Fermilab

Mbone Product and Usage Notes

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Abstract

The Unix Applications Support (UAS) Group at Fermilab supports a package of desktop videoconferencing tools that will allow users to send and receive audio and video over the Internet. This document gives an overall review of the requirments necessary to run the Mbone product and how to use the different Mbone application tools.

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1 What Is The Mbone Product?

Mbone stands for Multicast backbone - more specifically, a virtual Internet backbone for IP Multicast. Mbone video conference programs are layered on top of IP mulitcast packets. The Fermilab Mbone product combines into one package the binary forms of desktop videoconferencing tools that will allow users to send and receive audio and video over the Internet.

2 Workstation Hardware Requirements

2.1 Audio and Video

No additional hardware is required to receive audio and video on those systems that have audio built in because the rest is done in software. DEC systems require an AudioFile server for sound I/O. To send audio requires a microphone; to send video requires a camera and video capture device which are only built-in on a few systems. Such devices include SUN's SunVideo Card and VideoPix Card, and SGI's IndigoVideo Card. The camera needs to be compatible with the video capture hardware.

The audio and video conferencing tools – all varieties – are *not* suitable for use on X-terminals. First, there is no standardized way for audio data to be sent to an X-terminal, so the audio tools have no support for this. Second, the data rate of a video window makes it impossible to view any real- time image larger than a postage stamp. Many workstations on an ethernet can view a conference image by receiving the same 128 kbit/sec multicast data stream, but to send the decoded image to a remote display would require 1.5 to 5 megabits of unicast data to *each display*.

The whiteboard (wb) and still-image (imm) tools do function acceptably on an X-terminal.

2.2 Networking

Routers that forward unicast (single destination) IP packets do not necessarily forward multicast packets. To get multicast routing to a subnet that does not yet have it will require an upgrade to the router that connects that subnet. Contact the Data Communications and Networking group to have this done. You may have a program "mrouted" on your system which describes itself as a multicast router, but the tunneling mechanism used by mrouted is inefficient in comparison with having our Cisco routers perform the function. Furthermore, if you start mrouted on any machine on your subnet, it will draw in all multicast traffic. The Cisco routers will forward multicast packets addressed to only those destinations that some machine on your subnet has requested. A list of subnets which have multicast service is kept on the Data Comm web server at *http://www-dcn.fnal.gov/Net/mbone-support.html*. As of this writing, the list includes the following.

- The Highrise and Feynman Center backbones, including subnets 8, 10, 55, 100, 110, and a few others.
- Outlying subnets bridged to one of the above, including subnet 22 (Labs 3, 4, 7), 29 (LSEC), 199 (EAD), and 203 (C0).
- The DCD Backbone, subnets 32, 33, 40, 219, and 220.
- The Hornets' Nest and 12NW conference rooms on subnet 28.
- HEPNRC subnets 43 and 47.
- CDF, except the farm and online subnets.
- Subnets 19 (Directorate) and 85 (USG) are still served by mrouted tunnels to workstations on those subnets.

3 IP Multicast

3.1 Sun SPARC

Solaris 2.x has IP multicast built in as a standard part of the operating system.

3.2 Silicon Graphics

Silicon Graphics includes IP multicast as a standard part of their operating system.

3.3 DEC Alpha OSF/1

DEC OSF/1 supports IP Multicast functionality.

4 MBONE Etiquette

Currently, there are no formal procedures for scheduling the use of the MBONE. Management of the bandwidth is a cooperative procedure depending upon the good behavior of the participants.

Many events are announced by a message to *rem-conf@es.net*. Advance announcements usually prevent overloaded scheduling of Internet-wide events and alert potential participants. An announcement might ask for expressions of interest or objections in order to gauge whether the event would be appropriate to broadcast. Then events are usually advertised using sd so that interested recipients can easily join.

5 Mbone Product Structure

Version v2_0 of mbone contains the following application tools.

```
IRIX 5.x

nv      v3.3            vat     v3.4
wb      v1.58           sd      v1.14
imm     v3.3            ivs     v3.4
vic     v2.6            mmcc    v.55a
vat_nv_record   v13

SunOS 5.x

nv      v3.3            vat     v3.4
wb      v1.59           sd      v1.14
imm     v3.3            ivs     v3.4
vic     v2.6            mmcc    v.55a
vat_nv_record   v13

DEC OSF/1

nv      v3.3            vat     v3.4
wb      v1.59           sd      v1.16
imm     v3.3            vic     v2.6
mmcc    v.55a
```

6 Setting MBONE Conference Scopes

MBONE conferences may be restricted in scope by setting the time-to-live (TTL) field of the multicast packets to an appropriate value. Sd will pass the selected TTL to the applications. A TTL value of 1 will restrict a conference to a single network segment. Use this if you want to try high-rate video. The value 16, denoted by 'Site' in the sd session-creation menu, will restrict traffic to within Fermilab. A TTL of 32, denoted by 'Region' in sd, selects all ESNET sites. 'World' sets the TTL to 127, which will reach every continent on the MBONE, and should be used only when appropriate. The world-wide MBONE runs over some physical network links with severely limited bandwidths, and the conferencing tools do not adapt as TCP does to congested networks.

As a general rule, you should not send video with a data rate of more than 128kb/s to the world. 256kb/s to ESNET or within the lab is all right. When creating a conference for test purposes, always select the smallest useful scope. And be careful to never leave your workstation transmitting sound or video overnight!

7 Point-to-Point Conferencing

Most of the conferencing tools will enable two-party conferencing using unicast IP packets without the need for any multicast support on either end. The Multimedia Conference Control Program (mmcc) is useful for initiating such sessions. Some users find the Shared Whiteboard tool plus the telephone to be a very effective combination.

8 Mbone Application Tools

8.1 SD - Session Directory Tool

Sd is the tool for advertising and locating many of the audio and video transmissions being broadcast over the MBONE. At session creation, all the address parameters and data formats necessary to join the session are published. Sd multicasts the advertisements to be picked up by anyone else running sd. The audio and video program sessions can be invoked using sd. Vat and nv are the default audio and video tools invoked by sd. Wb will also be invoked if the session is utilizing it.

There is a TCL script file named .sd.tcl (see example below) that must be present in the user's home directory (i.e. ~/.sd.tcl) that controls the actions taken at the start of a new sd session. The user can replace or customize this file as necessary, for instance, making ivs the default video tool invoked by sd.

```
Example of a .sd.tcl file

# $Header: VIC.SD.TCL,v 1.4 94/11/30 05:06:00 van Exp $

set ipc_chan 0
proc get_channel { confid } {
        global ipc_tab ipc_chan
        if { [info exists ipc_tab($confid)] } {
                return $ipc_tab($confid)
        }
        incr ipc_chan
        if { $ipc_chan > 300 } {
                set ipc_chan 1
        }
        set ipc_tab($confid) $ipc_chan
        return $ipc_chan
}

proc start_audio {} {
        global sd_sess sd_audio
```

```
        set audiofmt ""
        set packetfmt "-n"
        set mode "-c"
set chan 0
if {[info exists sd_sess(video)]} {
global sd_video
set chan [get_channel $sd_sess(address)/$sd_video(port)]
}
        foreach a $sd_audio(attributes) {
                case $a {
                        fmt:* { set audiofmt [string range $a 4 end] }
                        vt  { set packetfmt "-v" }
                        lecture  { set mode "-l" }
                }
        }
        set confaddr [format "%s/%s/%s/%s/%s" $sd_sess(address) \
                $sd_audio(port) $sd_audio(conf_id) $audiofmt $sd_sess(ttl)]

        global vat
if {$chan} {
exec $vat -I $chan -C $sd_sess(name) $packetfmt $mode $confaddr &
} else {
exec $vat -C $sd_sess(name) $packetfmt $mode $confaddr &
}
}

proc start_video {} {
        global sd_sess sd_video
        set videofmt "nv"
        foreach a $sd_video(attributes) {
                case $a {
                        fmt:* { set videofmt [string range $a 4 end] }
                }
        }
        case $videofmt {
                vic { }
ivs { }
nv { }
telesia { set videofmt ivs }
                jpg {
                        global imm
                        exec nice $imm -p $sd_video(port) -I $sd_sess(address) \
                             -ttl $sd_sess(ttl) -n $sd_sess(name) &
return
```

```
                }
default { return }
        }
global vic
if {[info exists sd_sess(audio)]} {
set chan [get_channel $sd_sess(address)/$sd_video(port)]
exec nice $vic -I $chan -A $videofmt -t $sd_sess(ttl) \
-C $sd_sess(name) \
$sd_sess(address)/$sd_video(port) &
} else {
exec nice $vic -A $videofmt -t $sd_sess(ttl) \
-C $sd_sess(name) \
$sd_sess(address)/$sd_video(port) &
}
}

set sd_menu(video) "fmt: vic nv ivs jpg"
set vic vic
```

center

8.2 Using SD

When you invoke the **sd** command, your environment will be checked to insure that your DISPLAY variable is set. The DISPLAY variable must be set in order for the Session Directory to be displayed. Also, there must be a .sd.tcl configuration file located in your HOME directory. See the section titled ***SD - Session Directory Tool*** for a sample .sd.tcl file. If this file is not present, a default .sd.tcl file will be placed in your HOME directory. Once the DISPLAY variable is set and the .sd.tcl file is in your HOME directory, invoking the sd command will bring up the Session Directory panel with a title of "sd" (See Figure 1).

The top section of the sd panel lists event titles and the bottom section contains individual event information. Each section has scroll bars and the Session Directory panel can be resized for easier viewing. Session Directory option buttons are located at the bottom of the panel.

8.2.1 Joining a Conference Event

To join a conference event, highlight the conference you wish to join by clicking on the event title. Conference information will appear below the list of events. This information includes a brief description of the event, the scheduled duration of the event, and the media information (i.e. whether audio and/or video is being broadcast and/or if there is a whiteboard session being used) along

Figure 1: SD Panel

with the Port/ID addresses for each application tool. After viewing the event information, select the 'Open' option to open the application tools and begin viewing the conference event.

8.2.2 Creating a Conference Event

The first step in creating a conference event involves announcing the event. Advance announcements help prevent scheduling overload of Internet-wide events and they alert potential participants. It is good practice to announce conference events 1-2 weeks prior to broadcast. Events are announced by a message to *rem-conf@es.net*.

Next, the event needs to be placed in the Session Directory so that interested recipients can easily join the event during broadcast. To place the event in the Session Directory, select the 'New' option. A different "sd" panel will appear (See Figure 2). In this panel, you will be able to enter and select the appropriate options for your broadcast event. Use the 'TAB' key to move through the options.

- **Name.** Enter the title of your event here. Try to keep the title under 30 characters.

- **Description.** Enter a short, detailed description of the event being broadcast and any other information that may be useful (e.g. If there is a WWW site that can be accessed that will have more information on the event, the URL of the page could be included here).

- **Address.** An IP address will be assigned to this event by default when you select the 'New' option. You do not need to make an entry here.

- You can select the broadcast type(s) next. By default, Audio is selected when you select the 'New' option, as denoted by the check in the box to the left of Audio. You may select/unselect Audio, Video, and Whiteboard by clicking on the box to the left of the option. When you select a broadcast type, a Port and ID address will be assigned and placed to the right of the option.

- **Scope.** Here, you will select the scope of your event broadcast. To do this, select 'Site', 'Region', or 'World' by clicking on the appropriate diamond to the left of the option. Then enter a ttl in the box below the 'World' option. See the section on *Setting MBONE Conference Scopes* for details on selecting the appropriate scope for your broadcast.

- **Lifetime.** To assign a lifetime for your broadcast, you will need to select a start date (Starts:), start time (at:), and duration (for:). Use the up/down arrows to the right of the fields to scroll through the available options.

Figure 2: SD's Session Creation Panel

- **Create.** Once you have entered and selected the appropriate information for your broadcast, clicking on the 'Create' button will create your conference event for listing in the Session Directory.
- **Cancel.** You may cancel your created session by clicking on the 'Cancel' button.

All the broadcast information entered and selected from the Create panel will appear in the appropriate sections of the Session Directory.

Please note that creating a conference event in the Session Directory only sets the necessary address parameters and data formats that will be used for your broadcast and places the event advertisement in the Session Directory. To begin broadcasting your event, you will need to bring up the appropriate application tools by joining the conference event and starting the broadcast.

8.2.3 Editing a Conference Event Listing

If you need to edit information in a conference event session that you previously created, click on the 'Edit' button to bring up the "sd" panel containing the event information. Make your changes and click on the 'Create' button. The changes will now appear in the Session Directory listing for that event. If you do not wish to make any changes while in the "Edit" panel, click on the 'Cancel' button and the Session Directory listing will not be changed.

8.2.4 Deleting a Conference Event Listing

At times, there are numerous Session Directory listings and you may want to delete one or more conference event listings from your Session Directory that do not interest you. To delete event listings from your Session Directory, highlight the event listing that you wish to delete and click on the 'Delete' option.

8.2.5 Exiting the Session Directory

To exit the Session Directory, click on the 'Quit' option.

8.3 VAT - Visual Audio Tool

Vat allows users to conduct host-to-host or multihost audio teleconferences over an internet. Vat does not work in unicast mode under Solaris 2.3 due to a kernel bug. There is a workaround included in the distribution - solaris.2.3-unicast-vat-workaround.tar.

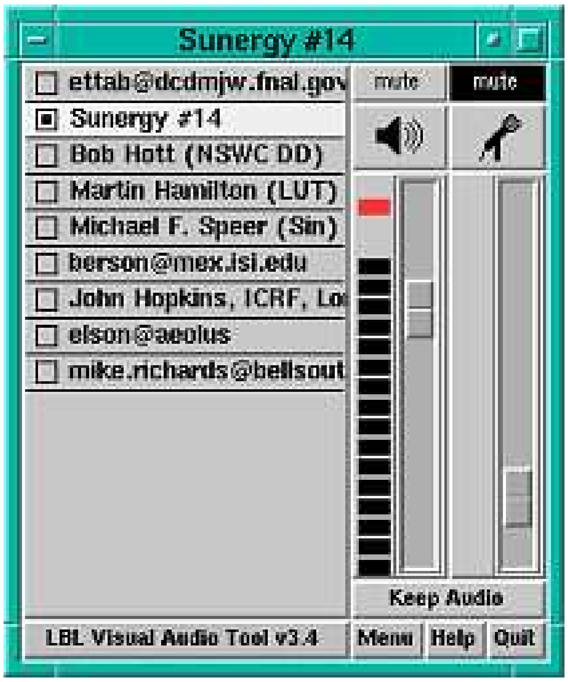

Figure 3: Vat Panel

8.4 Using VAT

The vat audio tool can be invoked via the command line or via sd. Following is a sample command line entry to invoke vat (Please see the vat man page for flag definitions):

```
% vat -C "Radio Free Vat" -n -c 224.2.253.119/42147/56416//191
```

The vat panel is divided into two sections (See Figure 3). The right section contains the controls for the local audio. The left control is for playback and consists of a slider, a button to toggle output between the built-in speaker and the headphone jack, and a button to mute/unmute the speaker. The right control is for the microphone and consists of a slider, a button to control acquisition of the audio hardware, and a button to mute/unmute the microphone.

The sliders are used to adjust the microphone and speaker gains. To adjust the sliders, click on the desired position or click and drag the slide button to the desired position. For best results, adjust the microphone and speaker gain sliders so that the peak readings are about 80% of full scale.

The status display of the hosts participating in the conference is found in the left section of the vat panel. The list contains every site that is currently participating in the conference, with your site always listed first. Whenever a site is speaking, the site name is highlighted. Clicking on the box to the left of a site name will disable audio from that site. You may want to disable audio from a site when there is interference from that site, such as echoing.

There are a few auxiliary controls located at the bottom right of the vat panel. The 'Menu' control will bring up a panel of other auxiliary controls (See Figure 4). The Audio Tests section of the menu allows for some audio test modes. You ***should not*** select these modes during a conference. The loopback audio test will cause input from the microphone to be sent to the local speaker and is useful for checking audio levels. The three tone tests will generate one of three reference tones through the local speaker. Again, this is useful for checking levels.

The Output Mode control buttons control what vat will do to avoid feedback/echo from the microphone to the speaker. In 'Mike mutes net' mode, vat will mute the speaker whenever it thinks that your site is speaking. In 'Net mutes mike' mode, vat will mute the microphone whenever input from the network arrives. In 'Full duplex' mode, vat will assume that feedback cannot happen and do nothing to avoid it.

The 'Name' box at the bottom of the panel is a type-in box which can be used to change the participating host name that is announced to other sites. (Note: if you change the Name, you must hit the Return key for the change to take place).

To exit the panel, click on the 'Dismiss' button at the bottom of the panel.

8.5 NV - Network Video Tool

Nv allows users to transmit and receive slow frame rate video across an internet. Video streams can be either sent point-to-point, or sent to several destinations simultaneously using IP multicast. The recommended and preferred mode of transmitting and receiving video is to use a local workstation. Transmitters need some sort of frame capture hardware.

8.6 Using NV

The nv video tool can be invoked via the command line or via sd, if it is set as the default video tool in the .sd.tcl configuration file located in your $HOME directory. Following is a sample command line entry to invoke nv (Please see the nv man page for flag definitions):

```
% nv -ttl 127 224.2.1.1 4444
```

The control panel of nv v3.3beta consists of a menu bar, a scrollable video icon box, a conference information section, and a section for video transmit options (See Figure 5). There is also a video receive defaults section which by

Figure 4: Vat Menu Panel

Figure 5: Nv Panel

default, is not shown but can be shown using the Panels menu, which will be discussed shortly. The Info menu lets you see the version of nv being used. The Grabbers menu lets you select among the available grabbers. Grabbers which are supported by nv but not available on the local host are greyed out and cannot be selected. The Encodings menu lets you select which video encoding to use when transmitting. The Panels menu allows you to toggle on and off the presence of each additional panel.

The video icon box shows a small video image for each video stream it receives. Clicking on that video icon will toggle the display of a larger video panel and clicking on the larger display will toggle a video transmit options panel (See Figure 6). In this options panel, you will be able to adjust the brightness and contrast of the image. It also displays the source address of the sender, the video format, the incoming and displayed frame rate, and the incoming bandwidth with an approximate amount of network loss. Other option controls include a set of size buttons, buttons to switch from greyscale to color, and a capture button which allows you to capture the current image into a new window.

8.7 WB - Shared Whiteboard Tool

Wb is a shared drawing surface that can be used by conference participants to draw on and edit shared documents in real-time. Wb can also be used to export and view PostScript files. Wb is intended to compliment the sd and vat tools. To include PostScript images in a wb conference, you will need the postscript renderer Ghostscript which is included in the latest release of the Fermilab Ghostview product. The Fermilab Mbone product is configured such that Ghostview is a dependent product of the Mbone product.

8.8 Using WB

Wb can be used to draw on, view text documents, and export and view PostScript files. The tool can be invoked via the command line or via sd. Following is a sample command line entry to invoke wb:

```
% wb -t 127 -C "wb:USC-CS VR Conference Room" -l 224.2.212.30/6
```

Included with the product release of mbone is a postscript file located in $MBONE_DIR/doc named Whiteboard.ps which is a good source for learning how to use wb. Please refer to this document for instructions on how to use wb.

In addition, there is a tool that will help with giving seminars via wb. Wbimport can be used if you have a set of postscript files that you would like to import into wb in some sequence (e.g. for a prepared presentation). Place the postscript file names in a file where each line has the format:

```
<label>   <filename>
```

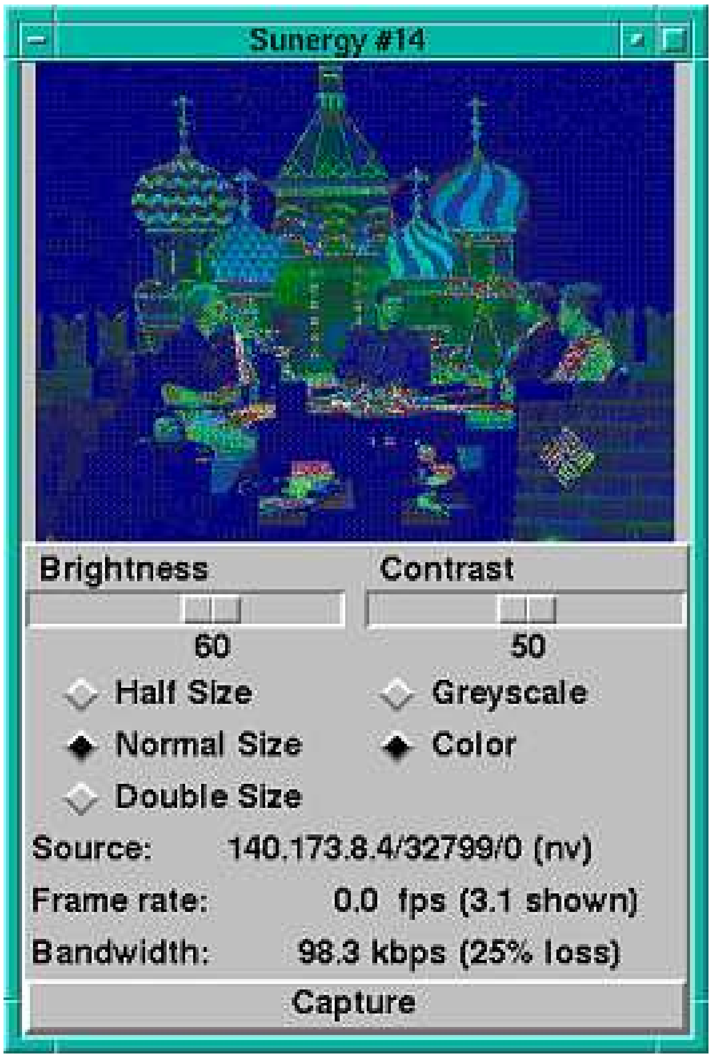

Figure 6: Large Nv Panel

Figure 7: Wbimport List Panel

Then start wbimport giving the name of that file, a list panel (See Figure 7) showing each label will be displayed. If you click on a label, the associated postscript file will be imported into wb. Once a file has been imported once, its wb page number will be placed after the label and whenever you again click on the label, wb will simply switch to that page (i.e. the file will only be imported once).

To illustrate, say you have postscript images of animals for a talk that you are going to present. Create a file called "animals" containing:

```
golfer ~/golfer.ps
snowflake ~/snowflak.ps
```

Then start wbimport with the following command:

```
% wbimport animals
```

A list panel with the names dog, cat, and tiger should appear. Clicking on one of the names will render that associated postscript file in wb.

Only the session creator can use wbimport to import postscript files. Other participants must use wb's import option to import postscript files.

8.9 VIC - Video Conference Tool

Vic is a video conferencing tool that allows groups of users to transmit video to each other over an IP Multicast network. A host must be equipped with a camera and frame digitizer to send video, but no special hardware is required to receive and display it. Vic allows point-to-point conferencing as well as multiparty conferencing.

8.10 Using VIC

The vic tool can be invoked via the command line or via sd if it is set as the default video tool in the .sd.tcl configuration file located in your $HOME directory. Following is a sample command line entry to invoke vic (Please see the vic man page for flag definitions):

```
% vic -t 127 -C "TMAB exhibit" 224.2.197.7/32106
```

The vic panel consists of an area for all sources that are actively transmitting video to the conference address (See Figure 8). If no sources are active, the text 'No Network Sources' is displayed in the panel. Each source will have a thumbnail sized image, identification text, some bit and frame rate statistics, a mute button, a color button, and a stats button.

Selecting the 'mute' button will cause vic to ignore video from the respective source (It is a good idea to mute your own video transmission.). The 'color'

Figure 8: Vic Panel

button will toggle between displaying the video image in color and greyscale. The 'color' button does not affect your own transmitted video. The 'stats' button brings up a top level panel containing network and video statistics for the respective source. These statistics are updated once per second.

To get a larger viewing panel of the respective source, left-click on the thumbnail image. Along the bottom of the larger panel are additional controls. The 'Dismiss' button will close the panel. The 'Size' button causes a pop-up menu to appear so that the panel size can be set. The pop-up panel that appears when the 'Mode' button is selected allows for changing the switching mode of the panel. By default, the switching mode is "locked". This means that the panel is locked onto the indicated video source. In "browse" switching mode, vic will cycle through the set of active video sources. The last switching mode is "voice-activated". Running in voice-activated mode in tandem with a vat session will cause vic to switch to video sources of whoever is speaking.

Located at the bottom of the main vic panel are three option buttons. The 'Help' button will bring up a help window which contains some helpful hints on using vic. The 'Quit' button will allow you to exit the vic panel. To pull up the vic control panel, click on the 'Menu' button. The control panel is separated into three sections, Transmission, Encoder, and Session. The transmission controls include a toggle button labeled 'Transmit', which opens the

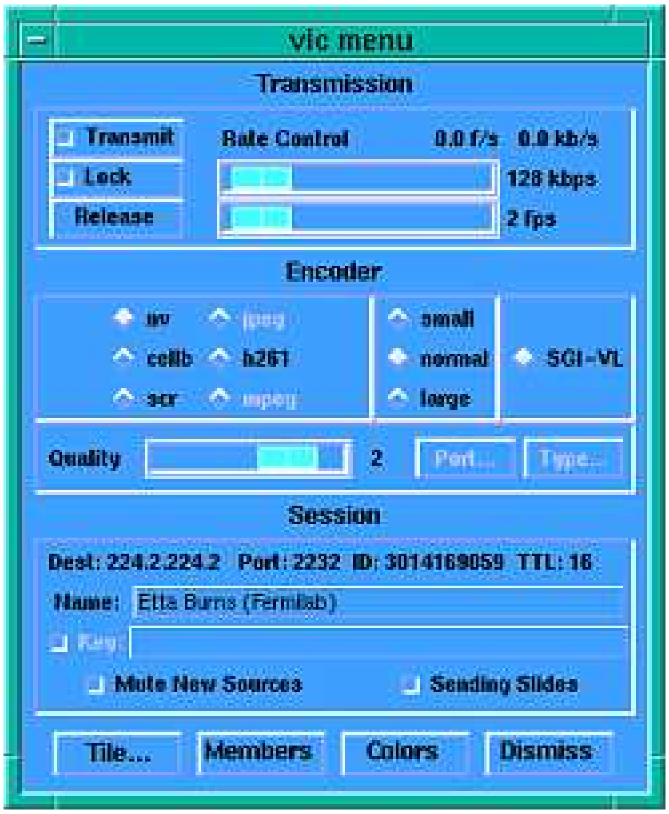

Figure 9: Vic Menu Panel

video capture device and begins transmission. The 'Release' Button terminates the active transmission. The 'Lock' button prevents any external source from automatically initiating or terminating transmission.

The encoder controls are used to select coding formats, video image size, coding quality level, device ports, signal type, and device. Not all options are supported by all devices. Options not supported appear in greyscale and are disabled. The session controls section displays the conference address information. The 'Name' type-in box can be used to change the session name announced to other sites. The 'Key' type-in box contains a session key for encryption. Vic allows the audio packet streams to be DES encrypted. Only sites sharing the same key will be able to decrypt and listen to the encrypted audio. Encryption is enabled by entering an arbitrary string in the key box (a string previously agreed upon by all parties who are to be allowed viewing). Encryption can be turned off by entering a null string (a simple carriage return) in the key box.

At the bottom of the control panel menu are several buttons. The 'Tile' button is a pull-down menu which allows you to specify the number of columns to use for displaying the thumbnail summaries of each active source. The 'Members' button brings up a panel with a scrollable list of all the participants in the session. The 'Colors' button invokes a dynamic optimization of the color map. The 'Dismiss' button will close the control panel.

8.11 IVS - Inria Videoconferencing System

Ivs is an X11-based videoconferencing tool for various Unix workstations. Ivs allows users to conduct multi-host audio and video conferences over the Internet. Ivs uses H.261 video encoding, achieving better data compression than nv at the expense of greater CPU usage. Ivs requires a workstation with a screen with 1, 4, 8 or 24 bits depth. Ivs may be run either in multicast mode or in unicast mode. Multi-host conferences require that the kernel support multicast IP extensions.

No special hardware apart from the workstation's built-in audio hardware is required for audio conferences. On video input, an appropriate video board is required; VideoPix, SunVideo or Parallax for SparcStations; IndigoVideo or GalileoVideo boards for SGI IRIS Indigo and Indy workstations. Ivs may be run either in multicast mode or unicast mode.

8.12 Using IVS

The ivs tool can be invoked via the command line. Following is a sample command line entry to invoke ivs (Please see the ivs man page for flag definitions):

```
% ivs -t 127 224.2.224.2/2232
```

The ivs panel for running multi-host audio and video conferences is shown in Figure 10. Running ivs in unicast mode requires you to call someone on the

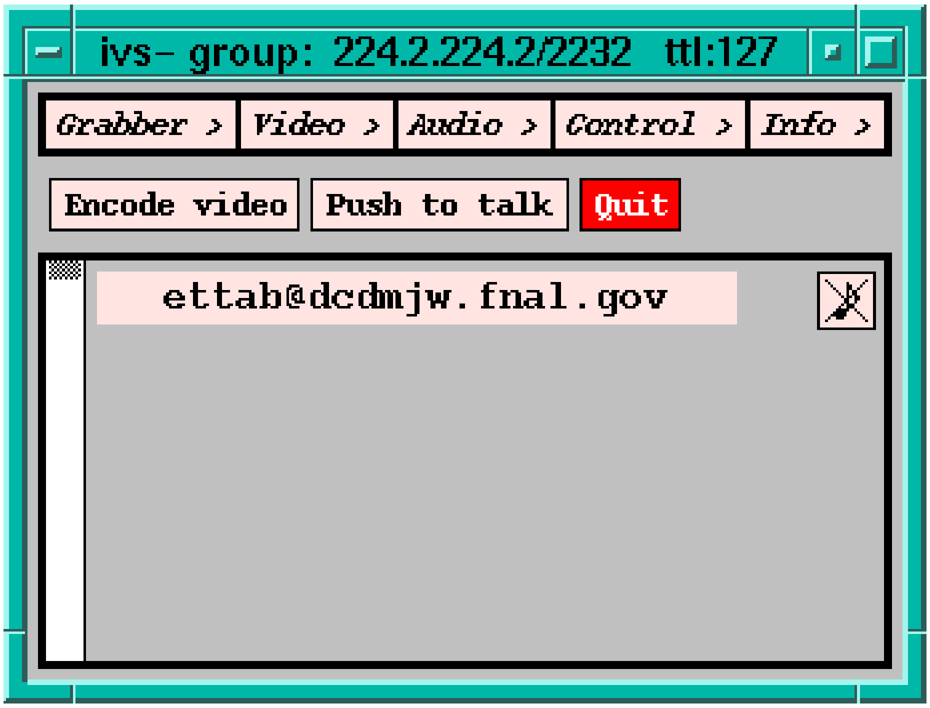

Figure 10: Ivs Multicast Panel

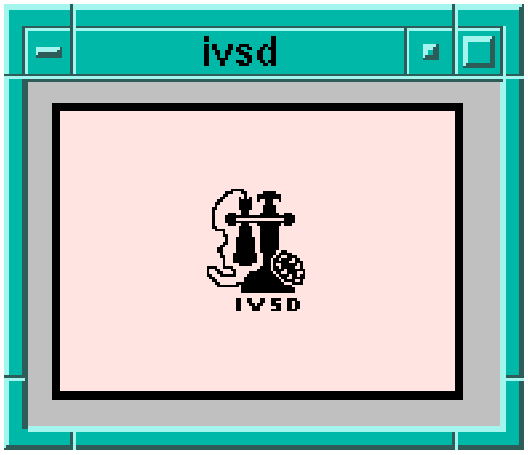

Figure 11: Ivsd Panel

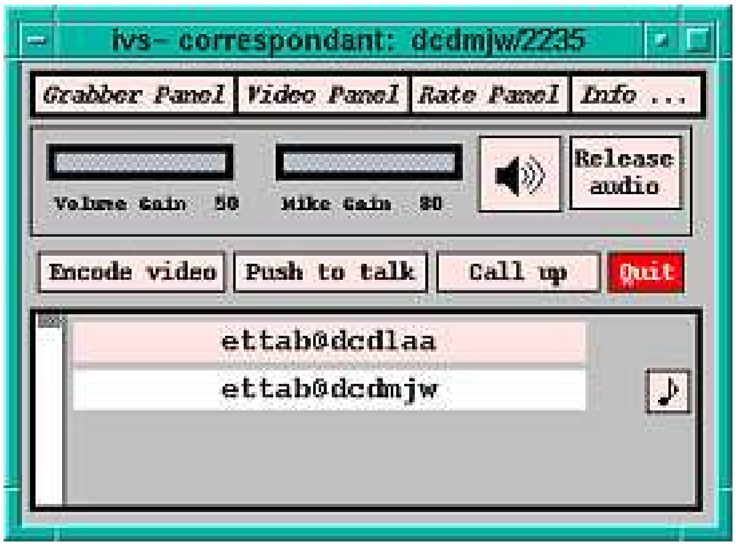

Figure 12: Ivs Unicast Panel

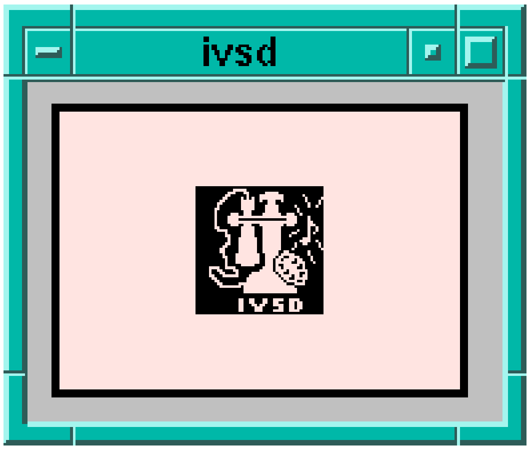

Figure 13: Ivsd Call Panel

Figure 14: Ivsd Call Request Panel

network. The party you are calling needs to be running an ivs daemon (ivsd). When you run ivsd, a small icon appears (See Figure 11). To ring the other party, simply click on the 'Call up' button in the ivs unicast panel shown in Figure 12. When a remote ivs talk request is received, the ivsd icon will change (See Figure 13) and a message will notify your party that a talk request has been made (See Figure 14). At this point, your party need only click on 'Accept' to start the ivs call. If your party does not respond, you can abort the ivs talk by clicking on the **Abort** button and a message will notify your party of the aborted talk request.

The Control Panel menu, as shown in Figure 15, allows you to choose the output rate control method. In most cases, the default 'Automatic' control should be used. However, you can enforce a maximal video output rate using 'Manual' control or you can let the coder run without constraints by turning control 'Off'.

The Video Grabber Panel lets you select the appropriate video board for your workstation (See Figure 16). Manipulating the video display is done using the Video Coder Panel shown in Figure 17. The Audio Panel shown in Figure 18 allows you to tune audio and select the audio encoding method. To avoid undesirable echo, the loudspeaker is automatically muted while speaking. However, you can disable this mode using the "Echo on/off" button.

There are also ivs tools that will allow users to record ivs audio/video sessions and then play them back at a later time. Ivs_record writes audio/video data in a file from one ivs participant or all the participants from an ivs session. Ivs_record is invoked via the command line as follows (Please see the ivs_record man page for flag definitions).

```
% ivs_record 127 224.2.224.2/2232 -clip MboneIVS
```

To start recording with ivs_record, click on the 'Push to start recording' button (See Figure 20). As soon as the button 'Push to stop recording' appears, the recording begins. A clip may be deleted by clicking on the 'Clear' button. To replay an ivs audio/video clip or broadcast a recorded ivs session, invoke the ivs_replay tool as follows (Please see the ivs_replay man page for flag definitions).

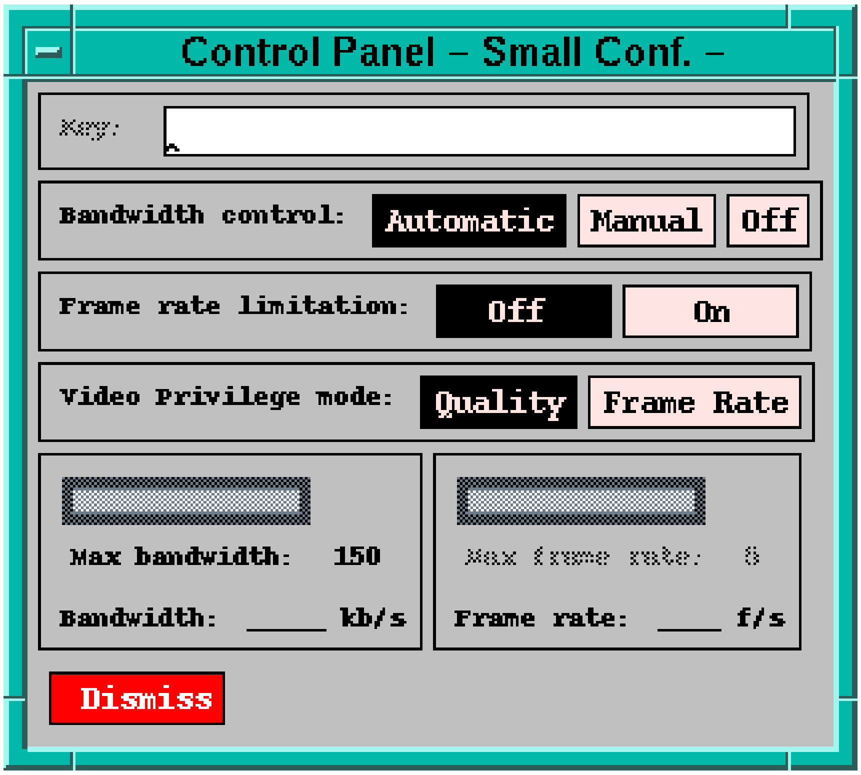

Figure 15: Ivs Control Panel

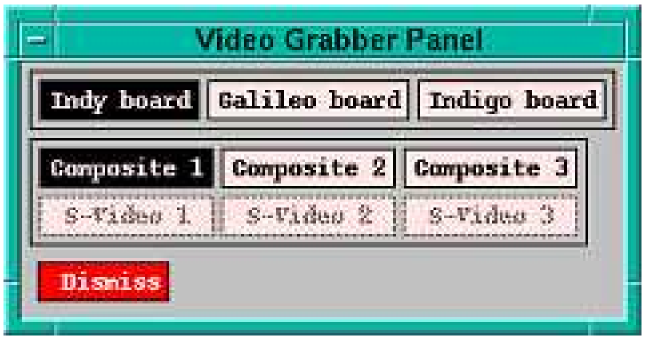

Figure 16: Ivs Grabber Panel - SGI

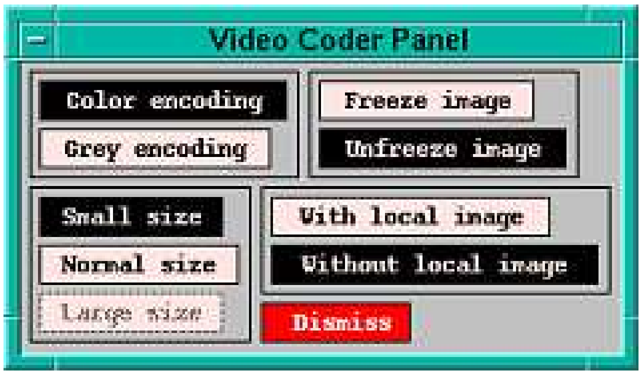

Figure 17: Ivs Video Coder Panel

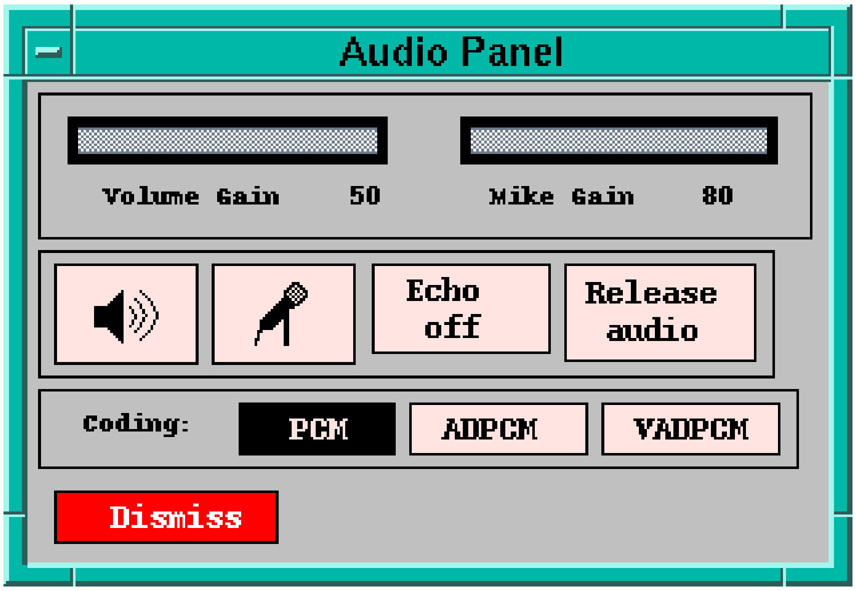

Figure 18: Ivs Audio Panel

Figure 19: Ivs_Record Panel

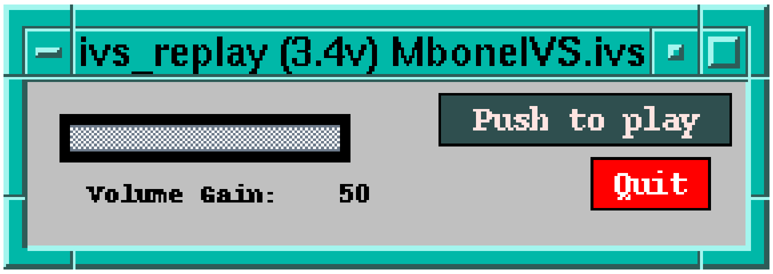

Figure 20: Ivs_Replay Panel

```
% ivs_replay 127 224.2.224.2/2232 -clip MboneIVS.ivs
```

To begin playback, click on the 'Push too play' button (See Figure 20). The 'Pause' button allows you to stop temporarily the replay. To continue the replay, click on 'Cont'.

8.13 IMM - Image Multicaster Client

Imm is a client program which receives multicasted images. The still images received by imm are fed to a viewer. The default viewer for imm will be xli which is included in the Fermilab product ximagetools. For this reason, ximagetools is a dependent product of the Mbone product. Successfully received images are automatically loaded onto the root window of the client host. If the environment variable DISPLAY is defined, imm will attempt to load the image onto the defined display.

Imm achieves reliable reception by requesting retransmission of missed packets. Imm also has the capability to archive received files into a specified directory. If the environment variable 'IMM_IMAGE_DIR' is defined, files will be cached into the specified directory.

Immserve is a server program which multicasts JPEG/GIF images as UDP packets. Immserve can be initiated from within imm or on the Unix command line.

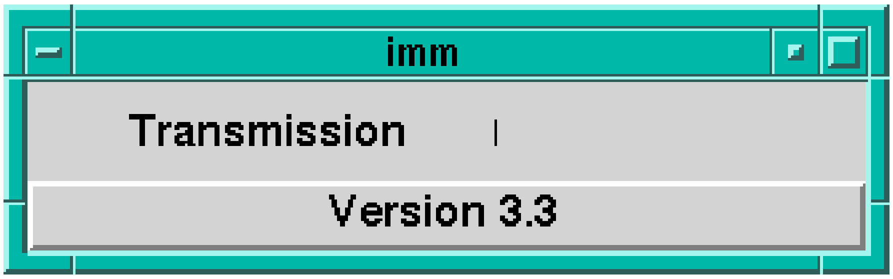

Figure 21: Imm Panel

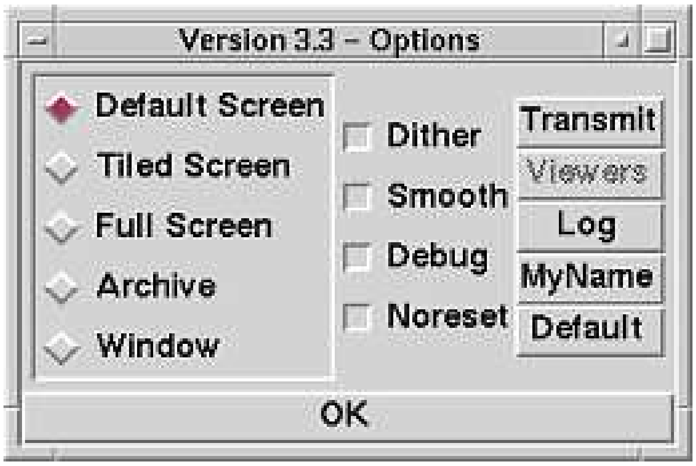

Figure 22: Imm Options Panel

8.14 Using IMM

To display the last received image, click on the 'Transmission' button of the main panel (See Figure 21). Imm will call xloadimage to display the image.

Clicking on the lower bar of the main panel will cause an options panel to appear (See Figure 22). The buttons in the left of the panel alter whether xloadimage loads the image on the entire screen ('Full Screen' option) or tiles the screen with the image ('Tiled Screen' option). The 'Window' option simply places the image into its own window.

Transmitting your own imm images can be done using the imm transmit panel (See Figure 23). In the imm options panel, click on the 'Transmit' button to bring up the imm transmit panel. Next, create a directory entry which points to your images by clicking on the 'Create' button and entering the directory name. Then click on 'Enter entry into table' to include the entry in the list.

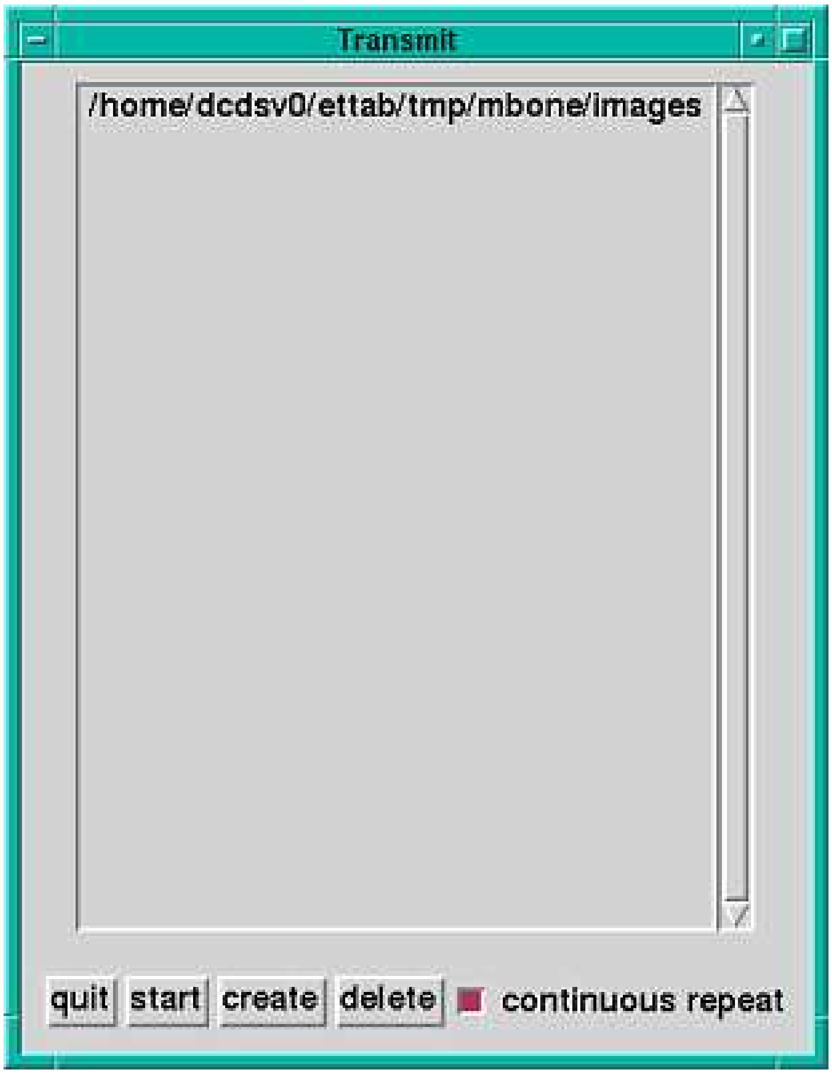

Figure 23: Imm Transmit Panel

8.15 MMCC - X-based Multimedia Conference Control Program

Mmcc is a session orchestration tool that provides point-to-point or multipoint teleconferences. It allows a caller to explicitly invite others to participate in a conference, and alerts them to accept or decline. It automatically spawns underlying audio, video and groupware (whiteboard) programs among members of a session, then tears them down at session completion. Mmcc will distribute a session key for confidential sessions.

Mmcc may be configured to start up with a database of remote user aliases and addresses. By default mmcc looks for the file .mmccrc in your home directory. Each line in the file includes an alias for a user, the user's login id, and the user's workstation host name or host address. The port field is optional, and by default has a value of 5050. Create your own .mmccrc file, as you begin to acquire remote users' addresses.

```
Example of a .mmccrc file

#alias          login          hostname               [port]
"Grant Hill"    granth         nba.det.com
Class88         wbb            isu.cyclone.edu
Daffy           dduck          128.9.160.400          5051
Anita           abaker         rab.soul.com
```

A '#' at the beginning of a line indicates a comment. The alias field refers to the nickname of the user, which may be multiple words if enclosed in double quotes. The login is the user's login id, the hostname is the internet name or address of the user's workstation, and the field port, indicates the port at which mmcc resides and is an optional entry. If port is omitted, mmcc's default port value is used.

8.16 Using MMCC

Mmcc is used to supplement the session directory tool, sd, with a more private session style for smaller conferences. Thus, session advertisement is internal to the group of conference participators. By default, mmcc brings up the visual audio tool, vat, and offers the option to start the network video program, nv, and the shared whiteboard tool, wb.

To invoke mmcc, issue a command line entry such as the following (Please see the mmcc man page for flag definitions):

```
% mmcc -autoyes -locttl 127
```

The main panel, (See Figure 24) contains several control buttons. To initiate a session with remote users, click on 'Connect'. The connect panel shown in

Figure 24: MMCC Panel

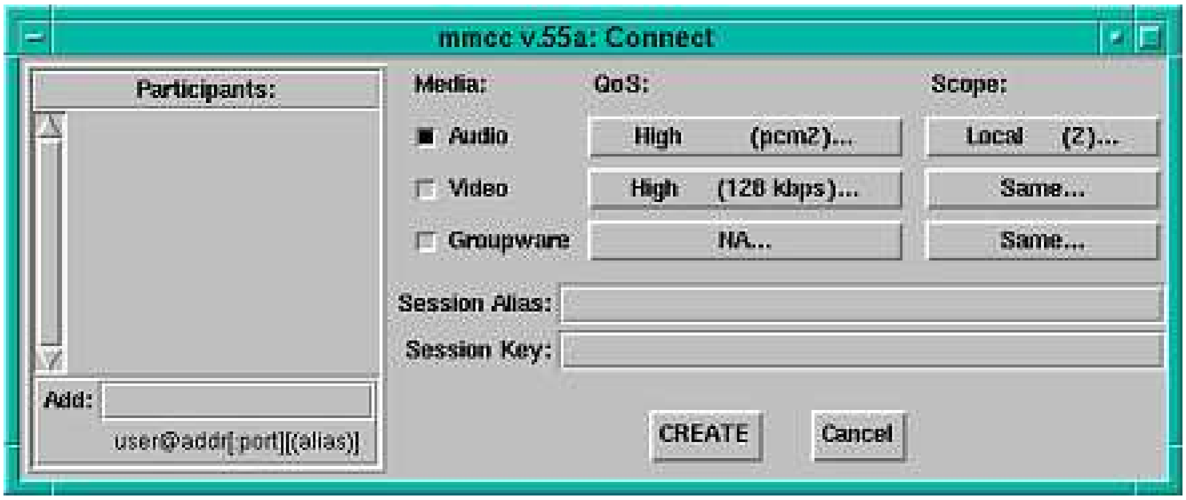

Figure 25: MMCC Connect Panel

Figure 25 will appear. A session name can now be assigned by selecting (left-click), then typing in the 'Session Alias' field. If this field is left blank, the name of the session is automatically generated and is based on the session initiator's alias. To specify a session encryption key, left-click, then type in the 'Session Key' field.

Under the 'Participants' list, use the left mouse button to click on the aliases of any remote users who should be included in the session. Repeated clicking on the same user's name toggles the selection. To include a user not in your user configuration file, type in the 'Add' field at the bottom of the Participants list. Only the user and address fields are required. When the entry is complete, simply hit RETURN to enter it in the participant list and select it.

Under the 'Media' list, left-click to select the media to include in the session. 'Audio', 'Video', and 'Groupware' map to the programs vat, nv, and wb. By default, audio is included.

An mmcc session must be running a remote user's workstation in order to communicate with that user. The mmcc panel may be inconized to place it out of view when it is not in use. Any in-coming requests will automatically re-open the panel.

Click on the 'Create' button to initiate the session, or on 'Cancel' to cancel the request. The selected conferencing tools will appear on each participant's workstation once the invitation to participate is accepted.

Returning to the main panel shown in figure 24, the 'Disconnect' button will disconnect from the sessions highlighted in the Sessions scrolling window. If only one session exists, then mmcc disconnects from that session without it having to be highlighted. When a user disconnects, the associated vat, nv, and wb also get disconnected.

The 'Modify' will allow a user to invite additional parties, join an existing session, place a session on hold, merge multiple sessions.

The 'View Log' option will toggle between displaying and undisplaying the log of error and warning messages produced by mmcc during operation.

The 'View Log' option will toggle between displaying and undisplaying membership and media information associated with the session that is highlighted in the Sessions scrolling window. Status includes the list of session participants, as well as the session alias, session key, media included, their multicast or unicast addresses and port numbers.

8.17 VAT_NV_RECORD - VAT/NV Recording Tools

Vat_nv_record is a set of tools that will allow you to record vat audio and nv video conference sessions and then retransmit them at a later time. You can record and retransmit conference sessions that you originate or conference sessions that are originated by others. The tools are invoked via the command line.

8.18 Using the VAT/NV Recording Tools

The five tools that are distributed with vat_nv_record are vat_record, vat_play, nv_record, nv_play, and av_play. Users can record or playback conference sessions while at a workstation or while they are away from a workstation. To record conference sessions while away from a workstation, it may be best to place the appropriate commands to invoke recording or playback in a script and run the script at the time the conference is scheduled to be broadcast (Note: 'crontab' can be used to run the script at a scheduled time).

8.18.1 Vat_record

Vat_record will record the audio sent on a vat conference channel. The audio is stored in files that are by default placed in the current working directory and have a default filename prefix of 'audio'. The following command line entry is an example of how to invoke vat_record.

```
% vat_record -i 224.2.210.99 -p 39735 -c 14419 -d $HOME/recording
  -f Speech_audio -t 30
```

The following parameters can be changed with the following command line options.

```
-i <ip address>         The IP address of the conference. (default 224.2.0.1)
-p <UDP port>           The UDP port number of the conference. (default 3456)
-c <conference id>      The conference id. (default 0)
-d <directory>          Directory to put audio files. (default ".")
-f <filename prefix>    Filename prefix of audio files. (default "audio")
-s <seconds>            Seconds of audio per file. (default 180)
-t <min to record>      Number of minutes to record (default unlimited)
-b <max bytes>          Maximum number of bytes to record (default unlimited)
```

8.18.2 Vat_play

Vat_play will retransmit a recorded vat conference session. Before you retransmit a recorded vat session, you must create a conference event in which to transmit the recorded session (see the section on *Creating a Conference Event*). The following command line entry is an example of how to invoke vat_play.

```
% vat_play -i 224.2.147.141 -p 35821 -c 11596 -t 127 -d $HOME/recording
  -f Speech_audio
```

The following parameters can be changed with the following command line options.

```
-i <ip address>         The IP address of the playback. (default 224.2.0.1)
-p <UDP port>           The UDP port number of the playback. (default 7878)
-c <conference id>      The conference id. (default 0)
-t <ttl>                TTL level to be used during the playback. (default 16)
-d <directory>          Directory to read audio files from. (default ".")
-f <filename prefix>    Filename prefix of audio files. (default "audio")
-o <time offset>        Jump <offset> number of seconds into recording.
-k                      Keep long periods of silence.
```

8.18.3 Nv_record

Nv_record will record the video sent on a nv conference channel. The video is stored in files that are by default placed in the current working directory and have a default filename prefix of 'video'. The following command line entry is an example of how to invoke nv_record.

```
% nv_record -i 224.2.210.99 -p 39735 -d $HOME/recording -f Speech_video -t 30
```

The following parameters can be changed with the following command line options.

```
-i <ip address>         The IP address of the conference. (default 224.2.1.1)
-p <UDP port>           The UDP port number of the conference. (default 4444)
-d <directory>          Directory to put video files. (default ".")
-f <filename prefix>    Filename prefix of video files. (default "video")
-s <seconds>            Seconds of audio per file. (default 180)
-t <min to record>      Number of minutes to record (default unlimited)
-b <max bytes>          Maximum number of bytes to record (default unlimited)
```

8.18.4 Nv_play

Nv_play will retransmit a recorded nv conference session. Before you retransmit a recorded nv session, you must create a conference event in which to transmit the recorded session (see the section on *Creating a Conference Event*). The following command line entry is an example of how to invoke nv_play.

```
% nv_play -i 224.2.147.141 -p 35821 -t 127 -d $HOME/recording -f Speech_video
```

The following parameters can be changed with the following command line options.

```
-i <ip address>         The IP address of the playback. (default 224.2.1.1)
-p <UDP port>           The UDP port number of the playback. (default 4444)
-t <ttl>                TTL level to be used during the playback. (default 16)
-d <directory>          Directory to read video files from. (default ".")
-f <filename prefix>    Filename prefix of video files. (default "video")
-o <time offset>        Jump <offset> number of seconds into recording.
-k                      Keep long periods of video silence.
```

8.18.5 Av_play

Av_play will retransmit recorded vat and nv conference sessions in parallel. Before you retransmit recorded sessions, you must create a conference event or events, in which to transmit the recorded sessions (see the section on *Creating a Conference Event*). One conference event may be created to retransmit both the recorded vat and nv conference sessions, or separate conference events may be created, one for each of the recorded sessions. The following command line entry is an example of how to invoke av_play.

```
% av_play -i 224.2.147.141 -p 35821 -c 11596 -t 127 -d $HOME/recording
  -f Speech_audio -j 224.2.147.111 -q 39324 -e $HOME/recording -g Speech_video
```

The following parameters can be changed with the following command line options.

```
-i <audio ip address>   The IP address of the playback. (default 224.2.0.1)
-p <audio UDP port>     The UDP port number of the playback. (default 7878)
-c <conference id>      The conference id. (default 0)
-t <ttl>                TTL level to be used during the playback. (default 16)
-d <audio directory>    Directory to read audio files from. (default ".")
-f <filename prefix>    Filename prefix of audio files. (default "audio")
-j <video ip address>   The IP address of the playback. (default 224.2.1.0)
-q <video UDP port>     The UDP port number of the playback. (default 4444)
-e <video directory>    Directory to read video files from. (default ".")
-g <filename prefix>    Filename prefix of video files. (default "video")
```