Networking for Smart Spaces

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The Edge

The Core

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What's Changing?

- Increasing Prevalence of Mobile Work and Ad Hoc Teams
- Growing Population of Embedded and Portable Information Appliances
  - PDAs, Cell Phones, CrossPad, InfoPen …
- Rich and Growing Technologies for Pico-Cellular Wireless Communications
  - Bluetooth, HomeRF, 802.11, 802.11b, IrDA …
- Emerging Technologies for Dynamic Service Discovery
  - Jini, Universal Plug-and-Play, Service Location Protocol …
- Leading toward Smart Spaces?

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What's a Smart Space?

- A Wireless Island in a Global Wired Ocean where
- Available Information Services and Embedded Sensors and Devices are Discovered, Accessed, and Exploited by
- Portable Devices Carried onto the Island and the
- Combination of Imported and Native Devices and Services is Exploited to Support the Information Needs of Current Island Inhabitants

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Smart Spaces Project

- Implement a pilot consisting of multiple smart spaces
  - One exploring passive, multi-modal HCI sensing issues
  - Two exploring networking and distributed systems issues
- Integrate and evaluate current technology available to realize smart spaces
  - Pico-cellular LANs
  - Dynamic Service Discovery
  - Distributed Computing Infrastructure
  - Multi-modal Passive Sensing (speech, vision, language)
- Networking for Smart Spaces Project
  - ***AirJava***: Exploring the Edge
  - **Aroma**: Exploring the Core

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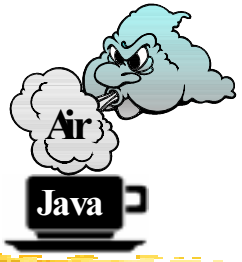
Exploring the Edge

Claim: Within 5 years Systems-on-a-chip (SOC) costing $10 will include
- **pico-cell wireless transceiver**
- **virtual machine**
- **run-time environment**

- **Deploy embedded and portable, computer-controllable devices within a pico-cellular wireless edge network connected to the wired infrastructure**
- **Discover local devices and automatically configure foreign portable computers to use the discovered devices and services- also enable the export of local devices and services to remote correspondents**
- **Discover local embedded file and compute infrastructures that allow ad hoc injection of transient foreign information and programs**

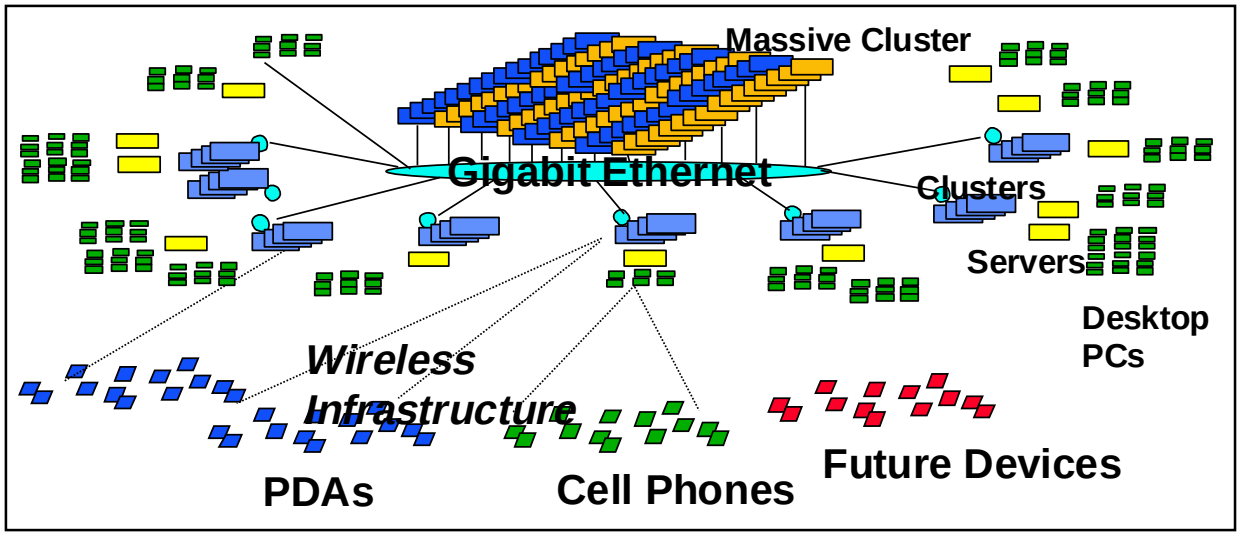
A Jini-based Device Adapter



- ***AirJava* adapter emulates tomorrow's SOC**
  - Low-power microcomputer and flash memory
  - 2.4 GHz wireless LAN PCMCIA Card
  - Linux or Windows
  - Java VM and Jini
- ***AirJava* adapter provides a platform for investigating challenges**
  - Managing and Exploiting Discovered Services
  - Security Mechanisms for Transient Users
  - Self-Organizing Mesh of Services
  - Logical Networking Context for Mobile Collaborators

- **EPSON CARD 586**
  - **133 MHz, 48 MB RAM, 256 KB ROM, 1 MB Video Memory**
  - **Bus Controller, XGA Controller, FDC, COMBO Controller**
- **320 MB Flash Memory Card**
- **320x240 Pixel Color LCD**
- **2.4 GHz Wireless LAN PCMCIA Type II**

Exploring the Core



Picture courtesy of
David Culler
UC Berkeley

- Integrate *AirJava*-adapted devices and other portable wireless devices with wired networking infrastructure using UCB Ninja Software
- Develop, test, and evaluate algorithms for self-organizing service meshes along spatial, logical, and organization dimensions
- Develop and exploit on-demand virtual private network technology to scope and protect communications and to manage information for mobile, ad hoc teams

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You are invited to PC 2000

- Pervasive Computing 2000 Workshop
  - January 25-26, 2000 at NIST in Gaithersburg, Maryland
  - Keynote Speaker is Bill Joy from Sun Microsystems
  - Multiple Panels of mainly Industry, but some University Folks
- Panel Topics
  - Pico-cellular Wireless LANs
  - Dynamic Service Discovery Systems
  - Innovative Handheld and Embedded Devices
  - Programming Systems for Adaptive Distributed Systems
  - Multi-modal Human-Computer Interaction
- Contact Bill Young (wtyoung@nist.gov) for more info