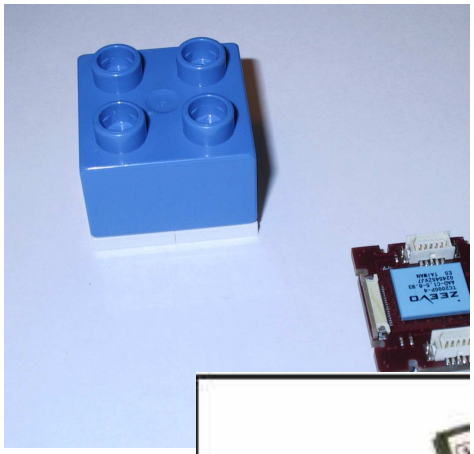
Experiment Design

- Deploy wireless array beside wired array
- Goals
  - Understand systems design issues
  - Validate by comparing data obtained using wired infrastructure



Longer Term Technology Trends

- Intel and Crossbow building sensor nodes with faster processors, more memory, better radios
- Examples
  - Stargate: x-scale processor
  - iMote: ARM core, Bluetooth radio



Intelligent Arrays

- Will not be feasible to pull all the data out of the network
- Future directions
  - Store/process data within the network
  - Users can query network
  - Nodes can trigger actions autonomously
- Center for Embedded Networked Systems
  - Focused on software technologies that will enable Intelligent arrays

CENS:
http://cens.ucla.edu/

The Embedded Networks Lab at USC:
http://enl.usc.edu/