How Should Sensors Work Together?

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Old School: Remote Sensing

- aerial observation (pre-computers) and satellites (1970s)
- initially: datasets and manual processing
  - stovepipes and custom code
- evolved to GIS systems that integrate multiple data sources
  - ARCinfo, GRASS, etc.
- casual users
  - Google Earth, MS Terraserver
- derived results
  - ex: Google Earth Hacks, etc.
New School: Sensor Nets

**Government:** vehicle traffic monitoring (USC/SPPD & ISI)

**Scientific:** micro-habitat monitoring (UCLA/CENS at James Reserve)

**Industry:** equipment monitoring and control (ISI and CiSoft)

**Military:** vehicle tracking (ISI at DARPA SensIT SITEX)
Sensornets and the Internet?
(view from Internet researchers)

- Possibly many independent sensornets
- The NEW Internet
  - Lambda / all optical
  - Overlay networks
  - Peer-to-peer structures
  - New security arch.
  - Etc.

The sensornet is basically a peripheral

Doesn’t face how sensornets and internet could interact
Sensornets and the Internet? (view from Sensornet researchers)

Sensor Net Architecture
[Culler, Stoica, et al.]  
ingovation: MAC-like SP as the waist of the architecture

Tenet Architecture
[Govindan, Estrin, et al.]  
ingovation: mix 32-bit nodes into 8-bit cloud
Sensornets and the Internet? (view from the Sensornet)

Sensornet architectures:
- make gateway explicit
- perhaps use IP in the sensornet

- still don’t explore how sensornets and the Internet could interact
Challenge: Towards a Richer Interaction

Surely there is benefit from richer interaction than simple gateways…
Richer Interaction Between Sensornets and The Internet

• should study the Internet-side of the sensor net

• should study applications that span multiple sensornet “islands”
Open Challenges

• Internet-side: how to go up the food chain?
  – what is the GIS equivalent?
  – what is the causal user interface?
  – what will be built on top?

• sensornet-side: getting beyond just wireless
  – how should sensornet islands work together?
  – central database? interactive/on-line operation?

• getting beyond a single central database?
GENI and Sensornets

- GENI
  - major infrastructure for network community (an MREFC-to-be)
  - supporting research in Future Internet-like architectures
- sensor networking as major influence
  - sensors as most common node on future Internet
  - sensor data streams as different from current Internet traffic
  - sensors forcing architectural changes (addressing, etc.)
- plans
  - and suburban sensornet testbeds
  - indoor testbed for controlled experiments
  - “kits” supporting standard host, OS, sensor packages
Slogging: Sensor Blogging

• what if there were millions of collaborating sensornets
  – the sensornet equivalent of blogging
  – each mini-sensor net run by a “citizen-scientist”

[due to Mark Hansen, keynote talk at SIAM Conf. on Data Mining, 2005]
Recent (and ongoing) Research

• architectures that blend sensornets and the Internet
  – network protocols to enable slogging
  – sensornets bridged over the Internet
  – support for sensor search, discovery, evaluation

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