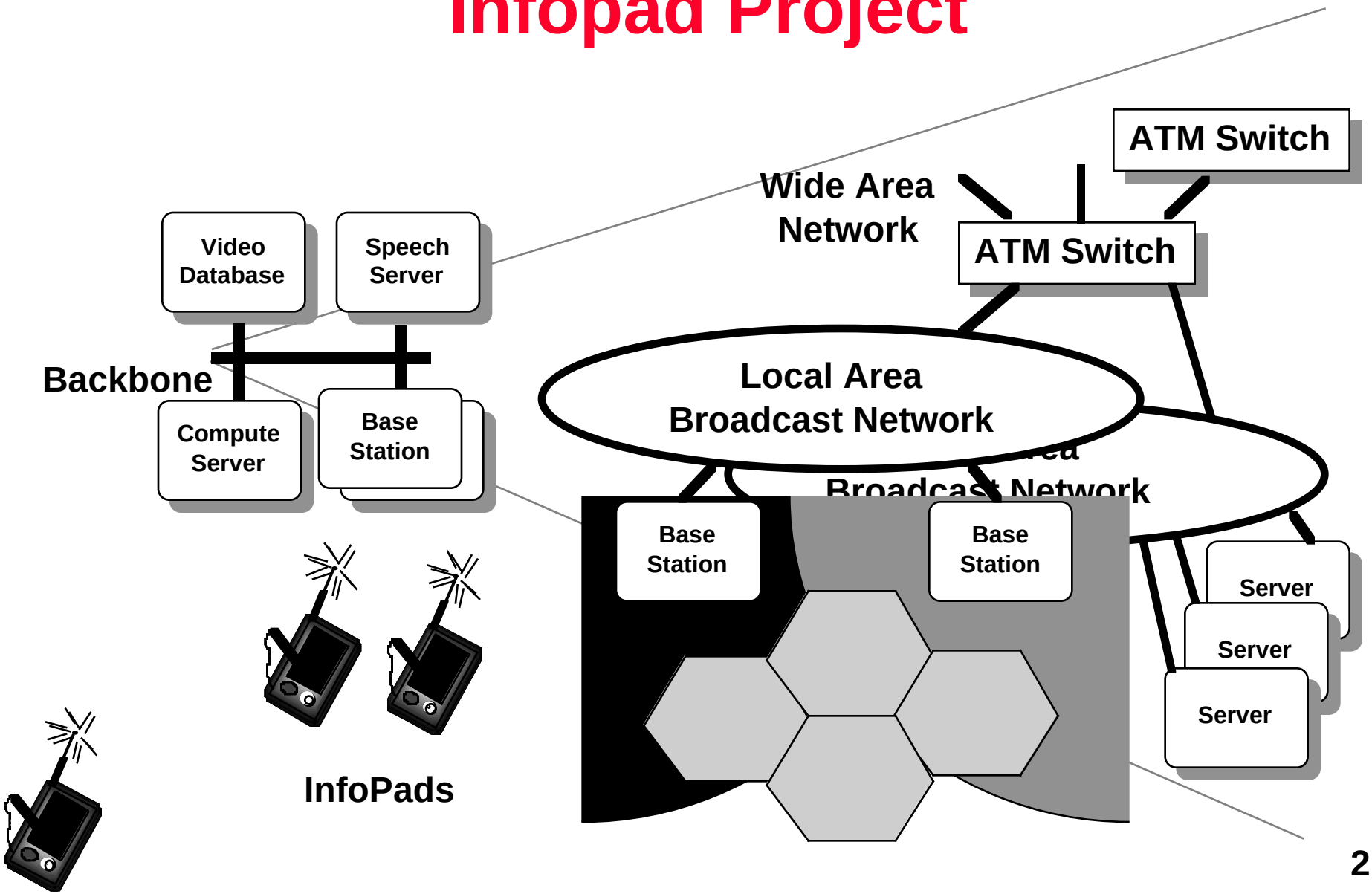
Presentation Outline

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

Infopad Project



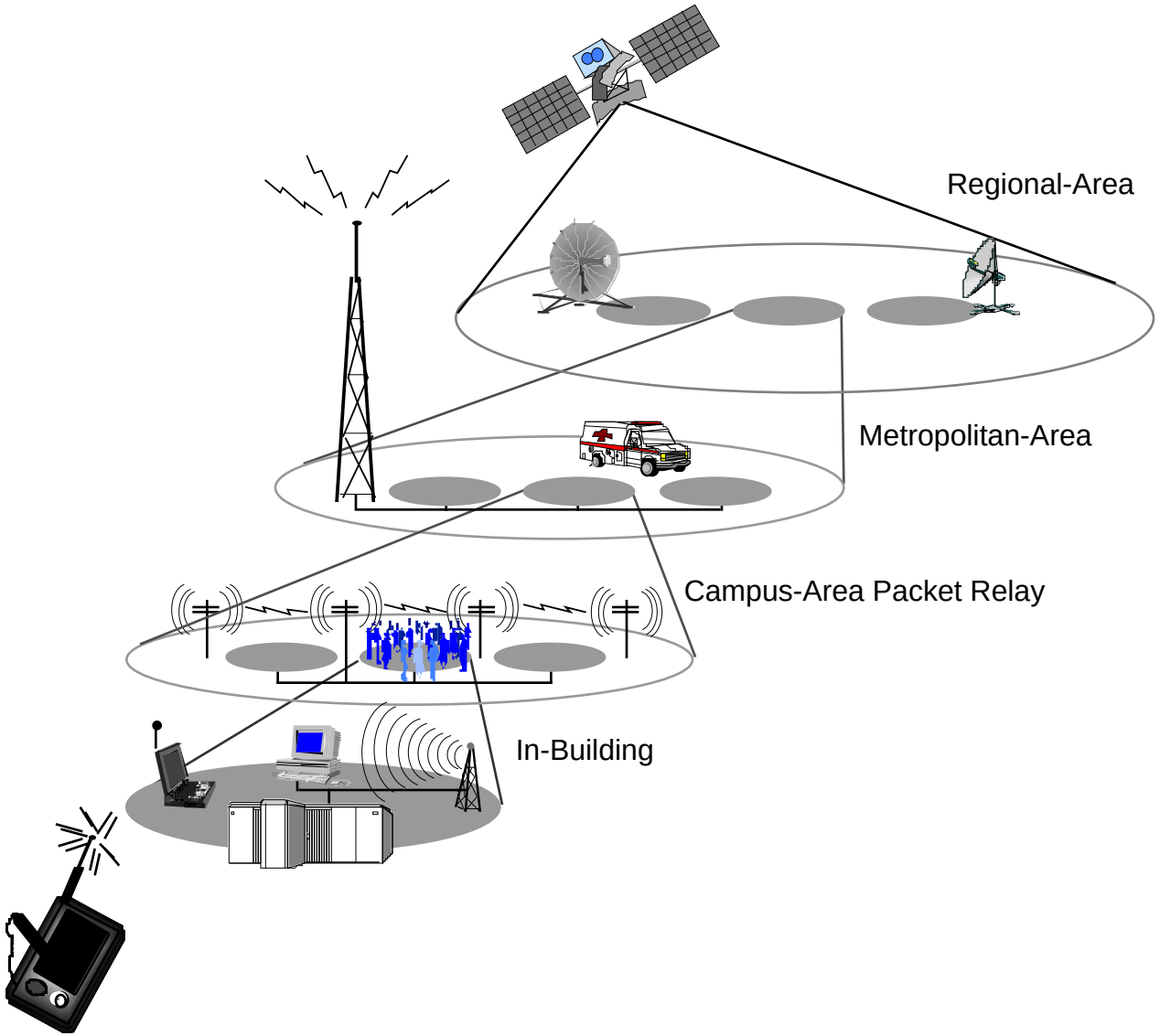
Wide-Area Wireless Testbed

Multiple Overlayed Wireless Networks

Seamless Mobility Across Overlays

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

Wireless Overlay Concept



Remote Clinics

↓

Ambulance Dispatch

↓

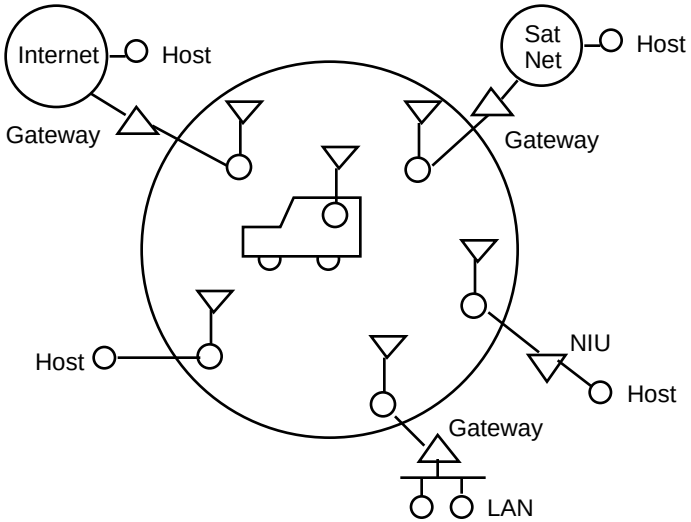
Hospital Campus

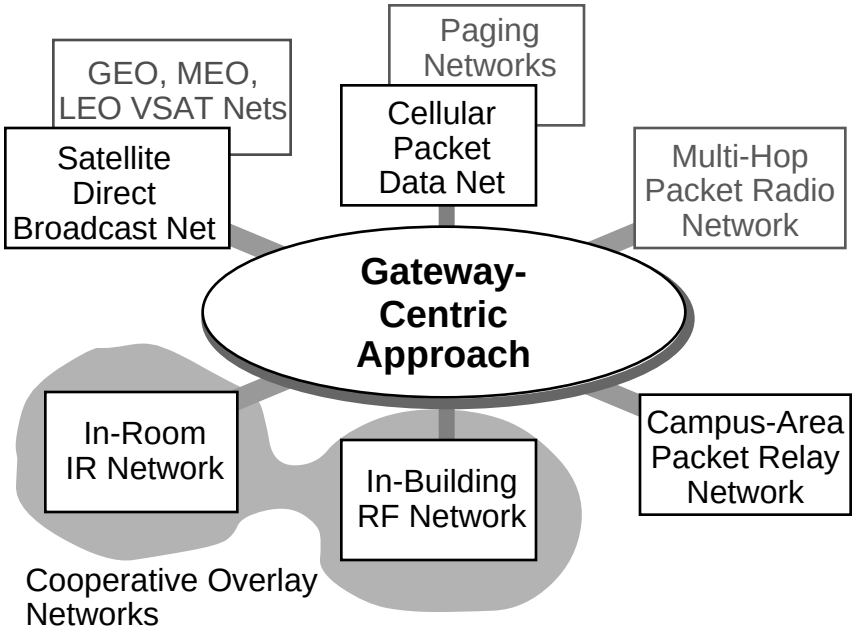
↓

Hospital
Operating Room
Emergency Room

Application: Emergency Response

Overlay Internetworking





Network Centered

Within homogeneous net

No roam between nets

Gateway Centered

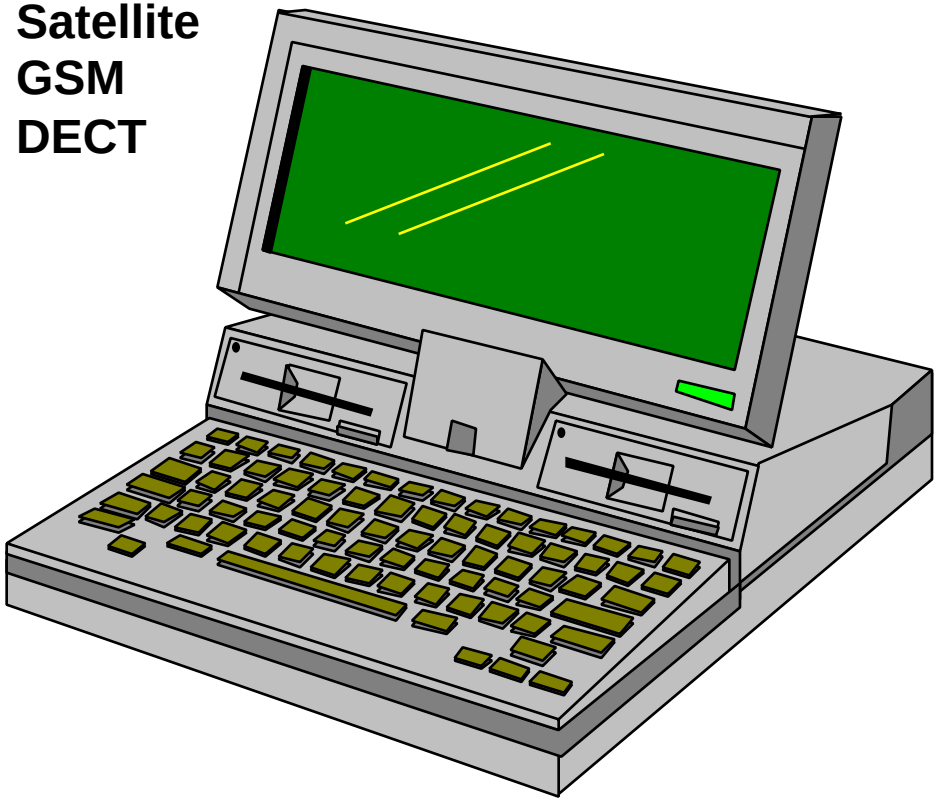
Heterogeneous nets

Roam between them

Multimode “Radios”

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

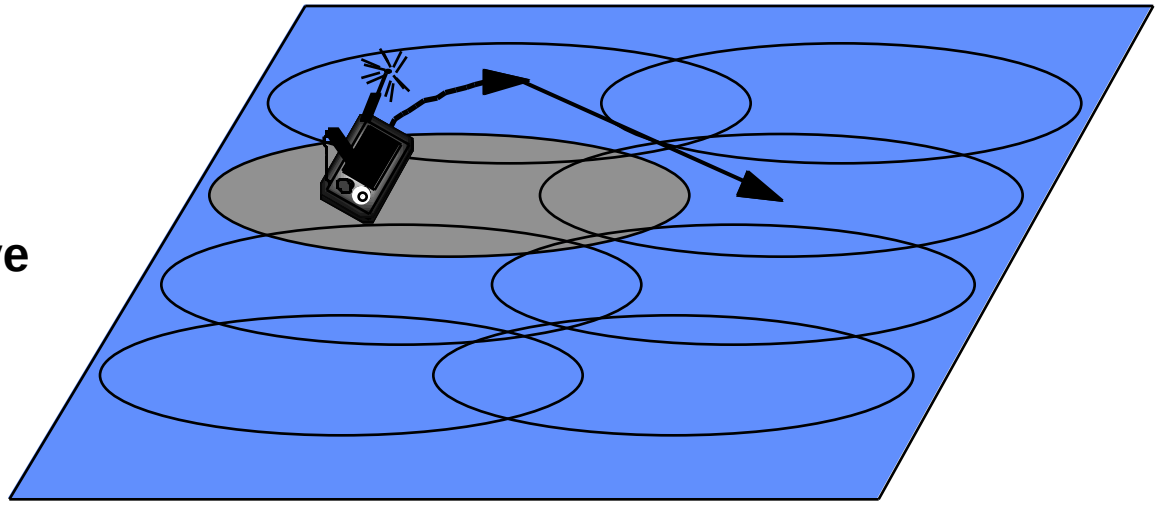
- **Satellite**
- **GSM**
- **DECT**



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

Mobility Challenges: Horizontal Roaming

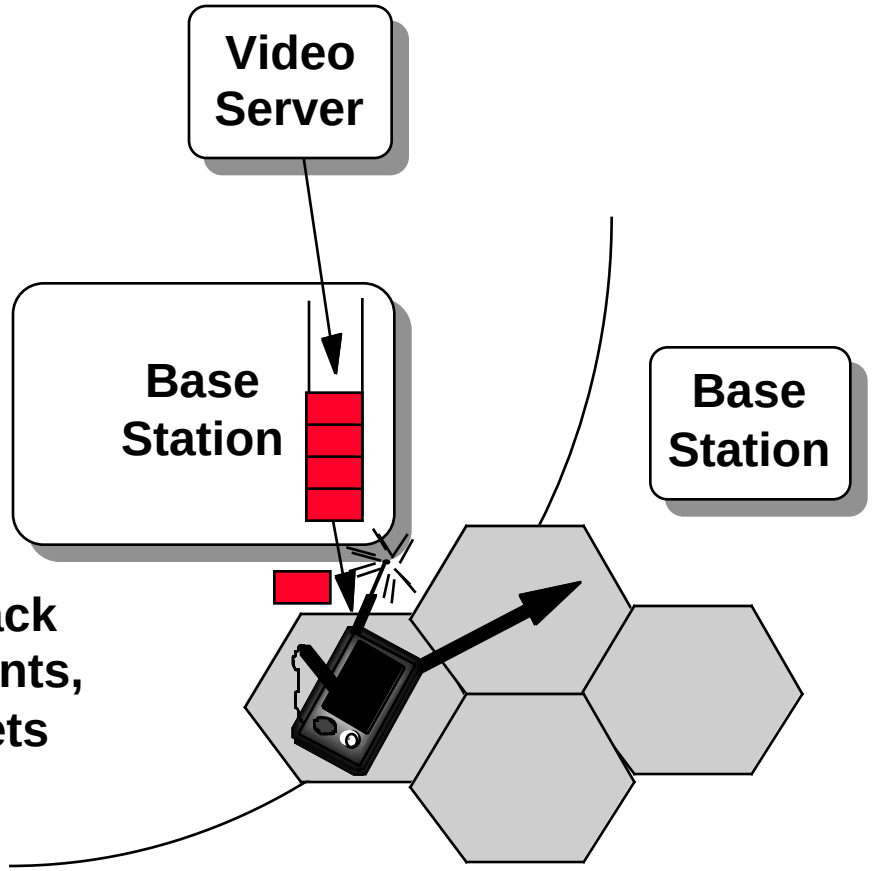
Single Administrative Domain



Roaming within an administrative domain

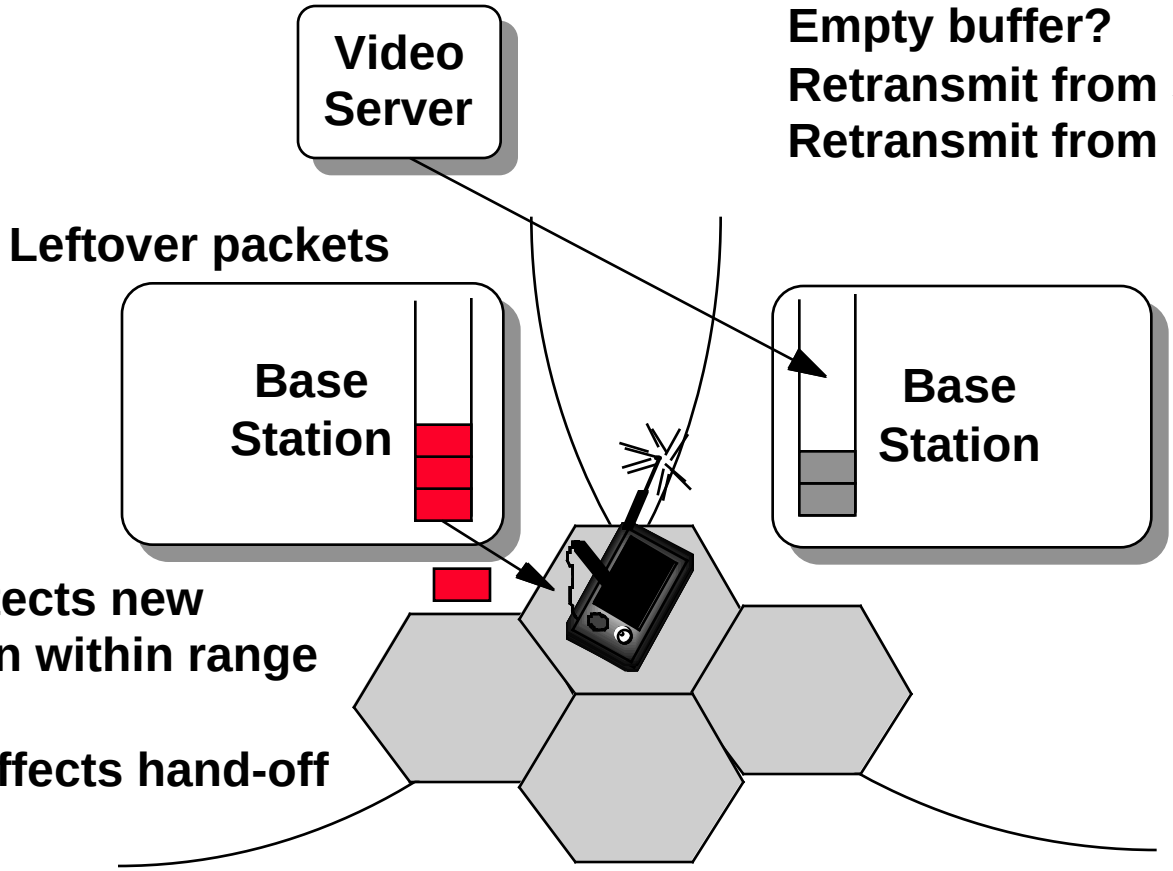
- **-- Mobile IP provides initial solution for the routing problem**
- **-- Single authentication with home domain**

Migrating Hosts



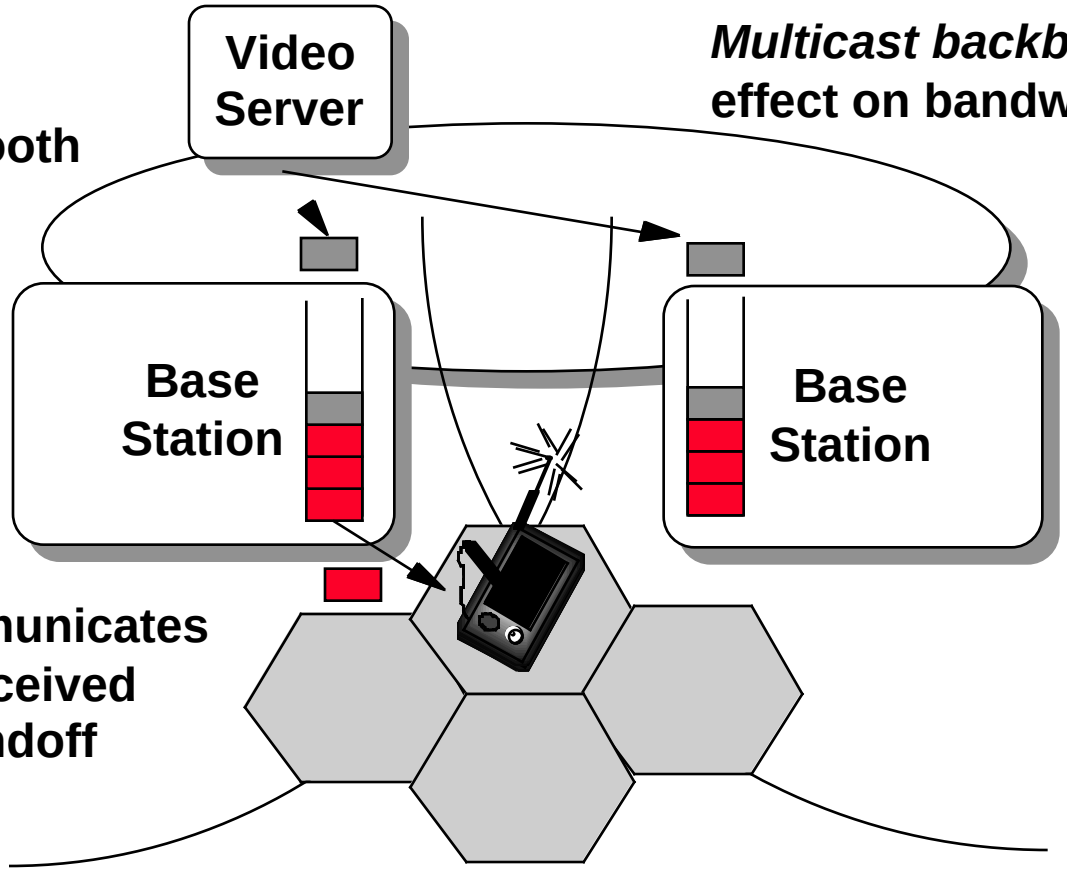
For continuous playback with real-time constraints, must readahead packets to the base station

Migrating Hosts



Migrating Hosts

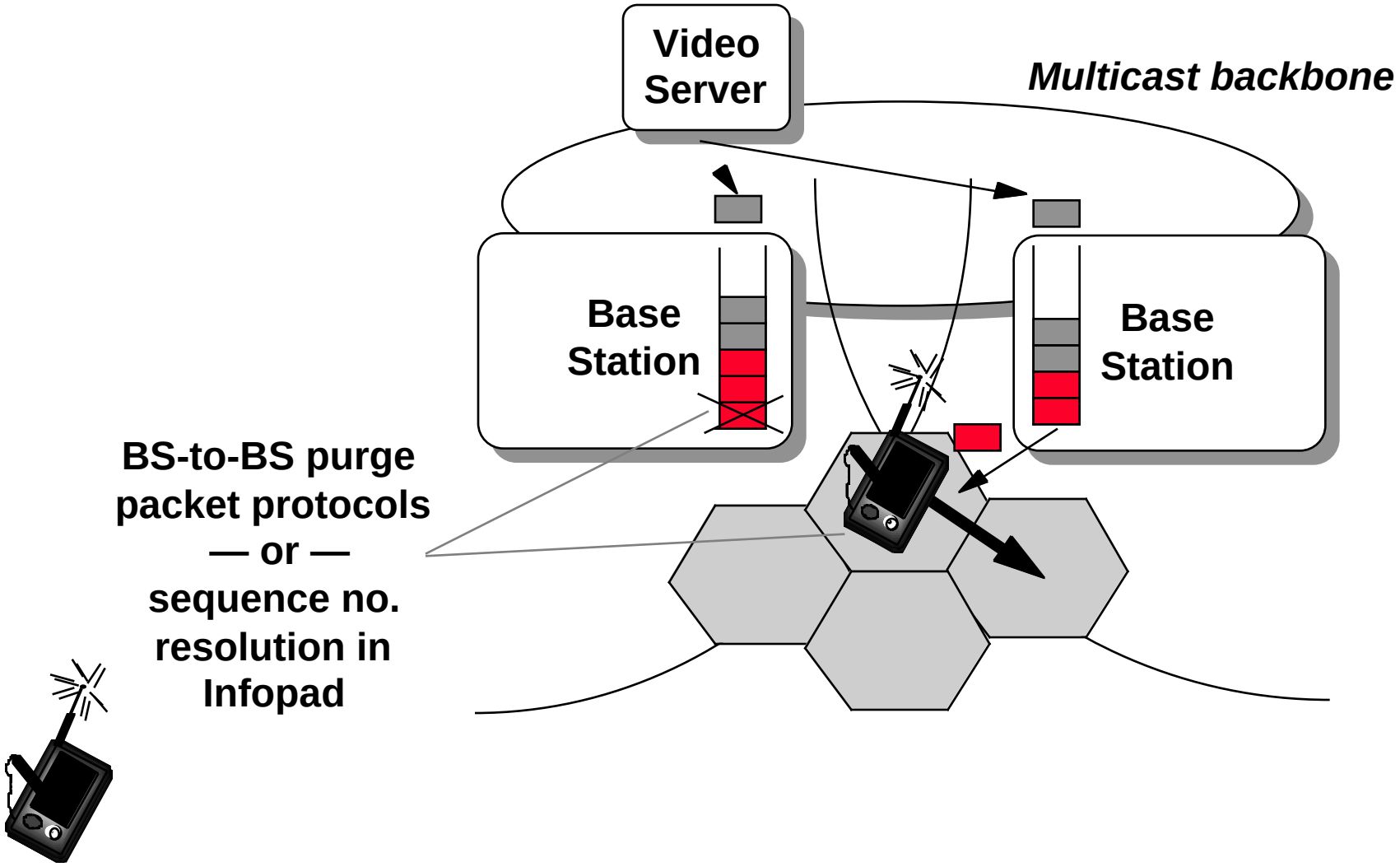
New idea: broadcast packets to adjacent base stations to smooth hand-offs



Multicast backbone effect on bandwidth?

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

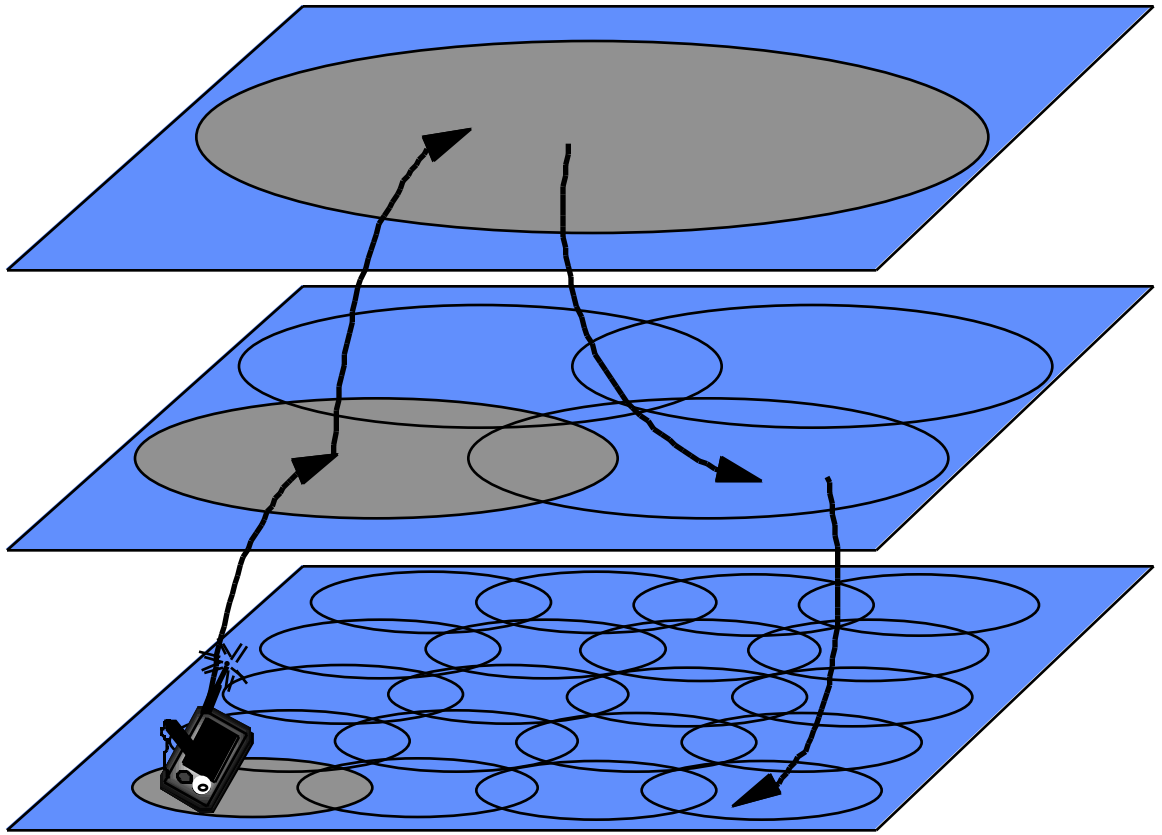
Migrating Hosts



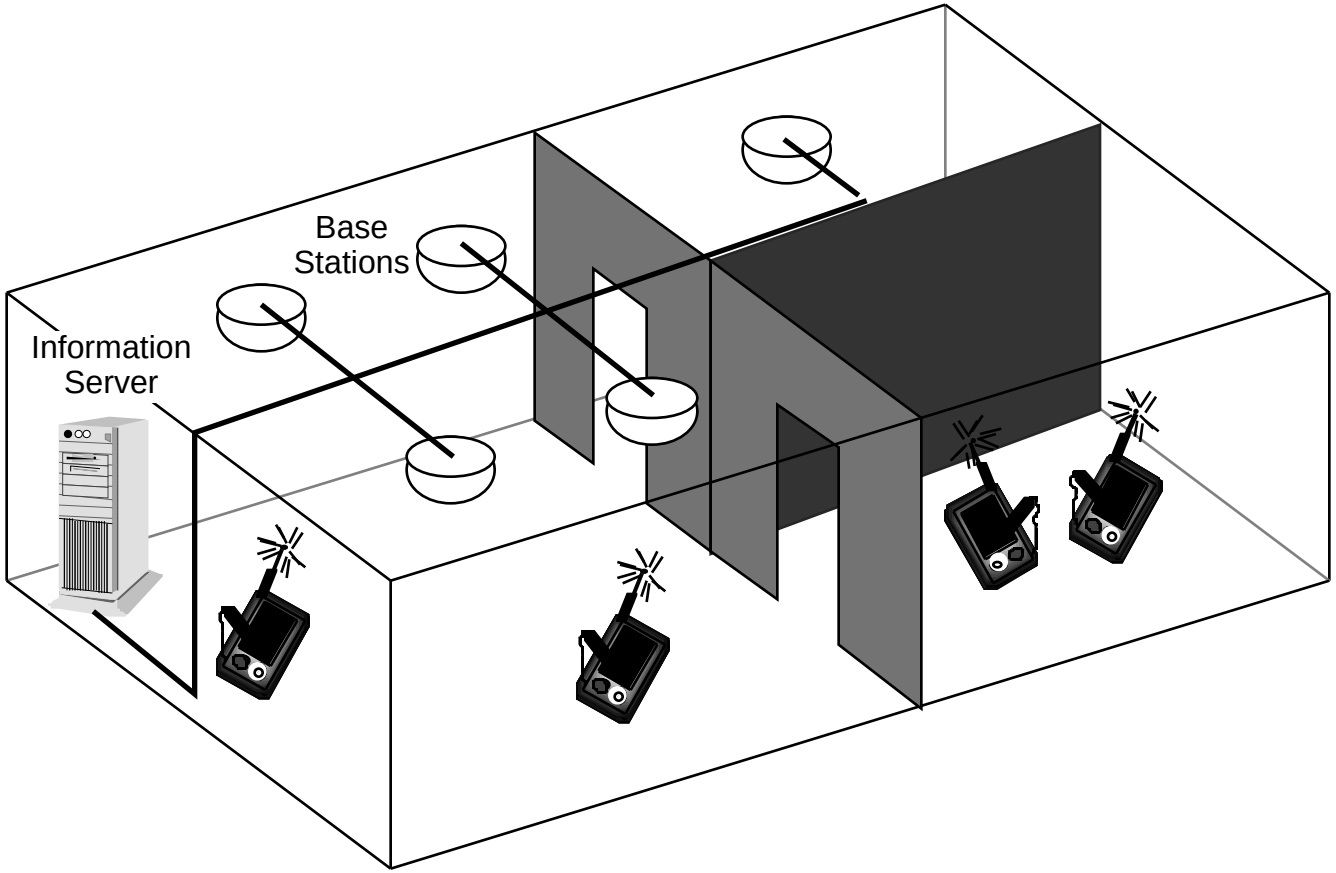
Mobility Challenges: Vertical Roaming

Multiple Administrative Domains

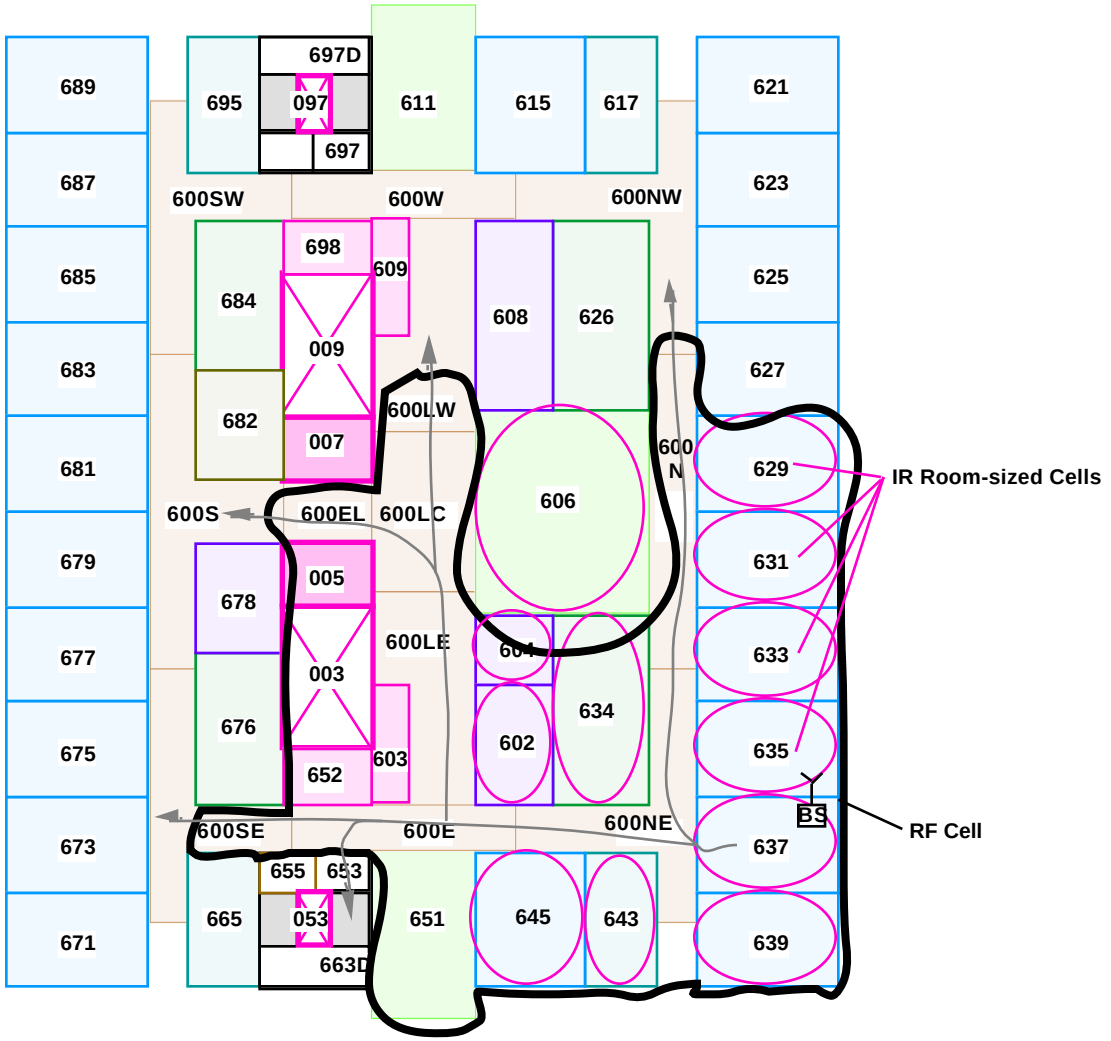
-- Handoff
-- Authentication
-- Routing
– Billing



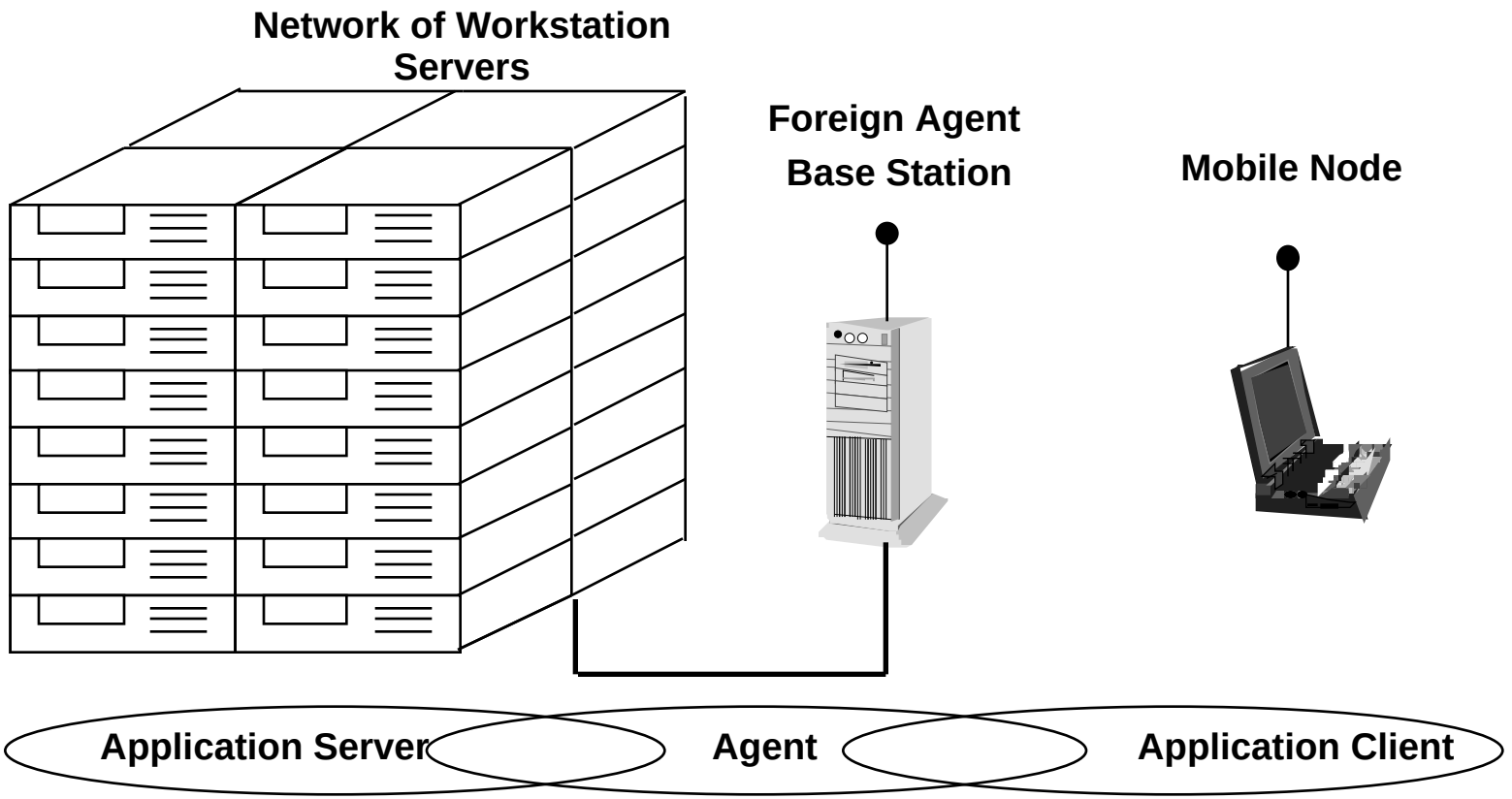
In-Building Cooperative Networks: IR and RF



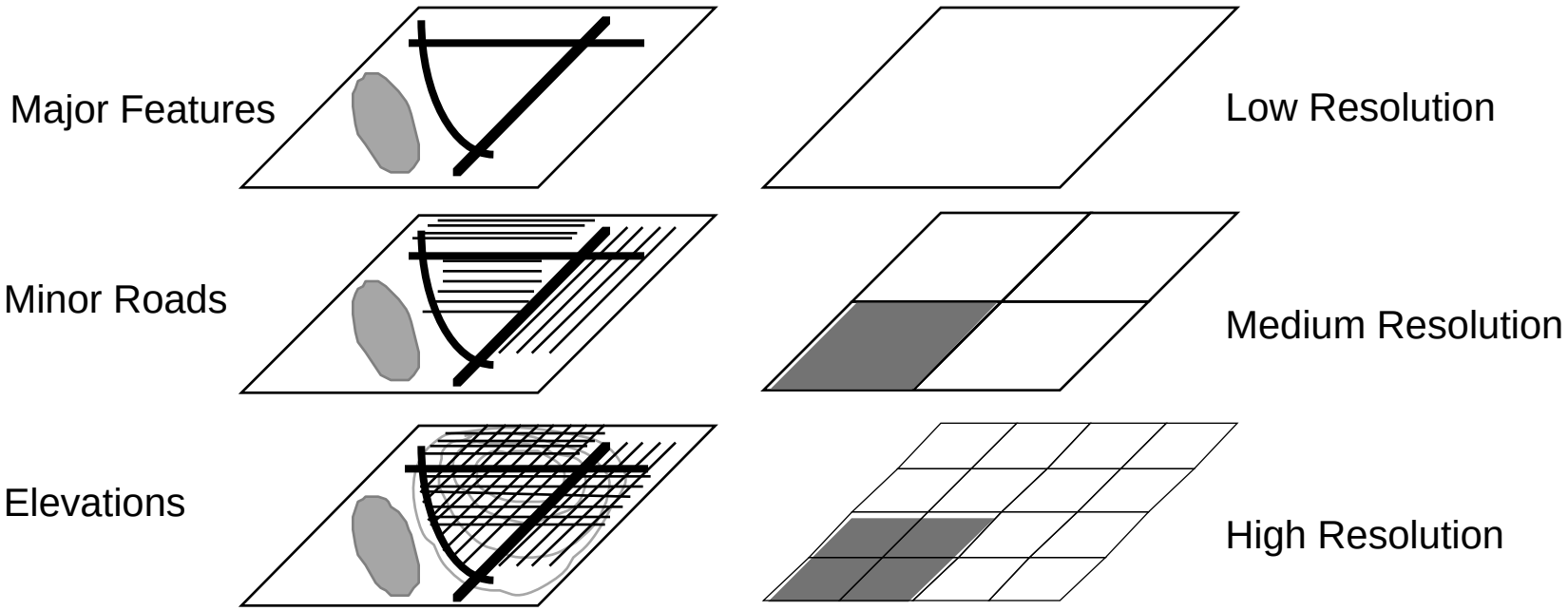
In-Building Cooperative Networks: IR and RF



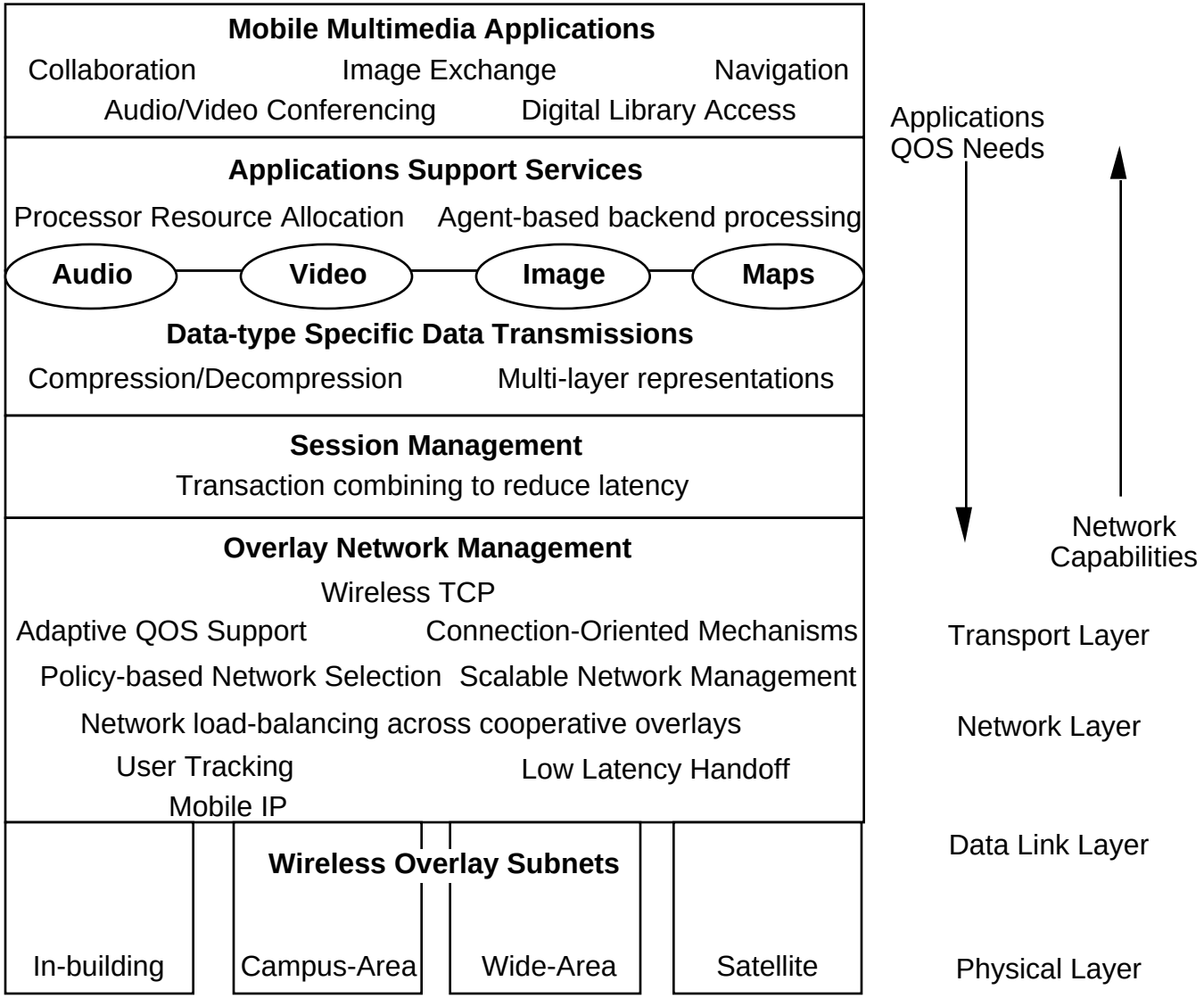
Application Support



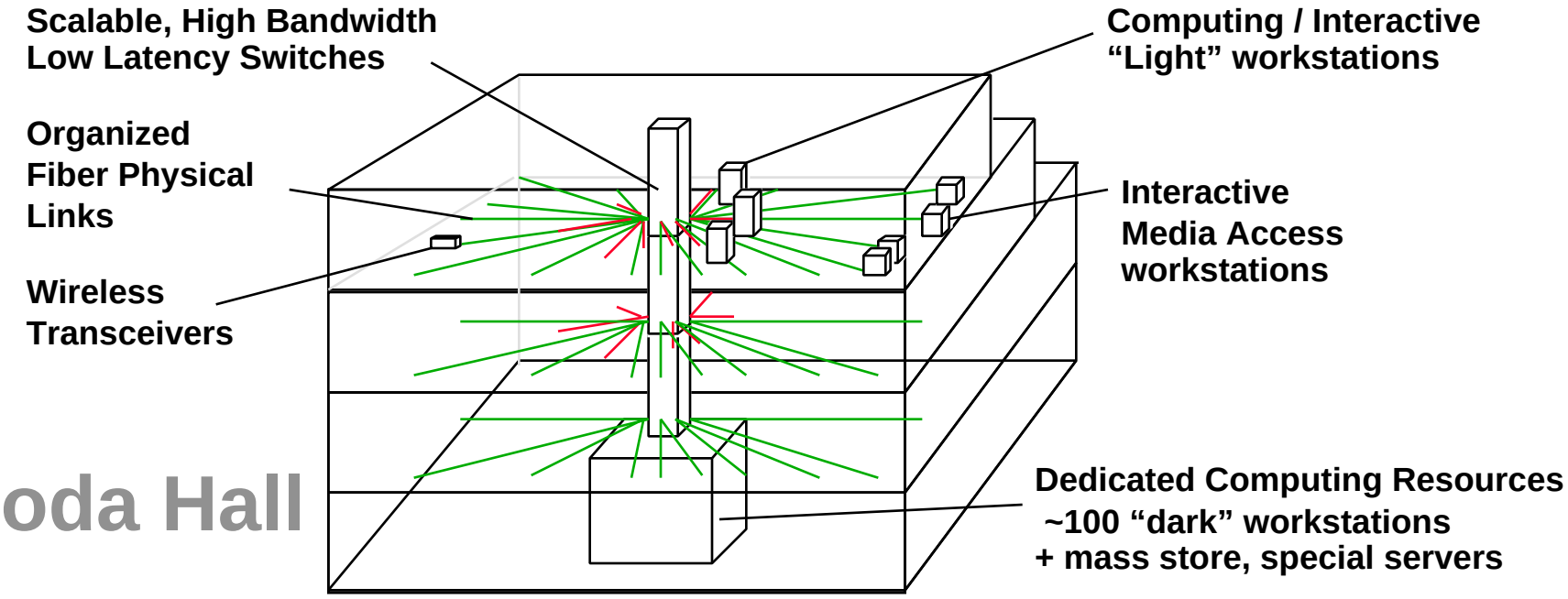
Application Support: Map Browsing



Layered Architecture



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**

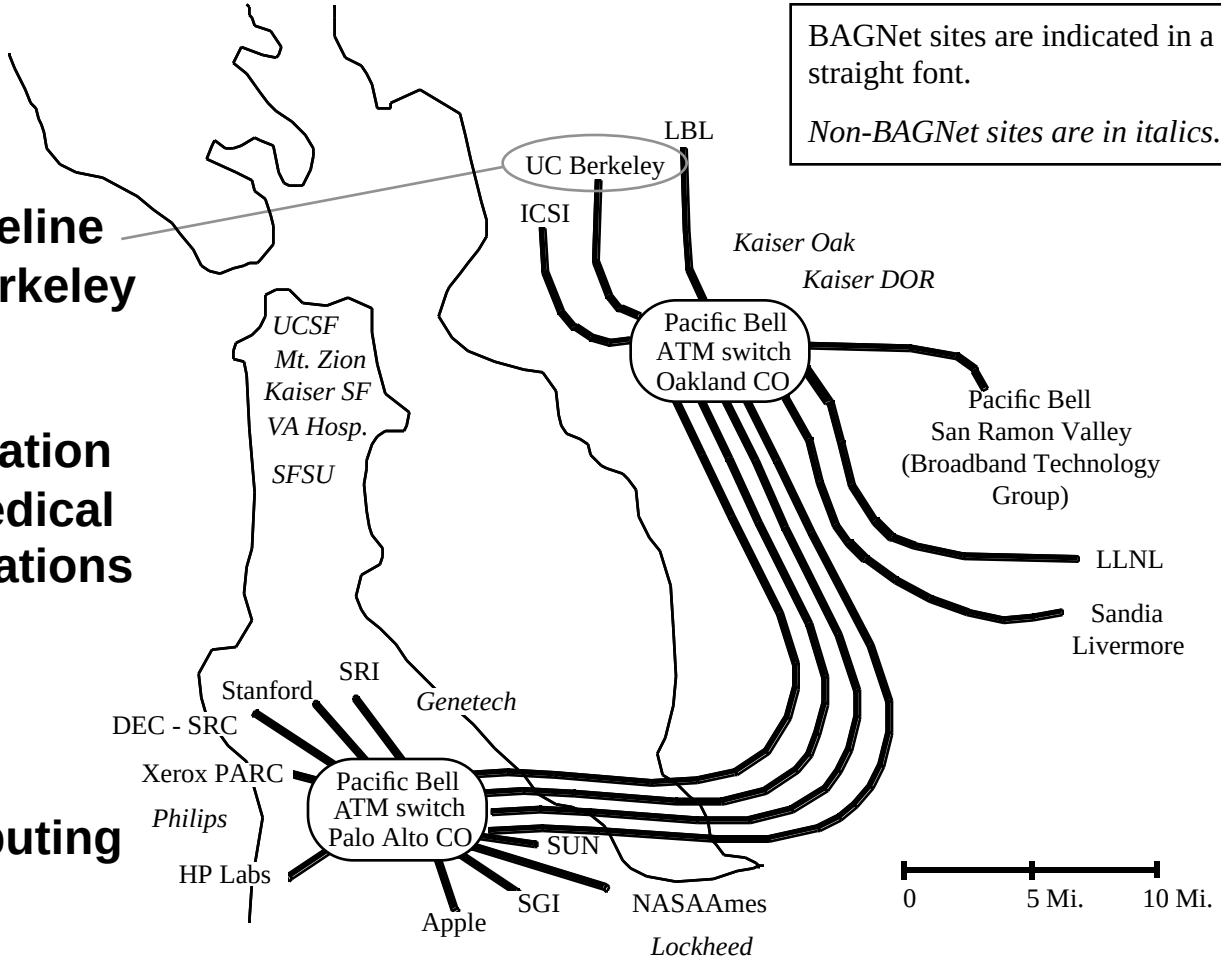
Integration with building-scale computing resources

Wide-Area Wireline Infrastructure

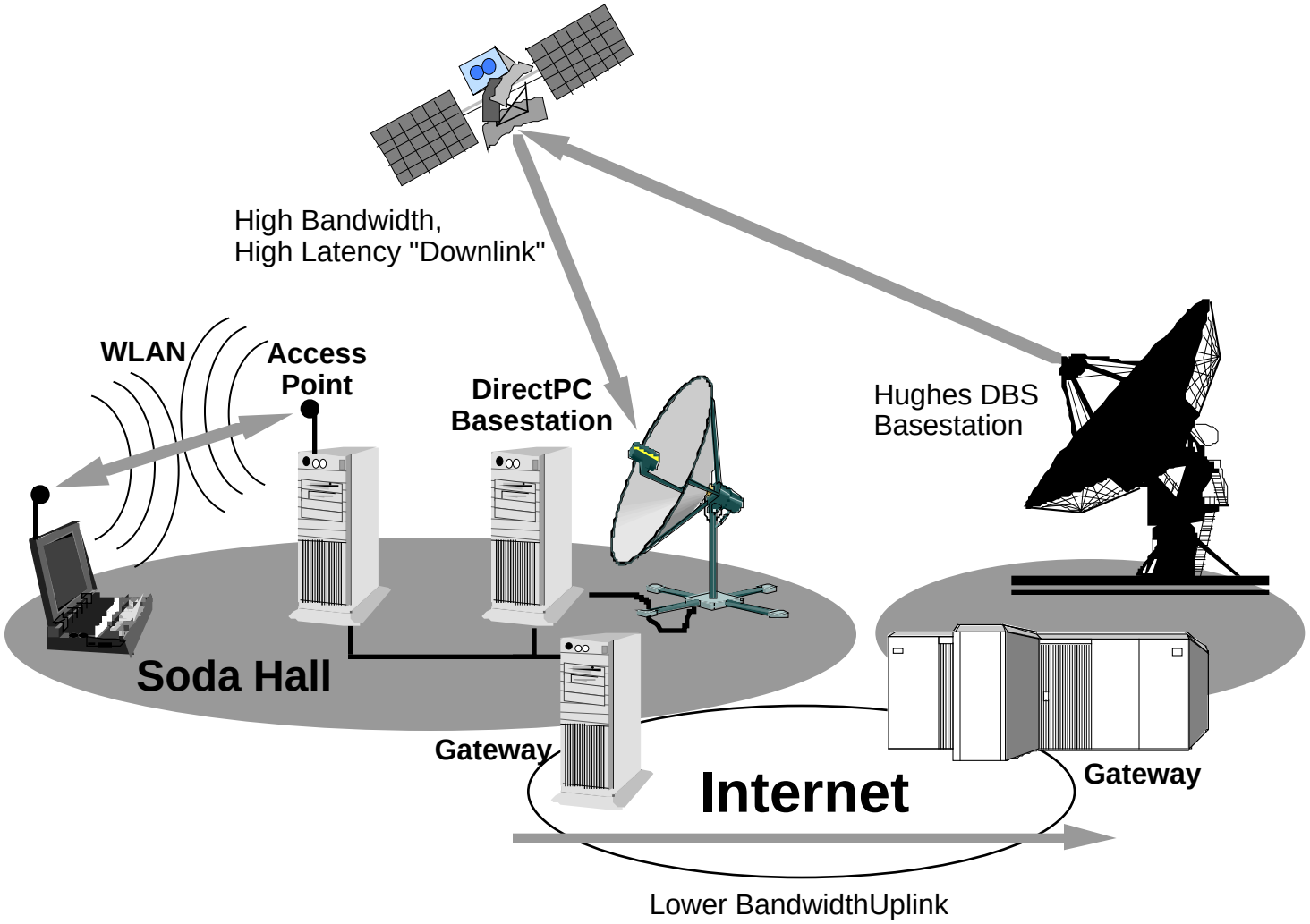
Wireless-to-wireline gateways in Berkeley

Possible exploration of wide-area medical dispatch applications

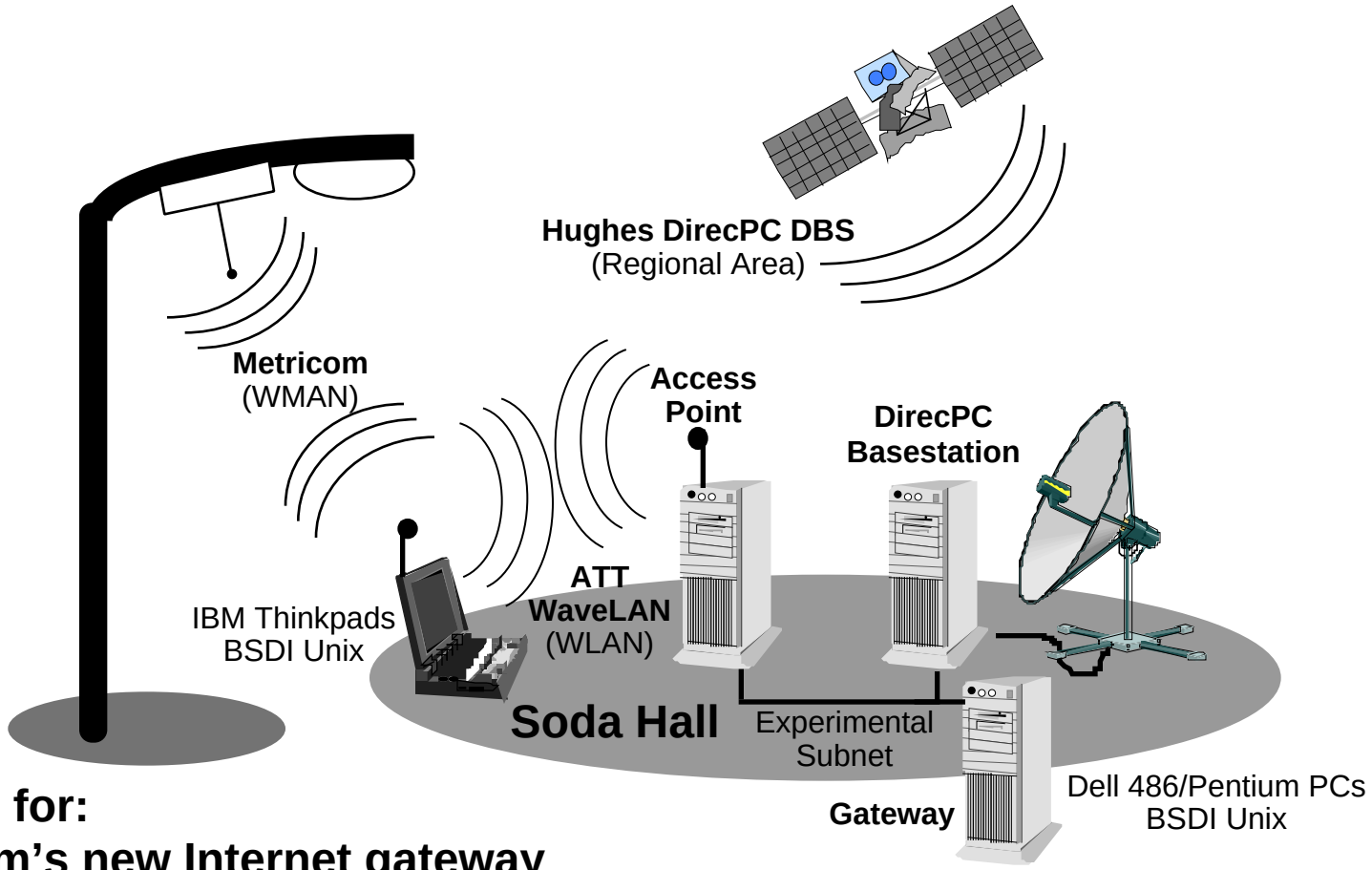
Integration with wide-area computing resources



UCB-Hughes DBS Testbed



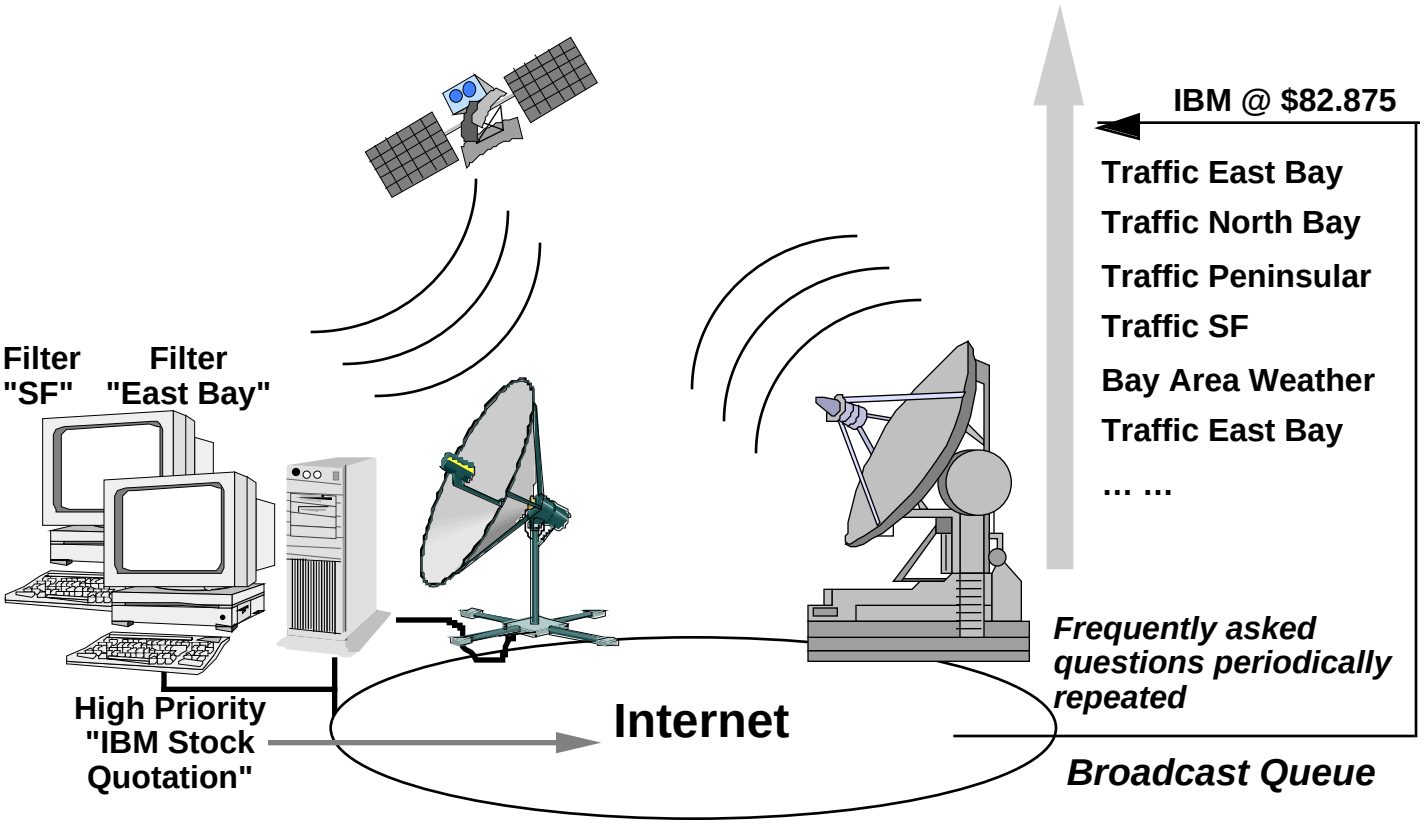
BARWAN Testbed (June 95)



Beta testers for:

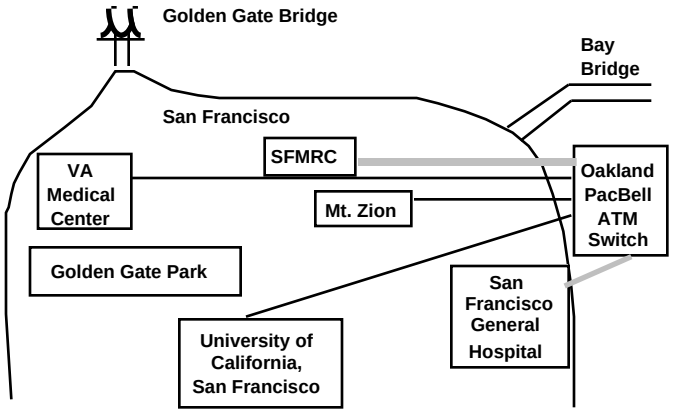
- **Metricom's new Internet gateway**
- **ATT's 2.4 Ghz WaveLAN**
- **IBM's next generation IR devices**

Satellite Broadcast Application



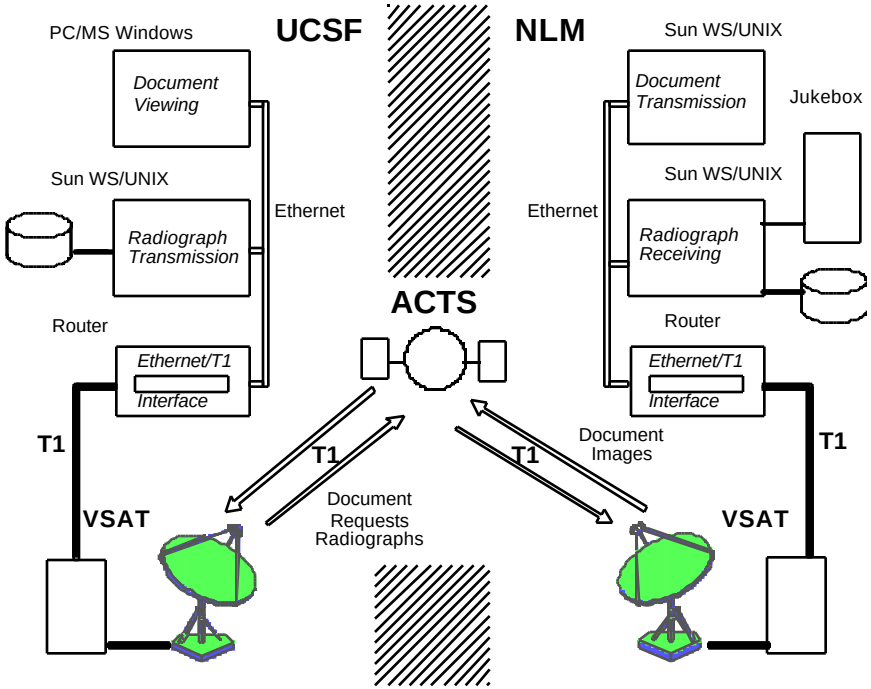
Data filtering and query combining

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



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**