

Providing Network Video Service to Mobile Hosts

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Outline

Infopad Overview

Video Service

- Use of a disk array for high-throughput, high-capacity storage
- Storage of multi-resolution video data

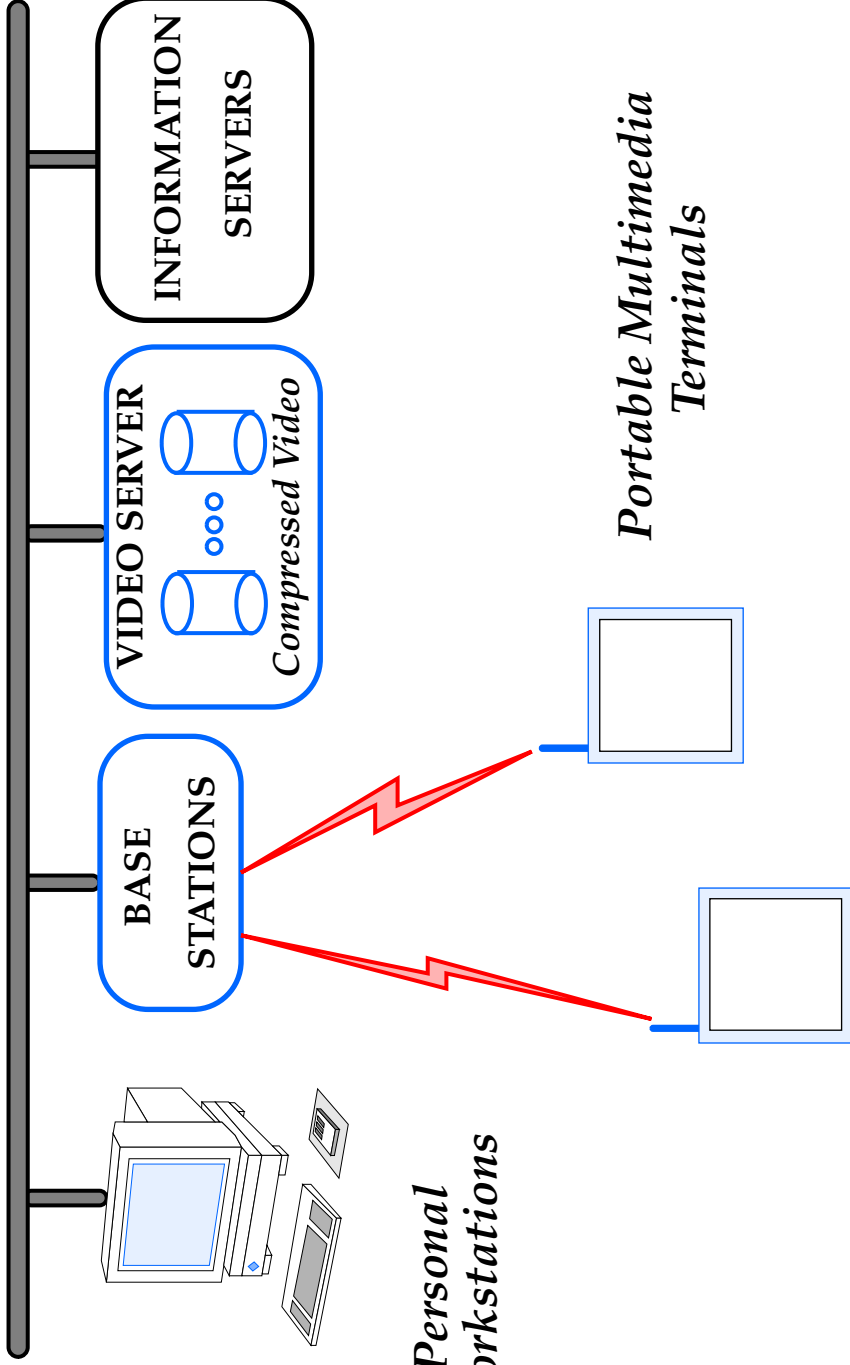
Network Services

- Connection-oriented network protocols supporting performance guarantees
- Connection re-routing to support host mobility

Research Issues in Mobile Computing

Future Computing Environment

Backbone Internetwork 100 Mbps - 1 Gbps



Personal Workstations

Portable Multimedia Terminals

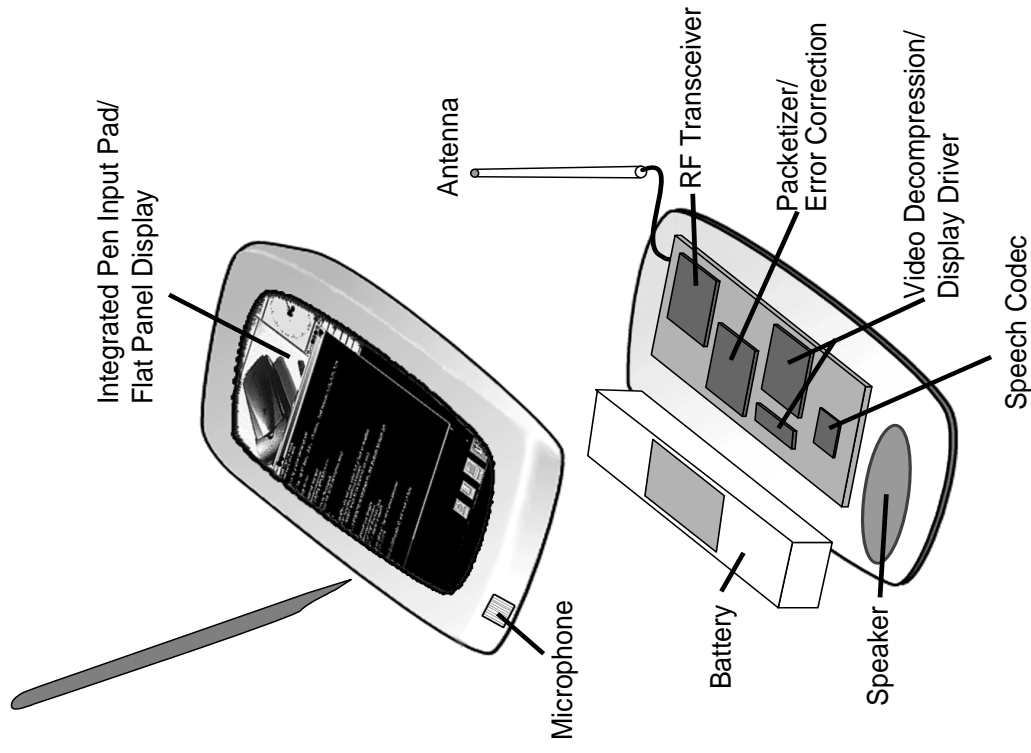
InfoPad Overview

Project Focus

- Integrate communication and computation
- Minimize power consumption

Multimedia Terminal

- Text and graphics
- Downlink video
- Speech input/output
- Pen input



Video Service to Mobile Clients

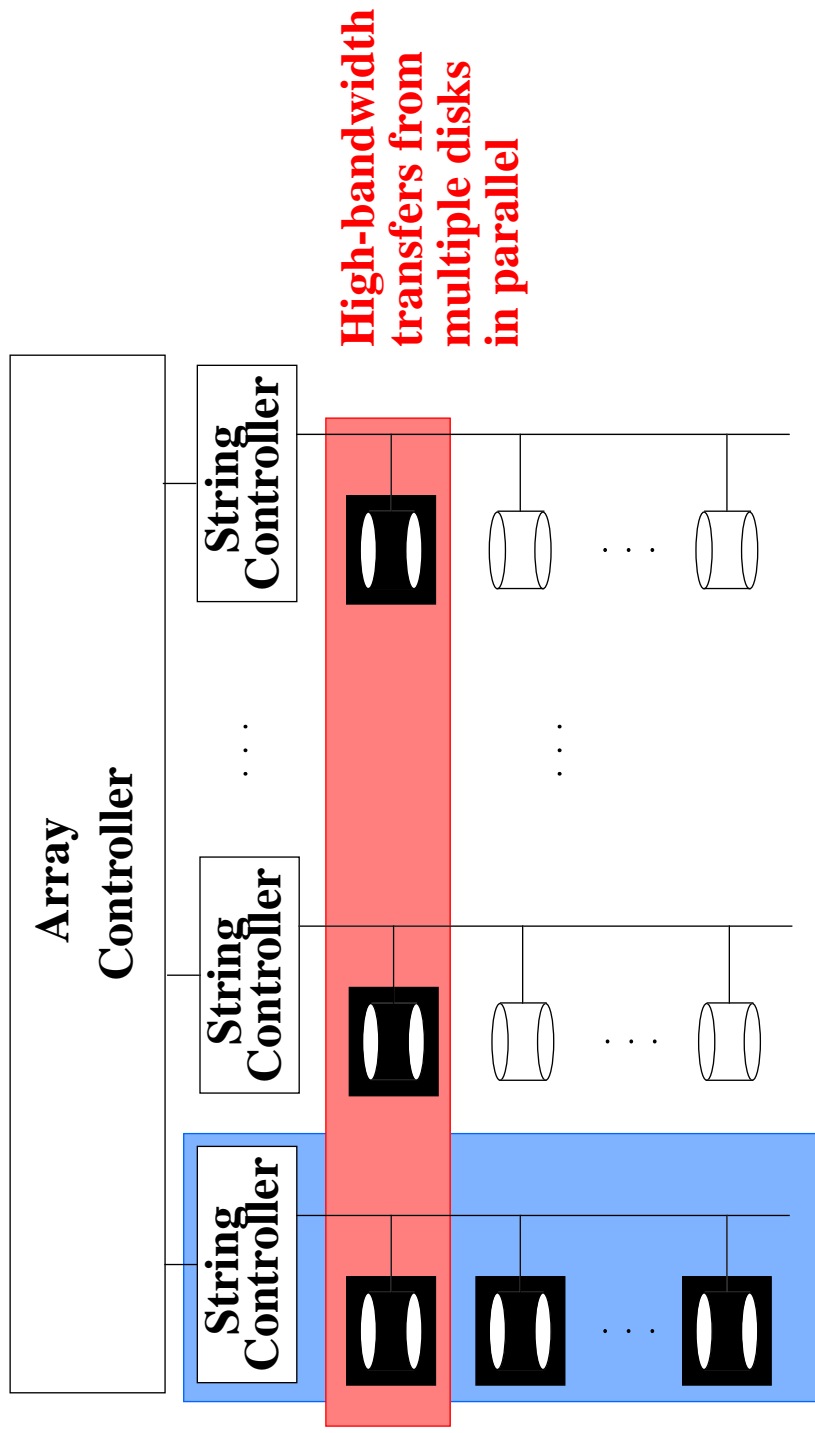
Video File Service

- Disk arrays for high-throughput, high-capacity storage
- Multi-resolution video for heterogeneous clients

Network Services

- Connection-oriented network protocols for performance guarantees
- Connection re-routing for host mobility

High Throughput from Disk Arrays



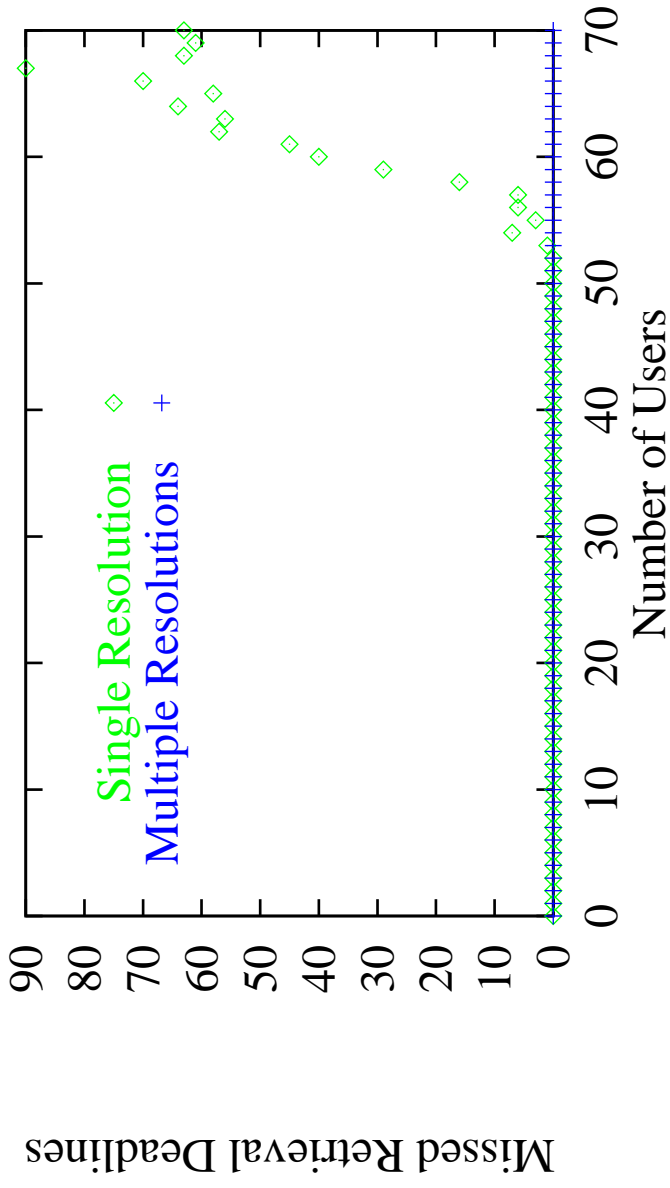
**Concurrent access
by independent
users**

**High-bandwidth
transfers from
multiple disks
in parallel**

Multi-Resolution Support for Heterogeneity

Multiple resolutions of video data stored on server

Data provided closely matches requested QoS parameters



Connections for Multimedia Communication

Multimedia data different than traditional data

- Periodic traffic patterns
- Well-suited for stream-based communication protocols
- Need predictable performance

Bandwidth, delay, delay jitter, packet loss due to congestion

Mechanisms to guarantee performance

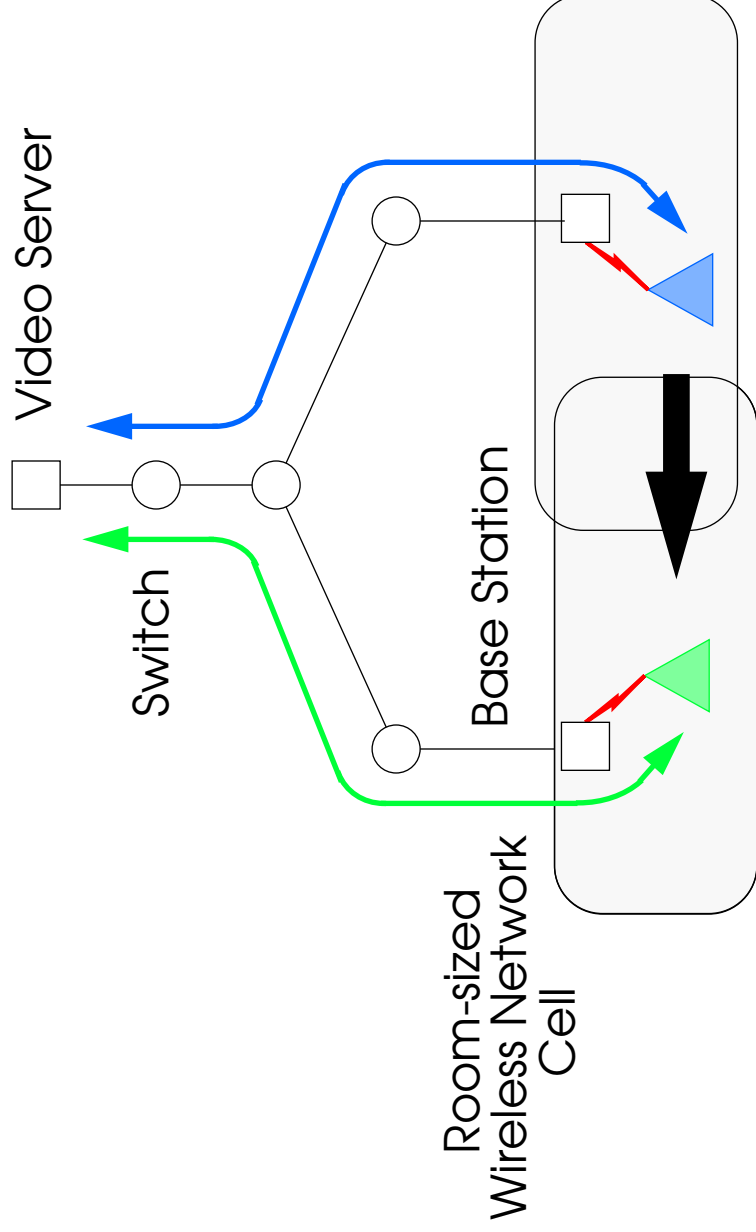
- Per-stream network resource allocation
- Per-stream admission control

Requires connection-oriented network layer protocols

The Connection Handoff Problem

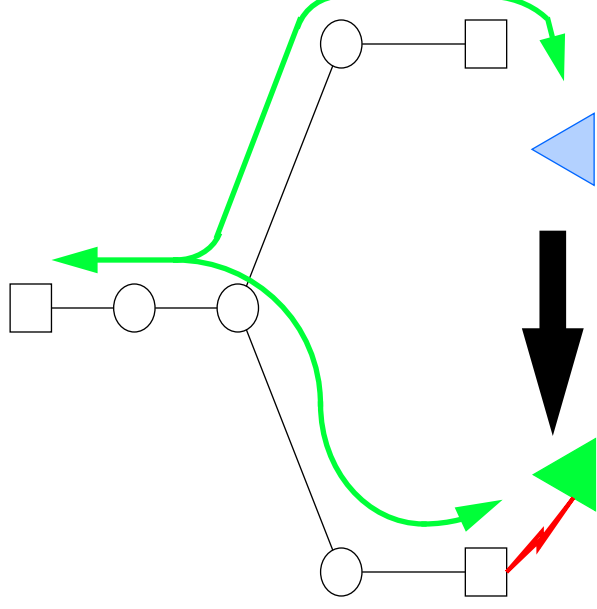
A handoff occurs when a host moves between adjacent cells.

The Handoff Problem: How to reroute network connections during cell transitions?



Multicast-Based Re-Establishment

Make connection modifications local to the cell transition site
Exploit the existing dynamic multicast facilities of a network to support handoff



Provides support for “soft handoff”

Video Service To Mobile Clients

Infopad Overview

Video Service

- Disk array storage for high-throughput, high-capacity storage
- Multi-resolution video data to support heterogeneous clients

Network Services

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- Connection re-routing to support host mobility

Research Issues in Mobile Computing

Architecture: How to divide functionality between the mobile and the supporting infrastructure?

Stateless vs. Stateful: Should the mobile have state?

Applications: How are they different for mobiles?

Communication and networking: What is the right communication paradigm?

Architecture: Division of Functionality

Applications influence requirements for architecture

Video playback application:

- Mobile host is “disconnected-rarely terminal”
- Computation and storage focused in wired backbone infrastructure
- Network responsible for re-routing and maintaining mobile connections

Mobile Host: Stateless vs. Stateful

State kept in mobile host depends on reliance upon wired backbone infrastructure

Video playback application:

- Network state necessary for network connections to mobile host
- Little data state required by playback applications

Video buffering for inter-frame compression and/or display

No consistency problems for read-only data

Display can resynchronize with data stream if necessary

- Display manager state

Mobile Applications

Application mix will be different on mobile hosts and workstations

Mobile applications will require:

- More access to existing data
- Less creation of new data

Video playback application:

- Choice of compression scheme influenced by:

Mobile host compute resources

Wireless link bandwidth constraints

Wireless link error rates

- Client heterogeneity handled well by multi-resolution video storage

Multimedia Mobile Networking

Connection-oriented network protocols

- Provide performance guarantees for multimedia data

Video playback and other information services:

- Require disconnected-rarely (i.e. mostly-connected) operation
- Allow asymmetric communication on wireless link

High-bandwidth downlink channel

Low-bandwidth uplink channel

Host mobility introduces new issues:

- Rerouting of network-layer connections to accommodate mobility
- Maintaining and adapting QoS guarantees across and during cell transitions

What are right semantics for mobile performance guarantees?