Challenges & Opportunities for Distributed Collaboration

Workshop on Advanced
Collaboration Environments
(August 6, 2001)

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Outline

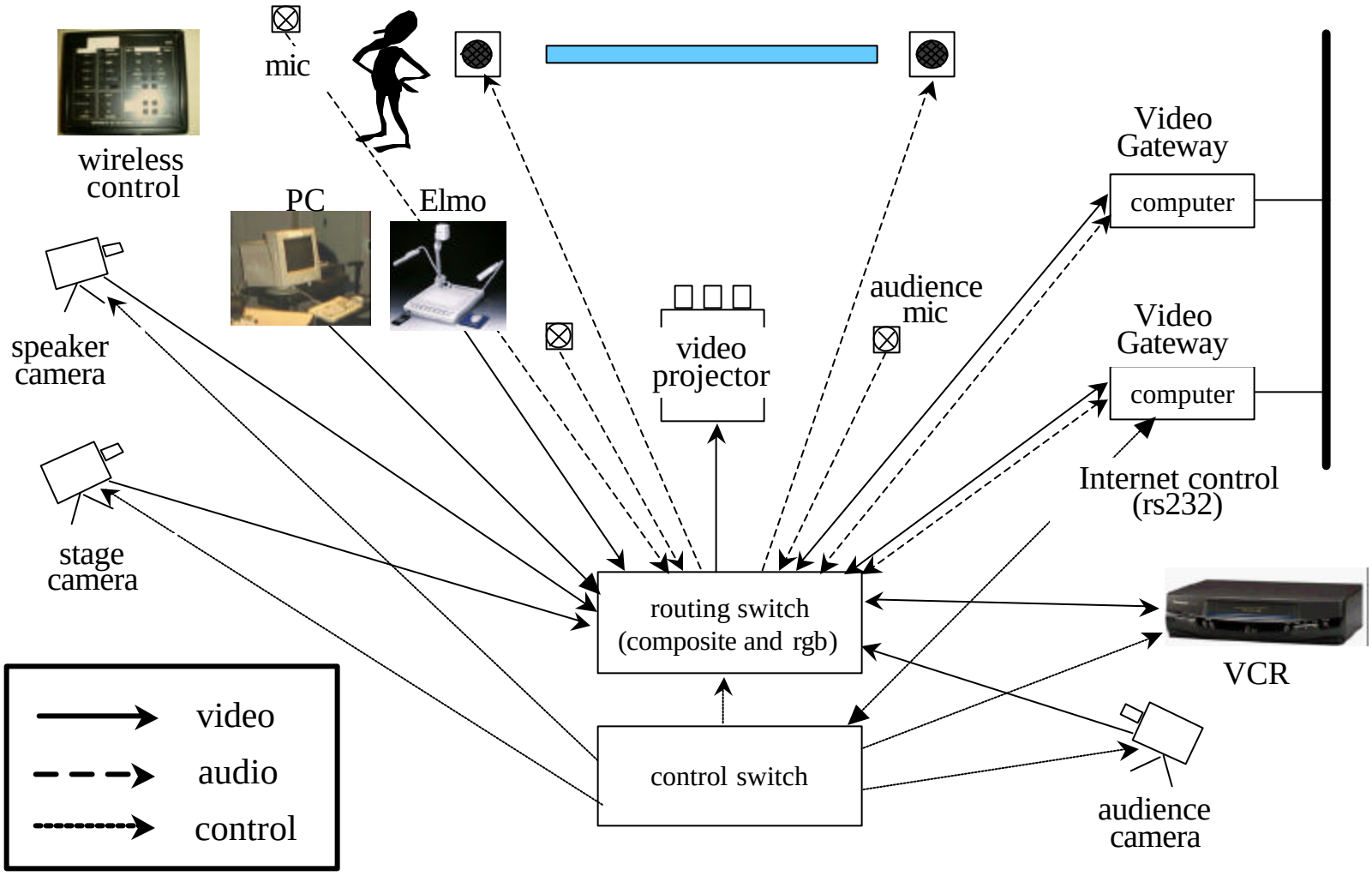
- Background
- Challenges
- Opportunities
- Open Mash Open Source Project

Internet Webcasting

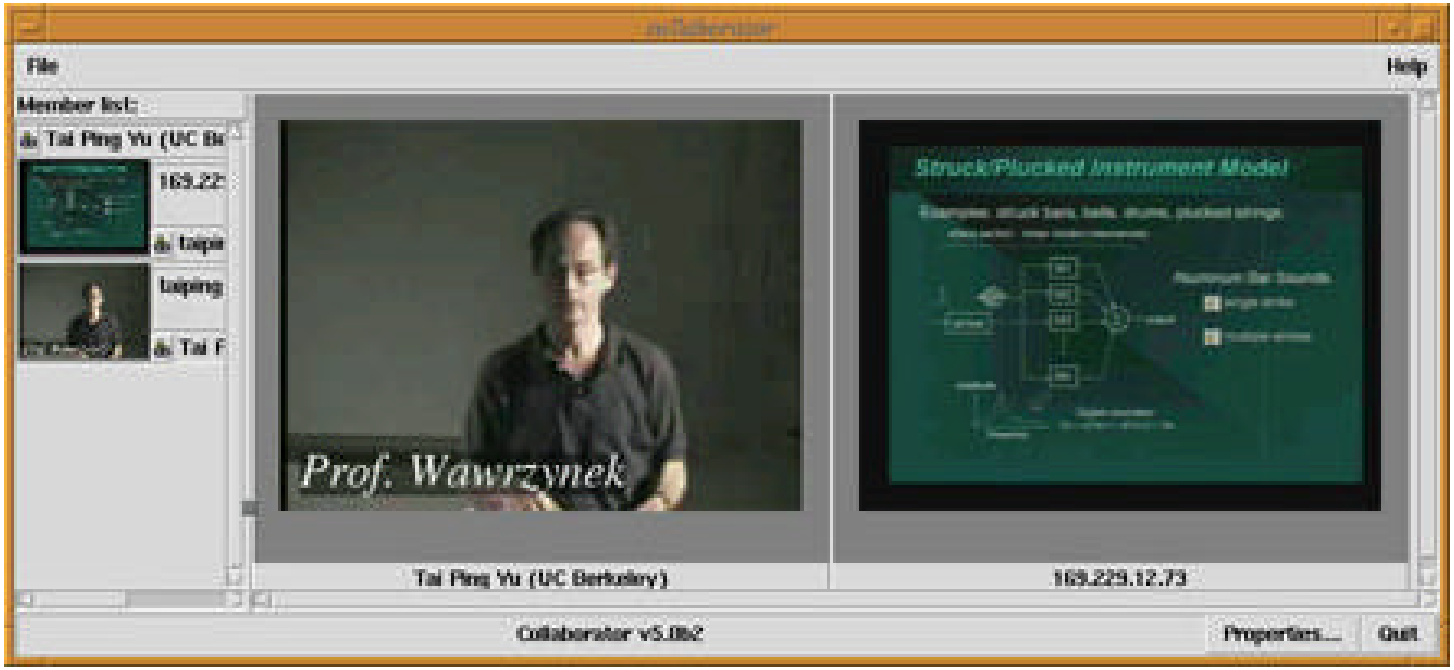
- Berkeley MIG Seminar
  - Weekly seminar webcast on Mbone since Jan ’95
  - Multiple streams
    - *Speaker + content*
  - Multiple transmissions
    - *Low and high bit rate Mbone webcast and Real Networks webcast*
- Mbone production tools
  - Use *vic*, *vat*, etc. for streaming
  - Developed tools to improve production quality
  - Developed infrastructure and tools to reduce cost and effort to produce webcasts

http://bmrc.berkeley.edu/courseware/mig

A/V Design


wireless control
mic
PC
Elmo
speaker camera
stage camera
video projector
audience mic
Video Gateway
computer
Video Gateway
computer
Internet control (rs232)
routing switch (composite and rgb)
control switch
VCR
audience camera
video
audio
control

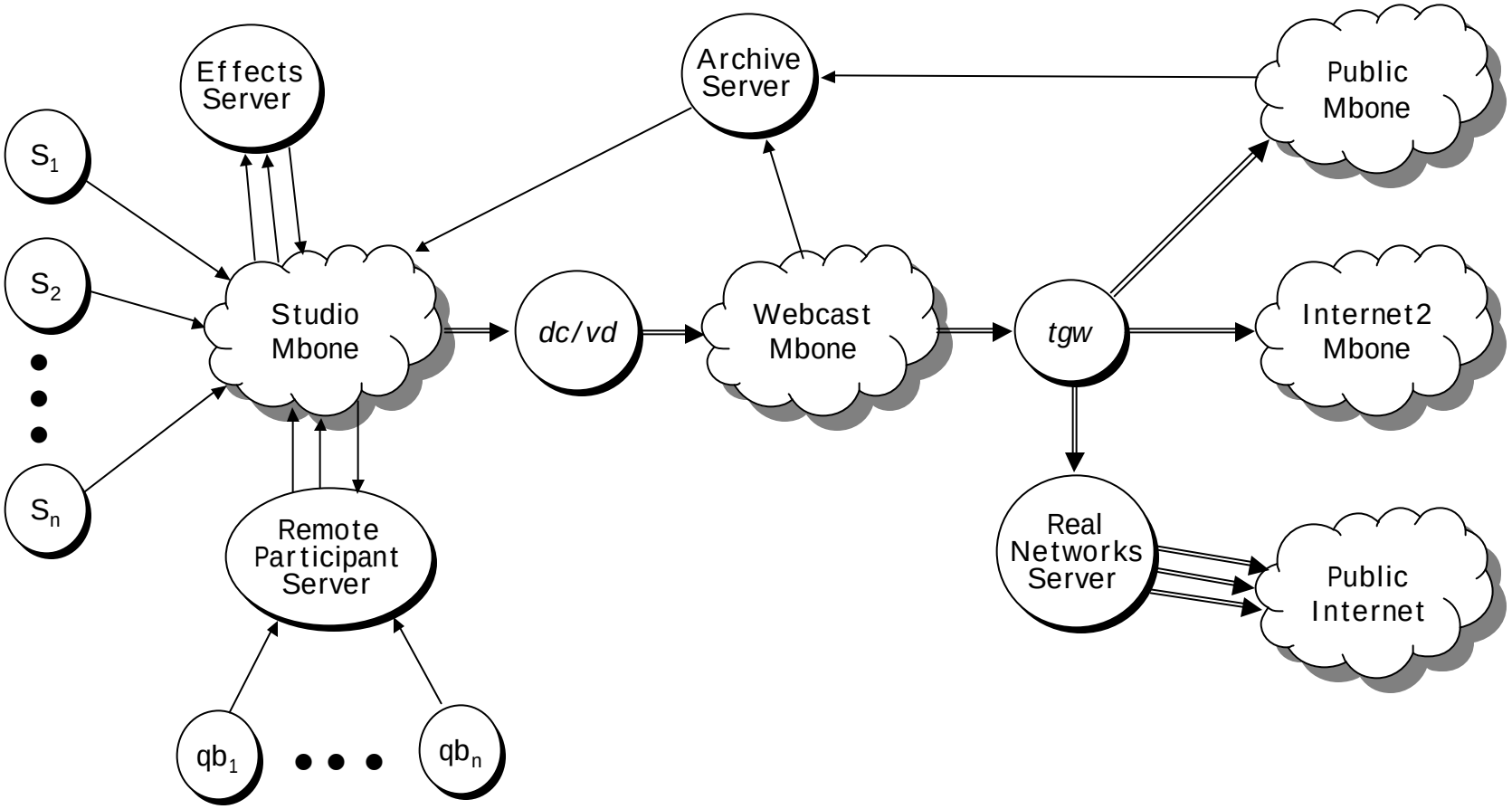
Remote View of Webcast



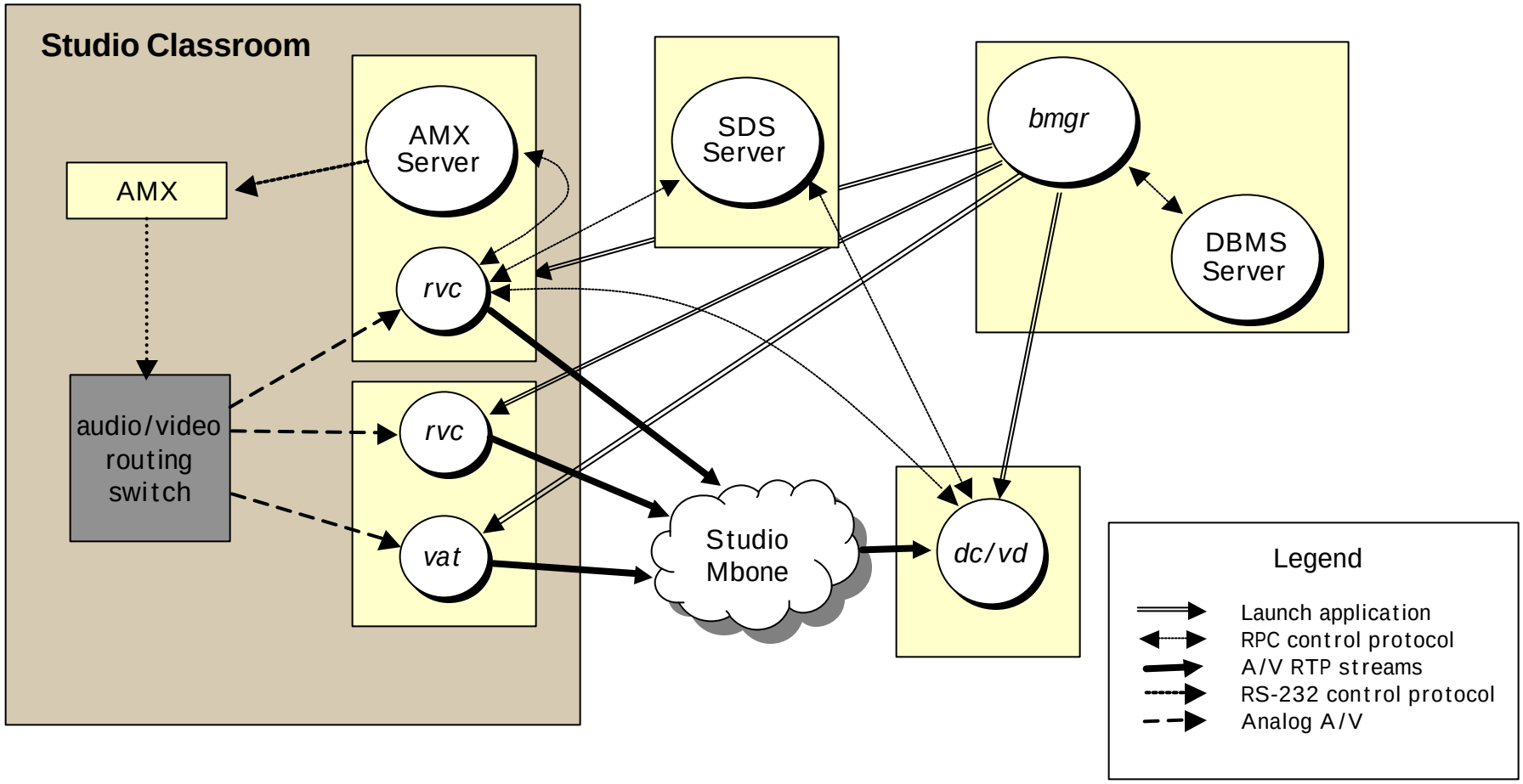
How to Control Equipment?

- Must have computer interface to equipment

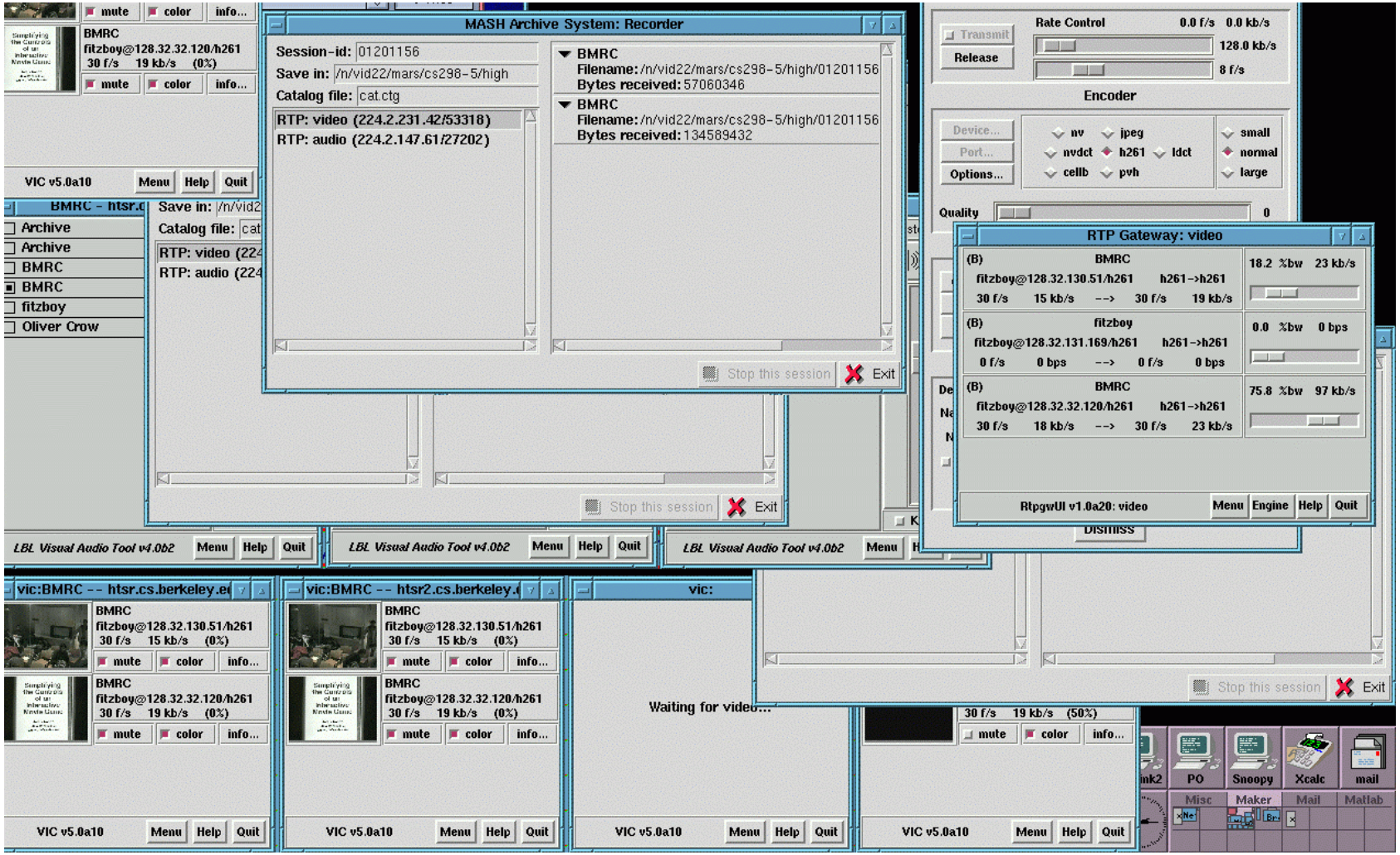
Webcast Production Architecture



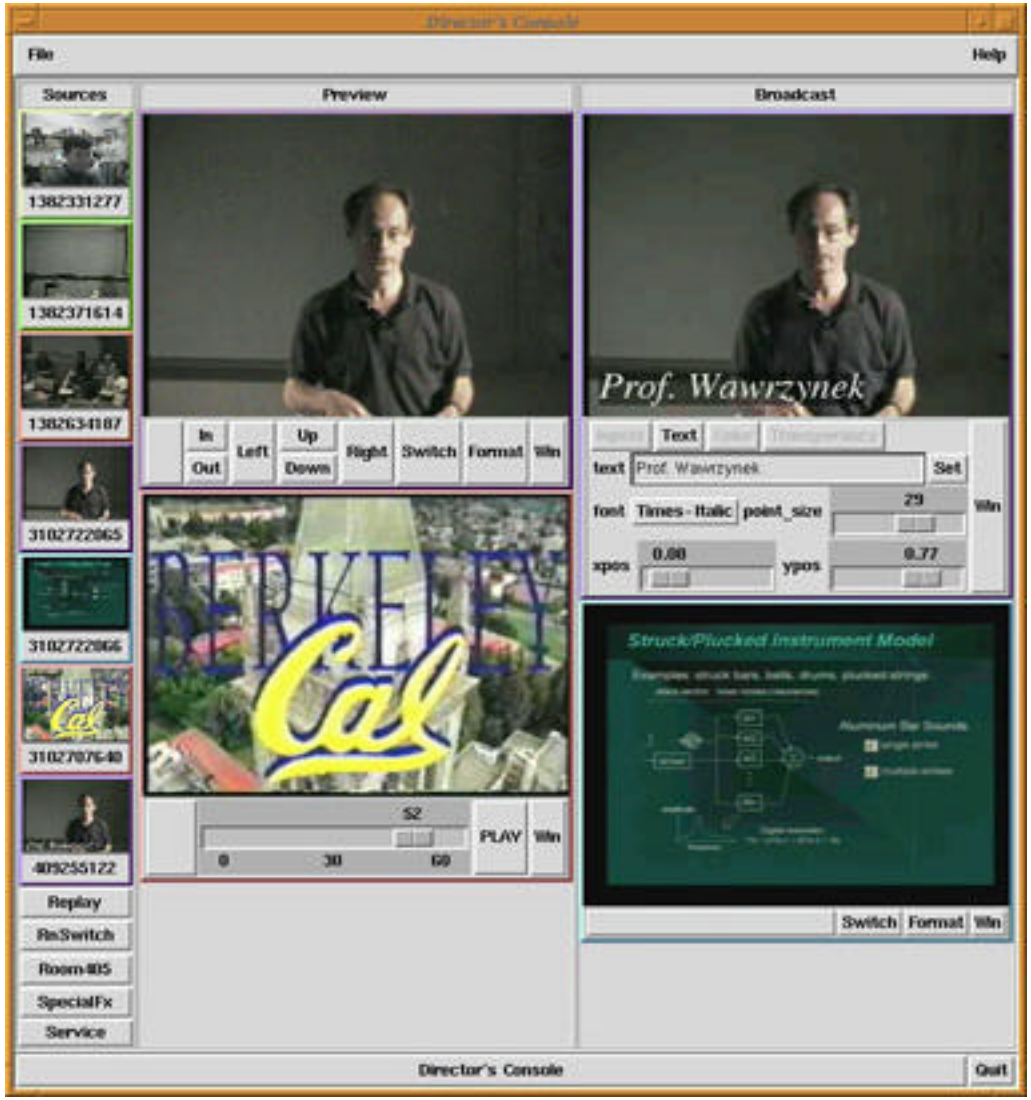
Software Architecture



Screen Dump of Webcast Operator



Director's Console



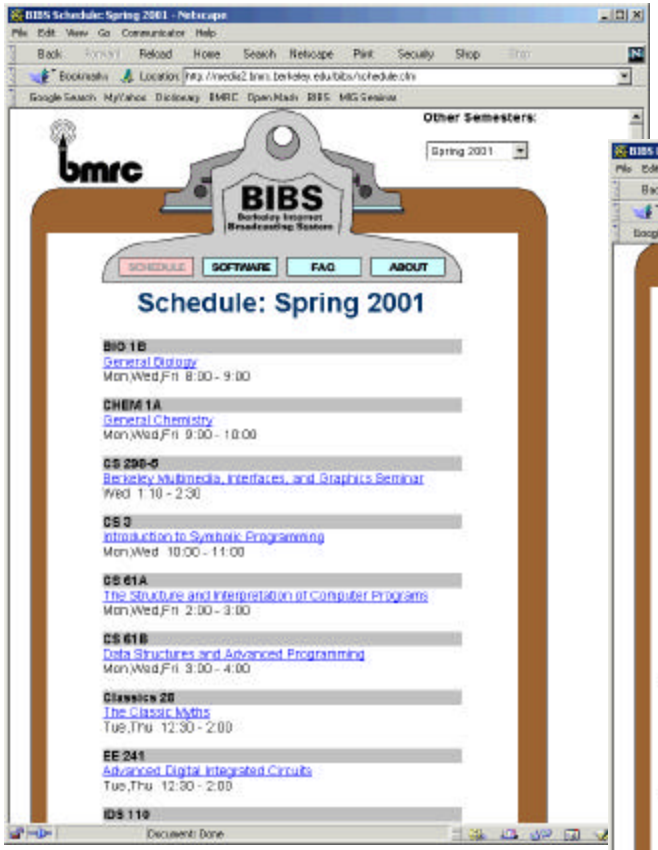
- Client/server model
- Lists available sources
- Shows current stream(s) in webcast
- Controls to manipulate stream (e.g., move camera or position stored media)
- Extensible interface to support new sources and controls
- Goal is to automate

Berkeley Internet Webcasting System (BIBS)

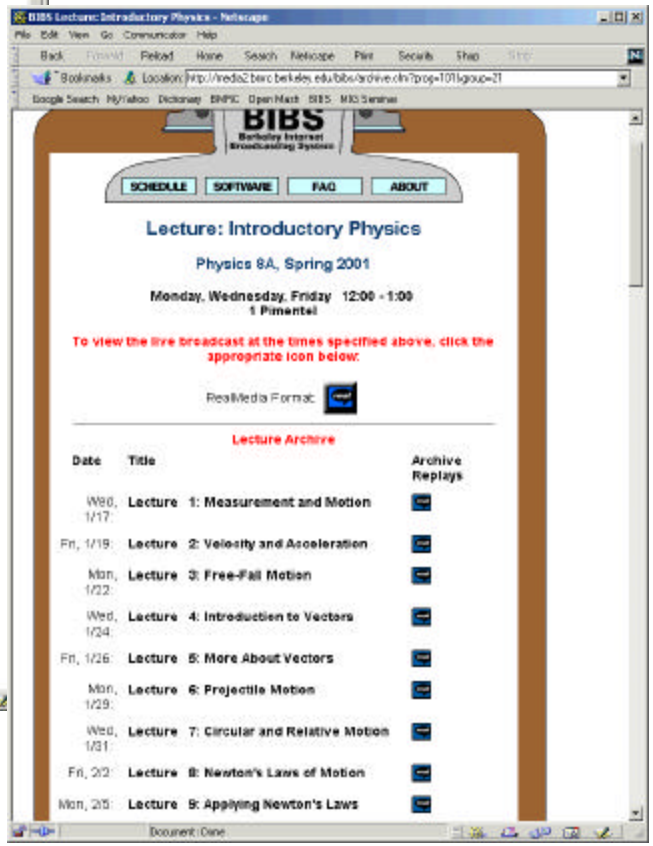
- Extend webcasting system to regularly scheduled classes on campus
  - Tried Mbone webcasts but failed
    - *Multicast problems and lack of Windows playback tools*
  - Switched to RN and succeeded beyond expectations
- BIBS Spring 2001
  - 15 classes with >4.5K students enrolled
  - 35 hours of original material each week
  - 20K lectures played each month
  - Used for on-demand replay to study for exams

http://bmrc.berkeley.edu/papers/bibs-report.html

BIBS Electronic Program Guide (EPG)

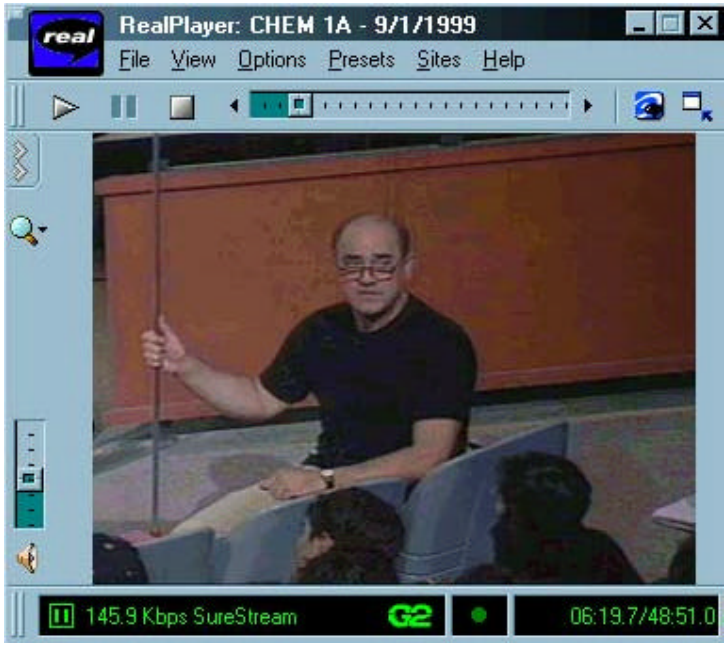


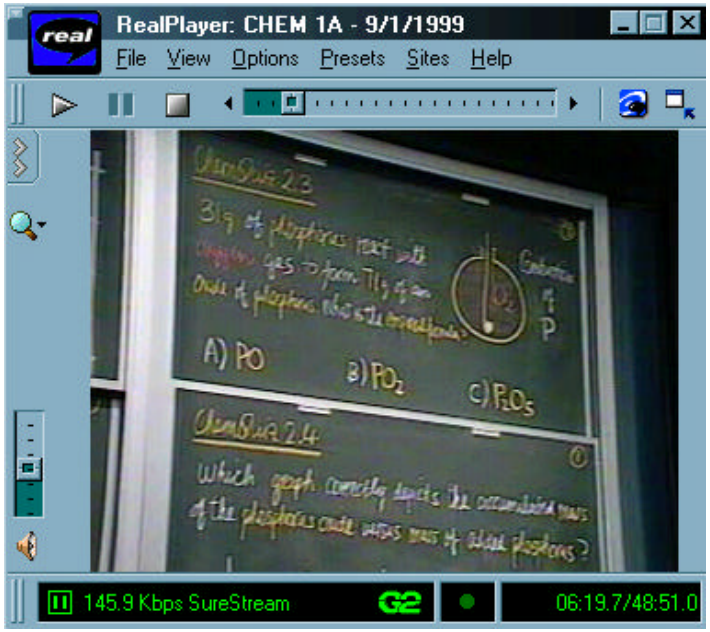
Schedule Page



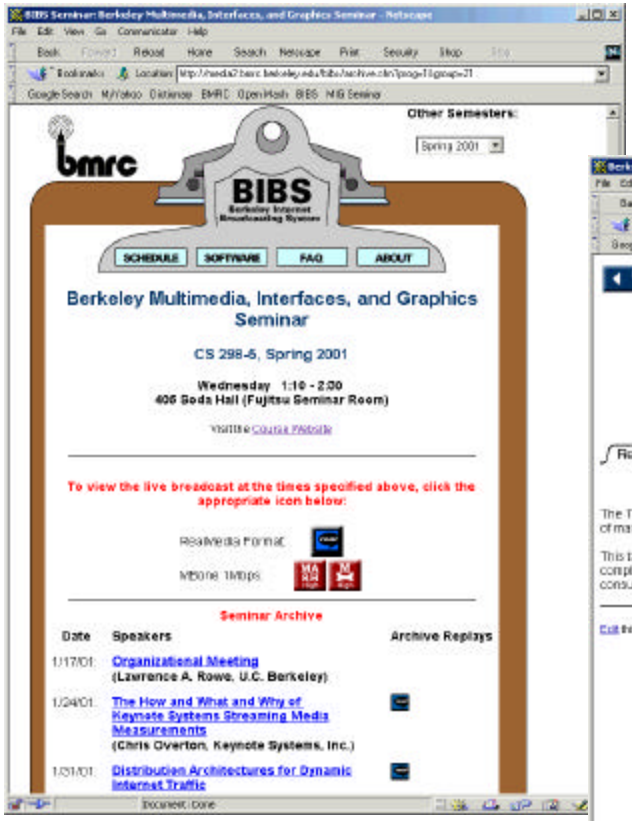
Class Lectures Page

Client Viewer





Berkeley MIG Seminar



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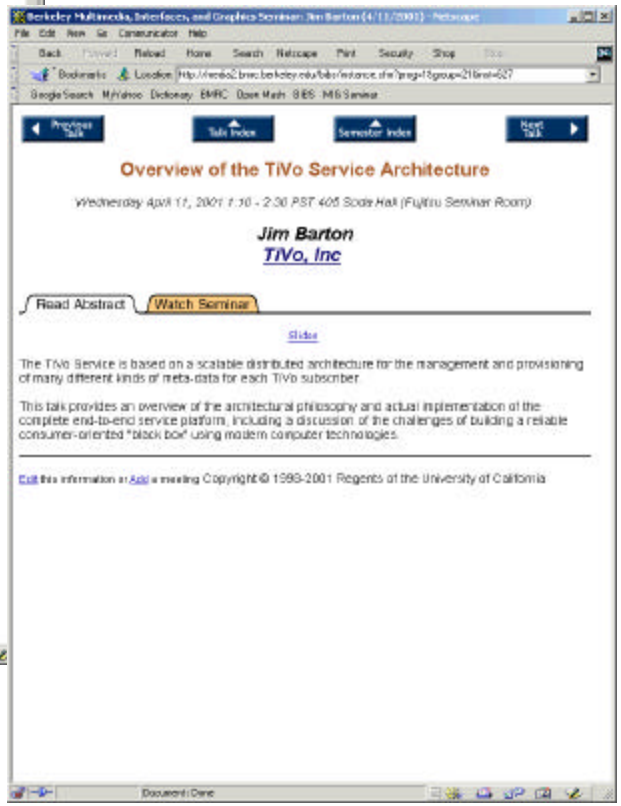
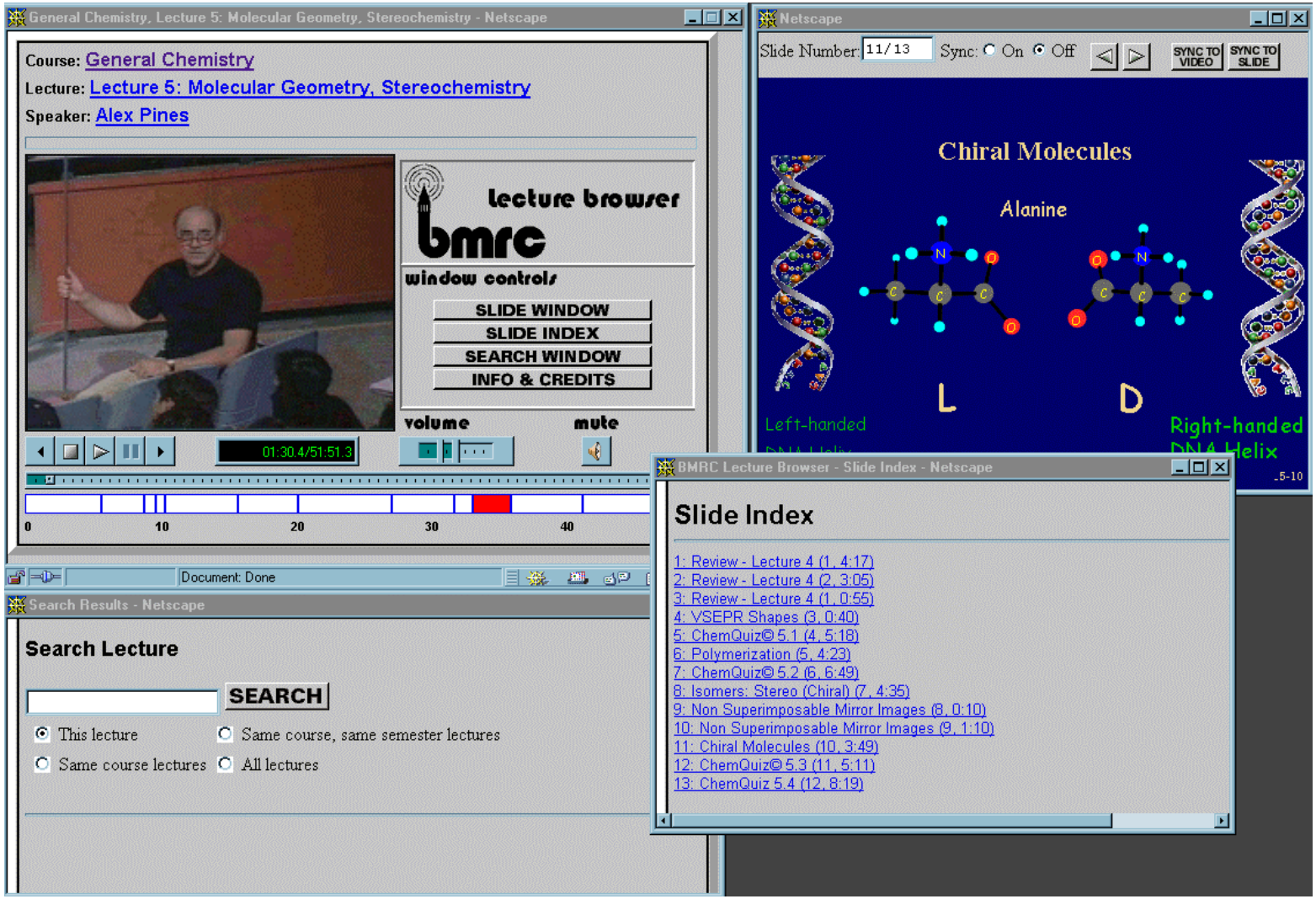
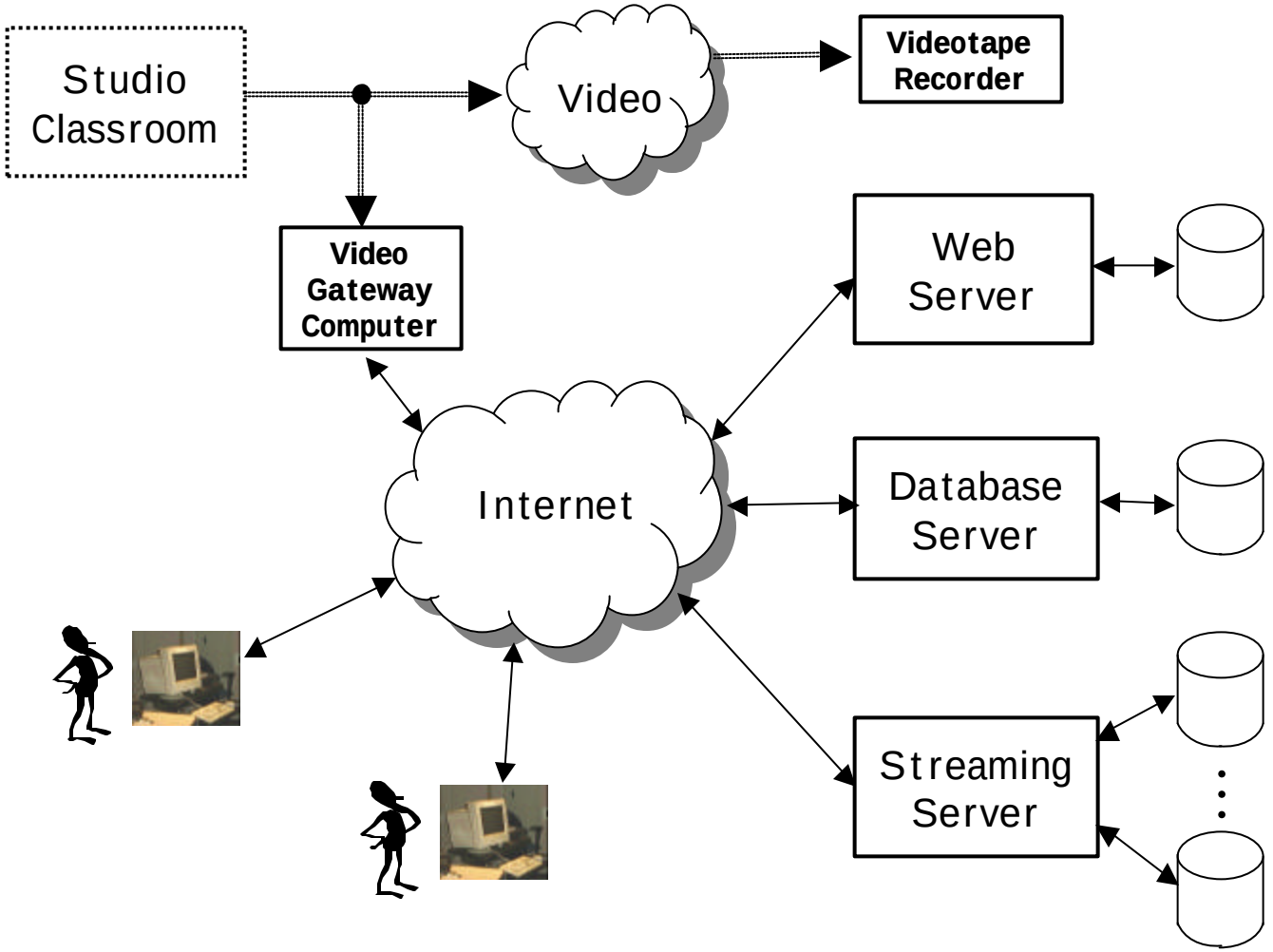


Seminar Lecture Page

Berkeley Lecture Browser



BIBS System Architecture



What is the "Killer App?"

- Access – web-enabled convenient sharing of data [publishing]
- Teamwork – shared data/apps with communication [collaboration]
  - Synchronous –vs- asynchronous
  - Data visualization and mining

What Lessons are there for Distributed Collaboration?

- Challenges
  - Improve experience
  - Reduce operational problems
  - Lower costs
- Opportunities
  - Declining cost for hardware and bandwidth
  - Exploit intelligent software
  - “Systems solution” thinking

Improve Experience

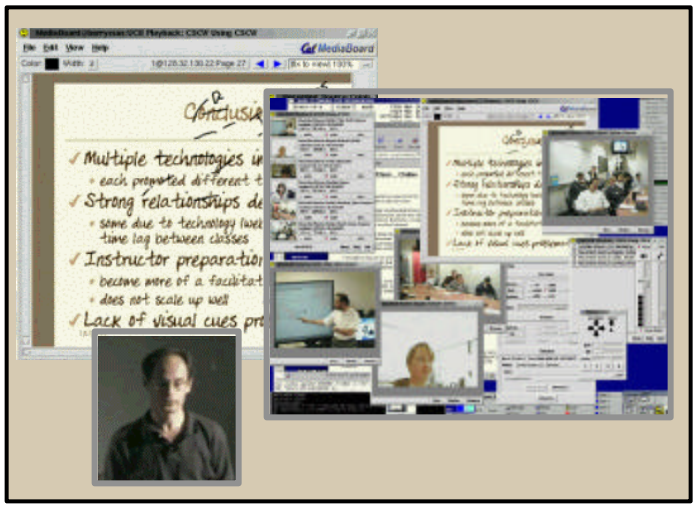
- Improve audio/video
  - Higher quality audio, video, and images
    - *Improved codecs, stereo/surround sound audio, RTPtv, etc.*
  - Issue: how to automate resource mgt & control?
    - *Size & placement of windows on display*
    - *Audio levels and thresholds*
    - *Communication bandwidth (think SDTV and HDTV streams)*
- Seamless interaction
  - Convenient access to shared material and objects
    - *"Put that there," incorporate portable wireless input devices, etc.*
  - Room & interaction control
    - *Location-independent room control devices*
  - Conversational cues
    - *Eye gaze, turn-taking and signaling (software assist?), sense of presence, etc.*

Interaction Example

AG Node Projected Display

Video Image of Remote Site Projected Display

Display After Click-Drag-Drop



1. Click on window in video
2. Drag to open area
3. Drop it
4. System invokes process and window on local screen
   - *Shared app => launch local copy and join*
   - *Non-shared app => launch local copy and set config (e.g., web browser with URL)*
   - *Non-shared app => open VNC window to remote app*

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Operational Issues

- Simplified operation
  - "One button" operation
    - *User can open a door and turn on the lights, but not much more*
    - *Note: AG "one click" join conference is a great example!*
  - Self diagnose problems
    - *Audio doesn't work (i.e., no sound, low/high levels, etc.)*
    - *What automatic maintenance could be done at 3 AM to test remote AG node?*
    - *Note: multicast beacon technology is a great example!*
  - Should AG node computers be located in conference room/lab?
- Support multiple types of nodes
  - Personal desktop, conference room, open lab, small/large classroom, etc.

Opportunities

- Declining cost of hardware
  - "God's on our side" => rooms cheaper over time
  - Still need very low cost entry node (<$10K)
    - *Desktop with 2-3 flat panel displays, speaker, mic (headphones?), and camera*
- Intelligent software and "systems solutions"
  - Think complete solution, not components put together by experts
    - *One button to turn on all equipment – maybe a rocker switch on the wall – software auto-launches on equipment and configures for collaboration (e.g., maybe join session with entrance room of random people/locations)*
  - Remote management of all equipment in room?

Opportunities (cont.)

- Mobile AG nodes

  Similar to Paulos/Canny Personal Roving Presence (PRoP) devices (see www.prop.org)

- Audio/Video MUD/MOO

  Xerox PARC Jupiter experiment was cut short…

- Sketching/collaboration tool

  PPT is great for formal presentations, but how do you

  Pull-up a blank sheet

  Sketch on it

  Allow other people to mark-up the page

  Save the final result & the sequence of operations

  Mash MediaBoard is a good foundation

Open Mash Project

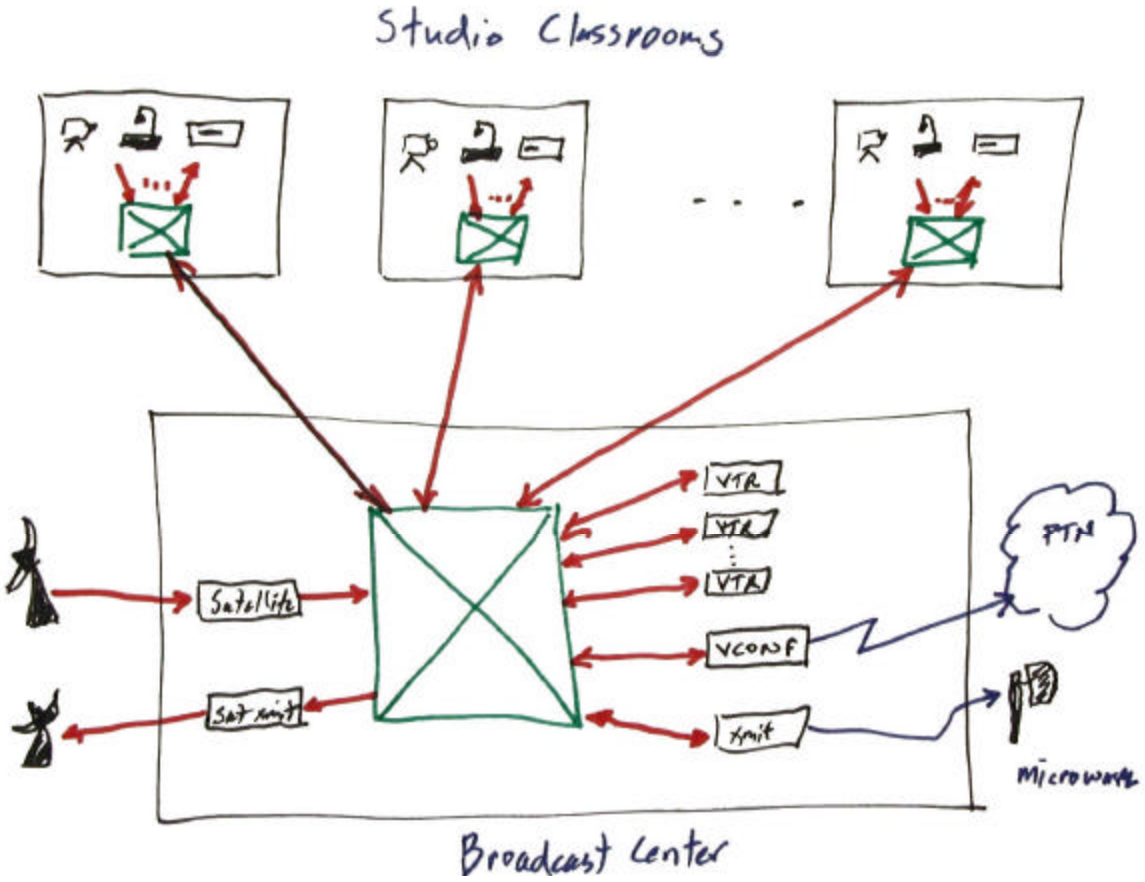
- Public domain, open source project
  - Support, development, documentation and training for Mbone tools => started with Mash software
  - Binary and source distributions
    - *Platforms: Sparc, PC Unix, Windows*
  - Source forge project
- Webcasting tools
  - *vic, vat, nsdr, dc/vd, rvc, bmgr, tgw, mb, mplug, as/1, mars,* etc.
  - RTPtv – production quality TV over Internet
    - *D1 (59.94 fields ps)/CIF (30 fps) images at 2.5-25 Mbs*
    - *Stereo Linear 16 audio at 16-48 KHz*
    - *Requires low cost mpeg board for Linux box ($400)*
    - *Open Mash modified to play video streams*

Development Projects (AY '02)

- RGB capture tool
  - Hardware board that will digitize RGB directly
  - Integrate with *vic*
  - Explore development of custom codec
- Improved headless *vic* (*rvc, rvic*)
  - Play still image, titling, etc.
- H.263 video codec (mpeg?)
  - Add heuristics to existing code
  - Goal: full-sized images, good quality at 500-800 Kbs
- 16-bit audio support and mp3 codec
  - Modify core abstractions so we can build reasonable combined audio/video player with a/v synch
- Video explorer
  - Interface to browse multiple video sources, map source to different sessions, rapidly join/leave sessions, PVR recording, etc.

Example Video Distribution Network

How do you browse the video streams
to see what is happening?



Development Projects (cont.)

- Explore new middleware standards initiatives
  - NSF, Internet2, Grid, MS, Corba, etc. are advocating development of middleware
  - Streaming media toolkits need to participate, but what is the appropriate standard?
- Some comments…
  - ITU & IETF defines standards for codecs and transport
    - *H.26x, H.72x, H.32x, RTP, RTSP, SD/SAP, etc.*
    - *Need standard for media storage and meta files*
  - SOAP/xmlRPC fits well with TclDP we use for low-performance control RPC
  - Has CORBA's time finally come?
  - Middleware services must include multicast services
    - *Announce/listen protocol, multicast transport (reliable/unreliable, single-/multiple-source), external device control services, etc.*

Summary

- AG/VRVS are are just the beginning
- Must build system as easy to use and as reliable as a telephone, TV, etc.
  - “Systems solutions” that sense and adapt
  - Automated systems that work “well enough” are acceptable for many situations
- Add services
- More nodes
- More events