# Announcements

- ACM meeting, Thursday Jan 18 at 5:30 PM in GSRC 328
  - All the benefits of membership in the first educational and scientific computing society
  - As if that is not enough, free **Pizza**
- Project Milestone 1: Due today
  - Email me your name, email address and interests

http://greenhouse.cs.uga.edu/~surendar/teach/spr01/ugaonly/members.shtml

- Ph.D. defense: ZongWei Luo, Fri Jan 19, 9:30 am

  Knowledge sharing, coordinated exception handling and intelligent problem solving to support cross-organizational business processes

# Outline for today

## Ubiquitous Computing Vision - continued

- *People, Places, Things: Web Presence for the Real World.* Cooltown Project at HP. In WMCSA '01

- *Next Century Challenges: Data-centric networking for invisible computing. The Portolano Project at the University of Washington* Mike Esler, Jeffrey Hightower, Tom Anderson and Gaetano Borriello. In Mobicom '99

# Cool town project

- The goal of this work is to bridge the electronic and physical world using the web as the glue
- Rationale:
  - Web is transparent access because of open standards Internet, http..
  - Access to the web is ubiquitous across different kinds of devices
  - Web already provides a wealth of electronically stored information.
- Places -home, office, malls etc.
- People - visitors we meet and interact with in Places
- Things - we find/use things when we visit Places

# Web Presence

- Web presence means that the entity is bound to a resource that has a URL and is accessible by HTTP
  - Each web-present entity has a web page
    - you should be able to access any entities in this class room (projector, laptop, wireless access point, my Palm pilot etc) via an HTTP URL

# Web Presence

- System-supported correlation: Places for web things and people in web places
  - URLs are distributed through restricted range wireless links, electronic tags ..
  - As people arrive in physical places, they discover URLs
- Web things and Web Places: Control and interrogation of devices
  - Ability to control a web-present device through its point of web presence
  - You can already configure printers, routers etc this way

# ..

- Web things talking to web things: Access by devices
  - Home management device interrogates a security monitoring services, finds that no one is home and turns on the lights ..

# Modes of web presence

- Internal support:
  - The device itself supports HTTP operations on its web presence

- External Support:
  - Non-electronic entities provide their web presence location using tags.


iButton in the door knob

# Discover URLs

- Discover via network system
- Sensing electronically
- Distribution can be
  - Active – pushing information within range
    - E.g. infra-red, bluetooth beacon
  - Broadcast or directed
  - Passive – awaiting a sensor to request information
    - E.g. UPC bar code, iButton, RFID etc

# Web presence for places

- Location specific web portals
  - Place contains a beacon that provides the URL of the place's portal.
    - Web portal for this class. Anyone should be able to find out who/what is here right now by pointing to Chem 453 portal URL.
  - Contents provided by services within the place
  - Portal changes whether CSCI 4900 is in CHEM 453 or some other class is here

# Web presence for people

- Information about people, way of communicating with them
- Global presence and place-specific web presence
- Identifying attributes can be place-specific
  - I can be Prof. Surendar Chandra or Surendar depending on the place

# Infrastructure

- Services everywhere
  - Wide-spread access to a open set of services
- Scalable
  - Trillions of web places, things ..
- Simple model of configuration by users
  - Easy to administer
- Layered infrastructure
  - So that, simple devices can coexist with complicated services

# Discussion

- Security
  - How do you provide secure access to authorized web entities?
- Information Overload
  - If there are trillions on web pages, possibly with multiple incarnations, how can we comprehend them?
- Delegation
  - If I see a nice art work and want to show it to you, what you see is not necessarily what I see?

# Data-Centric Networking for Invisible Computing

- This paper presents some technical challenges for invisible computing

- Specifically:
  - User Interfaces
  - Distributed Services
  - Infrastructure

# User Interface

- Multiple interface: How do we present information in multiple interfaces?
  - Do we present the same interface in all the devices (ala Windows CE approach)?
  - Do we present the interface customized for the device? (ala Palm approach)
- Invisible Interface: How do we make the interface vanish? How should the invisible interfaces work?

# Distributed Services

- Agent based approach
  - Agent perform tasks on behalf of users
  - Agents exist beyond the user who initiated it
- Horizontal integration
  - Components horizontally integrated
- Service deployment
  - Service should be able to discover your resources and configure itself
  - Dynamic upgrading, hot-swapping of components
    - DVD players already do this when you play special movies. Is this good?

# Infrastructure

- Resource Discovery
  - Local Service database (served based)?
  - ARP-style (broadcast) requests?
  - Data driven (the data runs code in the net to locate further resources)
    - Controlled replication
    - Reliability/fault tolerance

- Should the lookup provide name or object code (JAVA)?
  - In HW1, you provide hostname:port

# Data-Centric Networking

- Data should marshall, authenticate, adapt and pay for services as it proceeds
  - E.g. I want to buy a camera
    - I send the data packet with my model preference, credit card number, shipping information etc in a data packet
    - Data packet visits internet stores, find the cheapest price for the model
    - Places an order and has it shipped to my address

# Distributed Computing

- Data objects negotiate content type, move computation across the infra-structure to reach destination

- Intermittent Connectivity
  - When connectivity is lost, what happens to data packets?

# Important Research Topics

- Intermitted Connectivity
  - How do we deal with network failures
- Power consumption
  - Power consumption is very important on devices that we carry all the time
- Application development and deployment
  - Development for invisible interfaces
- Service architectures and discovery

- Active networking
  - Code associated with data runs in the network