Status Report

Equipment Procured

　Sparcstations

　HIPPI Switch

　HIPPI Serial Extenders

　Single- and Multi-Mode Fibers

SunOS port of RCAP completed. Sprite port of RCAP being tested.

SunOS port of RMTP/RTIP in progress, awaiting source code for current version of SunOS.

RAID II in final debugging phases, gearing up for a (non-XUNET) demo in January.

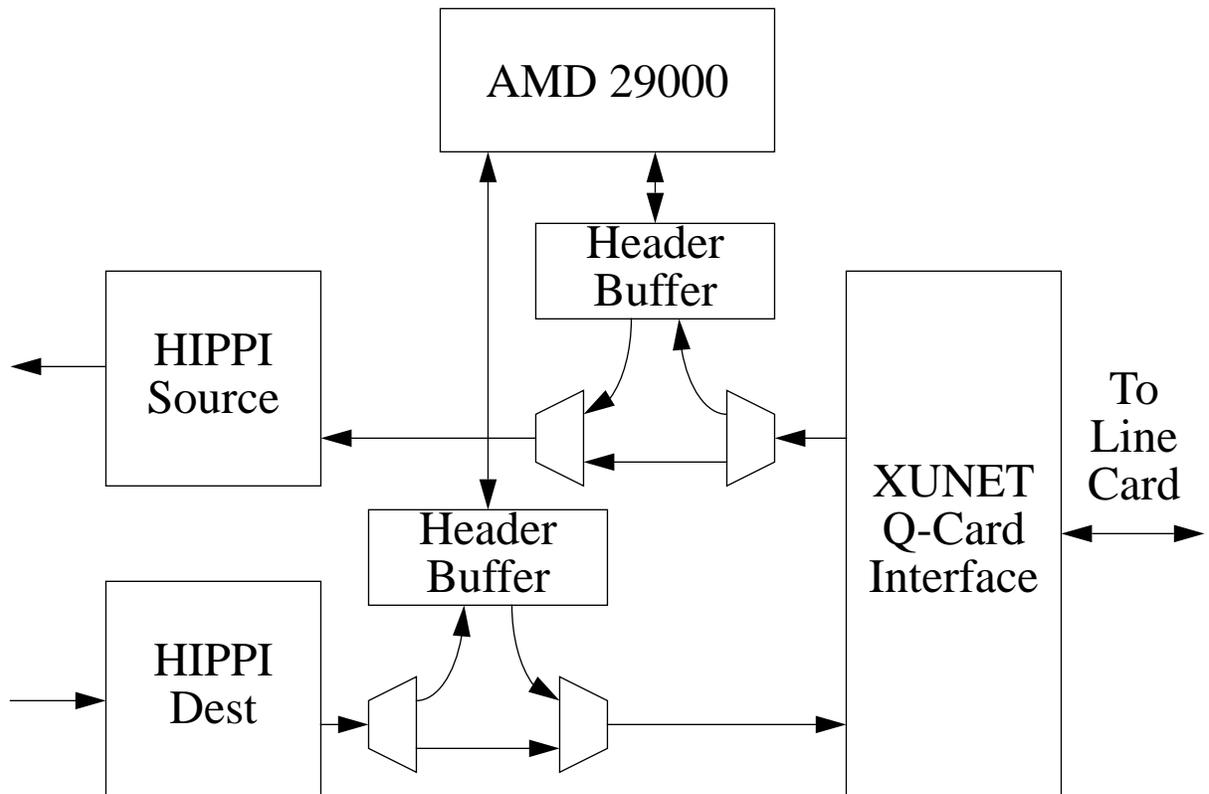Application development in progress.

Next steps:

　Test network connectivity between UCB and LBL.

　RAID II and Sprite port of RMTP/RTIP.

One conclusion already: Separating control and data delivery a big "win" for non-standard host environments (e.g. RAID II).
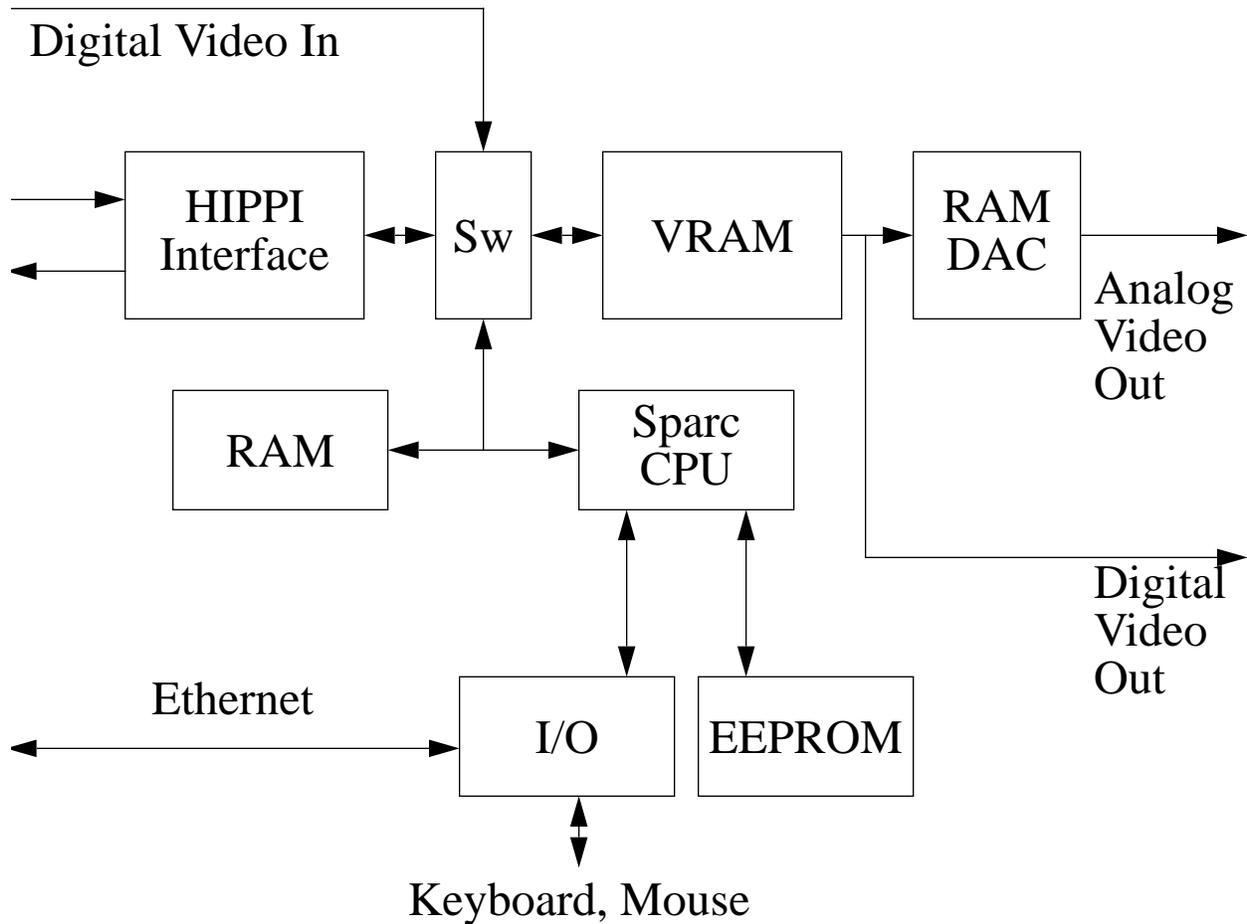
Entities

HIPPI-XUNET Adapter (HXA)

Connects to any XUNET line card.

XUNET 3 segment will use 622 Mbps line card to connect HIPPI segments of network to XUNET 2 ATM switch at UC Berkeley.

Heterogeneity test for Real-Time Protocol Suite.

Entities

Psitech Frame Buffer

```
                    Digital Video In ─────────────┐
                                                  ↓
┌→  ┌──────────┐      ┌────┐      ┌──────────┐   ┌──────┐
│   │  HIPPI   │◄────►│ Sw │◄────►│   VRAM   │──►│ RAM  │──────────►
└◄  │ Interface│      └────┘      └──────────┘   │ DAC  │   Analog
    └──────────┘        ▲                        └──────┘   Video
                        │                                   Out
         ┌──────────┐   │   ┌──────────┐
         │   RAM    │◄──┴──►│  Sparc   │──────────────────►
         └──────────┘       │   CPU    │            Digital
                            └──────────┘            Video
                              ▲     ▲               Out
        Ethernet              │     │
  ◄──────────────────►  ┌─────────┐ ┌──────────┐
                        │   I/O   │ │  EEPROM  │
                        └─────────┘ └──────────┘
                             ↕
                     Keyboard, Mouse
```

Support for real-time communication to/from frame buffer

Real-Time Protocol Suite on Sparc CPU

    Operating system

    Datapath bandwidth

Entities

RAID II (Continued)

Low-bandwidth datapath to host

16 Mbps vs. 800 Mbps

Protocol processing on HIPPI interface processors

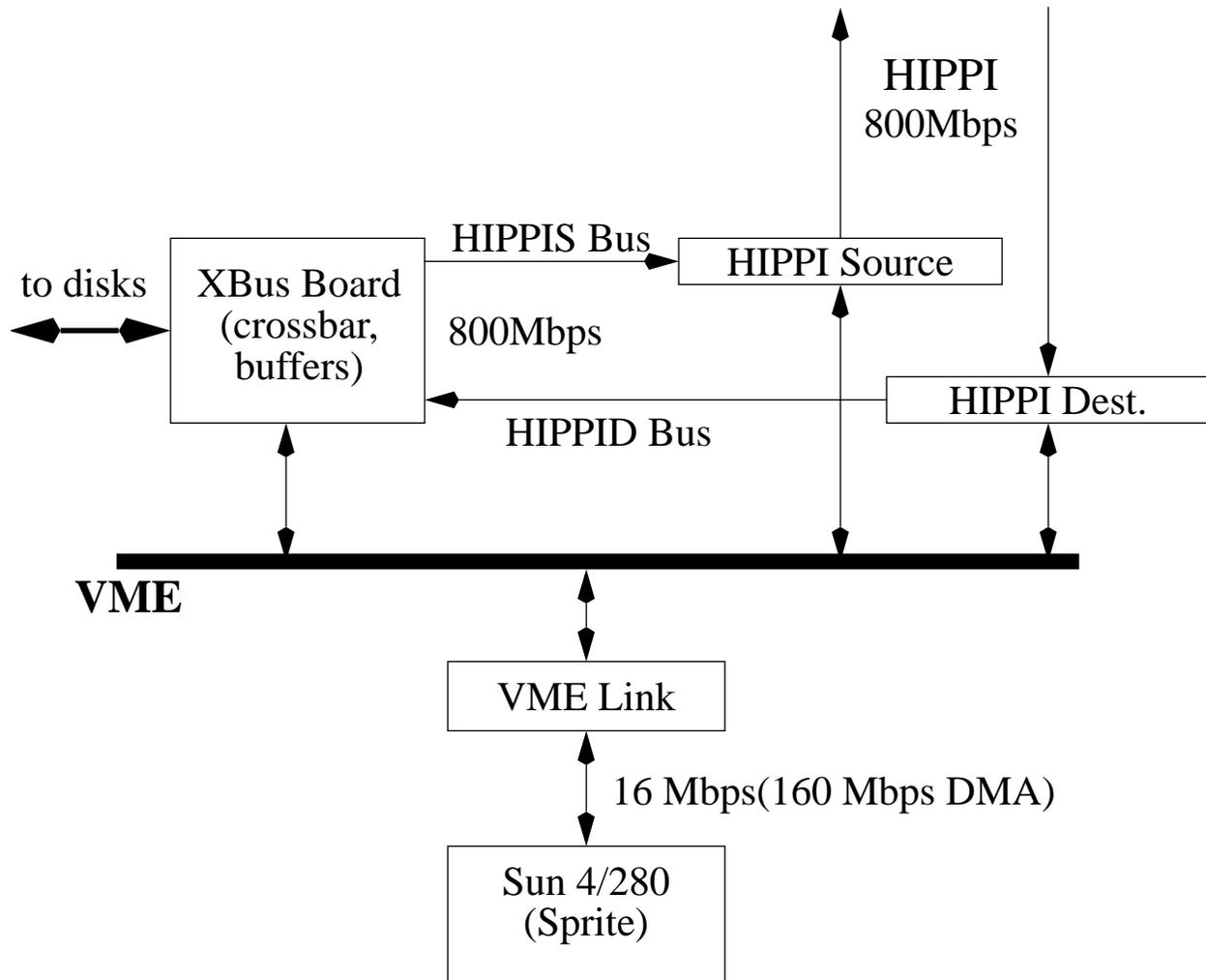Minimal processing if data delivery protocols on host

Network support for filesystem

Some portion of real-time protocols in Sprite kernel

Interface to Sprite filesystem code (LFS and inter-disk striping driver)

Entities

RAID II

A High-Performance Disk Array

HIPPI
800Mbps

to disks | XBus Board (crossbar, buffers)

HIPPIS Bus → HIPPI Source

800Mbps

HIPPID Bus ← HIPPI Dest.

VME

VME Link

16 Mbps(160 Mbps DMA)

Sun 4/280
(Sprite)

Goal: Provide real-time communication for remote filesystem access.

AMD 29K processors on HIPPI adapters

Possible to do protocol processing on outboard processors

Entities

Sun Microsystems Sun 4s and Sparcstations

Workstations equipped with VME and/or SBUS

Chi Systems HIPPI Interfaces

Tenet Real-Time Protocol Suite on SunOS 4.1.3
   Based on existing prototype Suite on DEC Ultrix 4.2A
   Similar network subsystem structure and user environment
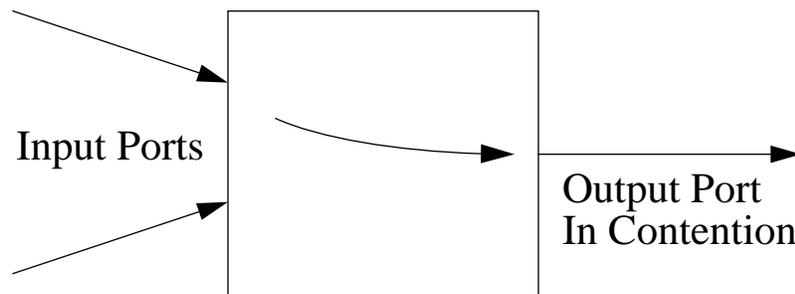
Entities

HIPPI Switches

Input Output Systems Corporation 4x4 Switch

Supports full link bandwidth (800 Mbps) on all ports simultaneously

Blocking due to circuit-switching nature of HIPPI

Need to hold all links on path from source to destination.

"Camp on" feature allows switch to arbitrate among contending ports.

Example of HIPPI Networking: IP over HIPPI (RFC 1374)

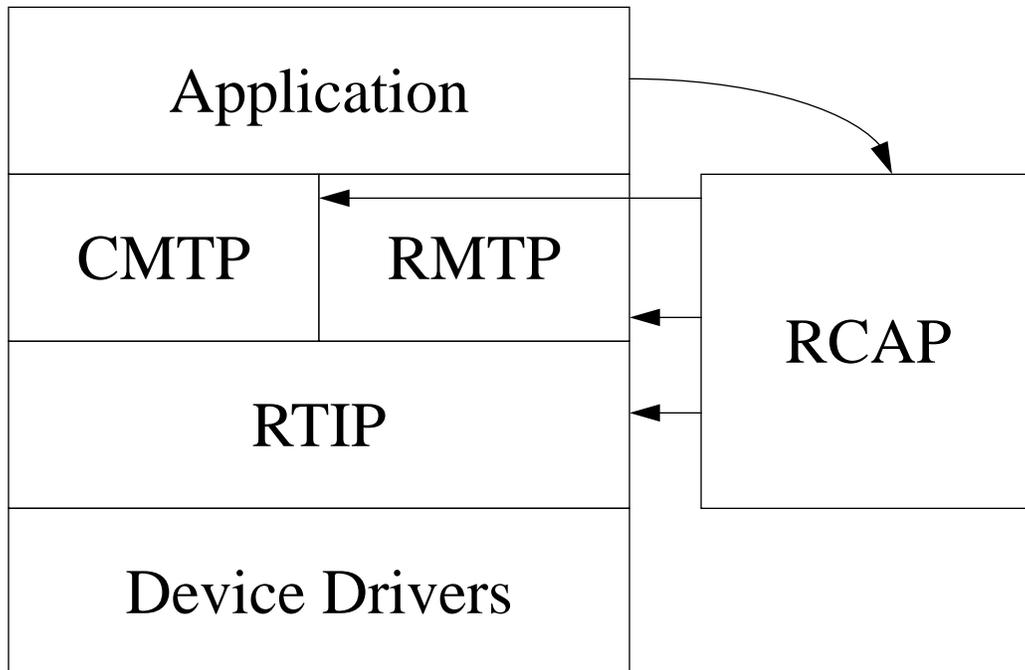Connection per packet

Restrictions on packet size

"Connection scheduling" in switches analagous to packet/cell scheduling in other network switches

Setting up connection per packet in large switching fabric is expensive.

Real-Time Guarantees?

The Network

The Tenet Real-Time Protocol Suite

```
┌─────────────────────────────────┐          ┌──────────────┐
│          Application            │───────┐  │              │
├──────────────┬──────────────────┤   ┌───▼──┤              │
│              │                  │◄──┘      │              │
│    CMTP      │      RMTP        │          │     RCAP     │
│              │                  │◄─────────┤              │
├──────────────┴──────────────────┤          │              │
│              RTIP               │◄─────────┤              │
├─────────────────────────────────┤          └──────────────┘
│         Device Drivers          │
└─────────────────────────────────┘
```
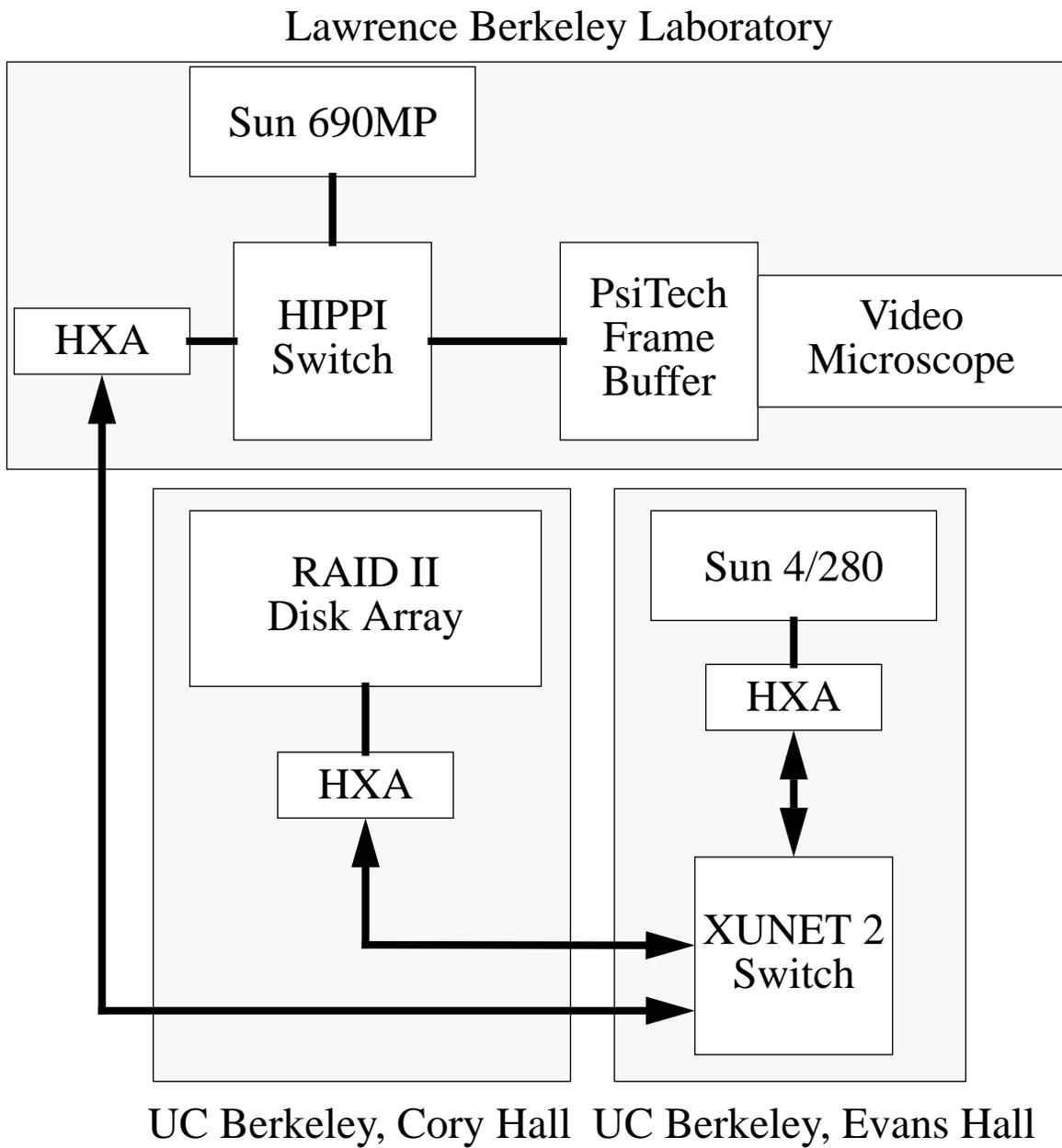
Continuous Media Transport Protocol (CMTP)

Real-Time Message Transport Protocol (RMTP)

Real-Time Internet Protocol (RTIP)

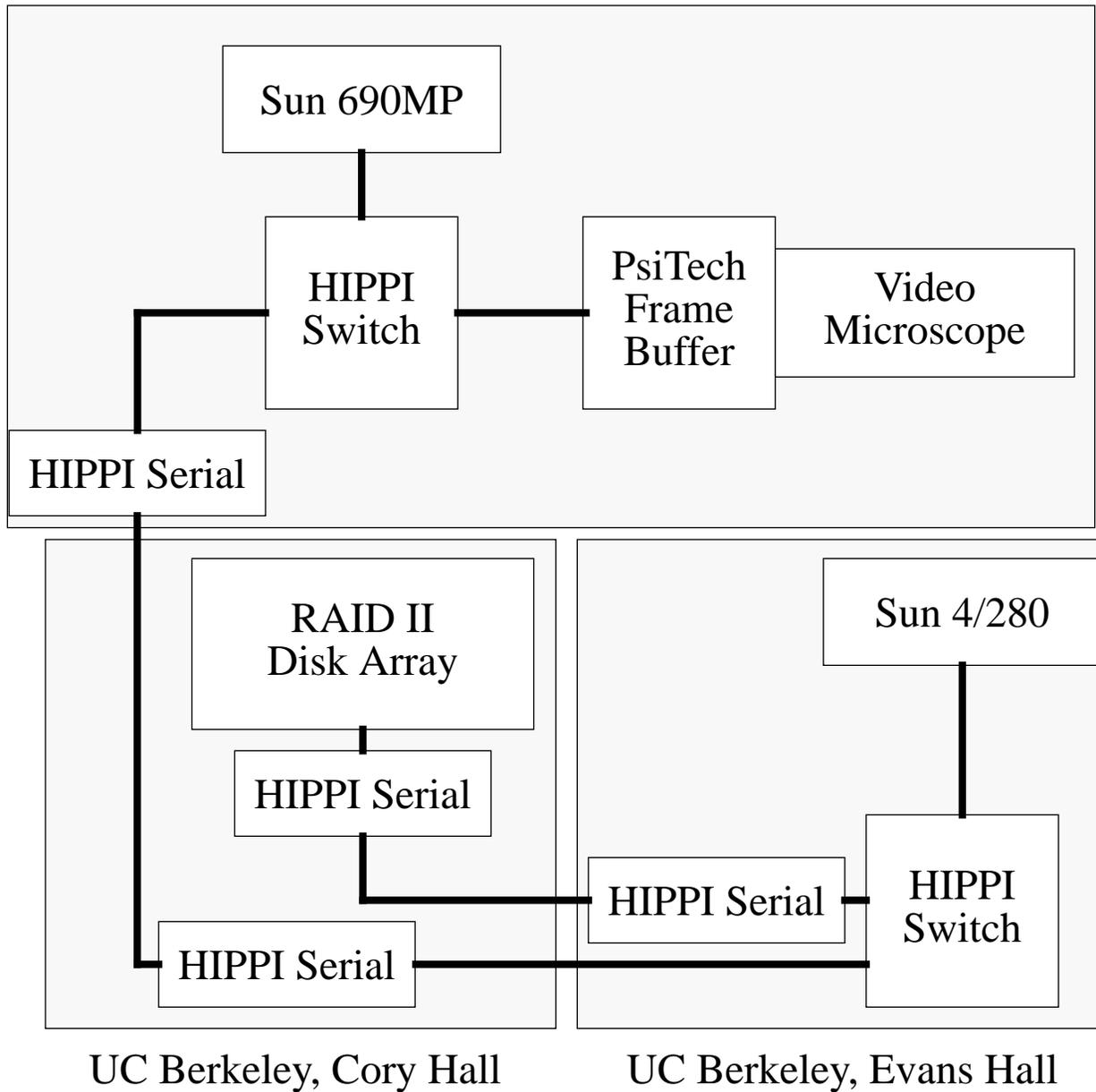Real-Time Channel Administration Protocol (RCAP)

The Network

Example Topology II

Lawrence Berkeley Laboratory

UC Berkeley, Cory Hall UC Berkeley, Evans Hall

The Network

Example Topology I

Lawrence Berkeley Laboratory

Sun 690MP

HIPPI Switch

PsiTech Frame Buffer

Video Microscope

HIPPI Serial

RAID II Disk Array

HIPPI Serial

HIPPI Serial

Sun 4/280

HIPPI Serial

HIPPI Switch

UC Berkeley, Cory Hall

UC Berkeley, Evans Hall

The Network

High Performance Parallel Interface (HIPPI)

800 Mbps, 32-bit parallel, point-to-point links

Circuit Switching

   No buffers in switches

   Low latency (propagation time)

   Output port blocking for connection lifetime

Physical Limitations

   25 meter maximum link length

   50 meter cables available

Serial-HIPPI

   Industry-developed standard

   Serial fiber or copper for long distances

Goals

Facilities

Provide a high-speed data path between UC Berkeley and Lawence Berkeley Laboratory.

Research

Tenet Real-Time Protocol Suite on a HIPPI Network

Investigate performance of Protocol Suite at "gigabit speeds"

Implementation on non-traditional host architectures

Applications

Real-time transfer of video/animation

High-bandwidth transfers to/from RAID II

Synopsis

The Goals

The Network

Entities: Challenges and Problems

HIPPI Switches

Sun 4 and SparcStations

RAID II

Psitech Frame Buffer

HIPPI-XUNET Adapter (HXA)

Status Report

The XUNET 3 High-Speed Networking Testbed

Bruce A. Mah
`bmah@tenet.berkeley.edu`

The Tenet Group
Computer Science Division
University of California at Berkeley
and
International Computer Science Institute

Hitachi-Tenet Meeting
11 December 1992