BuenaVista Videoconferencing System
User's Guide
Windows 95/NT Version 3.0

Tom Stachowiak and Marek Podgorny

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Introduction

Welcome to BuenaVista!

Thank you very giving our system a try!

BuenaVista is a videoconferencing application for Internet and for the Intranets. Our solution has a number of interesting features:

– it is multiplatform - at present, it runs on Windows 95/98/NT/2000 and on SGI IRIX machines; the versions for SunOS and Linux are forthcoming
– it is interoperable: PC and UNIX users can videoconference
– it is multi-user - not just another peer-to-peer Internet phone
– it only uses standard, H323-compliant codecs (H.263 and H.261 for video, GSM and ADPCM for audio)
– it is high performance - the codecs have been optimized to ensure frame rates as high as possible on a given hardware platform
– it is flexible - conference participants can use different audio/video formats and switch between them as dictated by network conditions without affecting session setup
– for LAN applications, it supports high bandwidth, high quality video formats (YUV9/PCM)
– it handles both half duplex and full duplex operation with either manual or automatic switching
– it provides built-in directory service
– it provides textual chat capabilities in addition to audio and video
– it optionally offers session archiving and replay capabilities
– it is extensible as it provides an API and a framework to create and integrate new applications
– it is fully integrated with TANGO Interactive, our ground-breaking Web-based collaborative and distance learning system.

About this Guide

This guide is designed to provide you with all the information needed to install and use BuenaVista software. BuenaVista is available in two flavors: as a stand-alone

videoconferencing system, and as the videoconferencing agent for our web collaboratory, TANGO Interactive. Both flavors are described in this document.

Users of TANGO Interactive will usually have access only to the integrated version of BuenaVista. The stand-alone version is a separate product.

This guide gives instructions for Windows 95, Windows 98, Windows NT, and Windows 2000 (when available) installations. Separate manuals describe BuenaVista for UNIX platforms.

Unless stated otherwise, this guide refers to BuenaVista version 3.0.

Contact Us

For additional information about the software visit our web site at http://buenavista.npac.syr.edu.

For technical support, please, e-mail a possibly precise description of your problem to support@webwisdom.com

System Requirements

Your system must meet following requirements to ensure correct operation of BuenaVista.

Software requirements

- Windows 95/98/NT 4.0/2000. Windows NT requires Service Pack 3 installed.
- For DX version of BuenaVista: Microsoft DirectX 5.0 (or higher) package
- Correctly installed drivers for audio and video capture cards

Hardware requirements

- A networked Pentium 133 MHz PC (Pentium 200 MHz is recommended for users with video cameras)
- Minimum 32 MB of RAM (recommended: 64MB for Windows 95/98, 128MB for Windows NT)
- 2 MB of disk space (4MB for TANGO Interactive version)
- Network card or a modem supporting IP protocol
- Audio card supporting 8 kHz 16 bits sampling (full duplex support recommended) The product has been tested with the following audio cards:
  - SoundBlaster 16 and SoundBlaster64
  - Ensoniq Soundscape Vivo
- Speaker/headphones
- Microphone
- Video capture card (optional) supporting RGB 24 and/or YUV9 format. The product has been tested with the following video capture cards or digital cameras:
  - Intel Smart Video Recorder III
  - Winnov Videum, including laptop digital cameras (this product integrates audio capture)
  - Panasonic Eggcam
  - Vicam USB digital camera (note that all cameras using USB port require Windows 98, Windows 2000, or Windows 95 release 950B)
- Camera or other video source (optional)

The hardware requirements listed above are the *minimal* requirements. That is, BuenaVista will *guaranteed* not work properly on slower machines. However, the minimal configuration is not guaranteed to provide satisfactory performance. "Satisfactory" performance is in the eye of the beholder, and users expectations

widely vary. Although many videoconferencing solution vendors are careful not to mention it, videoconferencing with useful performance requires either a powerful CPU, a hardware support for video encoding, or a lot of spare bandwidth. As a rule of thumb, lower bandwidth of the user's Internet connection imposes higher CPU demand on the user workstation. Realistically, a user connected to Internet via a modem, and using low-class Pentium PC cannot use videoconferencing in any useful fashion (that is, unless seeing the interlocutor moving once each few seconds and listening to garbled audio is considered useful)

BuenaVista is a multi-user system. It is not a two-users videophone. The natural question is, how many users can be concurrently supported? The answer in not obvious, as it depends on many factors. The detailed technical discussion is provided in Section 7 – Advanced Topics. As a rule of thumb, the minimal configuration will support two users. Every additional user takes more CPU to decode incoming audio and video streams, and more bandwidth to accommodate the streams. The lowest requested bandwidth per user for BV is around 20 Kbps. Realistically, BuenaVista will support two users on modem lines and up to 4 users on ISDN-grade connections. For LAN applications, the limiting factor is CPU power. To have a good quality 8-way video conference, a 450MHz Pentium II system is recommended on the desktop of each user.

Hardware and Software Configuration

Audio Card

In order to effectively utilize BuenaVista it is very important to properly configure audio drivers. After successful installation of audio card drivers it is essential to check their proper operation. The best way to do this is by using standard Windows audio tools such as Media Player and Sound Recorder, which can be accessed through Start/Program/Accessories/Multimedia/ menu. In case of any problems, first check the driver setting with Volume Control (placed at the same location). If manipulating standard driver setting does not improve the situation, please refer to your audio card manual or contact the audio card vendor. If basic Windows tools do not operate properly, it will be impossible to use BuenaVista.

If the user of BuenaVista also uses a variety of other audio applications, it is likely s/he will need to use Audio Mixer to select and adjust audio sources. The standard Windows audio mixer is a confusing application, to say the least. You should make sure that you clearly understand the difference between the "playback" and "recording" controls. Wrong setup of the mixer controls may make you think your videoconferencing application does not work. See helpful hints in the "Troubleshooting" section.

Since Windows audio architecture allows only one application to capture audio device, you must quit any application utilizing audio before you start BuenaVista[1]. Otherwise, after establishing the session, BuenaVista will terminate displaying an error message.

Video Capture Card

Video capture card is an optional element of the videoconferencing system. Without video card, you will be able to communicate through the audio channel and you will receive incoming video streams from other conference participants, but you will not be able to send the video stream from your camera. Pressing the camera button on a

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[1] This does not apply to CD players. CD players access audio cards via a separate hardware interface. This restriction does not apply to application using DirectX to access audio channel, but, except for games, they are rare at present

PC without the card displays a warning.

There are many video formats available through different video capturing cards. BuenaVista supports only the most popular ones, RGB 24 and YUV9[2], and any frame size over 176 x 144[3]. Your card must support at least one of those formats to work correctly with BuenaVista. Moreover, your video capture driver must be set to one of those formats *before* BuenaVista can use video capture capabilities. Otherwise, appropriate message will be displayed upon pressing the camera button.

To ensure the correct operation, when starting BuenaVista for the first time, go to the Edit/Options menu, choose Video tab (Figure) and press Video Format button. The appearance of Video Format window is dependent on the installed card and the driver (Figure 1). You must set appropriate format and size and close both Video Format and Options windows before you proceed.
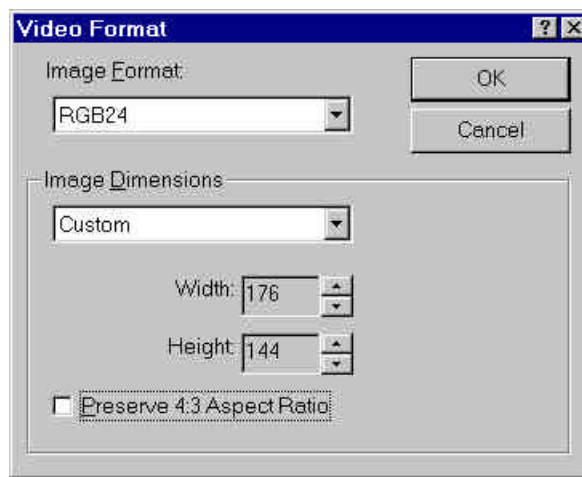

Figure 1: Video format selection panel for the Intel Video Smart Recorder card.

Some of the cards have multiple video inputs. Make sure that you have selected the correct input channel (Figure 2).

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[2] Some video drivers (e.g. Connectix QuickCam) do not provide clear description of the video format. Try a setting such as "Millions of colors".
[3] This frame format is known as QCIF. If you set up your video camera driver to a larger frame, you will get a "zoom" effect: BuenaVista will send a QCIF window cut from the center of the larger frame and discard the margins outside QCIF.

Figure 2: Input selection panel for the Intel Video Smart Recorder

Before using any videoconferencing software it is very important to test video
capture card. Most of the cards come with software applications allowing simple
video capture to the screen or a file. After the card is installed, always use the
software provided by manufacturer to check if the card can capture video. *If the
manufacturer software does not work, the card has not been properly installed and
BuenaVista will not work.* Be aware that an attempt to access a video driver that is
not installed correctly can lead to a serious system crash, including dreaded "blue
screen", or a complete freeze of the machine.

Installing BuenaVista

1. Download the BuenaVista package form the Web
   (http://buenavista.npac.syr.edu) or insert WebWisdom CD-ROM
2. Run the BV.exe file
3. Setup Wizard will guide you through the rest of the installation process.

Depending on your system configuration, the installer may ask you if you want to install the DX version of the program. See the box below for explanation.

It is not necessary to reboot your machine after the installation.

Note:
For the BuenaVista DX version you need to have Microsoft DirectX 5.0 or higher installed prior to the BuenaVista/TANGO Interactive installation.

DirectX is an extension of the Windows operating system designed to provide better multimedia capabilities, especially for games. DirectX supports audio functionality commonly available on UNIX workstations, such as audio stream multiplexing. DX version of BuenaVista makes use of these capabilities. DirectX use is recommended. DirectX is not available for Windows NT 4.0, and is optional for Windows 95. It is standard in Windows 98 and Windows NT 5.0 (a.k.a. Windows 2000)

BuenaVista for TANGO Interactive

BuenaVista for TANGO Interactive comes and automatically installs with your TANGO Interactive installation. Please, refer to the TANGO Interactive documentation for more detailed installation information.

Using BuenaVista

Main BuenaVista Window

The main panel of BuenaVista consists of three major components: session control ('Participants' frame), audio control ('Control' frame) and video control (Camera button). In addition, there is a status box that shows variety of messages related to BuenaVista operation. The TANGO Interactive version does not include session control component since session setup is performed through TANGO Interactive Control Application.
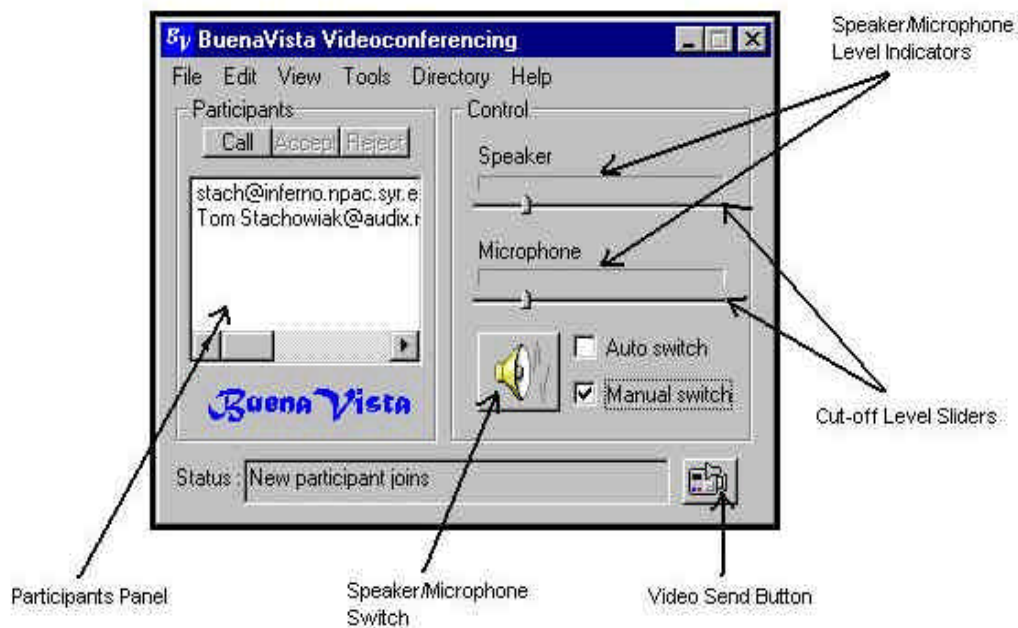

Figure 3 BuenaVista Main Panel

Call Button – allows direct session creation by sending invitation. Invokes 'Call User' window, where you can type the IP address of the host where invitation will be sent.

Accept/Reject Buttons – are activated only upon receiving a call. Not used in the 'Auto Accept' mode

Participant Panel – displays names and IP addresses of all session participants. Double clicking on a particular user displays additional information

Status Text Box – displays variety of messages regarding BuenaVista operation

Camera Button – initializes video capture and broadcast

Speaker/Microphone Level Indicators – show level of incoming/captured audio stream

Cut-off Level Sliders – sets threshold levels for automatic switching in the half-duplex mode. Microphone slider is additionally used to control the silence level (audio samples below that level are treated as silence and not sent)

Speaker/Microphone Switch – switches between send and receive for audio in the 'Manual Switch' mode

Auto/Manual Switches – set audio switching modes. Manual switch mode requires the user to manually switch between audio send and receive, similar to the walkie-talkie operation. This mode is required for certain secure applications. In Auto switch mode BuenaVista will automatically switch between send and receive based on the levels of audio signal from the microphone and the network (incoming audio). This option is only useful with half-duplex cards. It should be avoided with full-duplex cards as it may lead to a lower quality of transmitted audio. The audio level thresholds used in auto switch mode are set by the "Speaker" and "Microphone" sliders above the "Auto switch" checkbox.

Note that the mode switch controls are blanked if BuenaVista is not in a session.

Options Window

Options window can be accessed from main BuenaVista menu choosing Edit/Options. This window provides access to settings of all properties affecting BuenaVista operation. It is divided into three tabs: general, audio and video. Changes will be applied only after pressing 'Apply' (does not close Options window) or 'OK' (closes Options window) buttons. If you press Cancel, the changes you made will be ignored. For the user's convenience, invoking Options window interrupt video

capture/encoding/ transmission process. The process is automatically resumed after closing the window.
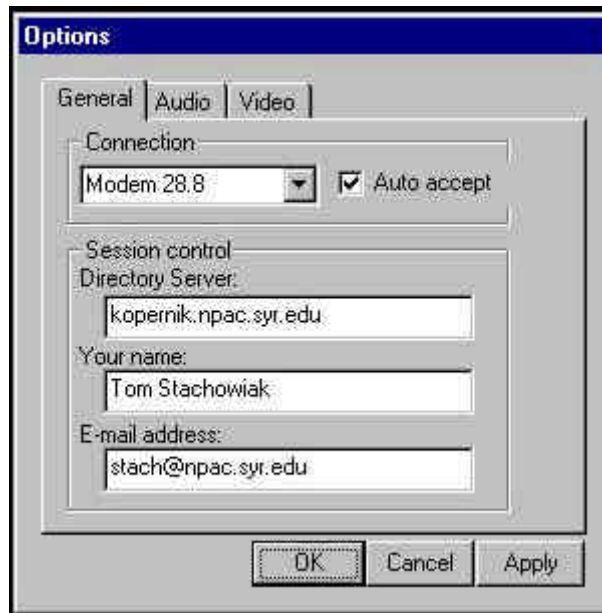
General Options

Figure 4 General Options Panel

Connection – determines the available network connection, It is very important to set this value properly in order not to exceed available network bandwidth. The selection includes Modem 28.8 (Internet connection bandwidth <28 Kbps), ISDN-1 (<64 Kbps), ISDN-2 (<128 Kbps), and LAN.

Name/E-mail address – identify the user to the Directory Service and during existing sessions; user is asked to set those values when starting BuenaVista for the first time

Directory Server – IP address or DNS name of the server that registers running instances of BuenaVista.

Audio Options
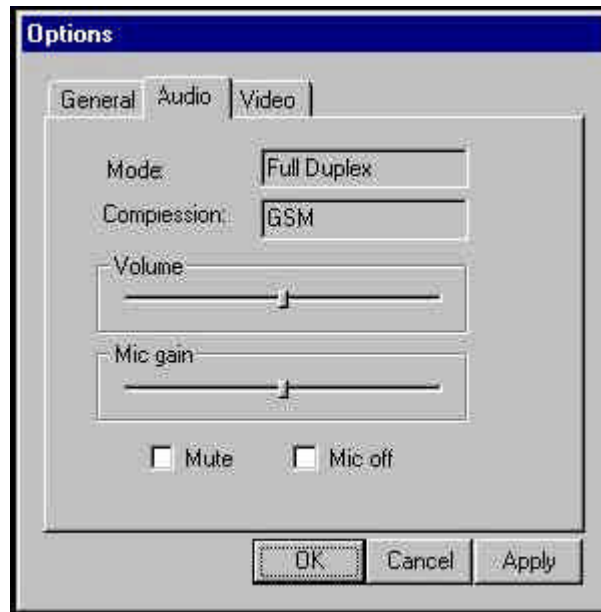
Figure 5 Audio Options Panel

Mode – indicates whether your audio card supports full-duplex or half-duplex mode

Compression – indicates the current audio compression option. Audio codec selection is determined based on the 'Connection' you selected from General Options panel

Volume/Mic Gain Sliders – allow adjusting speaker/headphones volume and microphone gain

Mute – mutes incoming audio

Mic off – switches off the microphone
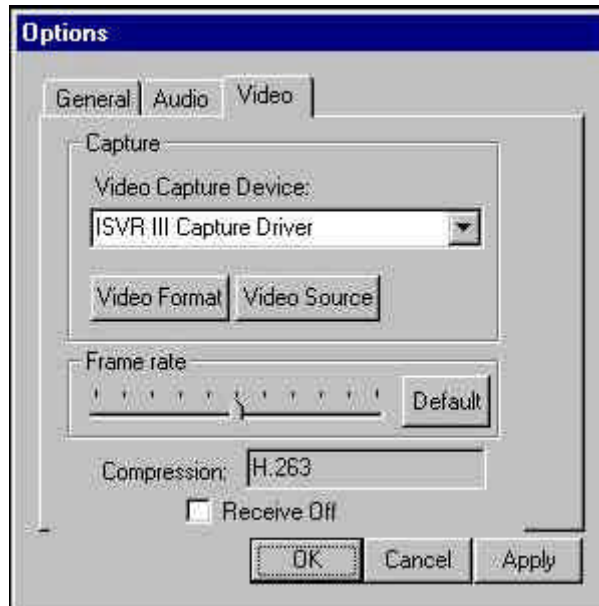
Video Options

Figure 6 Video Options Panel

Video Capture Device – since PCs may be equipped with more than one video
capture card, you may select the one you want to use from this menu. Remember to
set appropriate video format after any changes to this selection!

Video Format/Video Source – those buttons invoke driver-specific windows control
capturing parameters. Refer to your video capture card manual for details

Frame Rate – allows to control captured video frame rate; this options has direct
impact on outcoming bandwidth and CPU performance, default value is chosen
automatically for your network connection and CPU power; in some situations you
may want to decrease it (e.g. , when you use another CPU intensive application);
'Default' button restores the original setting

Compression – indicates the video compression option being used. Video codec
selection is determined based on the 'Connection' you selected from General
Options panel

Receive Off – switches off display of all incoming video streams
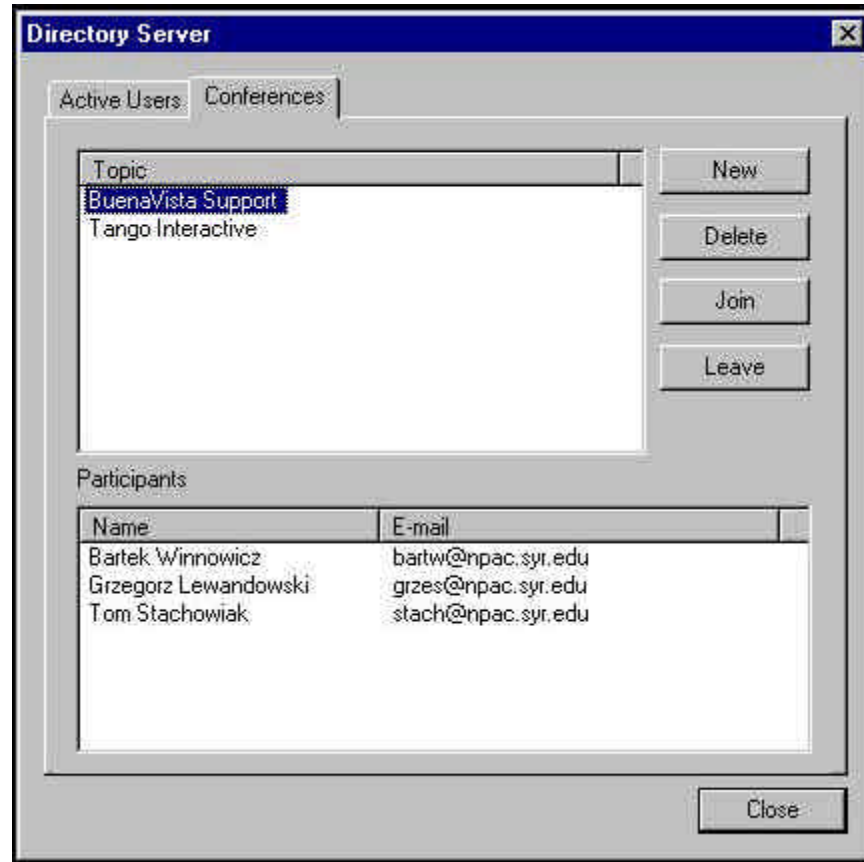
Directory Service Window

Figure 7 Directory Service Conferences Panel

Topic List – list of currently available conferences

Participants List – list of participants of the highlighted conference

New Button – creates a new conference. In the pop-up window you should enter the name and the type of the conference

Delete Button – removes the highlighted conference. You can only delete conferences created by yourself

Join Button – allows joining the highlighted conference (for some types of conferences, password or authorization may be required)

Leave Button – requests leaving the current conference

Conference Management

This section applies only to the stand-alone version of BuenaVista. All conference management operations in BuenaVista for TANGO Interactive are performed through the TANGO Interactive session manager.

BuenaVista session control distinguishes two different modes of operation: direct session management and Directory Service supported session management. Direct session management allows inviting participants by simple typing their IP address or DNS name. Directory Service supported session management takes advantage of the BuenaVista directory server that registers all users and enables them to create and join the open or protected sessions.

> **Note:** We provide directory service for BuenaVista users. Two available servers reside on `beast.npac.syr.edu` and `crpc1.npac.syr.edu`. You can use these servers, free of charge, to set up private conferences. If you wish to install your own directory server, please, contact our for server distribution.

General Preferences

In order to ensure correct operation of BuenaVista, it is important to properly initialize certain system parameters. User identification data are used both for Directory Service and for in-session identification. When you start BuenaVista for the first time, you will be asked to provide your name and your e-mail address. (BuenaVista for TANGO Interactive does not require identification since it uses appropriate TANGO Interactive information) You may change values of these data at any time through Edit/Options/General panel (see Figure 4).

Another important information is the address of the Directory Service. Initially, it is set pointing to the default server in NPAC. However, you may direct it to another server, just by changing the value of the Directory Server text field on the General

Options panel (Figure 4).

Finally, the crucial parameter required to be set properly is the Connection value. Adjust its value to best match your network connection. Incorrect setting is likely to produce serious problems with the audio and video quality or to congest your network connection. Check the Video Control section for information about other parameters needed to be set up correctly before using BuenaVista.

Direct Session Management

INVITING (CALLING) A USER*:*
1. Press 'Call' button
2. Type user IP address in the 'User' text box
3. Press 'Call' button on the 'Call User' panel
4. Status box will show whether user received invitation and what was his or her response

You are notified about receiving invitation with appropriate message in the status box and the ringing signal (manual mode only). Received invitation can be answered manually or automatically. This is determined based on the 'Auto accept' check box in the Edit/Options/General panel (see Figure 4). In manual mode 'Accept' and 'Reject' buttons on the main panel are activated upon receiving invitation, allowing user to make a decision. In the automatic mode all invitation are immediately accepted unless user is already in session in which case the invitation is automatically rejected in both answering modes.

Directory Service Supported Session Management

Directory Service advertises the users currently running BuenaVista and the available conferences. This way you can check who is on-line and what topics are discussed. Conferences are divided into three groups:

- Open – open without any restrictions to any users
- Password protected – requiring typing the password to enter the session
- Owner controlled – requiring the authorization from the session creator

You may either create your own session or join an existing one.

CREATING NEW CONFERENCE

1. Go to Directory/Conferences menu (see Figure 7)
2. Press 'New' button
3. In the 'New Conference' window type conference topic (name) and choose the type of your conference
4. Press OK

Conference will be created and you will automatically become it's participant. If you leave a conference when you are the only participant, the conference will be destroyed

DELETING CONFERENCE

1. Go to Directory/Conferences menu (see Figure 7)
2. Choose the conference you want to delete, highlighting it on the topic list
3. Press 'Delete' button

Note, that you can only delete a conference that you have previously created.

JOINING EXISTING CONFERENCE

1. Go to Directory/Conferences menu (see Figure 7)
2. Choose the conference you want to join, highlighting it on the topic list
3. Press 'Join' button
4. For password protected conferences type the password in the password window
5. Message on the main panel will confirm your participation in the conference (for Owner controlled conferences it can take some time to be accepted)

LEAVING CONFERECE

1. Go to Directory/Conferences menu (see Figure 7)
2. Choose the conference you want to leave, highlighting it on the topic list
3. Press 'Delete' button
4. Message on the main panel will confirm deleting from the conference

Audio Control

Although audio control user interface may seem too complicated, in many situations it is critical to manipulate all offered options properly in order to conduct effective

conference. An important thing the user needs to understand about PC audio is the concept of **half-duplex** vs. **full-duplex** hardware configuration. In full-duplex mode, it is possible to capture sound from the microphone and listen to the audio coming through the speakers at the same time. Unfortunately, many audio cards offer only half-duplex mode, where only one of those operations can be performed at any given time[4]. Thus, it is essential to ensure proper switching mechanisms to be able to effectively communicate. However, even with those mechanisms in place, awareness of the process taking place and maintaining certain speaking discipline is necessary.

BuenaVista offers two ways of dealing with half-duplex cards. First one is the manual switching between microphone and speaker mode. In this mode user has the ability of manually switching between microphone and speaker using the button placed on the main panel (see Figure 1). This option is activated with the check box located next to the button. Although this mechanism is easy and convenient for some purposes (e.g. distance learning), in other situations "hands-free", automatic switching is more appropriate. However, taking advantage of this option requires good understanding of the mechanism and some experience in using it. Major elements controlling the switching process are the level indicators and cut-off sliders on the main panel. Switch takes place only when the level on one of the indicators is below the cut-off level and above on the other. It is crucial to set the threshold level right above the environment noise, which is common for the computer audio equipment.

In general, we discourage use of the omni-directional microphones installed in some of the video cameras. These microphones are usually too sensitive and tend to pick up disturbing ambient noise. You risk that your private conversation is overheard if you accidentally leave such a microphone open. The best solution for teleconferencing is to use a good headphones set with integrated microphone.

> **Note:**
> In order to use BuenaVista effectively your audio card must be properly installed and configured. To facilitate customizing your volume and microphone sensitivity settings and other audio parameters you may invoke system audio panel directly from View/Audio Panel menu.

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[4] Please note that certain hardware cards can be full-duplex on Windows 95 and half-duplex on Windows NT. Full duplex support is provided by the card driver, not by the hardware alone. Carefully check with the card manufacturer availability of the full-duplex driver before buying the card.

Video Control

Taking advantage of the video capturing functionality requires proper initialization of the video card drivers. Refer to the Video Card Configuration section for details.

After successfully configuring your driver to work with BuenaVista, the video control process is very simple – camera button on the main panel decides whether you send your picture or not. Please, note that due to sophisticated compression algorithms needed to squeeze the video stream into limited bandwidth networks, sending video is very CPU intensive. Normally, frame rate of your video stream is automatically adjusted to the available bandwidth and CPU power. However, it might happen that CPU utilization is too high, slowing down the operation of the computer. In such situations you may limit CPU load using the frame rate slider on the Video Options panel (see Figure 6). Although the scale is from zero to ten, for some Connection options you might be prevented from setting your frame rate above certain default level that is deemed safe for your computer configuration.

Note: Windows 95 operating system has often problems with handling too heavy loads. Therefore, especially on older machines, BuenaVista may hang or freeze the operating system. If that happens, make sure to turn down the video frame rate next time you run BuenaVista.

Additional Functionality

Statistics

You can access additional information about the connection with a particular participant by double-clicking on the name in the participants list on the main panel. Figure 8 illustrates all the data that are displayed.

Figure 8 Statistics Panel

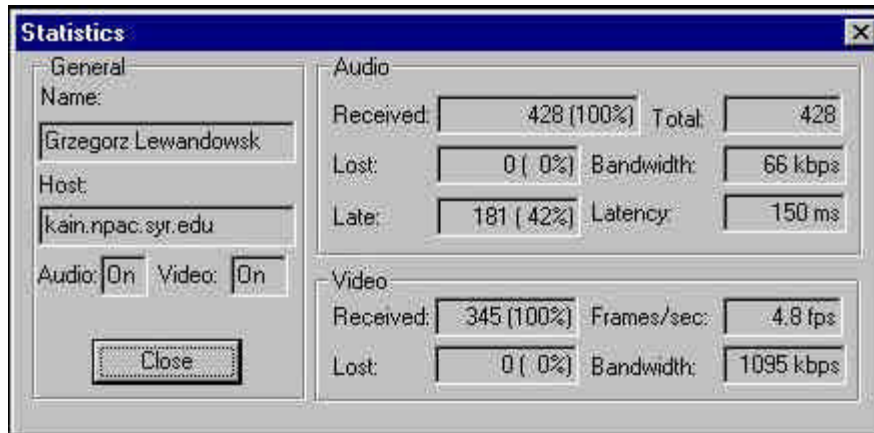### Text Chat

In case of problems with audio connection (e.g. bandwidth, configuration), BuenaVista is equipped in the Text Chat window accessible through Tools/Text Chat menu. Type your message in the text box at the bottom and press 'Send' button to pass the message to all participants. Any incoming messages will be printed on the big text panel above with the name of the participant who sent it.
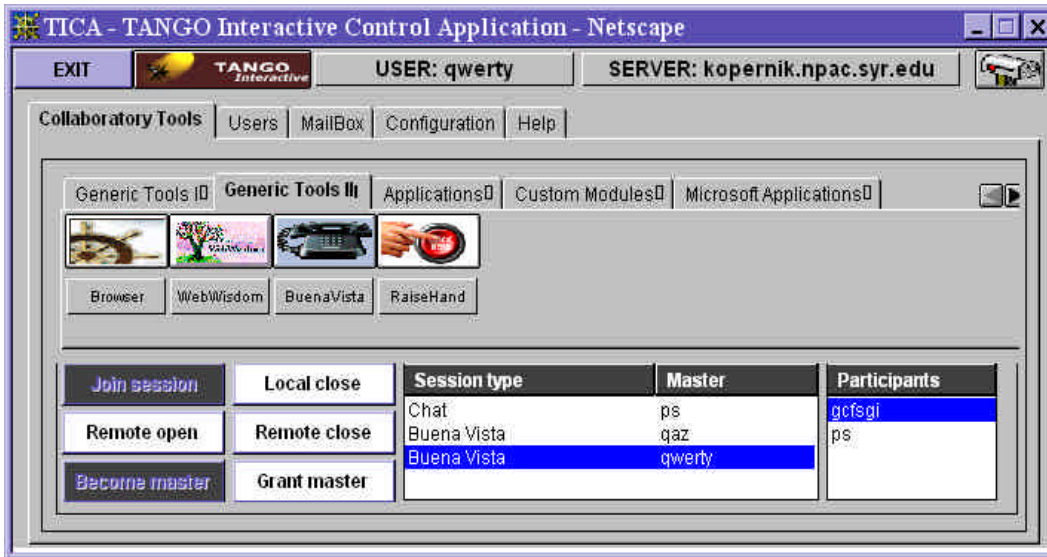
BuenaVista for TANGO Interactive

Figure 9: BuenaVista session in TANGO Interactive.

BuenaVista for TANGO Interactive session management is performed solely from the TANGO Interactive panel. In Figure 9 above, TANGO Interactive session manager shows BuenaVista as one of TANGO's many collaborative applications. Clicking the BuenaVista icon and using TANGO's session management to establish conferences starts TANGO's videoconferencing session. Fig. 7 lists two independent Buenavista sessions. The highlighted session serves three participants: qwerty, gcfsgi, and ps. As the "gcfsgi" name suggests, one of the participants uses SGI IRIX version of BuenaVista.

Since TANGO Interactive takes over all session management functions, BuenaVista for TANGO main window (Figure 10) includes neither participant list, nor direct conference management buttons. In addition, user identification fields in the General Options have been removed. Since TANGO Interactive performs also the functions of Directory Service, address of the server is eliminated. Some differences also apply

to the accessing and appearance of the statistics window. Other elements of
BuenaVista remain exactly the same.

*Figure 10: BuenaVista for TANGO Interactive in the sending and
receiving modes, respectively.*

Advanced topics

In this section we describe a number of advanced topics. Expert users and system administrator may find important operational information in this section.

Audio and Video codecs

BuenaVista uses exclusively standard coders/decoders (collectively known as "*codecs*" for both audio and video. Both encoding and decoding process is done in software. Video encoding is the most CPU-intensive operation.

For video, BuenaVista supports H.263, H.261, and H.261 without motion compensation (so-called "H.261-intra"). Of these coders, H.263 is most sophisticated, results in the lowest stream bitrate, but is also most computationally intensive and hence uses CPU cycles. Codec selection is always a trade-off: lower requested bandwidth demands more CPU power. If you have spare bandwidth, always use less computationally intensive codec – H.261 or even H.261-intra. H.263 takes usually twice as much CPU cycles as H.261 at the same frame rate.

Differences for decoders (processing and displaying of the incoming video streams are not as large.

Ballpark bitrate information for different encoders:

Table 1: Bitrate and CPU utilization for different codecs

Codec	Bitrate at ~5 fps	CPU utilization, 200 MHz Pentium Pro PC at 5 fps	Bitrate at ~2.2 fps	CPU utilization, 200 MHz Pentium Pro PC at 2.2 fps
H.263	~10 Kbps	~80%	~6 Kbps	~40%
H. 261	~24 Kpbs	~55%	~20 Kbps	~25%
H.261 intra	~53Kpbs	~48%	~25Kbps	~18%
YUV9	~1140Kbps	~16%	~500Kpbs	~8%

Please, note that frame rate decrease does not necessarily yields proportional bitrate decrease. This is because at the low frame rate the motion compensation algorithms (inter-frame compression) are much less effective.

BuenaVista encoding algorithms ensure that the session latecomers are always sent a keyframe, so the video distortion is kept to minimum.

Note that in order to be able to YUV9 codec on LANs you have to change the video capture format to YUV9. Consequently, YUV9 high-quality video is only available for users of video capture cards that support this format, such as Intel Smart Video Recorder.

For audio, BuenaVista uses two different encoding. On LANs we use PCM. This is practically raw, high-quality audio sampled at 8kHz, with constant bandwidth of 128 Kbps. For slower connections we offer ADPCM, with quality almost as good as PCM and the constant bandwidth of 32 Kbps. The low bitrate alternative is GSM audio, at 13 Kbps. GSM is the audio standard used in European digital cellular telephony. It is a high-quality speech codec. GSM is CPU-intensive, but our efficient implementation ensures that no more then few percent of the CPU cycles is used for audio encoding.

Transport/protocols

In the current release BuenaVista does not use multicast. This was a deliberate design decision. BuenaVista is aimed at distance learning and collaboratory application on today's Internet. Multicast coverage is very spotty today, and many campus system administrators refuse to support it for a variety of reasons. Hence, although the multicast-enabled version of BuenaVista exists, the public version uses unicast. This design has a negative consequence that for the N active users, the overall requested bandwidth scales as N^2. Aside of the CPU processing power, this is the 2nd most critical scalability limiting factor.

BuenaVista uses both TCP and UDP protocols. TCP is used for all session management tasks, while media streams are transported using UDP.

H.263 video encoding standard does not define transport layer. BuenaVista packs each video frame in a separate UDP packet. This solution minimizes negative impact of lost or disordered packets. RTP headers are used as well. For audio, 100 ms

chunks of audio are packaged with RTP headers and with the additional information that minimizes detrimental effects of the audio packet loss.

Adopting RTP paradigm, the audio and video streams are sent using separate channels, and they are synchronized at the receiver. Further, BuenaVista only sends audio when the average signal level remains above certain threshold (defined by the user) for a predefined period of time. Hence, silence is not sent and it does not contribute to the bandwidth.

Expected performance

The data in Table 1 provide an estimate on what performance can be expected. As an additional point of information, BuenaVista caps the video frame rate at 10 frame per second, even if there is sufficient CPU power available to handle higher frame rate.

The actual performance depends not only on the CPU power, but also on the bandwidth of the user's connection to Internet, traffic on the Internet backbone, and, very importantly, on the quality of the video camera/video capture card. To be portable, BuenaVista uses only standard video access methods supported by Microsoft multimedia libraries (including DirectX). The system does not use any driver-specific tricks. This makes it work poorly with certain digital cameras, vendors of which have chosen to write drivers only loosely adhering to Microsoft specifications. The example of such vendor is Connectix and their line of digital cameras using either parallel or USB ports. BuenaVista can, in principle, to use these cameras, but the frame rate never exceeds 1 fps and the CPU utilization may be very high. If you use a parallel port or USB port camera with BuenaVista, the performance in terms of the video frame rate will be poor. Our favorite video capture card products, ensuring best performance, are Intel Video Smart Recorder and derivatives (such as Panasonic's EggCam), and Winnov's Videum family of products.

Good setup practices

If you intend to use BuenaVista, or any other videoconferencing product for that matter, for professional activities, a good setup is a must. A good videoconferencing setup always includes a high-quality set of headphones with integrated microphone. As indicated in earlier sections, we discourage use of the camera built-in microphones. Those microphones are almost always omni-directional (i.e., they pick

up audio signals from the full radial angle), and they are overly sensitive, so that they pick up a lot of ambient noise. If you place a camera on top of the monitor, the microphone will pick up fan noise; if you place is on your PC tower, it will broadcast disk rattle in addition to the fan. This is a situation you want to avoid at any cost. Use of the camera microphones is very difficult if you use speakers to listen to the incoming audio – the acoustic feedback will make conferencing impossible. If you insist on using speakers instead of the headphones, you will need a high-quality, short-range, uni-directional microphone, preferably one with the on/off switch. Such a microphone does not have to be expensive – a $8 Labtec AM-22 performs very well. We strongly recommend use of a good quality headset with integrated microphone, though.

BuenaVista interface does not replicate audio mixer and volume controls. You will need to use standard system tools to properly set up audio levels for the microphone gain and speaker volume. Familiarize yourself with the audio mixer and pay particular attention to the distinction between "playback" and "recording" settings. Experiment with your settings and find the correct configuration. Don't change the configuration later on.

Using BuenaVista for Distance Learning

Using BuenaVista for distance learning is a somewhat special case. Very often we deal with a situation in which a single teacher in one geographic location delivers a class to a one or few groups of students using clusters of PCs located in one classroom or laboratory in another geographic location. Given the fact that the teacher does most of the talking, multicast would be very beneficial for such topology.

As indicated earlier, current release of BuenaVista uses unicast. If we decided that each of the N students runs an instance of BuenaVista, the same streams of audio and video will be send N times from the teacher location. Many campuses are still connected to Internet by a single T1 line. Class transmission would take a significant chunk of this bandwidth, possibly clogging the network and lowering quality of received streams. Further, handling broadcast of massive amounts of data slows the teacher workstation down.

Until the multicast version of BuenaVista can be easily deployed on top of the improved Internet routing infrastructure, we recommend that in the settings in which the remote students are gathered in one cluster, BuenaVista is only started on few

workstations, one of them equipped with good quality loudspeakers. Only this one workstation should play back the lecture audio stream. In such a setting it is important that no omni-directional microphones are active except when necessary for verbal interaction.. An active microphone will pick the loudspeaker playback and feed it back to the teacher with a delay of ~200 - 400 msec. Speaking on top of such feedback is almost impossible for the teacher, and the feedback must be eliminated. If a student wants to ask a question, s/he should join BuenaVista session from the Tango Interactive session manager only for the time necessary to state it.

If this solution is deemed unacceptable, the trade-off is to install the multicast tunnels between the parties involved in distance learning sessions as well as to ensure that all workstations in the teaching labs are capable of receiving multicast. The multicast version of BuenaVista can be obtained from NPAC upon request.

Troubleshooting

I DON'T HEAR OTHER CONFERENCE MEMBERS

There may be two major reasons for that – incorrectly configured audio card or a session status problem. You can distinguish between those two by observing the speaker level indicator on the main panel. If it displays changes in the incoming stream level, the problem is caused locally, probably by the audio card configuration or speaker/headphones connection. Please, refer to the audio card configuration section for details. Another possibility is an incorrect setting in your audio mixer: for playback to work, the playback of the wave output must be enabled and volume must be sufficiently high.

OTHER PEOPLE DON'T HEAR ME

Make sure you send the audio. Watch the microphone level indicator in the main panel of BuenaVista. Does it move when you talk? If it doesn't, either there is something wrong with your audio card setup, or you have simply muted the microphone in your audio mixer (make sure to check the "recording" parameters!)

If the indicator moves but others still don't hear you, you might have set the "silence" level threshold too high. Push it down and see what happens. Or, you may have switched to the "Manual" audio control and set BuenaVista for audio reception. For audio to be sent, the audio button must show the microphone icon.

AUDIO SOUNDS CHOPPY OR CLIPPED?
Today's Internet is not well equipped for distribution of the real-time multimedia streams. Thus, such problems might be simply caused by network congestion or delays. The only thing that can be done is minimizing the bandwidth by choosing 'Modem 28.8' connection on General Options panel. You can inspect the system performance data in the "Statistics" panel. If the number of late or lost packets exceeds 5%, you have a serious network performance problem.

Another possible cause of clipped audio is too high a setting of the microphone cut-off level on the sending participant machine. If some segments of his speech signal fall below this level, they are classified as silence and skipped. Please, instruct this participant to lower the threshold level.

MY MIRROR VIDEO WINDOW IS BLACK
Your camera is powered down or disconnected.

INCOMING VIDEO WINDOW IS FROZEN
The user might have stopped sending video stream. Ask the participant to press his video button.

UPON STARTUP, I GET "DIRECTORY SERVER DOES NOT RESPOND" ERROR MESSAGE
BuenaVista cannot elicit any response from the directory server set up in Options. Check the address. Server may be down for technical reasons. You can still use direct calling method.

BUENAVISTA CRASHES WHEN I LEAVE THE "OPTIONS" PANEL AFTER MAKING CHANGES TO THE PARAMATERS
This happens occasionally on certain video capture cards. If you see it happening, stop sending video before you change video settings and resume when you are done.

BUENAVISTA CRASHES WHEN I PRESS VIDEO BUTTON
This is almost always a sign of a bad video capture card installation. Verify if the card is reported by the "Multimedia" applet of the Control Panel. To further test the setup, localize the video capture software provided by the card manufacturer. Start it to verify that the card works properly. You should see a video of yourself on the screen. Next, make sure that the card supports RGB24 or YUV9 video capture formats. The cards that don't support one of these formats *cannot* be used with BuenaVista. Set the video format to RGB (on some cards, this may be denoted as "Millions of colors"). If the card works with manufacturer software and it is set to

correct format, BuenaVista should work. If the problem persists, and the card/camera is on the list of our certified hardware, the card may require re-installation. If the card is not on the list, please, let us know the manufacturer and model so we can put appropriate warnings in the manual

I GET "CAPTURE START ERROR" MESSAGE
This may happen if a user clicks the video button multiple times in a quick succession. This is basically an operator error. Understand that the video capture hardware in inexpensive PC cards needs time to reset. If the card receives video off/on sequence too fast, it will fail to re-initialize properly. With some luck, you may hang your computer. Don't abuse your video capture card!

MY COMPUTER BECOMES VERY SLUGGISH AFTER I STARTED VIDEO CAPTURE
To get a temporary relief, go to the Option menu, Video tab, and lower the frame rate. If your computer is slow with the slider in the lowest position, you definitely should start looking for a new machine … ☺ - or another video capture card.

I DID EVERYTHING YOU SAID AND BUENAVISTA STILL DOES NOT WORK
Send message with your story to tango-support@npac.syr.edu. Include data about your OS, PC model (CPU speed, memory), video capture card/digital camera model, driver designation, audio card model, driver designation, symptoms. We will try to help, but pllease, understand that a message like: "I installed BV and it does not work" cannot be constructively responded to!