Presentation Outline

- Historical Overview
- Radio Fundamentals
- US Developments in PCS
- Mobile Data
- Satellite Systems
- Problems with existing schemes
- **Wireless Overlay Networks**
- US Government Research Initiatives

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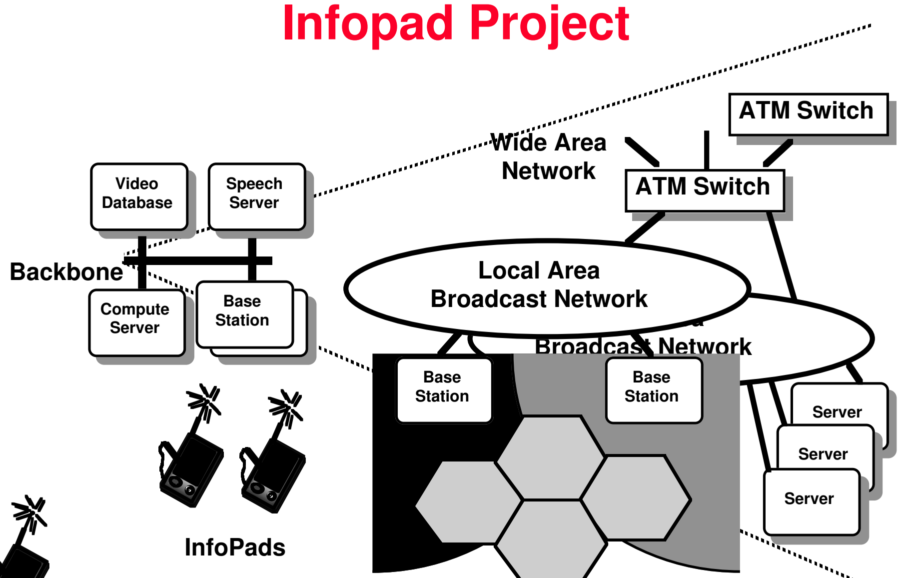
Infopad Project



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Wide-Area Wireless Testbed

Multiple Overlayed Wireless Networks

Seamless Mobility Across Overlays

Integration with wide-area high performance networks (BAGNet)
Bandwidth/latency aware APIs; Wide-area untethered applications

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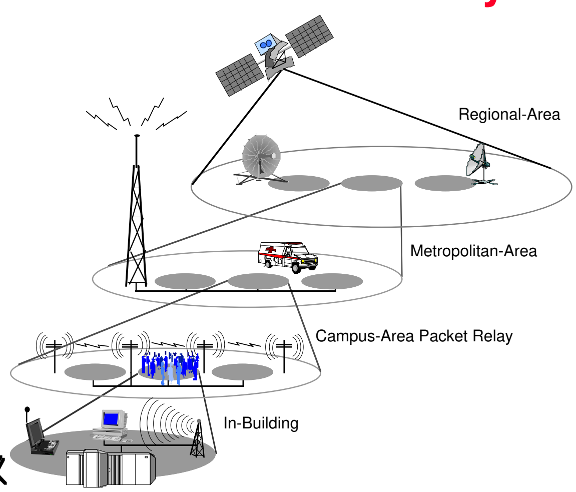
Wireless Overlay Concept



Remote Clinics
↓
Ambulance Dispatch
↓
Hospital Campus
↓
Hospital
Operating Room
Emergency Room

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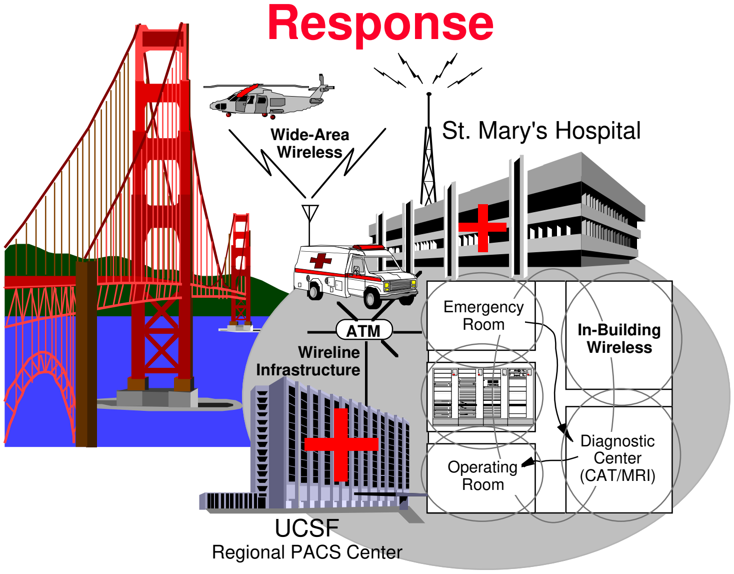
Application: Emergency Response



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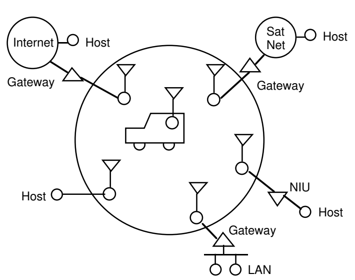
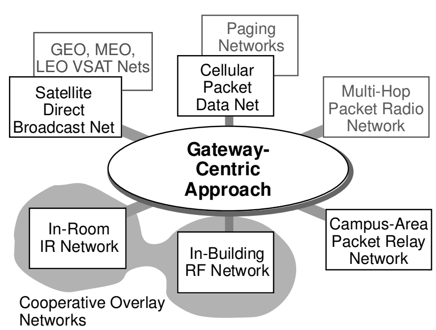
Overlay Internetworking





Network Centered

Within homogeneous net
No roam between nets

Gateway Centered

Heterogeneous nets
Roam between them

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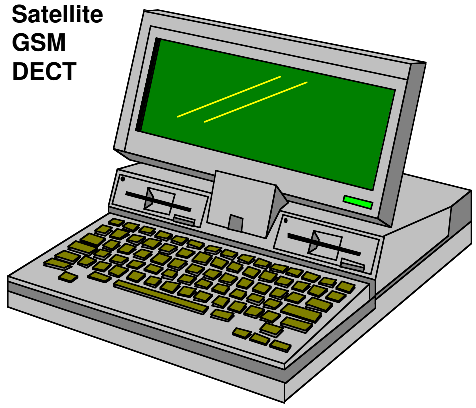
Multimode “Radios”

ITU “Future Public Land Mobile Telecommunications System” (FPLMTS)

-- Satellite
-- GSM
-- DECT



PCMCIA #1: IR modem
PCMCIA #2: RF modem
AT Slot: Hughes DirectPC
Floppy Slot: CDPD modem
Serial Port: Metricom modem

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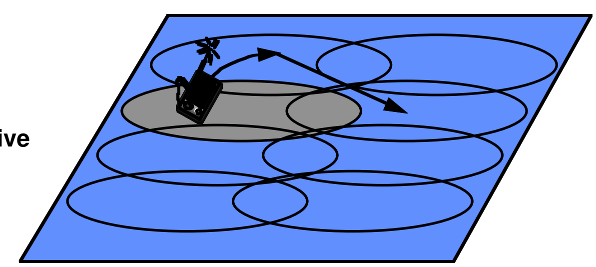
Mobility Challenges: Horizontal Roaming

Single Administrative Domain



Roaming within an administrative domain

-- Mobile IP provides initial solution for the routing problem
-- Single authentication with home domain

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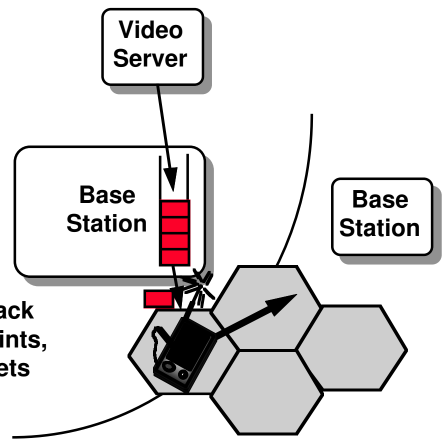
Migrating Hosts



For continuous playback with real-time constraints, must readahead packets to the base station

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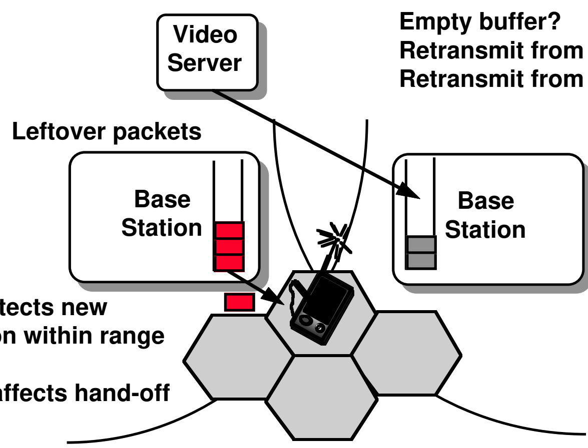
Migrating Hosts

Empty buffer?
Retransmit from server?
Retransmit from BS?



Infopad detects new base station within range

Buffering affects hand-off decision

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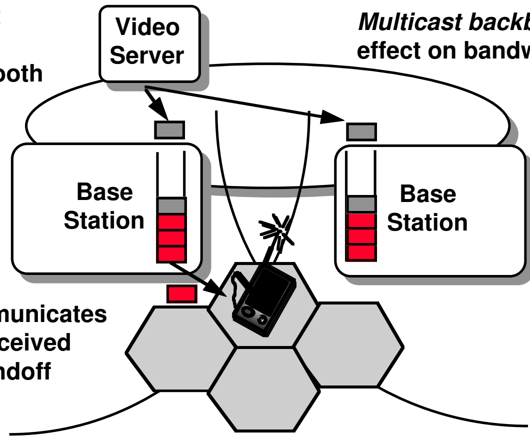
Migrating Hosts

New idea: broadcast packets to adjacent base stations to smooth hand-offs

Multicast backbone effect on bandwidth?



Mobile host communicates seq. no. of last received packet during handoff negotiation

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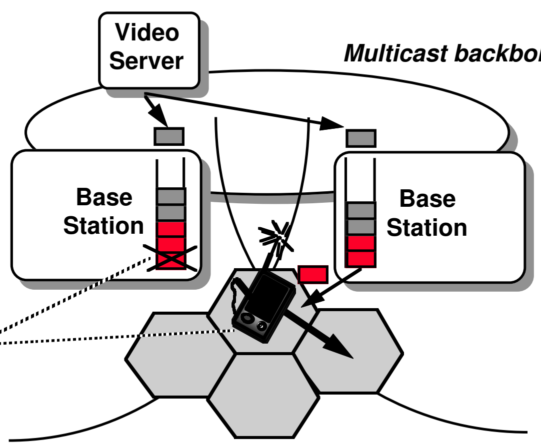
Migrating Hosts

Multicast backbone



BS-to-BS purge packet protocols
— or —
sequence no. resolution in Infopad

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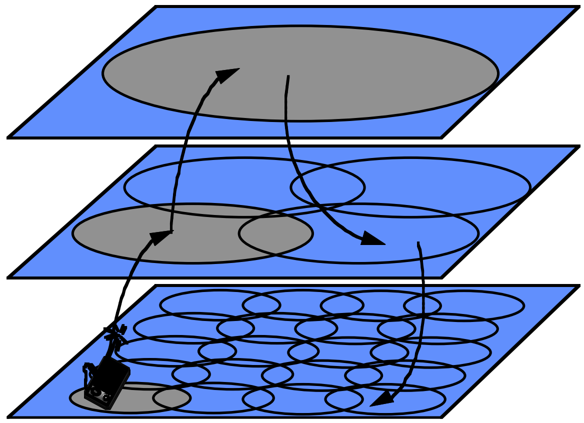
Mobility Challenges: Vertical Roaming



Multiple Administrative Domains
- -- Handoff
- -- Authentication
- -- Routing
- – Billing

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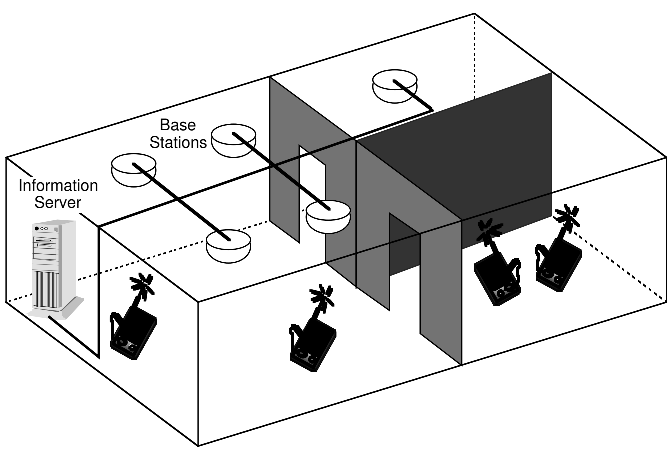
In-Building Cooperative Networks: IR and RF



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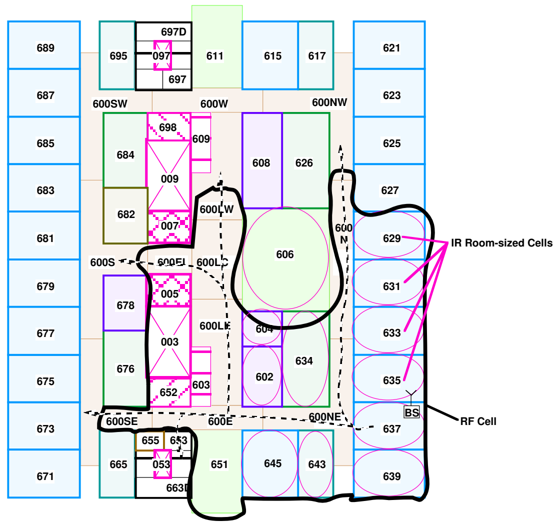
In-Building Cooperative Networks: IR and RF



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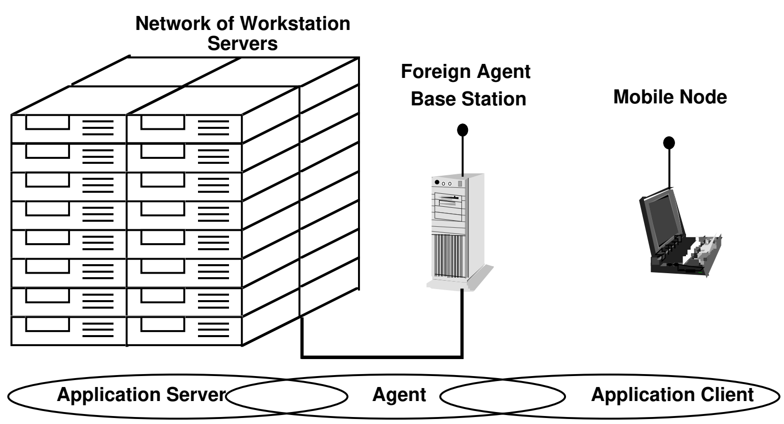
Application Support



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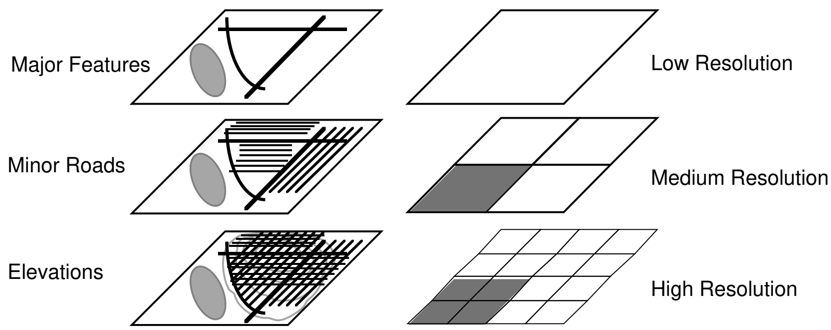
Application Support: Map Browsing



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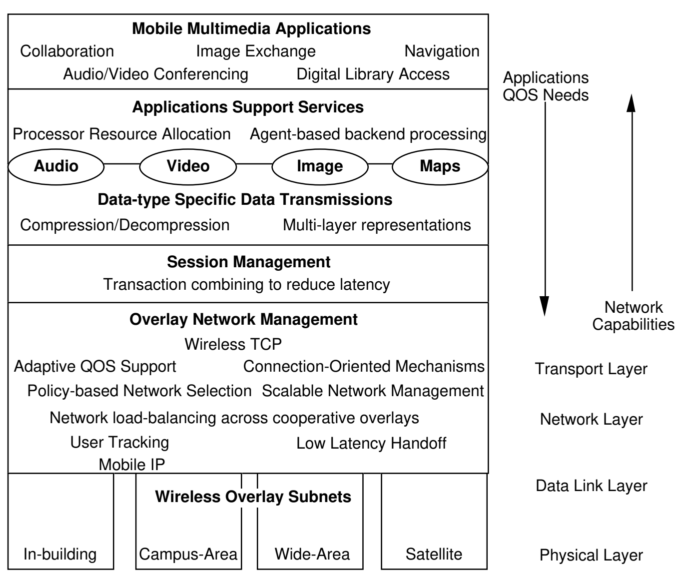
Layered Architecture



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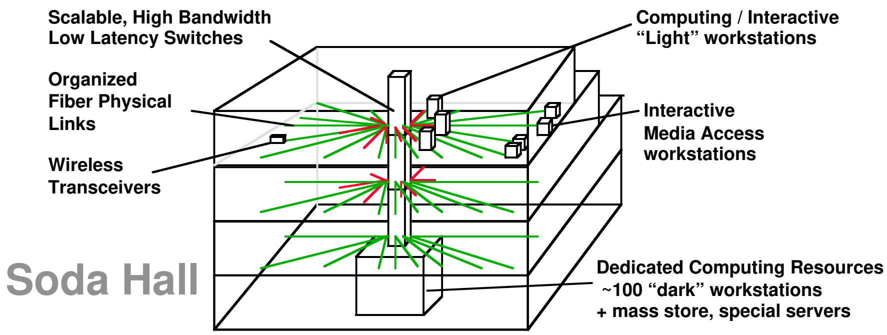
State-of-the-Art In-building Networking Infrastructure

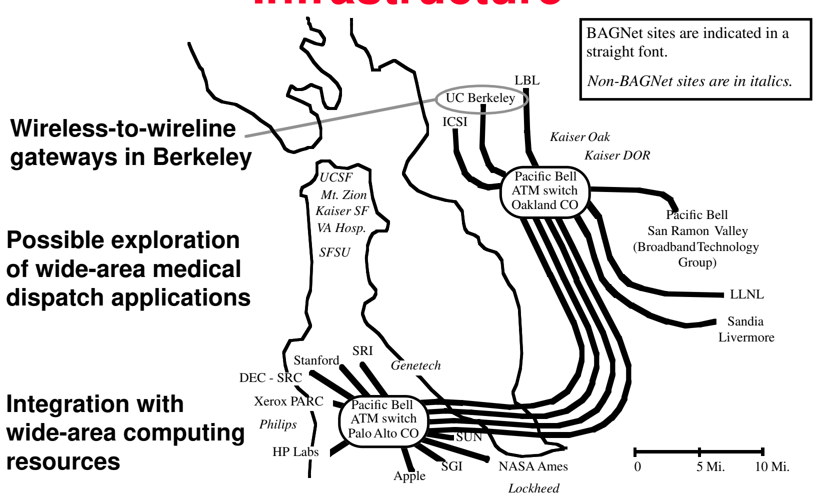


Cooperative In-building Wireless Overlays:

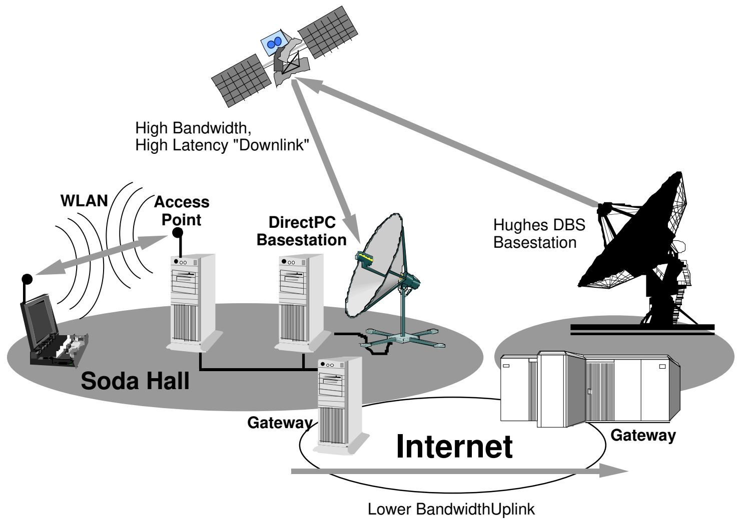
- **IR for offices, meeting spaces, classrooms**
- **RF overlay for "between" spaces, connectivity load sharing**

Integration with building-scale computing resources

Wide-Area Wireline Infrastructure



UCB-Hughes DBS Testbed



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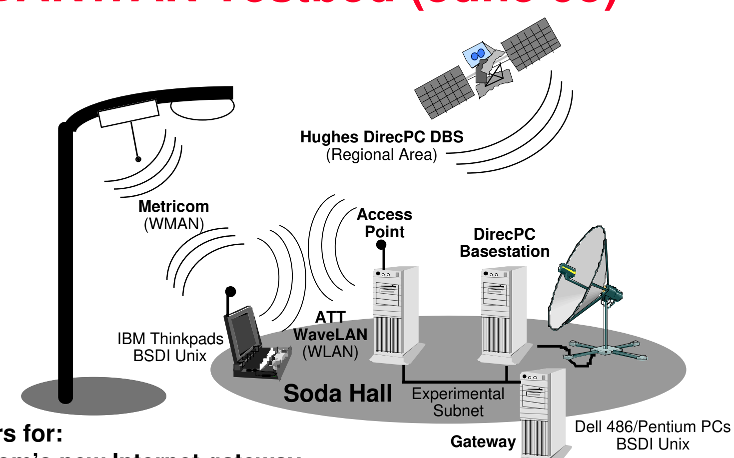
BARWAN Testbed (June 95)



Beta testers for:

Metricom's new Internet gateway
ATT's 2.4 Ghz WaveLAN
IBM's next generation IR devices

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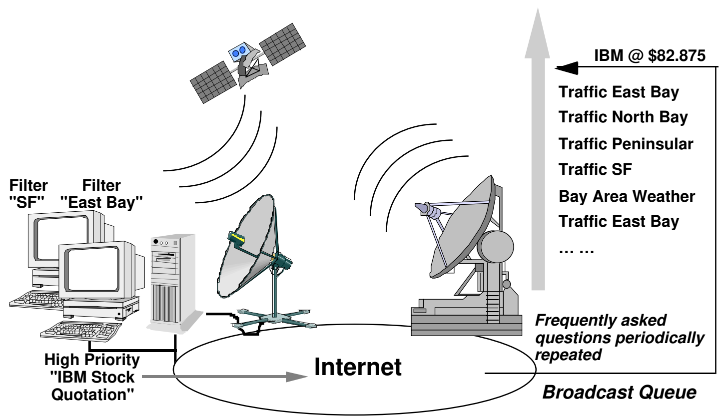
Satellite Broadcast Application



Data filtering and query combining

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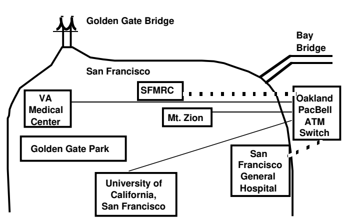
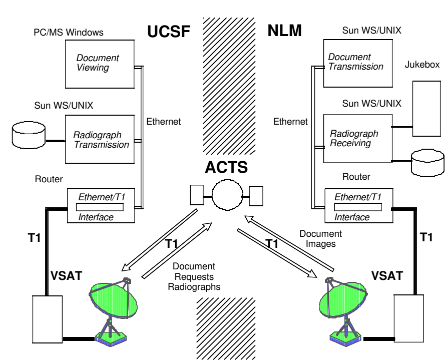
Collaboration with UCSF



Picture Archive and Communications System (PACS)
linking major hospitals in SF and the National Library of Medicine

Laboratory for Radiological Informatics at UCSF



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Research Issues

- **Seamless connectivity over multiple overlays**
  - Implementing low latency handoffs
  - Exploiting movement-tracking and geography
  - Performance characterization of channels
  - Authentication, security, privacy
- **Scalable mobile processing**
  - Hierarchical and distributed network management
  - Load balancing for network mgmt & application support
  - Integration with local- & wide-area networked servers
  - Application support for adaptive connections

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