

Middleware for Distributed Multimedia Control

AG Workshop
(March 4, 2002)

Lawrence A. Rowe
Berkeley Multimedia Research Center
University of California at Berkeley
<http://bmrc.berkeley.edu/~larry>

Outline

- AG Opportunities and Problems
- Open Mash Developments
- Remote Control of Resources
- Automated Operation
 - AG Conferences
 - Webcasts

AG Opportunites and Problems

- Improved quality
 - Higher quality visual images and sound
 - Seamless collaboration (e.g., floor control and app sharing)
- Reduce cost/complexity of operation
 - Automate operation at node – no operators!
 - Enter room, turn-on lights, join session(?), and go
 - Auto diagnose problems (a/v working?)
- Improved security
 - Authenticated access and encrypted media transport
- Ubiquitous access
 - Access from anywhere using any device (e.g., phone, pda, laptop, desktop, conf room, etc.)
 - Distributed work groups that come and go 24 hours a day
- Fix multicast!

Outline

- AG Opportunities and Problems
- Open Mash Developments
- Remote Control of Resources
- Automated Operation
 - AG Conferences
 - Webcasts

Open Mash Developments

- Release 5.2
- Current developments
- What's next

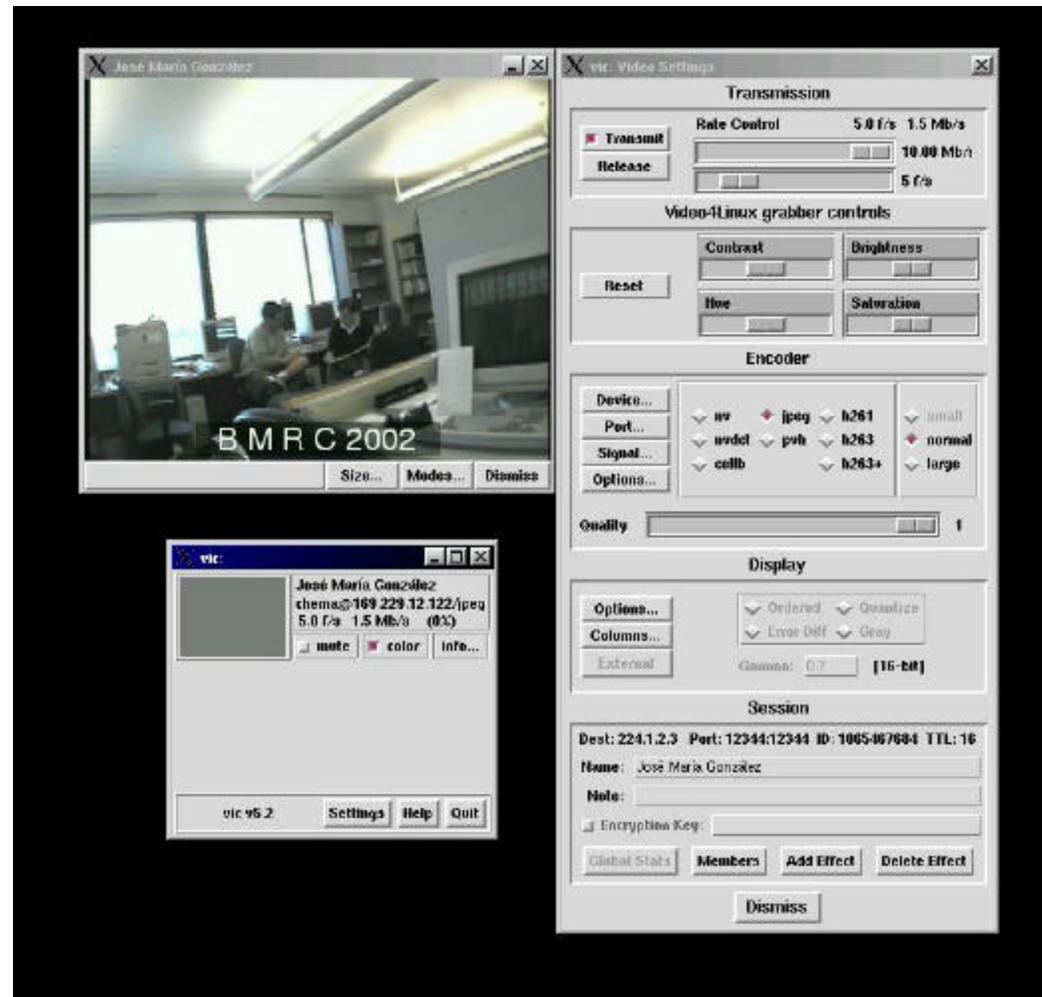
OM Release 5.2

- Bug fixes – too numerous to discuss 😊!
nsdr, merged ucl-vic bug fixes, audio driver problems, memory leaks, installation nightmares, etc.
- Enhancements
vic: RTPtv decoding support, auto-place
tcl/fx and Dali
Supports: Tcl/Tk 8.3, SSM, MMX, DirectDraw
- Platforms
PC FBSD, Linux, Win*, Sparc/Solaris
Many stability problems on Win* fixed

Current Developments

- RGB capture device
- Integrate fx processing into vic
 - Titling, logos, timer count down, fade into/out black
- H.263 codec
- Integrating Nsynch synchronization toolkit
 - Needed for webcast/videoconf automation
- Audio system enhancements
 - 16-bit, 44Khz, stereo
 - Mp3 capture/playback (using LAME)
- INDIVA
 - Middleware for multimedia resource control

Titling Example



Current Developments

- RGB capture device
- Integrate fx processing into vic
 - Titling, logos, timer count down, fade into/out black
- H.263 codec
- Integrating Nsynch synchronization toolkit
 - Needed for webcast/videoconf automation
- Audio system enhancements
 - 16-bit, 44Khz, stereo
 - Mp3 capture/playback (using LAME)
- INDIVA
 - Multimedia resource control middleware

What's Next

- Integrate rat engine
- Mac OS X port
- INDIVA
- <put your good idea here>

Outline

- AG Opportunities and Problems
- Open Mash Developments
- Remote Control of Resources
- Automated Operation
 - AG Conferences
 - Webcasts

Problem

- Streaming media not first class data type
 - Too hard to “watch CNN”, create multicast session with randomly selected streams, etc.
- Need middleware to manage videoconf and webcast equipment and resources
 - Access and control remote a/v equipment
 - High-level operations on services, media streams, multicast sessions, and conferences
- Automated operations
 - Replace human operator with software
 - Computer programs that make aesthetic decisions

Automated Operation

(a/v as first class data type)

- Automated operation of AG node

 - Control projected display

 - Window size and placement, projected apps, etc.*

 - Select material for local viewing versus transmission to all participants*

 - Control what is transmitted

 - Camera control, audio muting (?), etc.*

 - Adjust sound levels

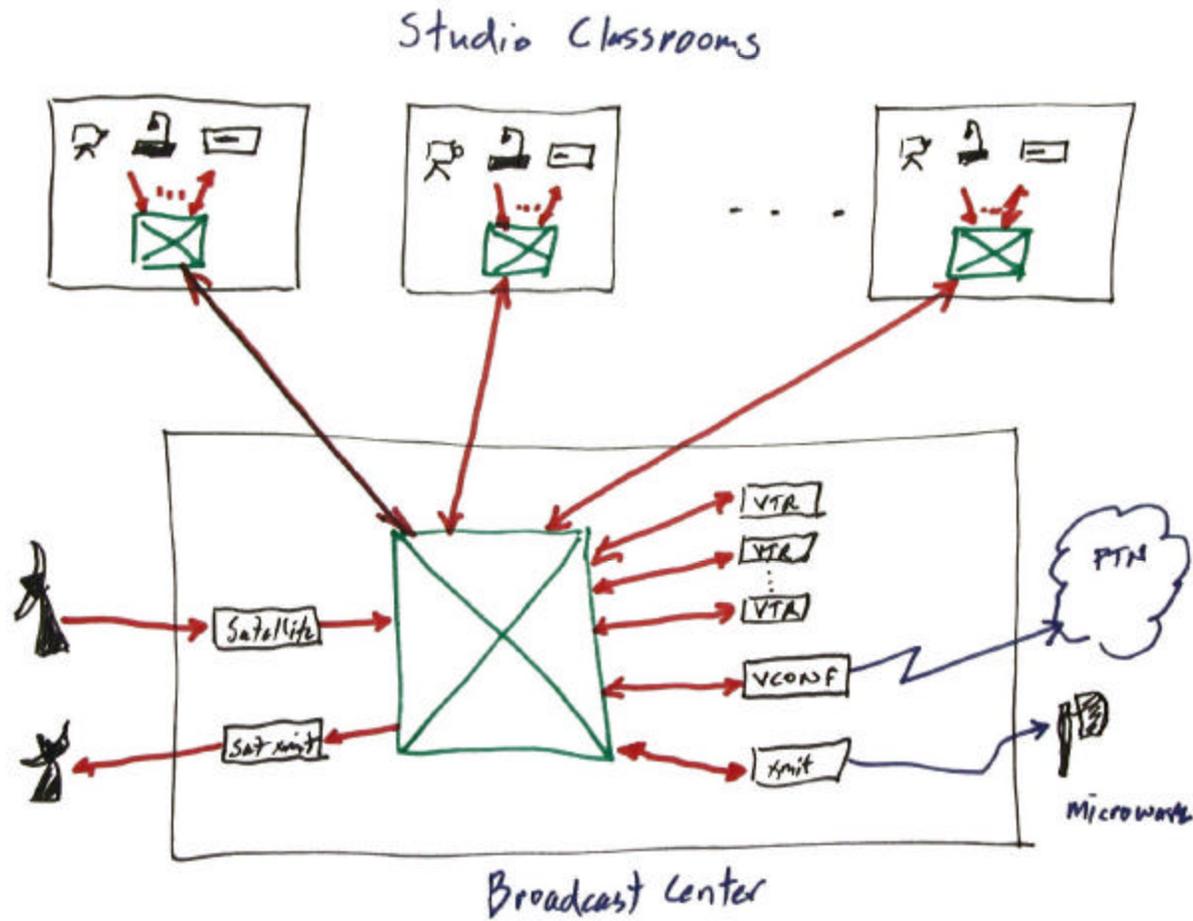
- Automated production of webcast

 - Produce moderated program from AG conf

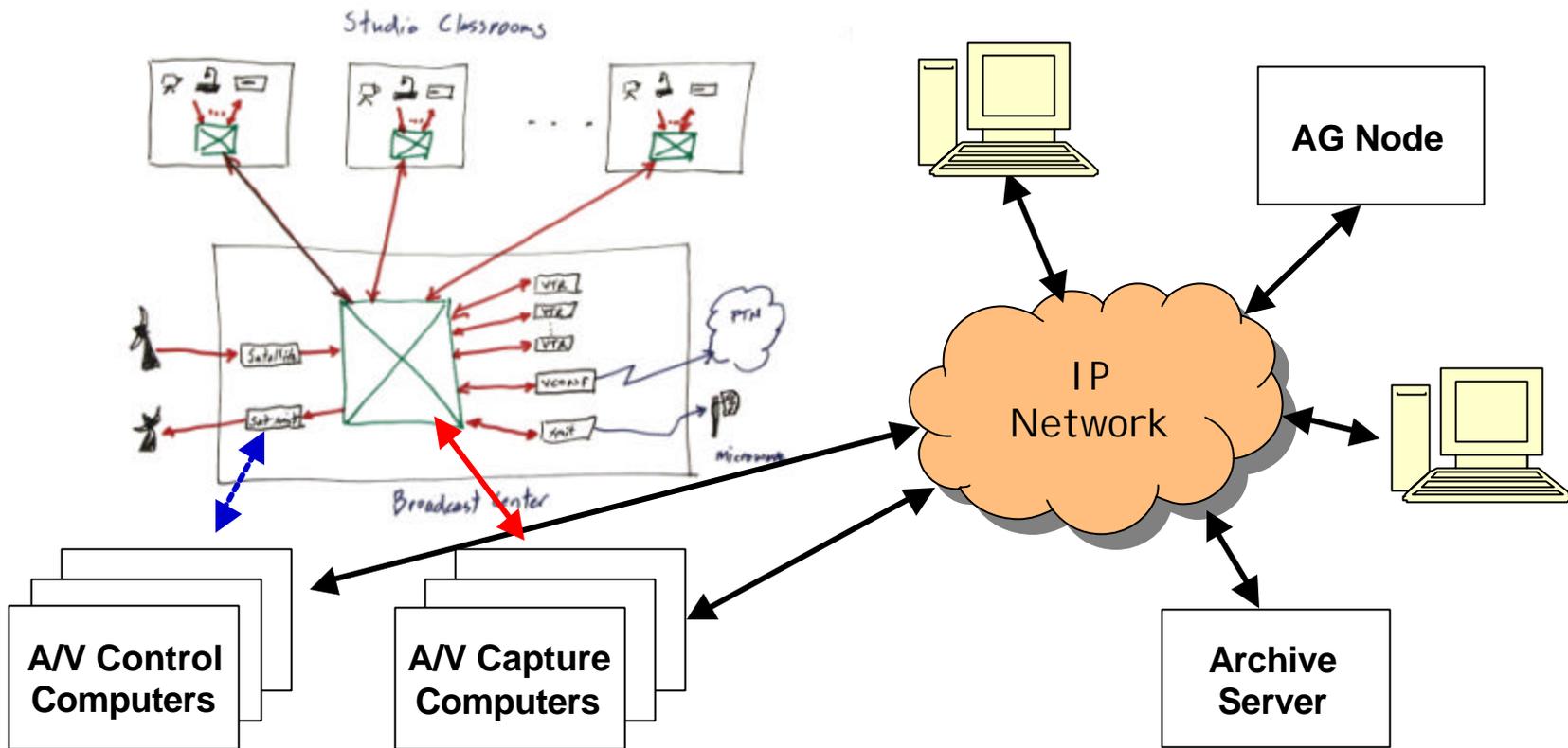
 - Select streams to be shown, incorporate special-effects, move cameras*

Note: H.32x MCU is a production switcher – problem is that it does not distinguish between participants and viewers unless you change distribution technologies (i.e., webcast)

Broadcast Center



Connected to the Internet

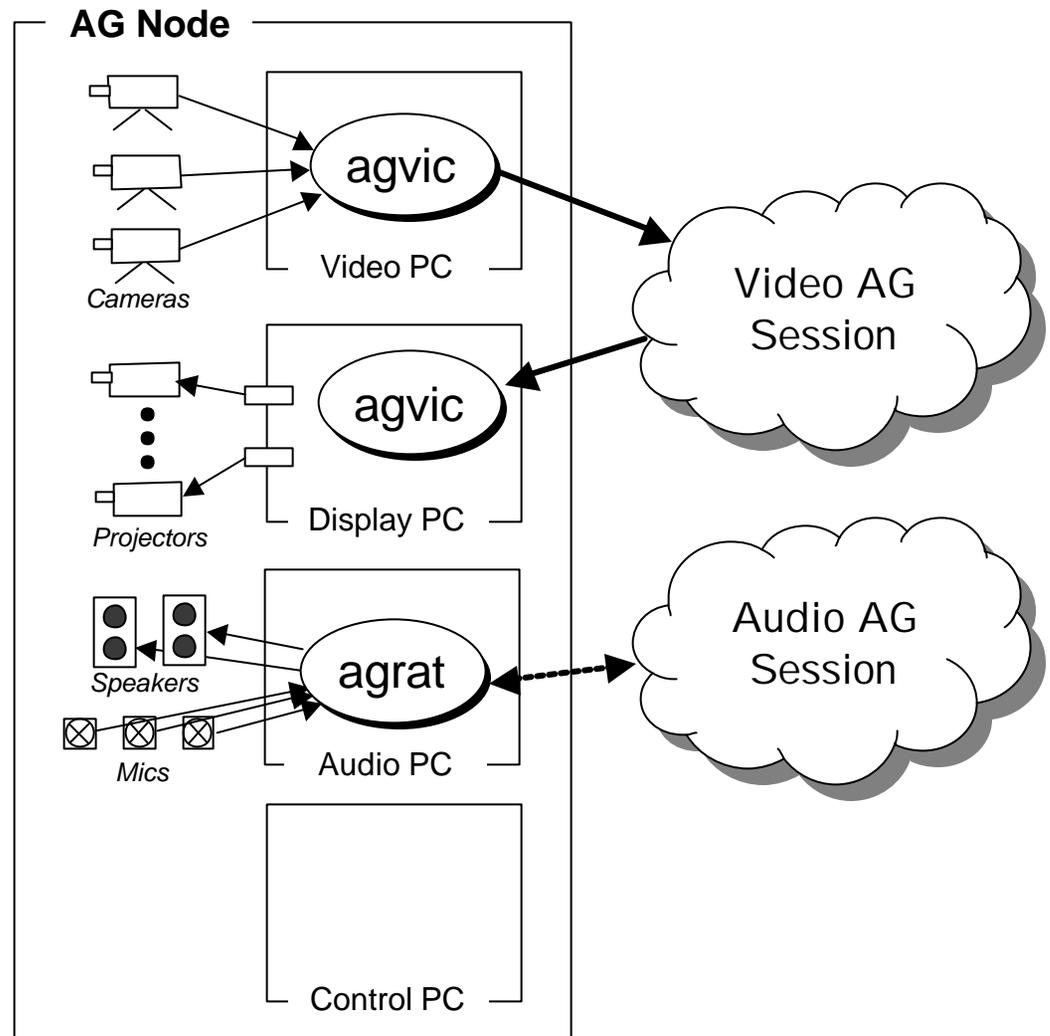


Get Rid of the A/V Network?

- One a/v source per computer
 - Expensive to setup and maintain
- Multiple a/v sources per computer
 - Cannot put computers in every classroom
 - Hard to produce events remotely – need to see alternative sources
- How to interface other a/v equipment?
 - Satellite dish, production switcher (special effects), mpeg encoders, etc.
- Interface to legacy systems

AG Node is Similar

- Remote equipment
- Multicast sessions
 - Side conversations?
- Incorporate new equipment and services



Simple Example

“I want to watch CNN on satellite dish”

- Check that dish is free
 - If dish is not free and someone else is watching CNN, join the multicast session
- Send command to switch channel to CNN
- Select free capture computer and device
- Send commands to route a/v signal to selected capture computer
- Allocate multicast sessions (audio & video)
- Launch vic/rat to capture and send to session
- Launch vic/rat on my computer to watch session

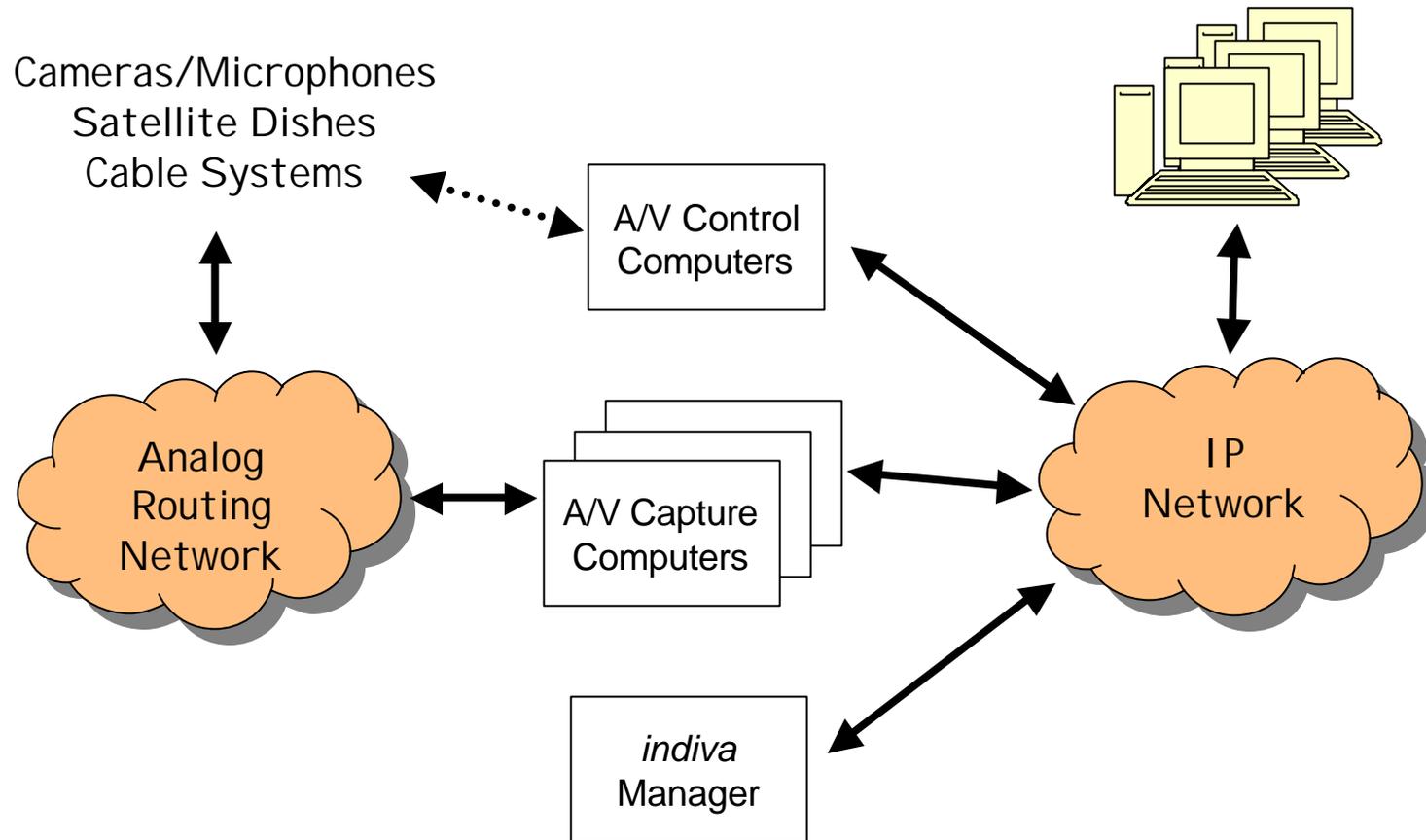
I am a dumb user, give me a TV set and remote control!

Other Problems

- Discover devices in particular location
- Watch all cameras at a location
- Watch selected cameras at several locations
- Forward streams to other sessions/conferences
- Launch transcoders
- Control remote cameras, mixers, switchers, encoders/decoders, etc.
- Control special-effects systems
- ...

Goal: specify "what you want" not "how to do it"

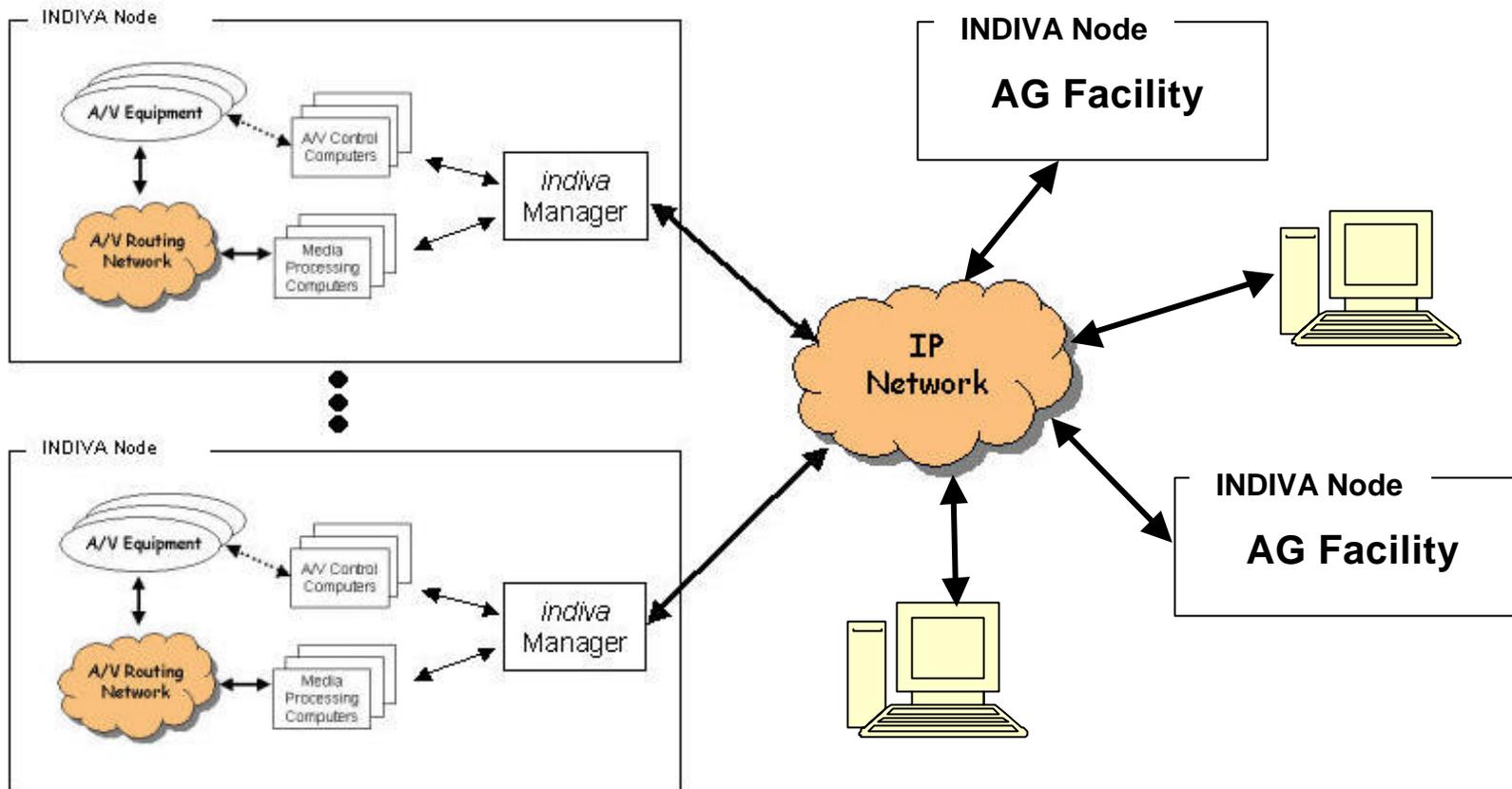
Infrastructure for Distributed Audio and Video (INDIVA)



Applications

- End-user shell
 - Ad hoc, interactive requests
- Webcast control system
 - Services required to automate webcast production
- AG conference control system
 - Services required to automate n-way distributed collaboration
- Foundation for automatic testing of a/v equip

INDIVA Architecture



Hierarchical Name Space

```
% mount /bmrc          # mounts bmrc broadcast center node
% ls /bmrc
conferences/  devices/  rooms/  services/  users/
% ls /bmrc/devices
audio/  production/  transmission/  video/
% ls /bmrc/devices/transmission
...      dish0 ... kaleido0 ...
% ls /bmrc/rooms
405-Soda/ 310-Soda/ ...
% cd /bmrc/rooms; ls 405-Soda
audcam@          ovhdcam@          stagecam@
audiomixer@     spkrcam@          vcr@
% cd ~larry; ln /bmrc/devices/transmission/dish0 satellite
% satellite info
```

Satellite is object that responds to methods to do things

Watch CNN

```
% ls
satellite@      std.conf
% puts $stdconf
/bmrc/users/larry/std.conf
% encode satellite -channel "CNN" $stdconf
% view $stdconf
```

Change channel on satellite

Allocated free capture computer and device

Determine path from satellite to capture computer and device

Launch encoder to stream media into default a+v sessions

Launch viewer app on desktop and join default sessions

Launches Desktop Viewer



- Menu has source- and device-specific items
 - Channel changer
 - Encoding parameters
 - etc.
- Viewer requests items and GUI interfaces from INDIVA manager
- Viewer also has thumbnail viewer for conference

Conference Viewer



- Right-click thumbnail
 - Source- and equip-specific menu
- Right-click window background
 - Session-specific menu
- Double-click thumbnail
 - Displays single stream viewer
- Other operations
 - Examine sap description
 - Add/remove streams

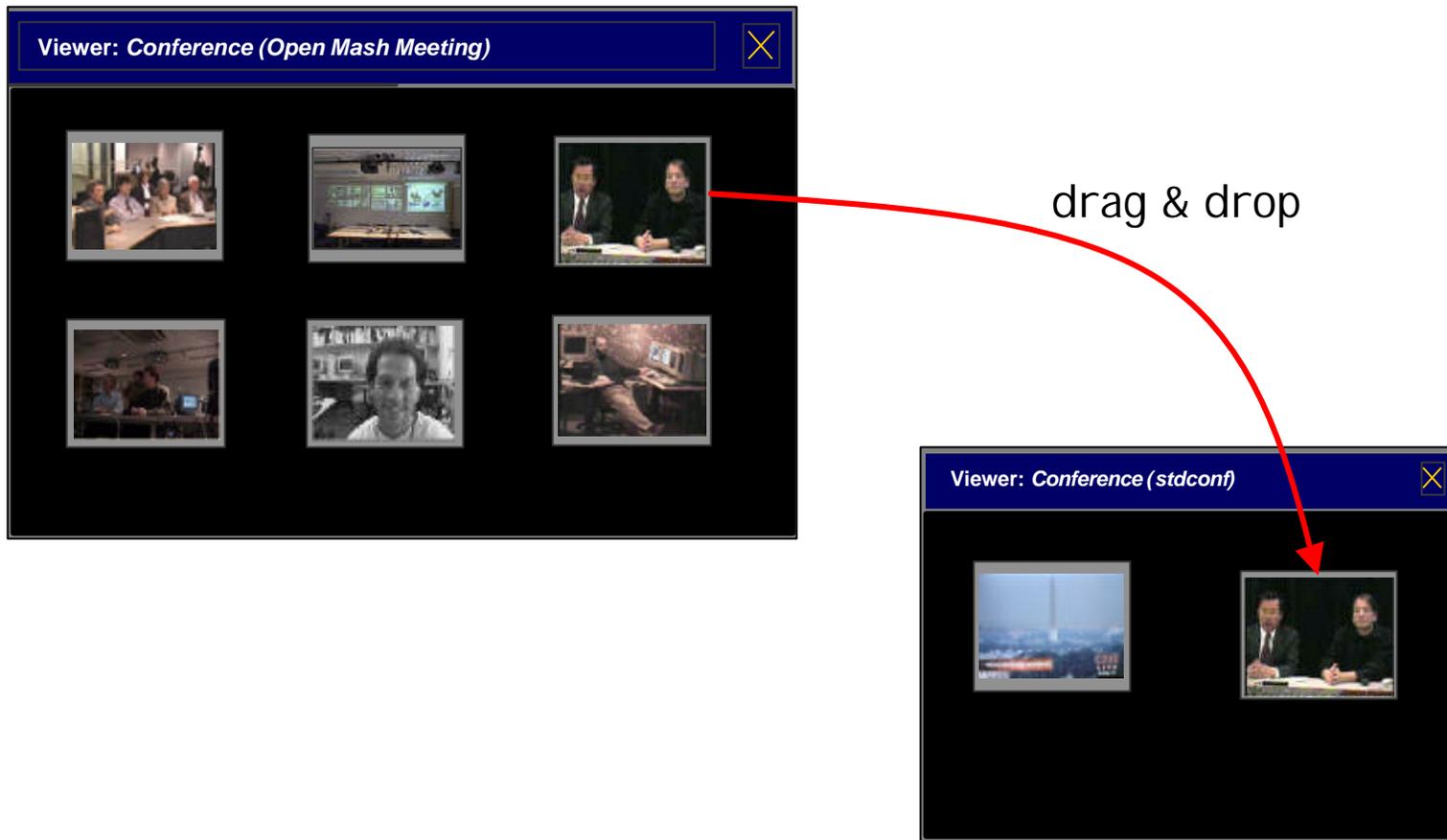
Conference Abstractions

```
% puts $stdconf
/bmrc/users/larry/std.conf
% ls $stdconf
audio.sess      video.sess      whiteboard.sess
% info $stdconf
Name: Berkeley MIG Seminar
Owner: BMRC Webcast Director
...
% info $stdconf/video.ses
IP Address: 224.2.3.4/4444
...
% ls $stdconf/video.ses
indiva@128.84.96.112:1.rtp indiva@128.84.96.112:2.rtp ...
% info $stdconf/video.ses/indiva@128.84.96.112:1.rtp
Source Host: 128.32.64.215
CNAME: George@bmrc.berkeley.edu
```

Conf Abstractions (cont.)

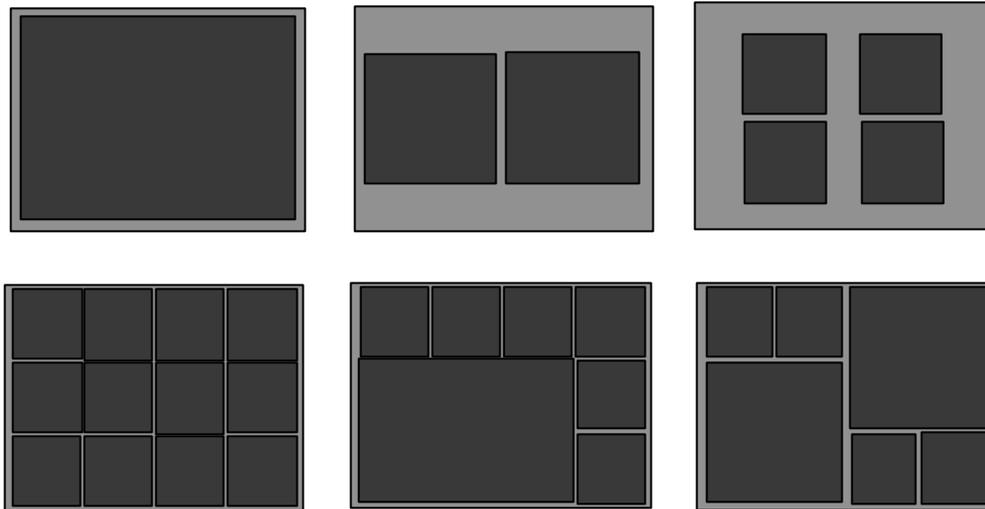
```
% info sdp $stdconf
s= Berkeley MIG Seminar
m= audio 22054 RTP/AVP 3
c= IN IP4 224.2.231.76/63
...
% mkcon -sdp $sap-announcement myconf.conf
% cd /bmrc/services/webcast/ ; ls      # list active webcasts
cs298-5.conf   cs298-3.conf   cs160.conf
...
% ls cs160.conf/video.sess           # list webcast sources
indiva@128.84.96.112:14.rtp   indiva@128.84.96.112:15.rtp
% forward cs160.conf/video.sess/indiva@128.84.96.112:14.rtp \
          $stdconf/video.sess
```

Desktop UI to Forward/Move

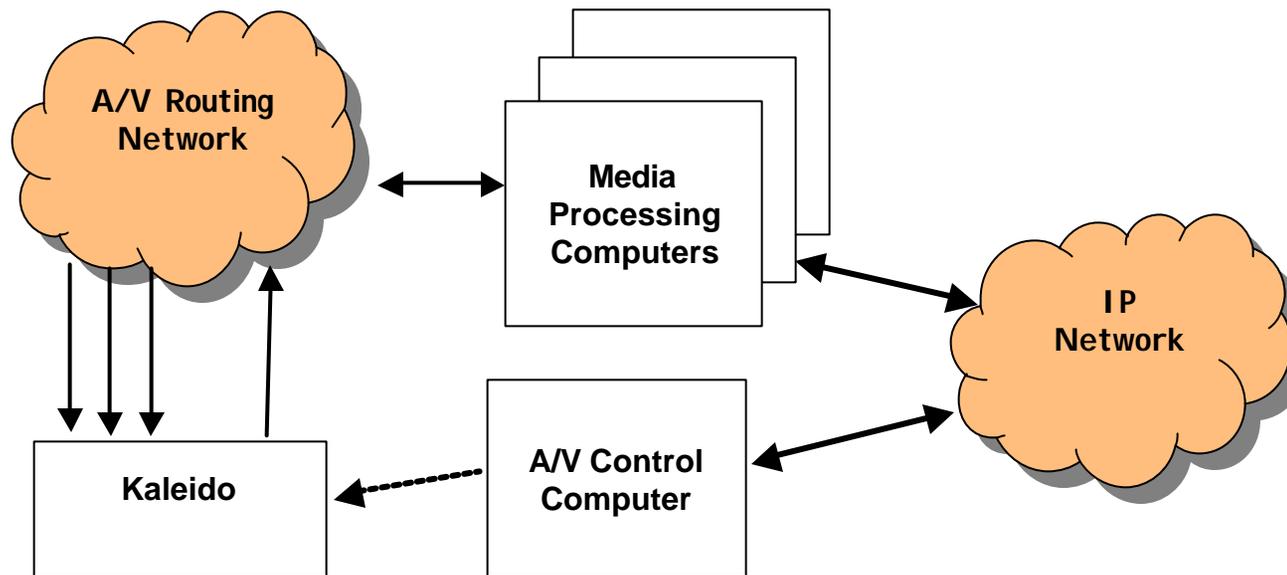


Integrating Other A/V Equipment

- Miranda Kaleido
 - Composites multiple streams into one stream
- Stored templates for output display



Integrating Kaleido into INDIVA



Kaleido Controls



drag & drop



Kaleido Output
Stream Viewer

Outline

- AG Opportunities and Problems
- Open Mash Developments
- Remote Control of Resources
- **Automated Operation**
 - AG Conferences
 - Webcasts

VideoConf and Webcast Control

- Use INDI VA middleware
 - Provides middleware to access/control resources
 - Use Nsync synchronization toolkit
 - Toolkit to write rules to control behaviors
 - Must extend beyond single process
 - Scripting language for decisions
 - Specify behaviors for automation
 - If question asked from left side of room, switch to audience camera and pan/zoom to preset*
 - Send one thumbnail from AG node that is periodically switched to give views of participants*
 - If AG speaker, pop-up large image of person*
- Note: AG behaviors can be customized at different locations or for different conf aesthetics

References

Open Mash (www.openmash.org)

www.openmash.org/resources/pubs/

Recent NSF proposals

[Webcast and Distributed Collaboration Control Automation](http://www.openmash.org/resources/pubs/2002/162/)

(www.openmash.org/resources/pubs/2002/162/)

[Webcast and Distributed Collaboration Control Automation](http://www.openmash.org/resources/pubs/2002/163/)

(<http://www.openmash.org/resources/pubs/2002/163/>)

INDIVA (bmrc.berkeley.edu/~weitsang/indiva/)

Webcasting

[Streaming Media Middleware is more than Streaming Media](http://www.bmrc.berkeley.edu/research/publications/2001/159/)

(<http://www.bmrc.berkeley.edu/research/publications/2001/159/>)