
# TraceBuster

## Users Guide

Revision 2.0.0

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Table of Contents



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# Introduction

The TraceBuster VoIP call monitor and protocol analyzer is the ideal tool for anyone who needs to monitor Voice and Video over IP calls and Voice quality, detect errors in VoIP traffic, debug signaling problems or capture media streams. TraceBuster's intuitive user-interface makes setup and operation a snap.

With TraceBuster you view your network traffic in an intuitive manner. From network overview to media stream and protocol details, each piece of information is presented in context. TraceBuster's analysis does not stop at the call flow level; however, it provides unparalleled analysis of each individual call component making difficult diagnostics simple.

TraceBuster is designed for the Windows operating system. Nearly all Windows operating systems are supported including:

Windows XP, Windows 7, Windows 10, Windows Server 2008, and Windows Server 2012, Windows Server 2016.

TraceBuster's capabilities automatically scale with the hardware on which it is installed.

Minimum recommended configuration:

- 3.6 GHz Core i3 – 8100 Processor
- 4 GB RAM
- 200 GB hard drive
- 1280x1024

**TraceBuster is optimized for 1280 x 1024 displays.**

The TraceBuster software is copy protected and is licensed for use on a single machine. Please make sure that you install TraceBuster on the machine with which you intend to use it. Installation of TraceBuster on multiple machines is not possible without authorization from Touchstone.

The following pages will demonstrate how to install, setup, and get started with TraceBuster. The next session is an overview of the latest additions.

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# Installation Types

## TraceBuster on CD-ROM

If you received TraceBuster on CD-ROM, please use the following procedure:

- Insert the TraceBuster CD in your CD-ROM drive.
- The installation program should start automatically. If it does not, use Windows Explorer to browse the CD and double-click the Setup.exe file.
- Continue to the next section.

## TraceBuster via E-Mail

If you received TraceBuster via E-Mail, please use the following procedure:

- Double-click on the e-mail attachment.
- Select "Save to Disk" option and select a temporary folder to store the self-extracting file.
- Use Windows Explorer to browse to the folder in which you saved the self-extracting file.
- Double-click the self-extracting file. Select a folder with which to extract the files.
- Use Windows Explorer to browse to the folder you extracted the files in and double-click the Setup.exe file.
- Continue to the next section in this document.

## TraceBuster via the Internet

If you downloaded TraceBuster via the internet, please use the following procedure:

- TraceBuster's setup.exe is compressed using WinZIp. Download tracebuster.zip and extract the setup.exe to a temporary location on the destination computer.
- Double-click on the Setup.exe file.
- Continue to the next section in this document.

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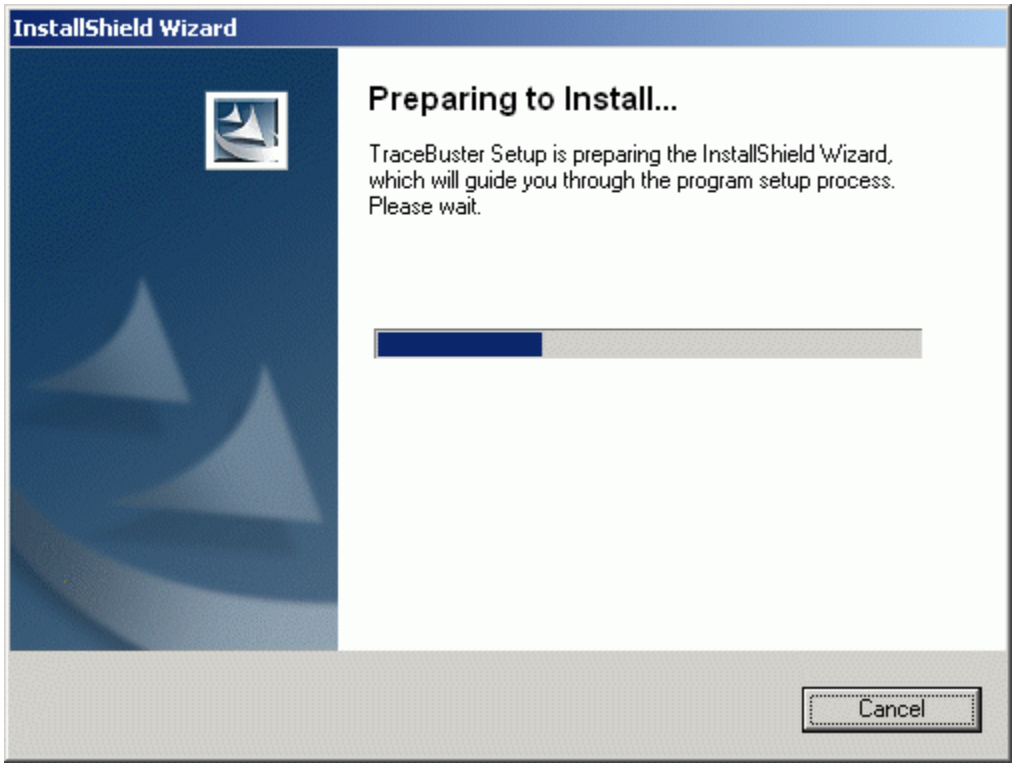
# TraceBuster Installation

The next few screens will appear during the installation process. Please follow the directions carefully using the "Next" button to navigate forward and the "Back" button to return to a previous page.

## TraceBuster Install Screen 1

Preparing Setup Wizard

Wait for the wizard to complete or press the "Cancel" to quit the installation.

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## TraceBuster Install Screen 2 - Beginning the Installation

Press the "Next" button to continue the installation or "Cancel" to quit.


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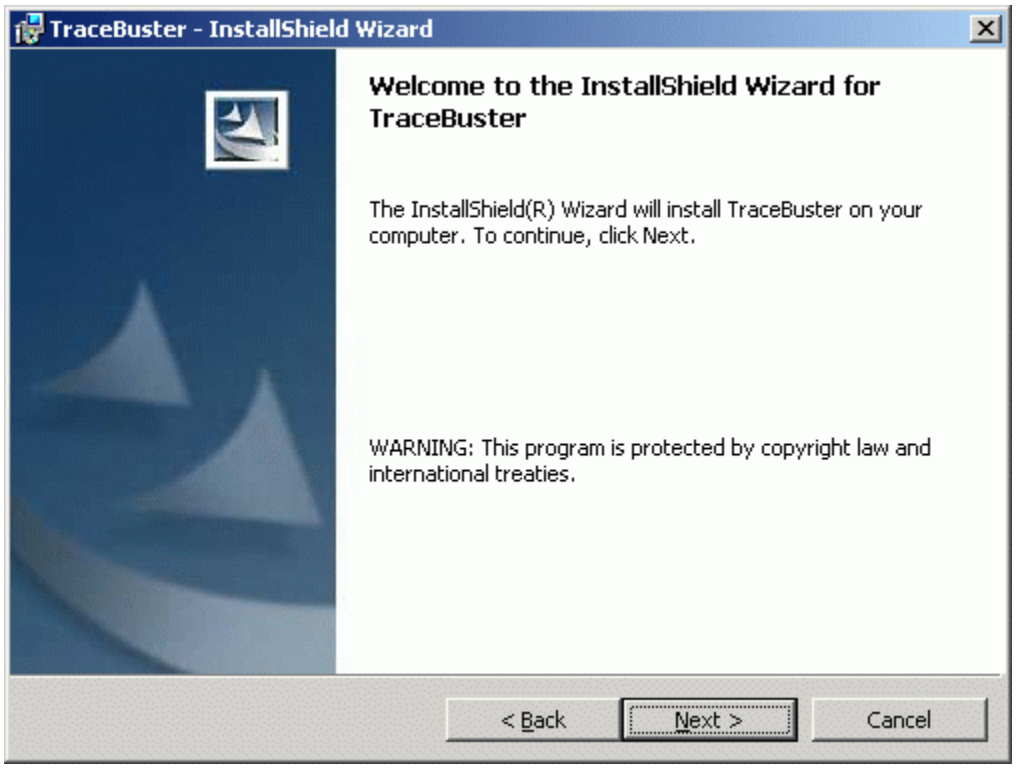
## TraceBuster Install Screen 3 - Beginning the Installation

Press the "Next" button to continue the installation or "Cancel" to quit.

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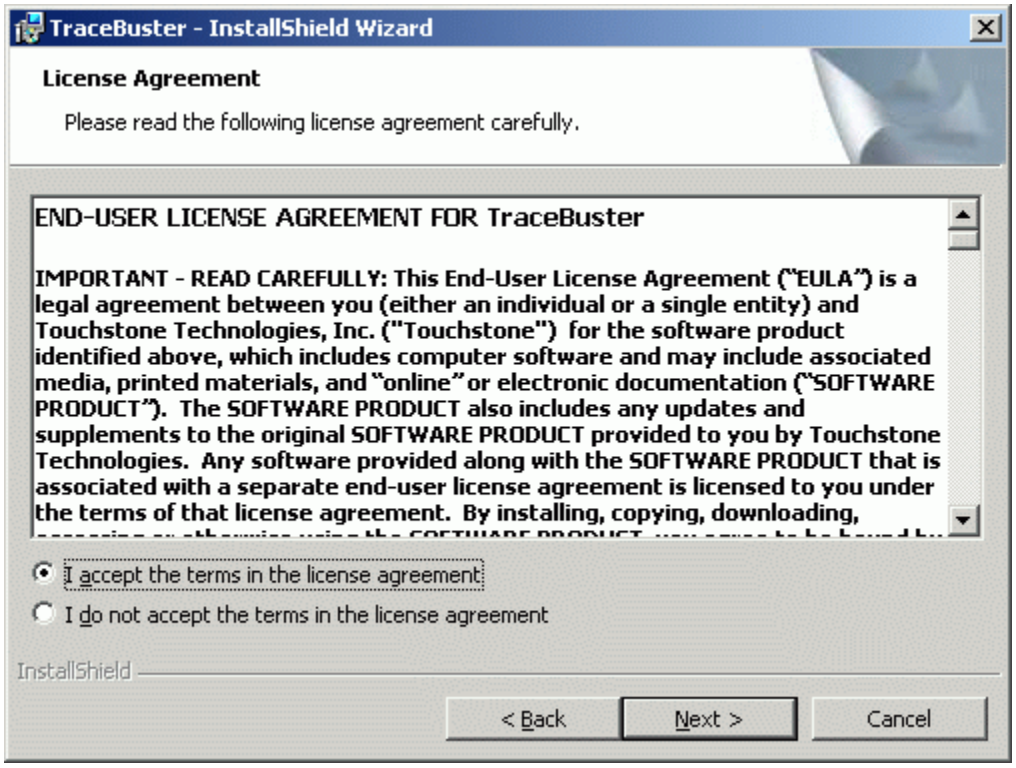
## TraceBuster Install Screen 4 - End-User License Agreement

Carefully read the End-User License Agreement. If you accept the terms, select the "I Accept" option, if you do not; select the "I do not accept" option.

Press the "Next" button to continue the installation or "Cancel" to quit.

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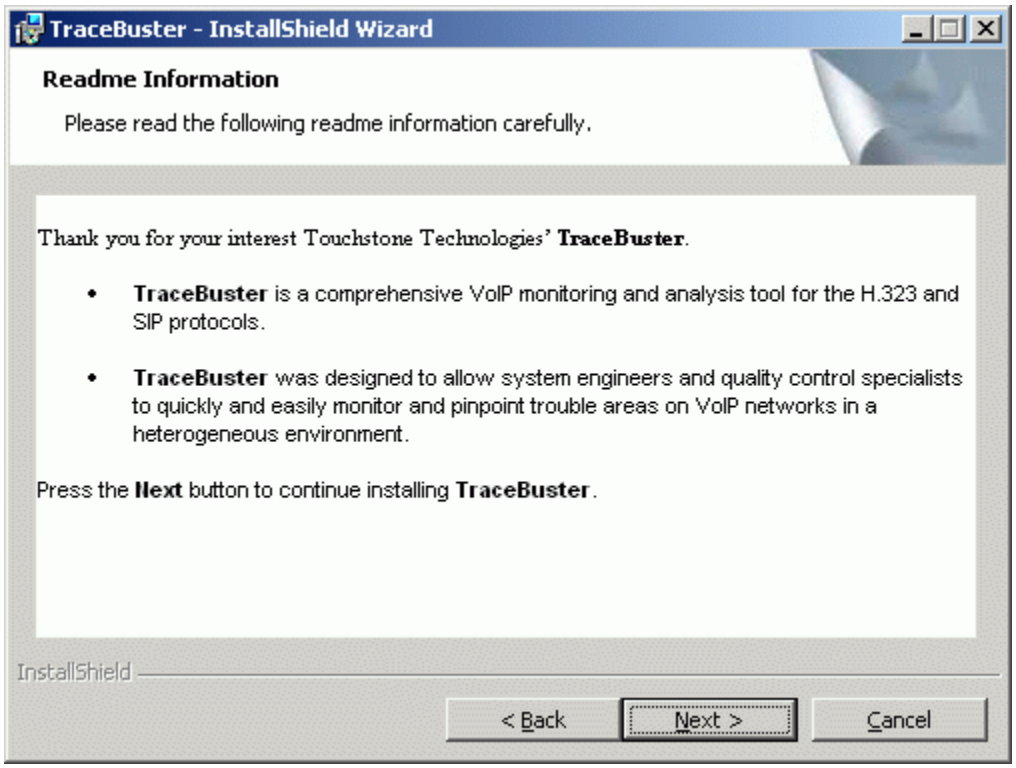
## TraceBuster Install Screen 5 - Readme Information

Press the "Next" button to continue the installation or "Cancel" to quit.

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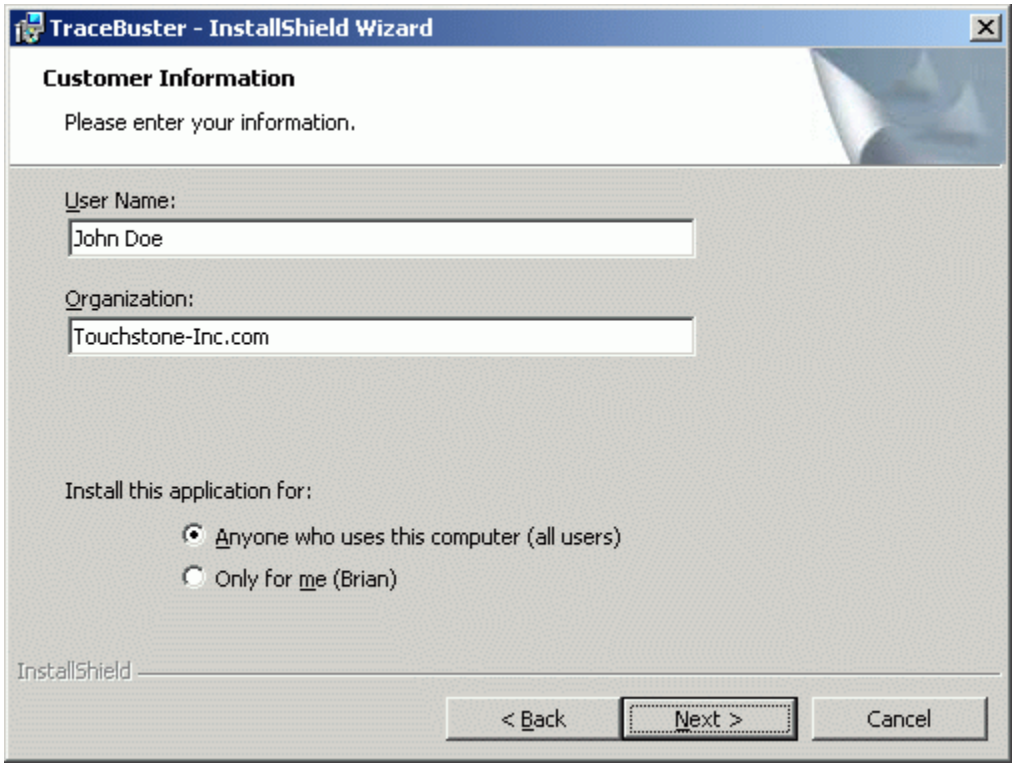
## TraceBuster Install Screen 6 - Customer Information

Please fill in your customer information and select the appropriate security option.




Press the "Next" button to continue the installation or "Cancel" to quit.

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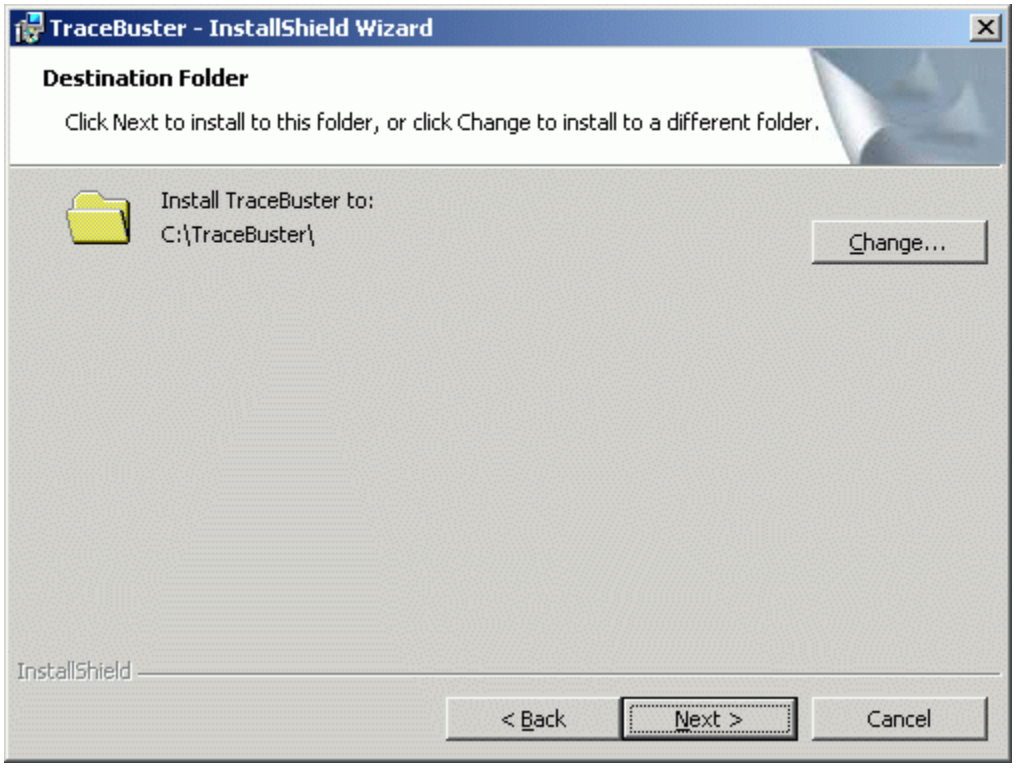
## TraceBuster Install Screen 7 - Destination Folder

Please select the folder in which you would like to install TraceBuster and its components.




Press the "Next" button to continue the installation or "Cancel" to quit.

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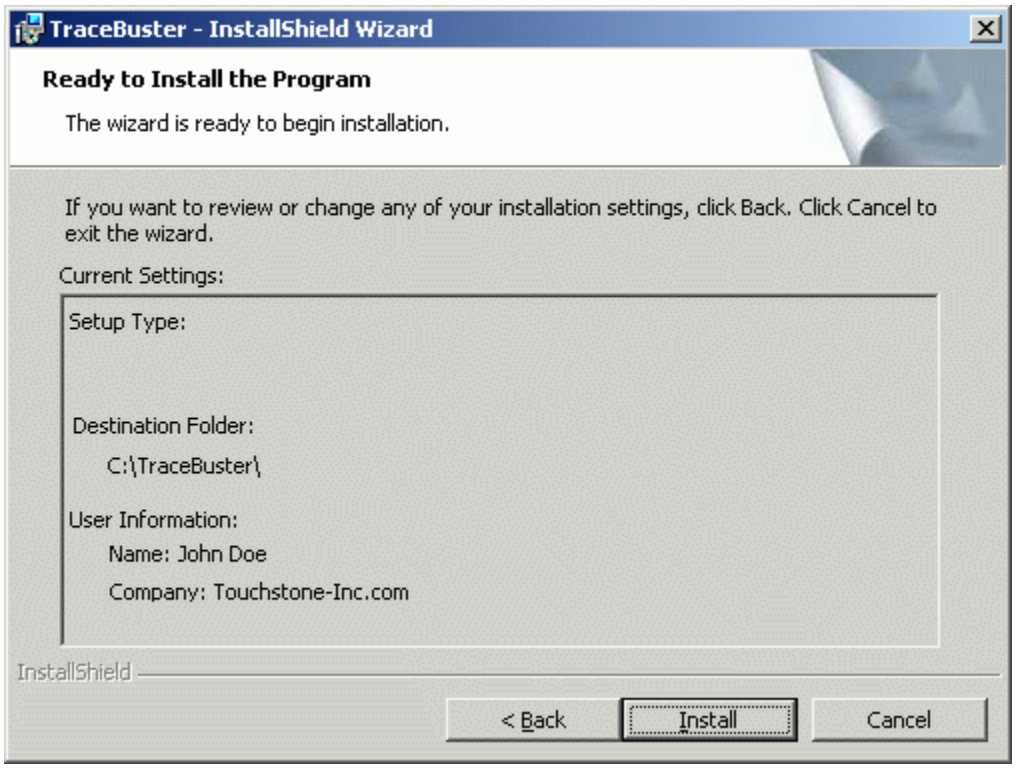
## TraceBuster Install Screen 8 - Ready To Install

Please review the information, if you need to correct anything, use the "Back" button to navigate to the appropriate screen, make your changes and use the "Next" button to advance back to this point.




Press the "Install" button to continue the installation or "Cancel" to quit.

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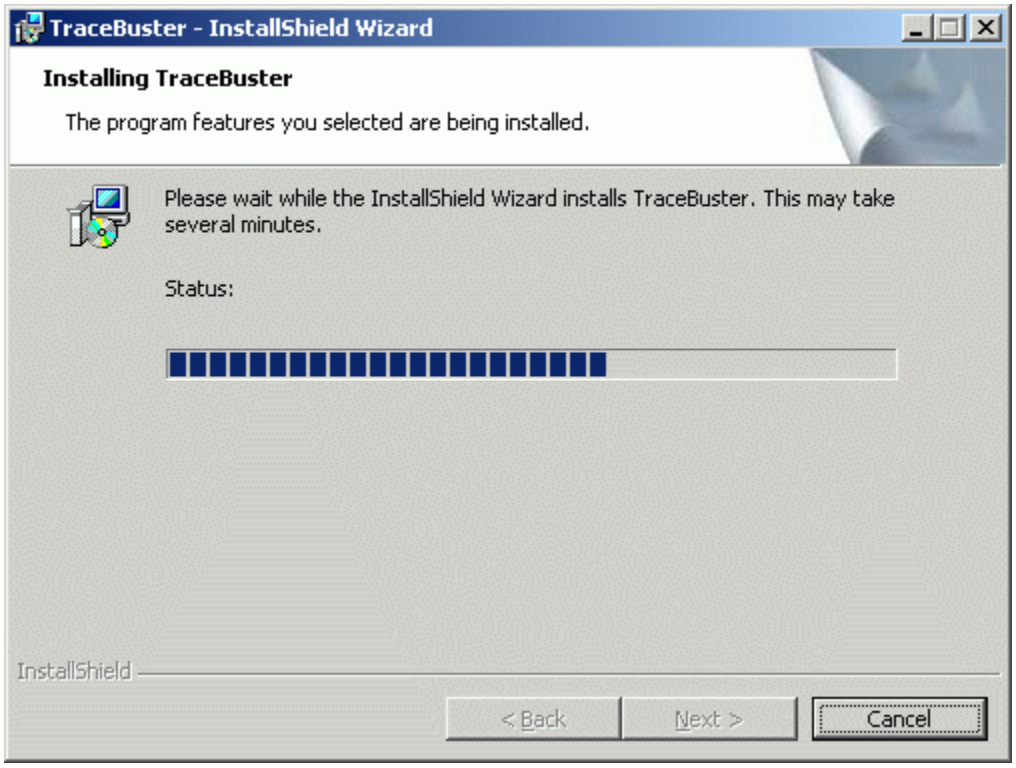
## TraceBuster Install Screen 9 - Installing TraceBuster

This screen will appear during the installation to inform you of the progress. Typically this screen will only appear for a very brief period of time.

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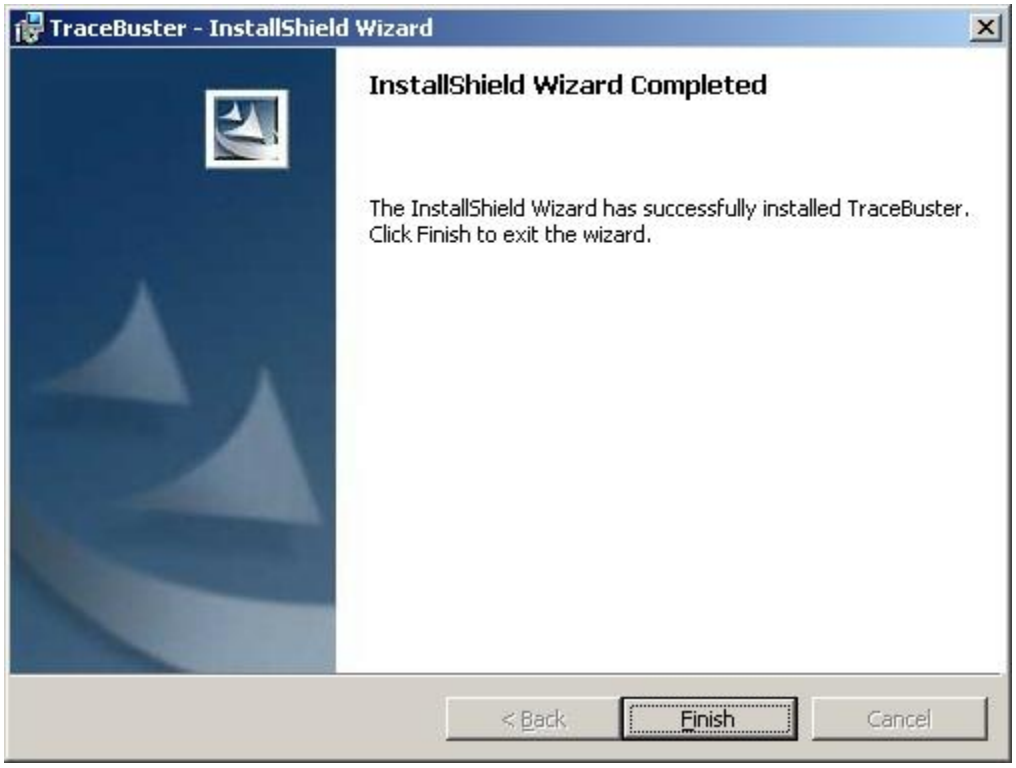
## TraceBuster Install Screen 10 - Installation Complete

This screen will appear at the completion of the installation process. Any errors that may have occurred will be reported at this time. Should you encounter any errors, please contact Touchstone for technical assistance at +215.672.6550 or support@touchstone-inc.com.




Press the "Finish" button to complete the installation.

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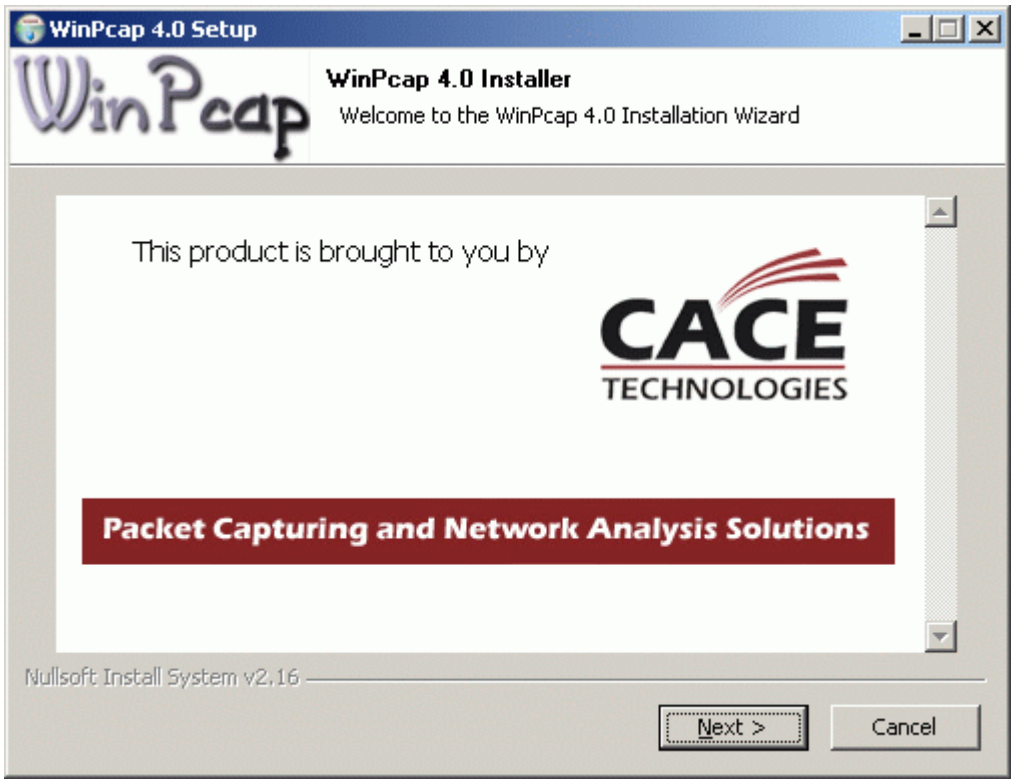
## WinPcap Installation

Before the installation is complete, it is necessary to install the WinPcap driver. If you have installed other products that use this driver (such as Ethereal), you will probably need to restart the computer after installation. The following screens will appear during the WinPcap installation process. Please follow the directions carefully using the "Next" button to navigate forward and the "Back" button to return to a previous page.

### WinPcap Install Screen 1 - WinPcap 4.0 Installer

Press the "Next" button to continue or the "Cancel" to quit the installation.

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**WinPcap Install Screen 2 - Welcome to the WinPcap Setup Wizard**

This screen will appear at the start of the installation process.


Press the "Next" button to continue the installation or "Cancel" to quit.

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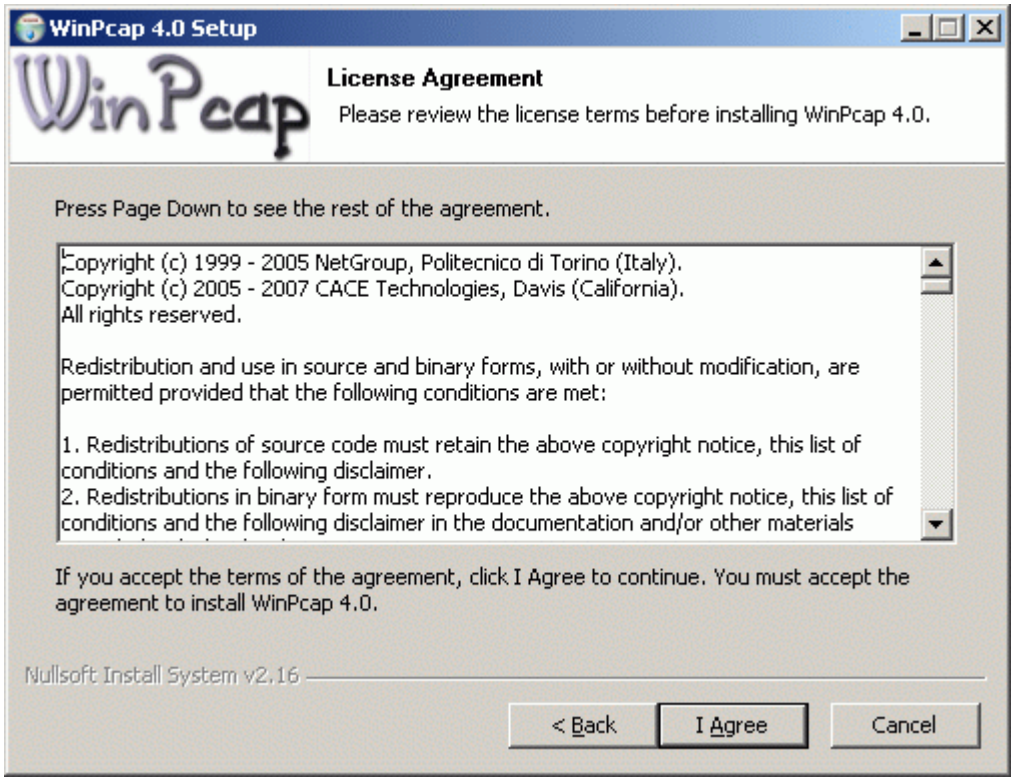
**WinPcap Install Screen 3 - End-User License Agreement**

Carefully read the License Agreement. If you accept the terms, press the "I Agree" button, if you do not, press the "Cancel" button.




Press the "Next" button to continue the installation or "Cancel" to quit.

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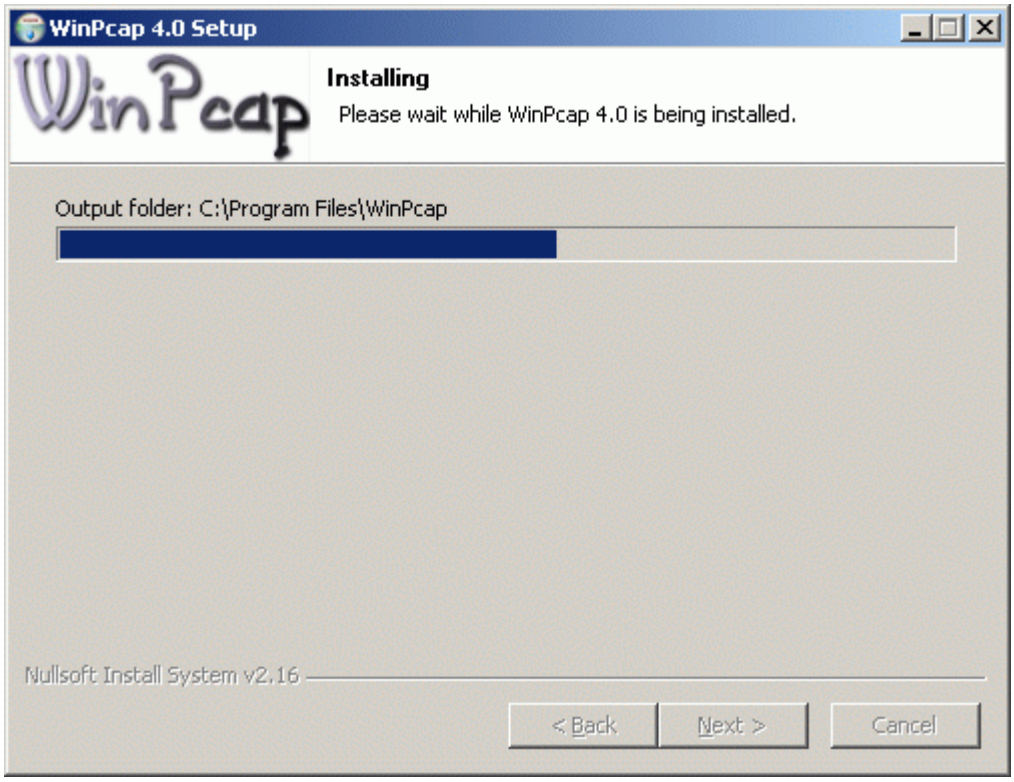
**WinPcap Install Screen 4 - Installation Progress**

This screen will appear while the setup wizard is in the process of installing WinPcap.

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**WinPcap Install Screen 5 - Installation Complete**

The following screen will appear at the completion of the WinPcap installation.


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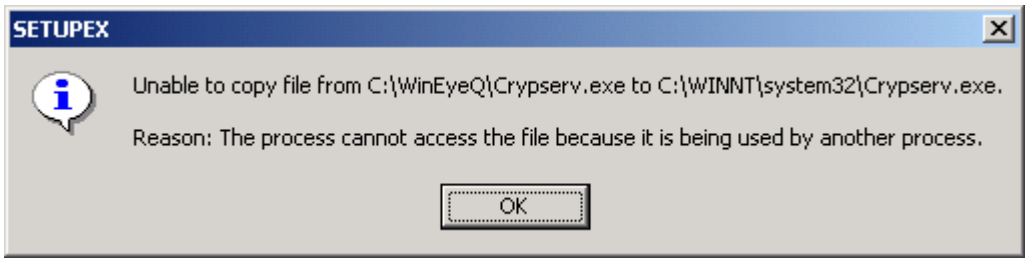
## Installation Notes

The installation process will create a shortcut on your Windows desktop for the TraceBuster application. The "Start" menu's "Programs" section will also contain an entry for TraceBuster. You may use either of these to run your TraceBuster application.

If there are other applications from Touchstone Technologies installed on your PC, a message similar to the one below may appear at the conclusion of the installation.




You can safely ignore this message.

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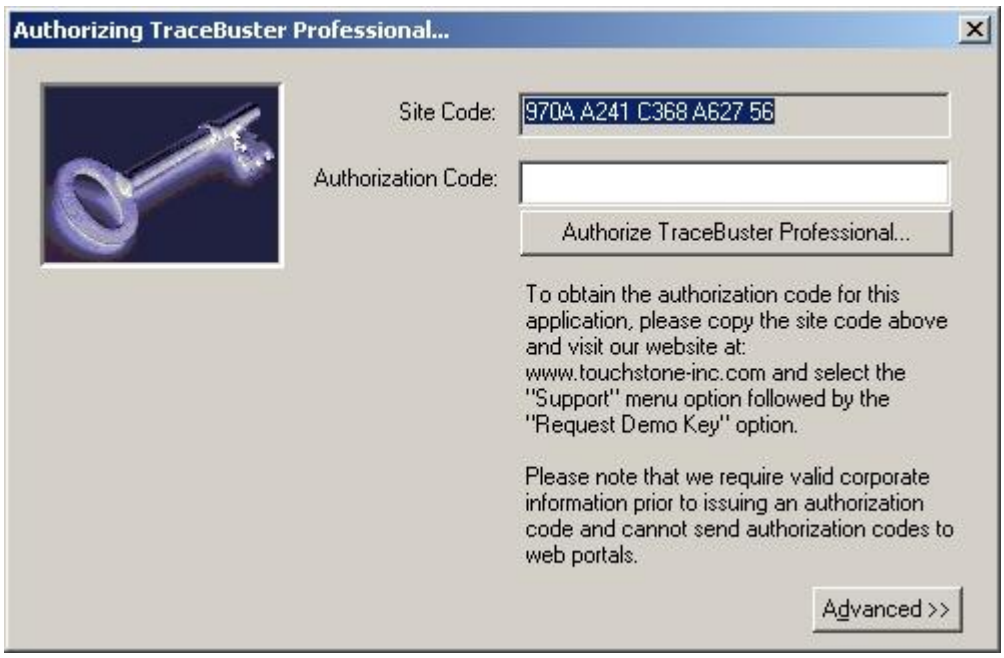
# Running TraceBuster for the First Time

TraceBuster software is copy protected and is licensed for use on a single machine. The first time you run TraceBuster, you will be provided with a site code. You must contact Touchstone in order to obtain the authorization code to enable the software.

Once the software is authorized, it may not be installed on any other machines without a new authorization code from Touchstone. If you have installed the software on a machine in error, do not authorize that installation. Re-install it on the appropriate machine prior to contacting Touchstone for the authorization code.

## Obtaining the TraceBuster Authorization Code

When you first run TraceBuster the following authorization dialog will appear:




In the field labeled "Site Code" a series of numbers and letters will appear. To authorize the application, contact Touchstone with the **exact** value of the site code field. Touchstone will provide the code to enter in the "Authorization Code" field. You must enter this **exactly** as it is provided to you in order to enable the software. It is strongly suggested that you 'copy' the site code into an email that you send to Touchstone, and then 'paste' the authorization code from the email you receive from Touchstone. Once you have enabled the software, you are just moments away from being able to construct your first test scenarios!

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# Transferring A License

The method of transferring a license is the same for all Touchstone Technologies products. For demonstration purposes WinEyeQ will be used to explain the license transfer procedure.

At the time of installation there are two options for licensing WinEyeQ. The first is to have a new key issued from Touchstone Technologies, and the second is to transfer a license from an existing WinEyeQ application to the newly installed version of WinEyeQ. Touchstone's software licenses are fully transferable from PC to PC within a customer's physical location. To transfer a license to a different location, please contact Touchstone Technologies at (215) 672-6550.

A floppy diskette or USB memory device is required to transfer a license.

There are three basic steps in transferring a license:

- Initialize transfer media on the PC with newly installed WinEyeQ.
- Export license from the PC with the originally installed WinEyeQ.
- Import license to the PC with newly installed WinEyeQ.

**Note:** Touchstone Technologies licenses will have to be re-issued if:

- The original installation directory of WinEyeQ is:
  - Copied or moved to a new directory on the original PC.
  - Copied or moved to a different PC.
  - Renamed
- One of the hidden files (deltapts.ckn or deltapts.inf) is deleted or modified.
- The license service (crypserv.exe) is stopped or uninstalled.

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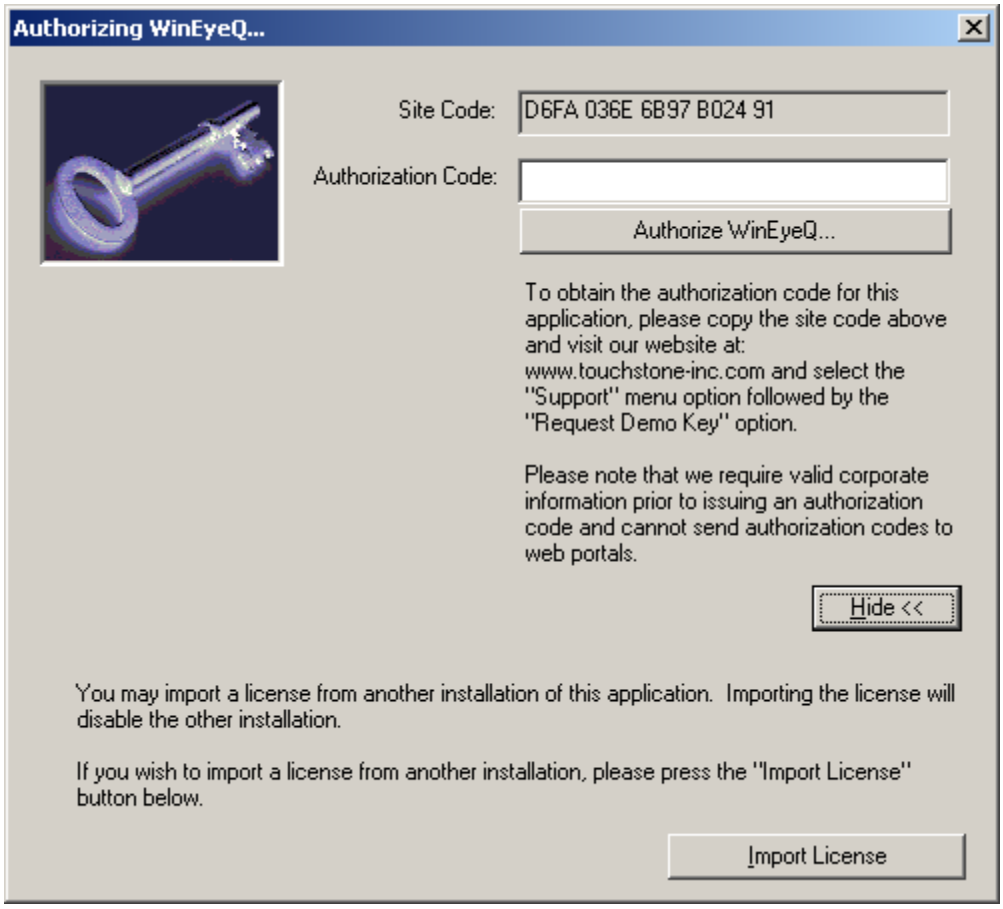
After a new installation is finished and the application is run for the first time, an 'Authorizing WinEyeQ' screen will appear. By clicking on the 'Advanced' button, an expanded dialog will be displayed:




Press the 'Import License' button to begin the license transfer procedure.

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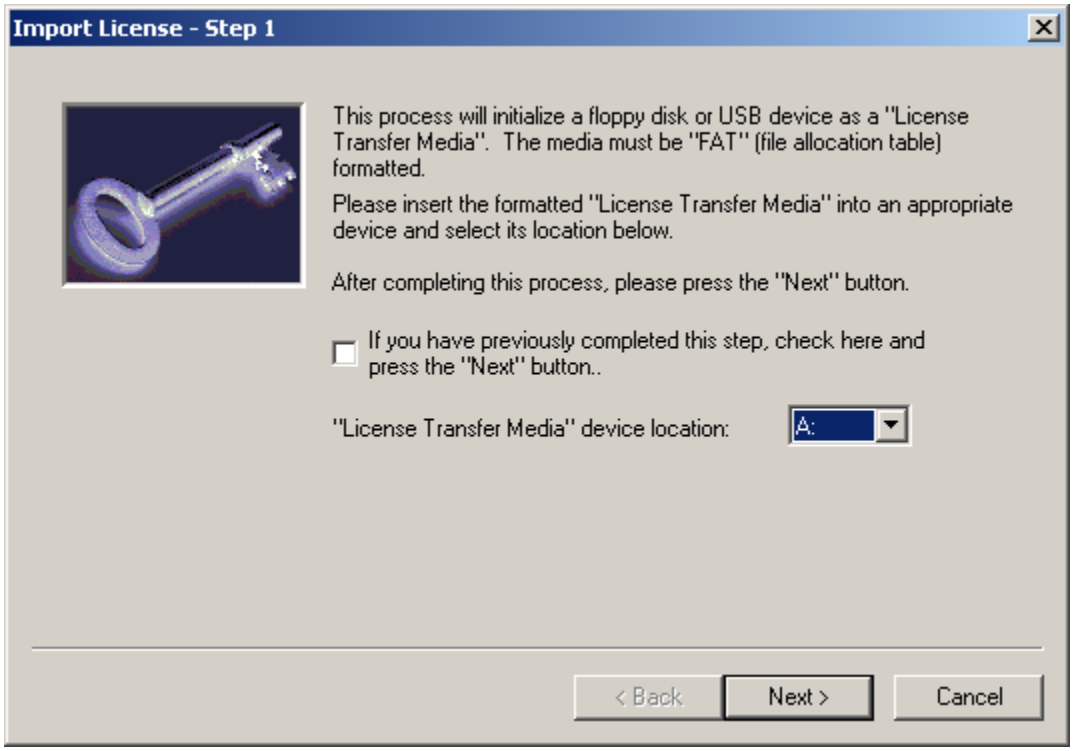
## Step One - Import License, Media Initialization

The first step of the 'Import License' transfer requires initialization of a diskette or USB device that will be used as the 'License Transfer Media'.




To initialize the transfer media, select the drive to be used as the transfer device, insert the transfer media and press the 'Next' button.

**Note:** If you have completed this step from a previous execution of WinEyeQ and already have the initialized transfer media, click the checkbox and then press the 'Next' button.

When step one is complete, the transfer media is initialized.

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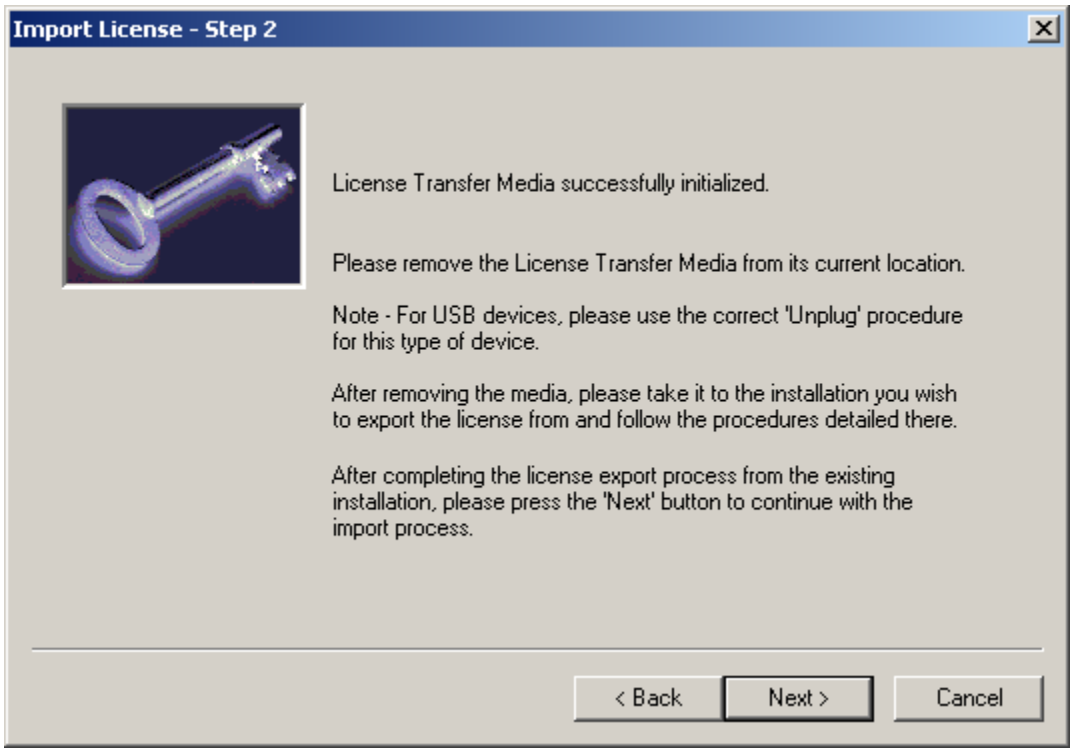
The 'Import License - Step 2' dialog will then appear:




The next step is to eject or unplug the transfer media and take it to the PC that has the license you want to remove.

**Note:** For USB devices please follow the correct unplug procedure for your device.

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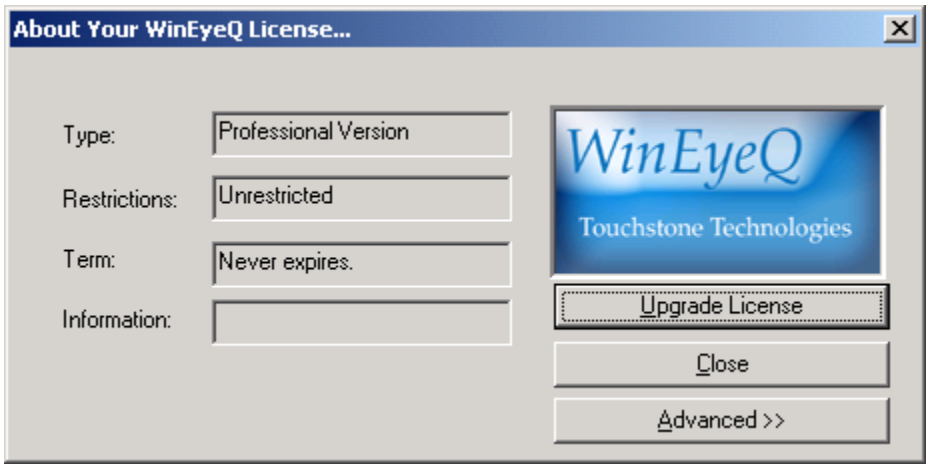
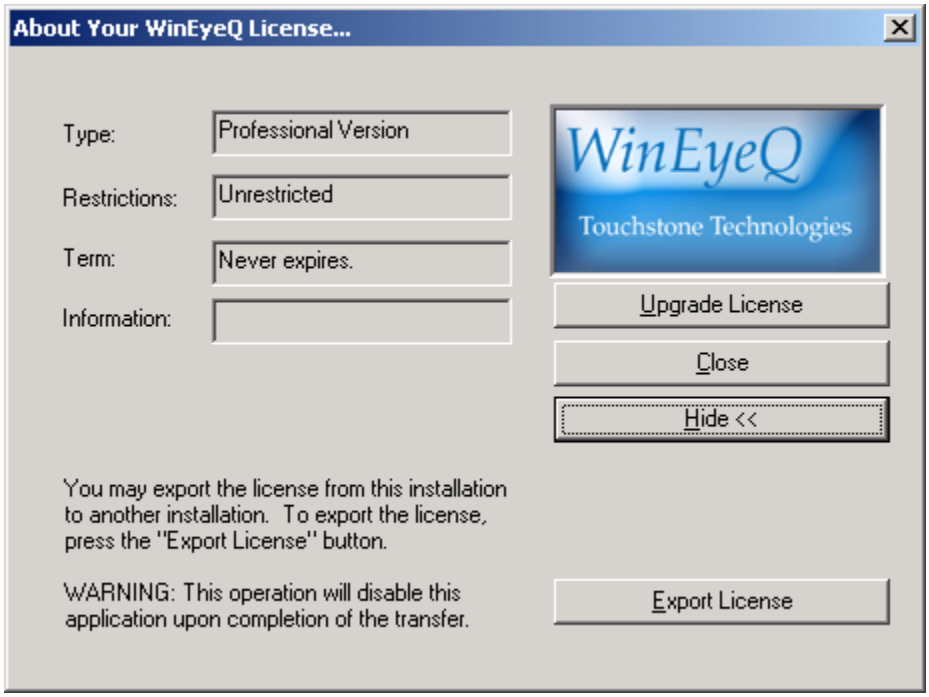
## Step Two - Export License

On the PC that you have selected to remove the WinEyeQ license, click on the 'Help' menu and then select 'Licensing Information'.

The Following dialog will appear:




Next click on the 'Advanced' button to expand the dialog:




Now click on the 'Export License' button.

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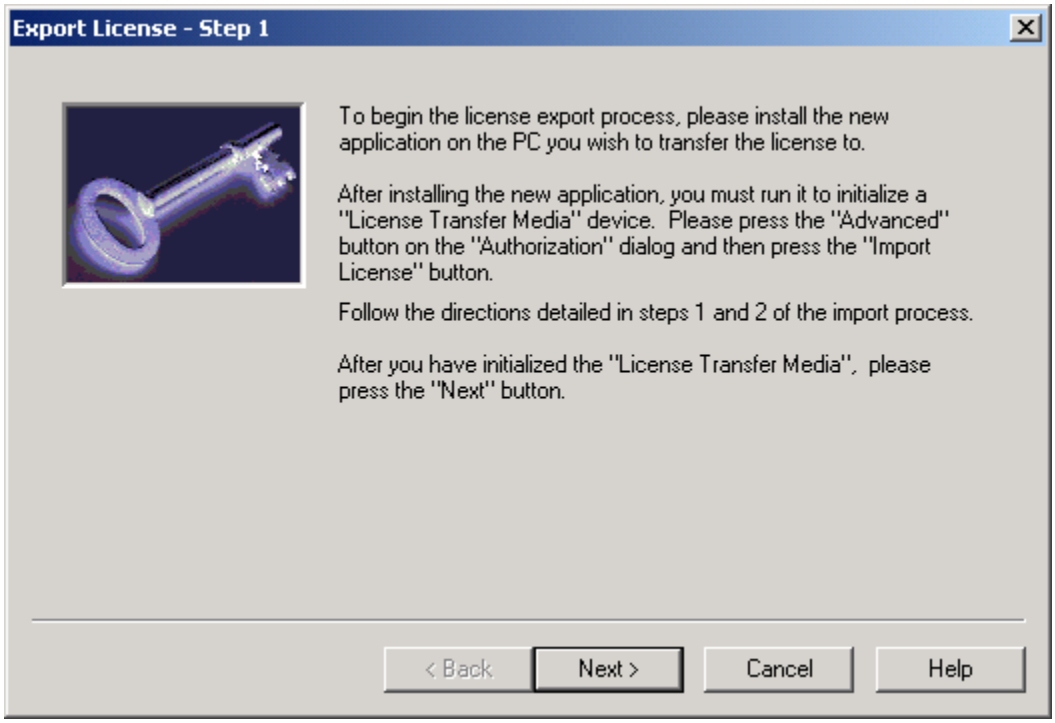
A warning dialog will be displayed next. It instructs you to read the procedure carefully and that the version of WinEyeQ currently running will be disabled after the procedure is completed.

If you are certain you want to transfer this license, press 'Yes,' if not, press 'No'.

The existing WinEyeQ application will not be uninstalled nor will any WinEyeQ files be removed from the WinEyeQ directory, the software will simply be disabled. Later if you wish, you can re-enable the application with a new license from Touchstone or with a WinEyeQ license transferred from another PC.

Step one of the export procedure displays the following dialog:




Click the 'Next' button.

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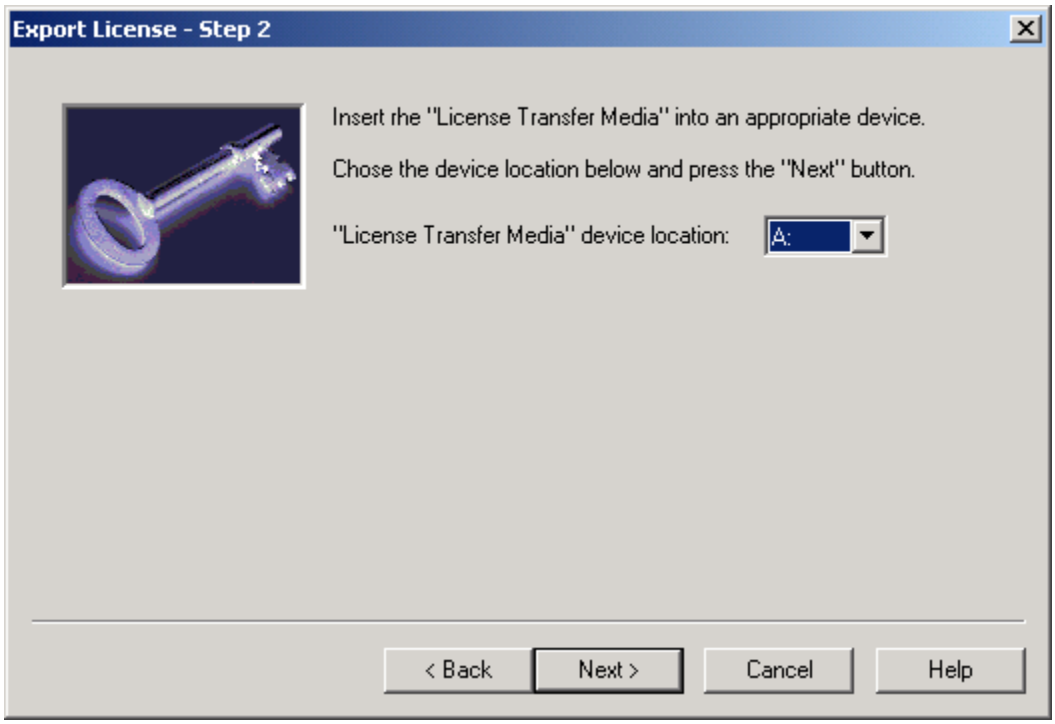
Step two of the license export procedure displays the following dialog:




Insert the transfer media that was initialized from 'Step One - Media Initialization,' select the drive to be used as the transfer device and press the 'Next' button.

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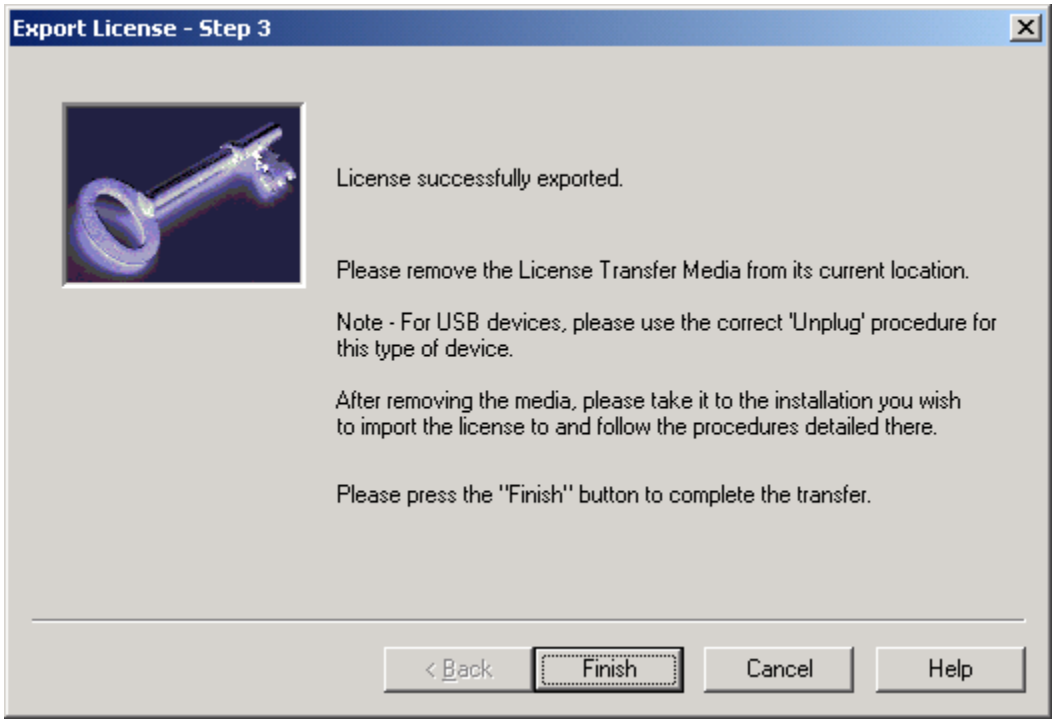
When the license has been successfully exported, the following dialog will appear:




When the 'Finish' button is pressed, the application will terminate. This completes the license export.

Remove and take the 'License Transfer Media' to the newly installed WinEyeQ.

**Note:** For USB devices please follow the correct unplug procedure for your device.

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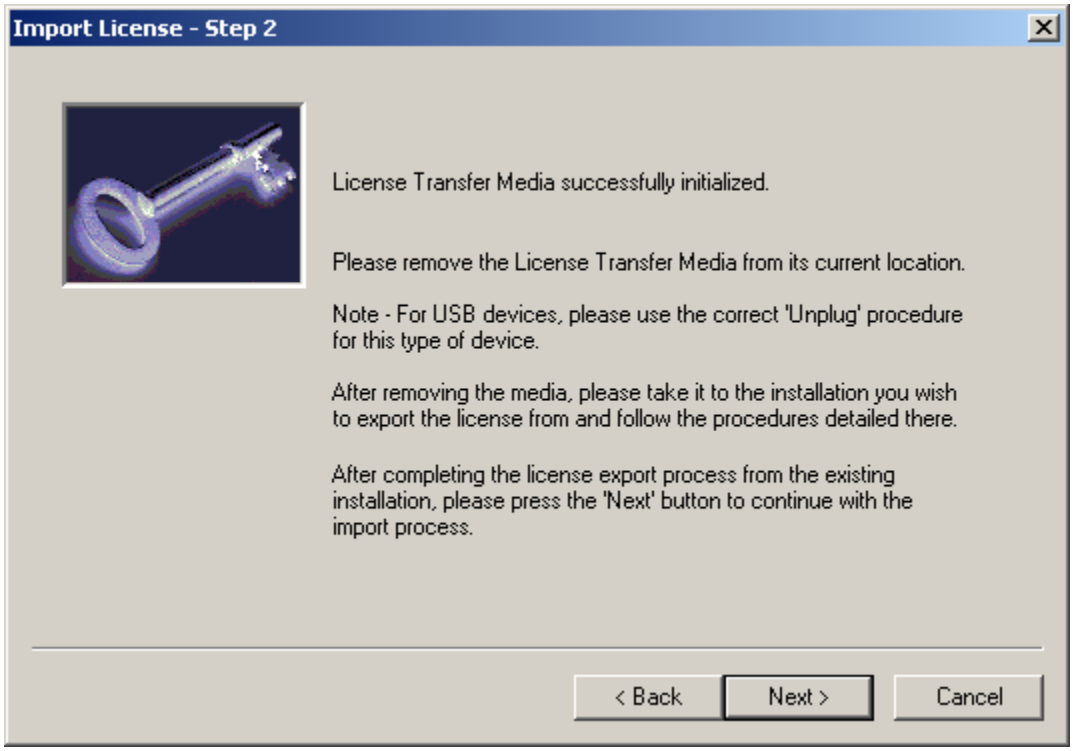
## Step Three - Install exported license

The PC with the newly installed version of WinEyeQ should still have the following screen displayed, 'Import License - Step 2':




After the export procedure is complete, and you have the license on the transfer media, insert or plug in the media and then press the 'Next' button.

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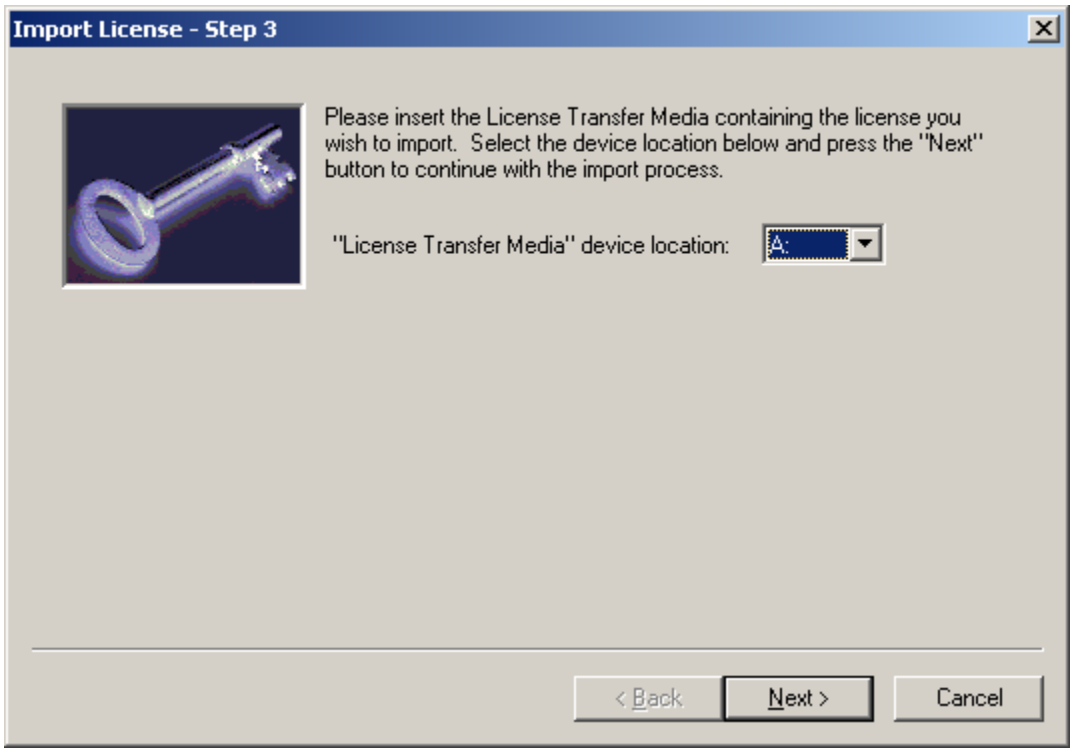
Select the proper 'License Transfer Media':




Press the 'Next' button when done.

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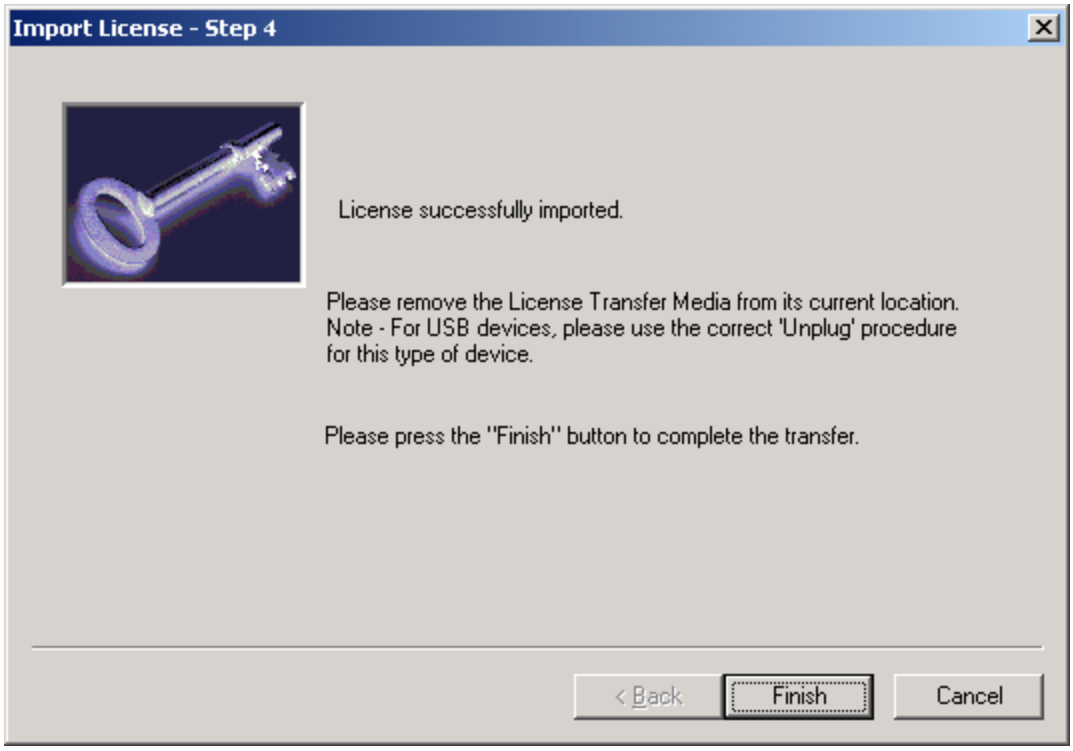
When the license has been successfully imported, the following dialog will appear:




The newly installed WinEyeQ is now fully enabled and ready to run when you press the 'Finish' button.

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## License Transfer Instruction Chart

| Action | New Installation | Existing Installation |
|---|---|---|
| **1.Install New Software** | Select the machine on which you would like to install the new instance of the product and follow the installation instructions.<br><br>Once installed, run the application and the licensing dialog will appear. | |
| **2. Initialize License Transfer Media** | When the new installation asks for the Authorization code, press the 'Advanced' button then, press the 'Import License' button. This will bring up a dialog that asks you to initialize a 'License Transfer Media Device'. This device may be a diskette or USB device.<br><br>Enter the letter of the drive where the transfer media is located and press the 'Next' button. Once you have pressed the 'Next' button, you may remove the License Transfer Device.<br>You must then take that diskette or USB device to the PC that has the license you want to export. | |

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| Action | New Installation | Existing Installation |
|---|---|---|
| **3. Export License** | | Run the application on the PC that has the license you want to export, go to the Help menu and press Licensing Information.<br><br>Press the 'Advanced' button to reveal the advanced options. Once visible, press the 'Export License' button.<br><br>Follow the step-by-step directions to export the license onto the License Transfer Media Device.<br><br>Remove the License Transfer Media Device. The existing installation is now deactivated.<br><br>Return to the new installation. |
| **4. Import License** | Insert your License Transfer Device into the appropriate device. Follow the instructions to import the license. The new installation is now activated. | |

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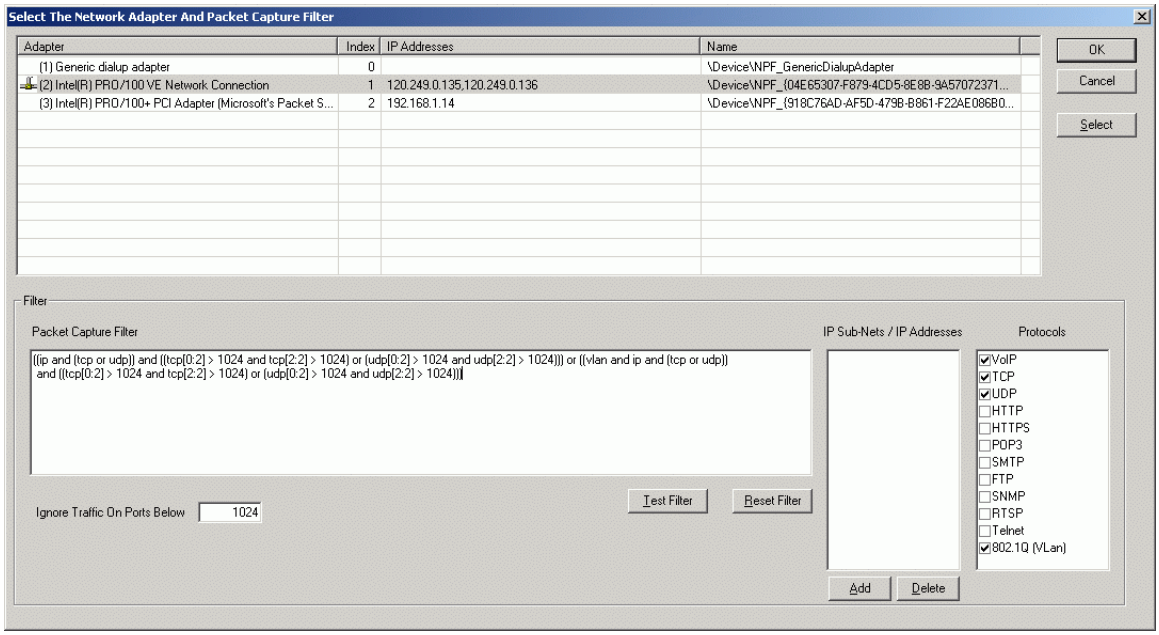
# Selecting the Network Adapter

One of the first steps in preparing to run TraceBuster is to select the network adapter you wish to monitor. TraceBuster will automatically display the Select Adapter screen immediately after starting it for the first time. You may also access this dialog from the Edit | Select Adapter menu item.




On the top part of the screen is a list of the Network Adapters that TraceBuster has discovered on your PC. Select the adapter you want to monitor by clicking the adapter line and then pressing 'Select' or by just double clicking the adapter line.

This window will be discussed in great detail later in the manual.

# TraceBuster User Interface

TraceBuster was designed to facilitate diagnostics by representing the network in a natural, intuitive, top-down manner. This presentation allows users to "drill-down" into areas of interest at the same time bypassing information that is neither relevant nor interesting at the moment.

## Data Scopes™

Version 1.5.0 of TraceBuster implemented a new series of graphical representations of both the Voice and Video over IP and non-VoIP components of your network. The "Data Scope" metaphor reinforces TraceBuster's drill-down user-interface approach. Each Data Scope™ is represented at its topmost level

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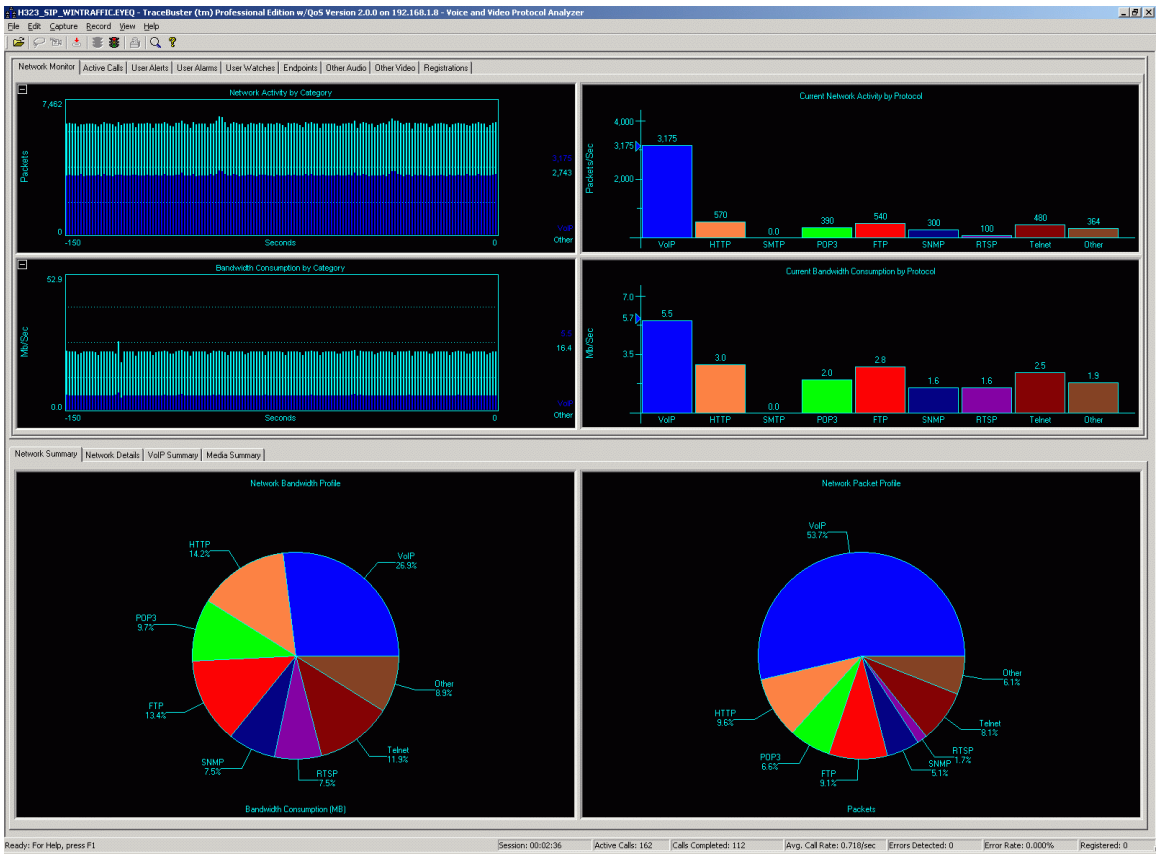
by a view of logically grouped components (e.g. network protocols) in a view that can be toggled between a pie chart and a bar chart. Each of these components has at least one level of depth beyond the first, which minimally would be a historical representation of the values of the component over time, which we refer to as a "histogram". At its most complex, the topmost Data Scope™ will be the highest representation of a series of cascading views which each end at a histogram. The following gives you an overview of the typical mechanism of a Data Scope™ for isolating the G.723 bandwidth utilization on a live VoIP network.

## Network Monitor View




If we zero in on the Network Bandwidth Data Scope™ (found in the bottom of the upper right quadrant), we see a Data Scope™ that appears as follows:

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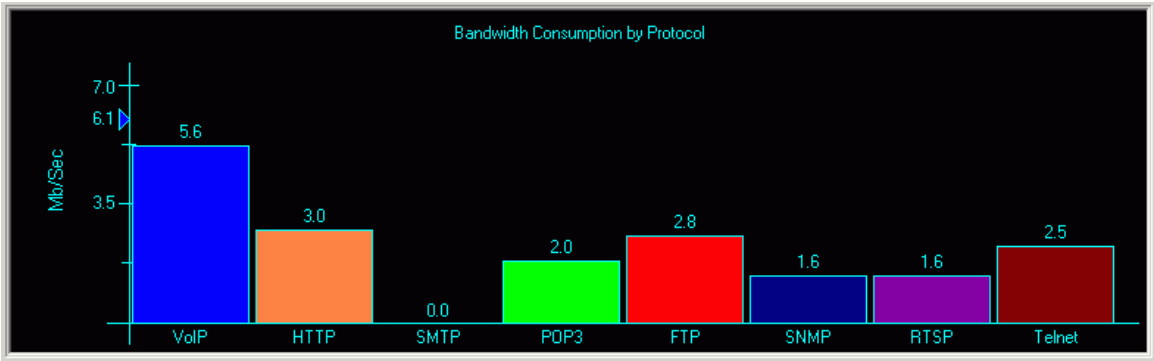
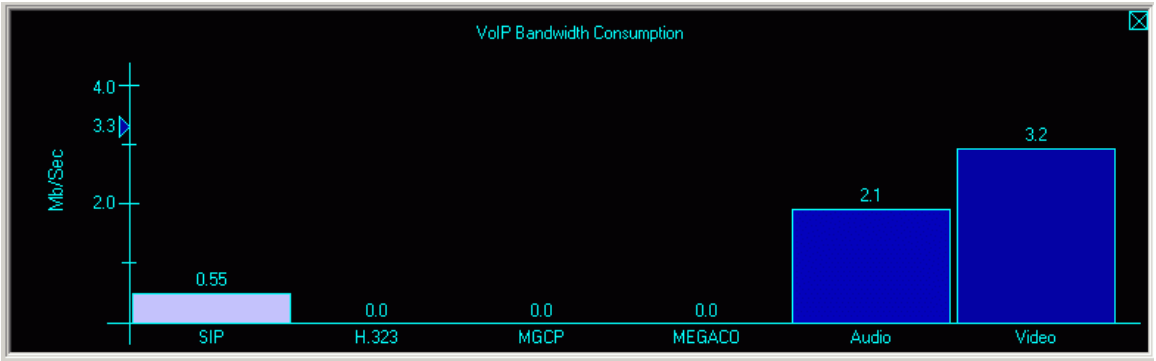
## Network Bandwidth Consumption; top view




Notice that the components are grouped logically and that this Data Scope™ provides a high-level view of the bandwidth utilization of the various protocols on the network. The leftmost component is the VoIP component. To further explore the bandwidth utilization of the VoIP component, we can drill down by double-clicking on it. This action would yield a view of the VoIP breakdown as:

## VoIP Bandwidth Consumption; level 2




Once again, the components of this sub-level Data Scope™ are grouped logically, representing the top-level view of the bandwidth utilization of the VoIP components. The leftmost component is the SIP component, followed by H.323, Audio, and Video components. To further explore the bandwidth utilization of the Audio component, we can drill down by double-clicking on it. This action would yield a view of the Audio components as:

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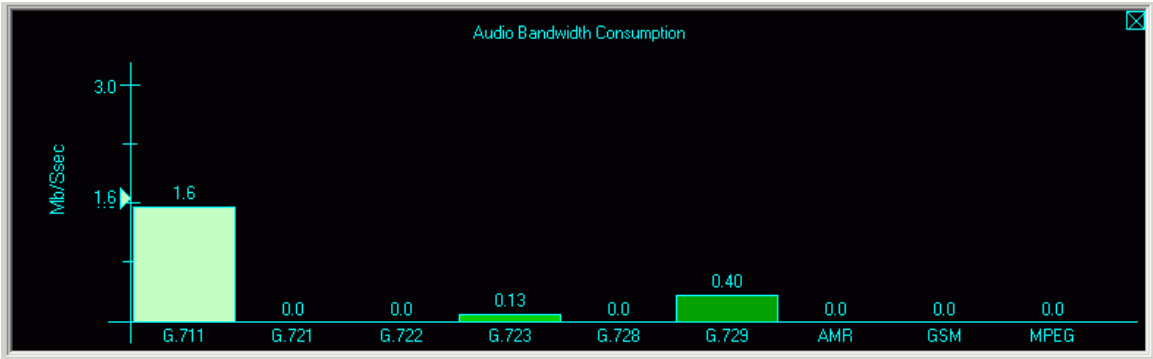
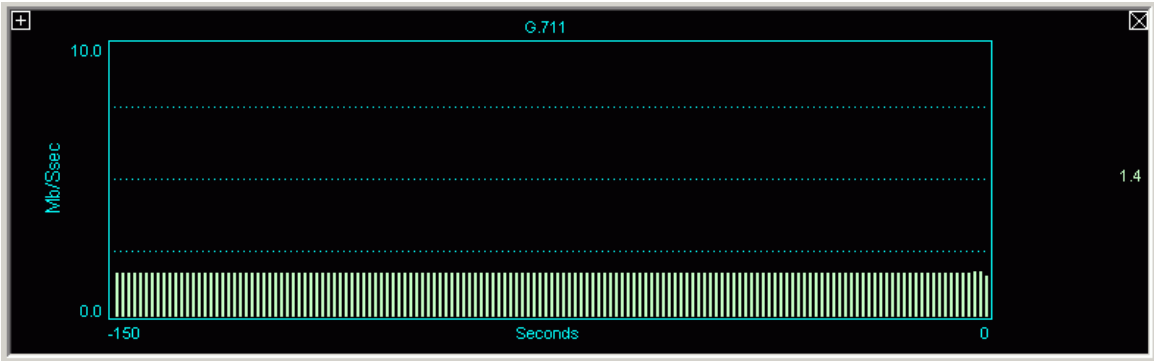
## Audio Bandwidth Consumption; level 3




The components of this sub-level Data Scope™ are grouped logically representing the bandwidth utilization of the audio component by codec type. The leftmost component is the G.711 codec, which also has a sub-level Data Scope™ further refining it to the Alaw and Ulaw components. To further explore the bandwidth utilization of the G.723 component, we can drill down by double-clicking on it. This action would yield a view of the G.723 component as:

## G.711 Bandwidth Consumption Histogram; level 4




By clicking the "+" sign on the histogram, we can "Zoom In" on the series of values.

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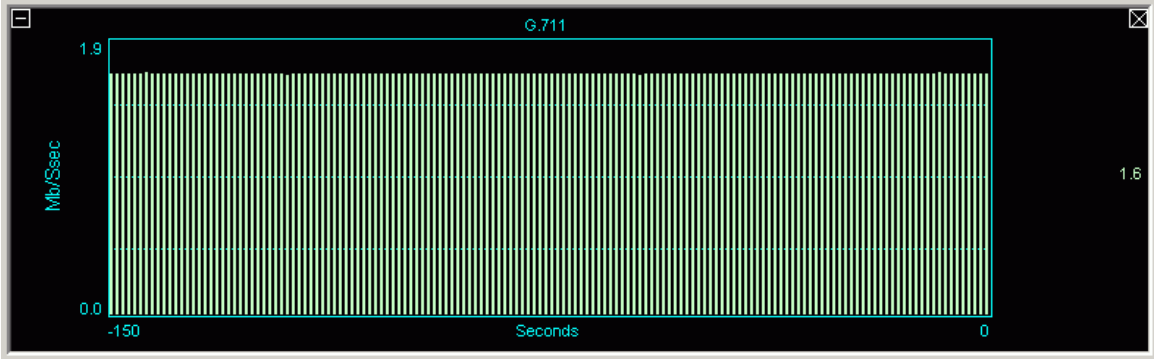
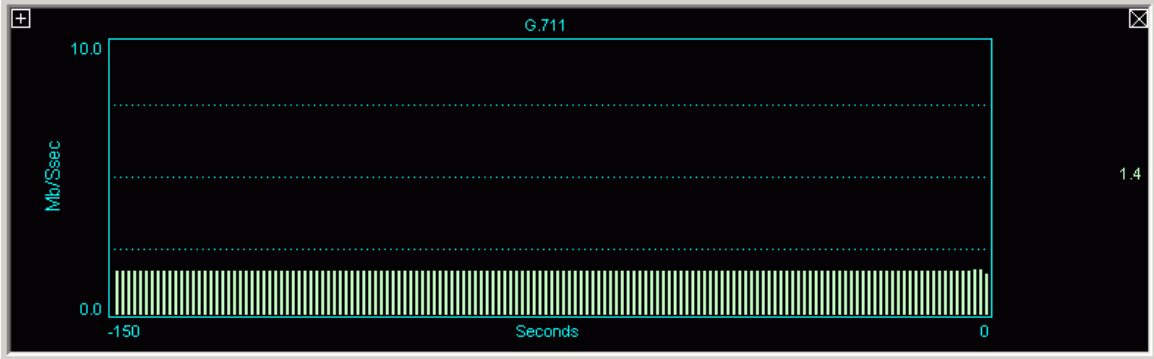
## G.711 Bandwidth Consumption Histogram; zoomed




By clicking the "-" sign on the histogram, we can "Zoom Out" on the series of values back to:




Once you reach the histogram of a component you are at the end of the journey. You may back out from any sub-level at any time by using the "X" in the upper-right corner. The following section provides the user-interface tips and tricks for using the data scopes:

Data Scopes™ in Bar Graph View provide high-water marks for the component with the highest value on the scope. These marks, indicated by an arrow on the left scale, have the same color as the component that they are associated with. These watermarks are re-calculated every 10 updates of the Data Scope.

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### Navigational Tips

- Right-click the background area of a Data Scope™ to toggle between Bar Graph View and Pie Chart View.
- Double-click components to drill-down.
- Click the "X" box on a sub-level component to navigate backwards.
- Right-click any component to view its histogram.
- Click the "+" box to zoom-in the scale on a histogram.
- Click the "-" box to zoom-out the scale on a histogram.

## User Interface: Step-By-Step

TraceBuster's user interface is comprised of nine (9) major views each containing up to thirteen (13) sub-views. The nine major views represent the following categories:

- Network Monitor
- Active Call
- User Alerts
- User Alarms
- User Watches
- Endpoints
- Anonymous or "Rogue" Audio Channels
- Anonymous or "Rogue" Video Channels
- Registrations

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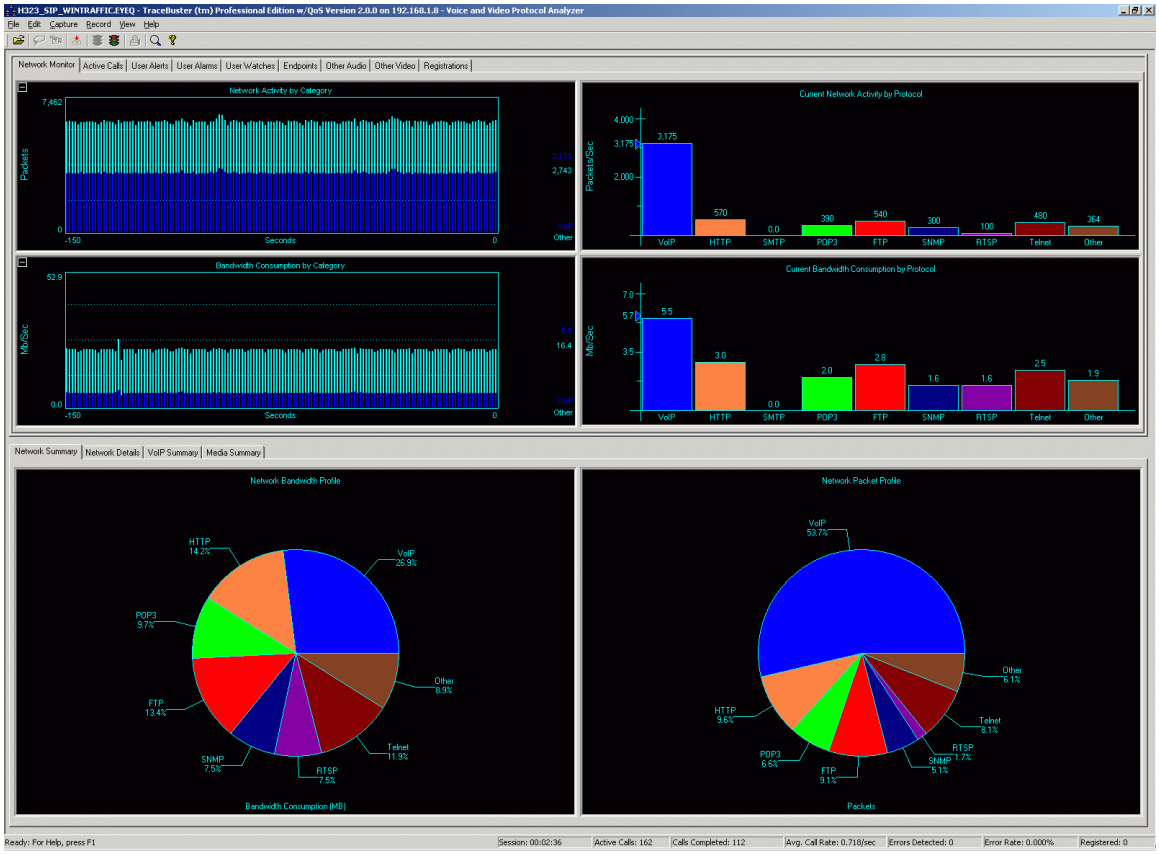
## The Network Monitor View

For the main view (Network Monitor) the Data Scopes™ are paired in Activity/Bandwidth pairs for logical groups of components. For example, Network Protocol Activity and Network Bandwidth Consumption by Protocol are paired together.




The Network Monitor View is designed to provide an overall picture of VoIP and Non-VoIP network traffic and resource utilization both instantaneously (top half) and historically (bottom half). You may elect to "drill into" any of the component elements as demonstrated earlier. The network monitor view has the following sub-views:

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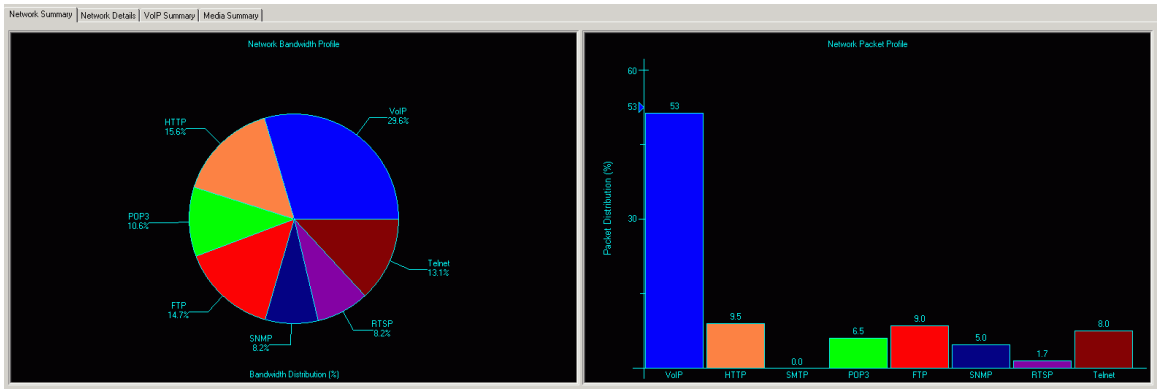
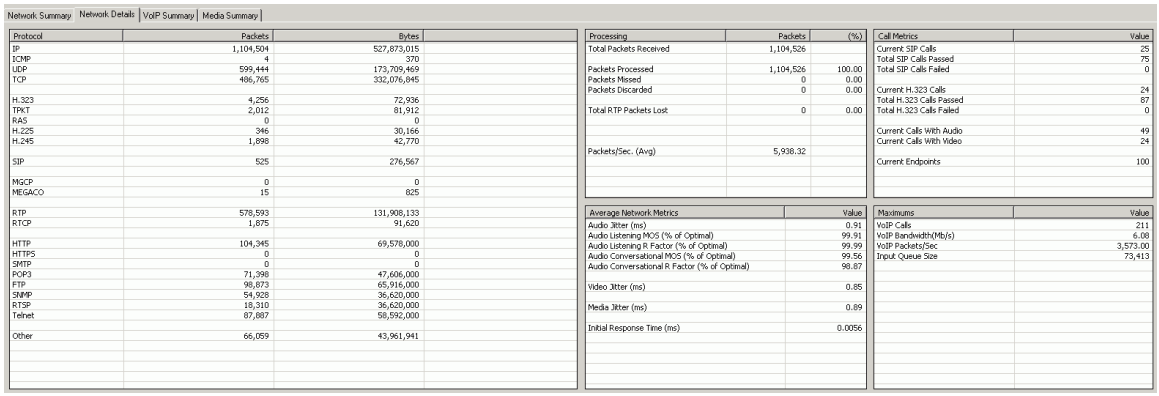
## Network Summary

This view presents the high-level Data Scopes™ that represent the Network Bandwidth and Packet Profiles by component over the duration of the session. In this example, the Network Packet Profile Data Scope™ is in Bar Chart Mode while the Network Bandwidth Summary is in Pie Chart Mode. These modes can be toggled back and forth by right clicking on the background of the Data Scope™.




## Network Details




This view provides a numerical summary of the packets and byte counts analyzed by layer. The layers include:

- IP, ICMP, UDP, TCP
- H.323, TPKT, RAS, H.225, H.245
- SIP
- MGCP, MEGACO
- RTP, RTCP
- HTTP, HTTPS, SMTP, POP3, FTP, SNMP, RTSP, Telnet, Other

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Additional network metrics include:

Processing:

Total Packets Received: The total number of packets that TraceBuster has received from the WinPcap driver.
Packets Processed: The number of packets that TraceBuster has processed and analyzed.
Packets Missed: The number of packets that the WinPcap driver has been unable to send to TraceBuster.
Packets Discarded: The number of packets that TraceBuster has discarded due to packet overload.
Total RTP Packet Lost: The total number of RTP packets that were expected minus the total number actually received.
Packets per Second (Average): The average number of packets per second that TraceBuster has processed since the analyzer was started.

Call Metrics:

Total SIP Calls Passed
Total SIP Calls Failed
Total H.323 Calls Passed
Total H.323 Calls Failed
Current Audio Calls
Current Video Calls

Average Network Metrics:

Audio Jitter (ms): The average jitter (as calculated from RFC 3550) for all audio streams of all completed calls.
Audio Listening MOS (% of Optimal): The average Listening MOS score attained for all audio streams of all completed calls. See below.
Audio Listening R Factor (% of Optimal): The average Listening R factor attained for all audio streams of all completed calls. See below.
Audio Conversational MOS (% of Optimal): The average Conversational MOS score attained for all audio streams of all completed calls. See below.
Audio Conversational R Factor (% of Optimal): The average Conversational R factor attained for all audio streams of all completed calls. See below.
Video Jitter (ms): The average jitter (as calculated from RFC 3550) for all video streams of all completed calls.
Media Jitter (ms): The combined average of the audio and video jitter values.
Initial Response Time (ms): The average time it took for the called endpoint to return its first response to the calling endpoint.

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Maximums:

VoIP Calls: The maximum number of concurrent calls that TraceBuster has analyzed.
Bandwidth (Mb/s): The highest bandwidth analyzed.
Packets/Second: The highest number of packets per second analyzed.
Input Queue Size: The highest number of packets that the TraceBuster processing queue has stored for processing.

**Optimal MOS Scores and R Factors.**

Different codec types have different highest attainable Listening and Conversational MOS scores and R factors. TraceBuster computes the normalized average network MOS scores and R factors by taking the MOS scores and R factors calculated for the audio media stream and dividing them by their theoretical maximum values. For example, if a G.728 audio stream received a Listening MOS score of 3.5, the normalized value would be 86.6 %. If a G.723.1 5.3 kb audio stream received a Listening MOS score of 3.5, the normalized value would be 96.1 %.

**Note:** Please see **Appendix A** for a chart of theoretical maximum MOS scores and R factors.

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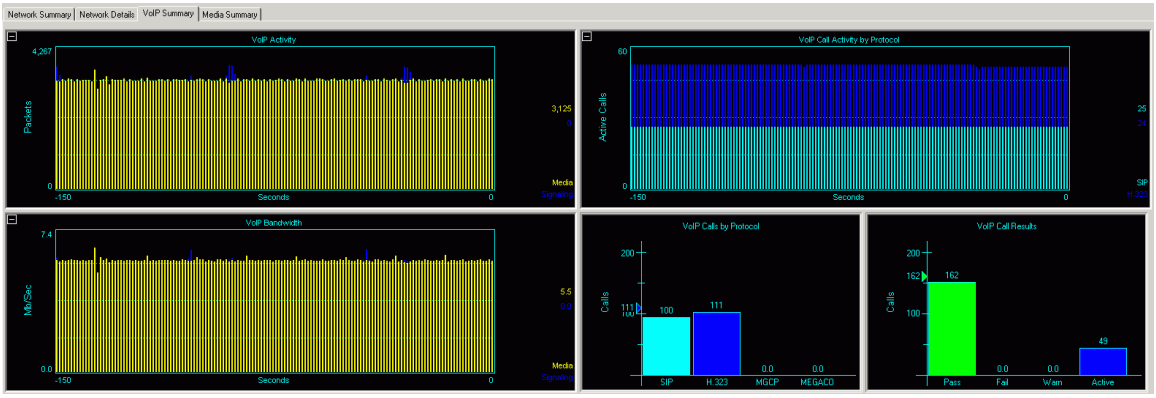
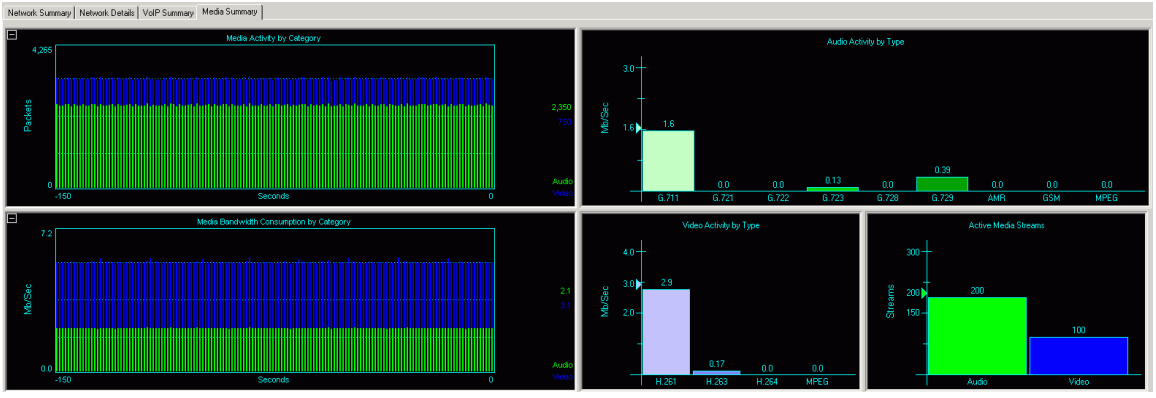
## VoIP Summary

The VoIP Summary paints a picture of the packet and bandwidth activity of the VoIP signaling and media components as well as detailing call activity by protocol, call distribution by protocol, and call status history.




## Media Summary

The Media Summary shows the bandwidth consumption and activity of the media components of the VoIP activity on your network. The bandwidth and packet activity are broken down by audio and video components. The right half of the screen breaks audio and video down by codec type as well as summarizing the active audio and video streams on the network.

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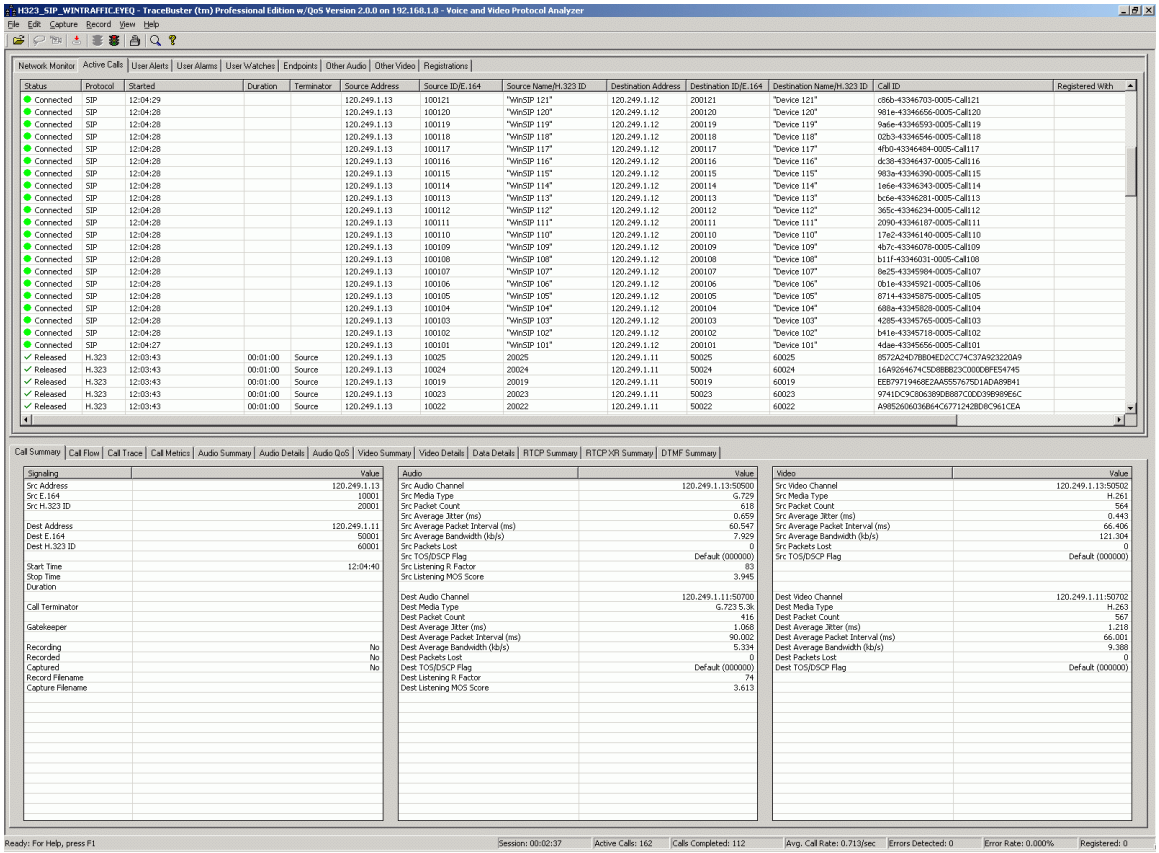
## Active Calls View




The active calls view is designed to provide an in-depth view of each VoIP call and its status. Each call is represented by an entry in the topmost report, the entries are updated once every second.

This view contains the following columns:

Call Status: The current status of the call. These may be things such as connecting, ringing, connected, error, etc.

Protocol: The values for this field are SIP or H.323.

Started: This is the time (local time) that the call was started.

Duration: The length of time the call is (or was) active.

Terminator: Which side of the call (Source or Destination) terminated the call.

Source Address: The address of the call initiator (caller).

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Source ID/E.164: The SIP user ID or H.323 E.164 alias of the caller.

Source Name/H.323 ID: The SIP display name or H.323 ID of the caller.

Destination Address: The address of the call receiver (party called).

Destination ID/E.164: The SIP user ID or H.323 E.164 alias of the party called.

Destination Name/H.323 ID: The SIP display name or H.323 ID of the party called.

Call ID: The SIP or H.323 call ID associated with this call.

Registered With: The gatekeeper's IP address, for H.323 calls, or the Proxy's IP address, for SIP calls.

Conference ID: The conference ID (H.323 calls only).

Each individual call has the following thirteen sub-views.

- Call Summary
- Call Flow (ladder diagram)
- Call Trace
- Call Metrics
- Audio Summary
- Audio Details
- Audio QoS
- Video Summary
- Video Details
- Data Details
- RTCP Summary
- RTCP XR Summary
- DTMF Summary

To display information about a particular call, select it (click the call line) in the call list. Whenever a call is selected, it will remain "locked" in the view for as long as you wish to view its details.

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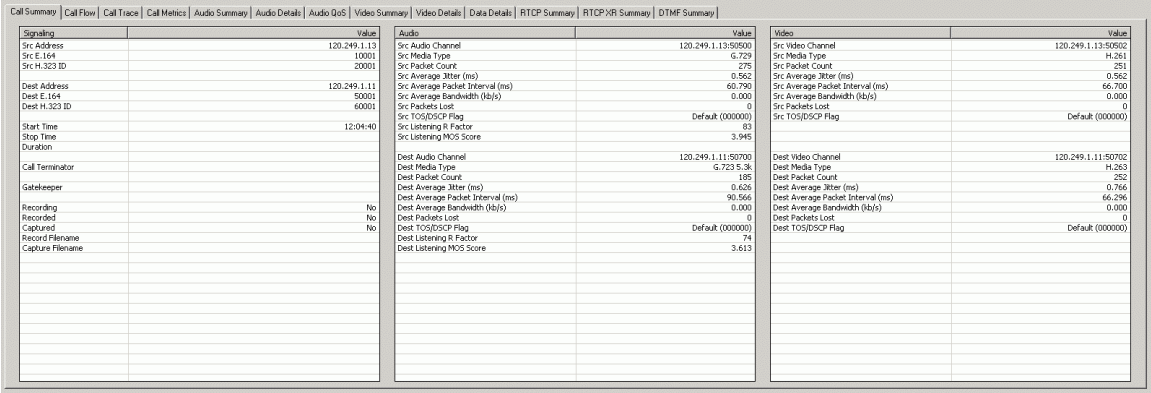
## Call Summary




This sub-view provides a summary of the call elements including source and destination addresses for signaling and media. There are three panes on this sub-view.

### Signaling pane

Source Address: The IP address of the calling endpoint.
Source ID/Source E.164: The source ID (SIP) or E.164 (H.323) of the calling endpoint.
Source Name/Source H.323 ID: The source name (SIP) or H.323 ID (H.323) of the calling endpoint.
Destination Address: The IP address of the called endpoint.
Destination ID/E.164: The source ID (SIP) or E.164 (H.323) of the called endpoint.
Destination Name/H.323 ID: The source name (SIP) or H.323 ID (H.323) of the called endpoint.
Start Time: The time the first packet was seen on the network.
Stop Time: The time the last packet was seen on the network.
Duration: The difference between the start and stop time.
Call Terminator: The endpoint that terminated the call.
Proxy/Gatekeeper: The address of the proxy (SIP) or gatekeeper (H.323) that participated in the call.
Recording: Whether or not the call is presently being recorded.
Recorded: Whether or not the call was recorded.
Captured: Whether or not the call was captured.
Record Filename: The file name of the record file.
Capture Filename: The file name of the capture file.

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**Audio pane**

Source Audio Channel: The IP address and port of the calling endpoint.
Source Media Type: The type of codec being used to send the audio.
Source Packet Count: The number of packets sent on this channel.
Source Average Jitter (ms): The average jitter value (as calculated from RFC 3550) for this channel.
Source Average Packet Interval (ms): The average inter-arrival time of packets on this channel.
Source Average Bandwidth (kb/s): The average bandwidth, in kilobits per second, calculated for this channel.
Source Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received.
Source TOS/DSCP Flag: The value of the Type of Service (TOS) / Differentiated Services Code Point (DSCP) flag in the IP header field.
Source Listening R Factor: The current Listening R factor for this media stream.
Source Listening MOS Score: The current Listening MOS Score for this media stream.

Destination Audio Channel: The IP address and port of the called endpoint.
Destination Media Type: The type of codec being used to send the audio.
Destination Packet Count: The number of packets sent on this channel.
Destination Average Jitter (ms): The average jitter value (as calculated from RFC 3550) for this channel.
Destination Average Packet Interval (ms): The average inter-arrival time of packets on this channel.
Destination Average Bandwidth (kb/s): The average bandwidth, in kilobits per second, calculated for this channel.
Destination Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received.
Destination TOS/DSCP Flag: The value of the Type of Service (TOS) / Differentiated Services Code Point (DSCP) flag in the IP header field.
Destination Listening R Factor: The current Listening R factor for this media stream.
Destination Listening MOS Score: The current Listening MOS Score for this media stream.

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**Video pane**

Source Video Channel: The IP address and port of the calling endpoint.
Source Media Type: The type of codec being used to send the Video.
Source Packet Count: The number of packets sent on this channel.
Source Average Jitter (ms): The average jitter value (as calculated from RFC 3550) for this channel.
Source Average Packet Interval (ms): The average inter-arrival time of packets on this channel.
Source Average Bandwidth (kb/s): The average bandwidth, in kilobits per second, calculated for this channel.
Source Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received.
Source TOS/DSCP Flag: The value of the Type of Service (TOS) / Differentiated Services Code Point (DSCP) flag in the IP header field.

Destination Video Channel: The IP address and port of the called endpoint.
Destination Media Type: The type of codec being used to send the Video.
Destination Packet Count: The number of packets sent on this channel.
Destination Average Jitter (ms): The average jitter value (as calculated from RFC 3550) for this channel.
Destination Average Packet Interval (ms): The average inter-arrival time of packets on this channel.
Destination Average Bandwidth (kb/s): The average bandwidth, in kilobits per second, calculated for this channel.
Destination Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received.
Destination TOS/DSCP Flag: The value of the Type of Service (TOS) / Differentiated Services Code Point (DSCP) flag in the IP header field.

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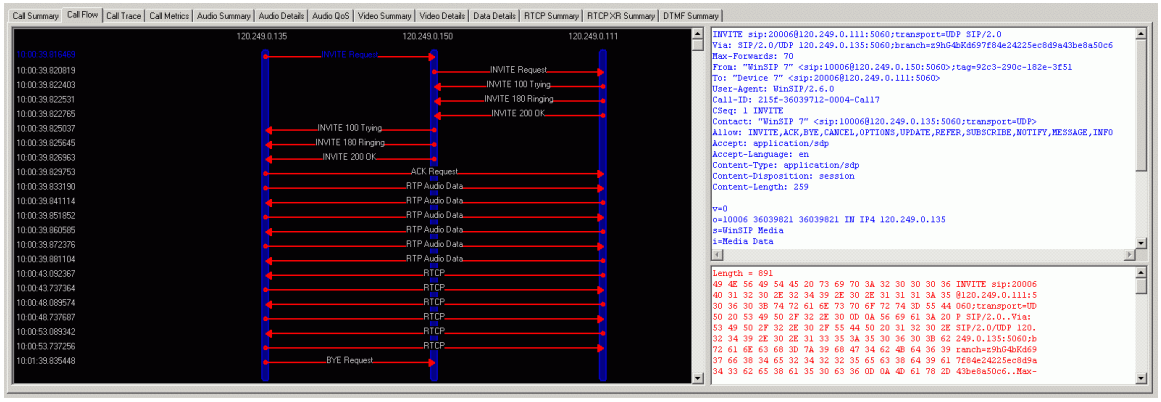
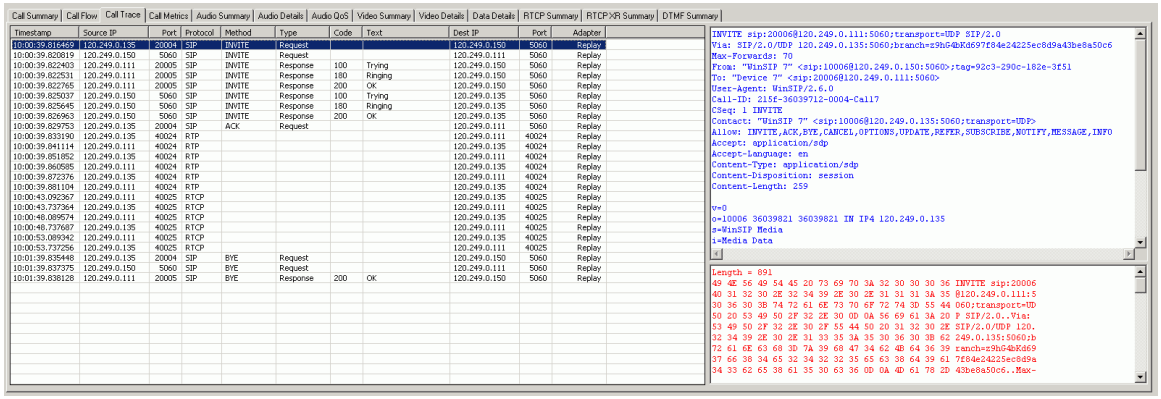
## Call Flow




This sub-view provides a time-stamped ladder diagram view of the call flow (signaling, media and media quality packets). Each "rung" in the ladder may be highlighted to display the decoded packet in both ASCII and hexadecimal representations.

## Call Trace




This sub-view provides a time stamped protocol specific display of the call flow (signaling, media and media quality packets). Each entry in the report may be highlighted to display the decoded packet in both ASCII and hexadecimal representations.

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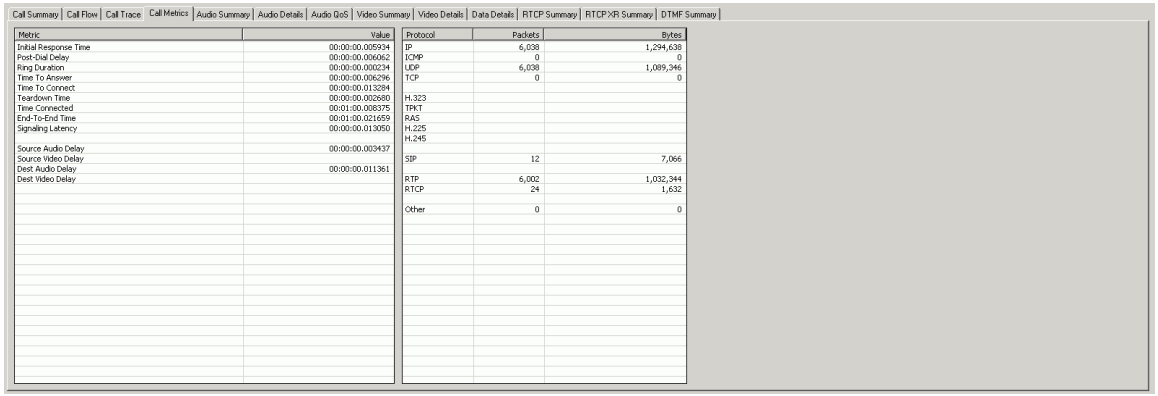
## Call Metrics




This sub-view provides a summary of the call elements including metric measurements for response times and signaling interval and packets and byte counts analyzed by each protocol layer.

Initial Response Time: The length of time it took for the first message that was sent by the calling endpoint to be acknowledged by the called endpoint or proxy/gatekeeper.
Time to Admit (H.323): The length of time it took for the gatekeeper to acknowledge the ARQ message.
Time to Connect: The length of time it took for the call to be connected.
Teardown Time: The length of time it took for the call close sequence to take place.
Time Connected: The length of time from when the call was connected until the close sequence started.
End to End Time: The length of time from the start of the call until it was completed.
Signaling Latency: The length of time it took for the call to connect plus disconnect.
Source Audio Delay: The length of time from when the call was connected until the first source audio packet was sent.
Source Video Delay: The length of time from when the call was connected until the first source video packet was sent.
Destination Audio Delay: The length of time from when the call was connected until the first destination audio packet was sent.
Destination Video Delay: The length of time from when the call was connected until the first destination video packet was sent.

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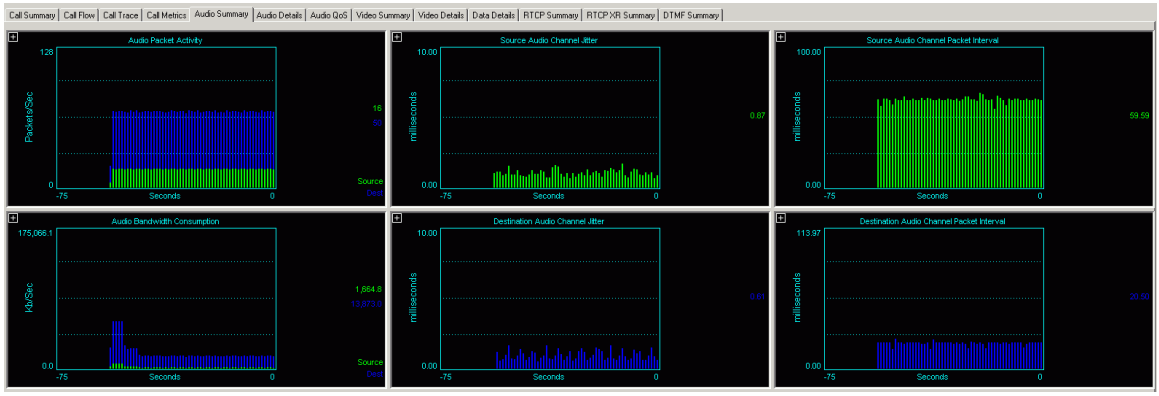
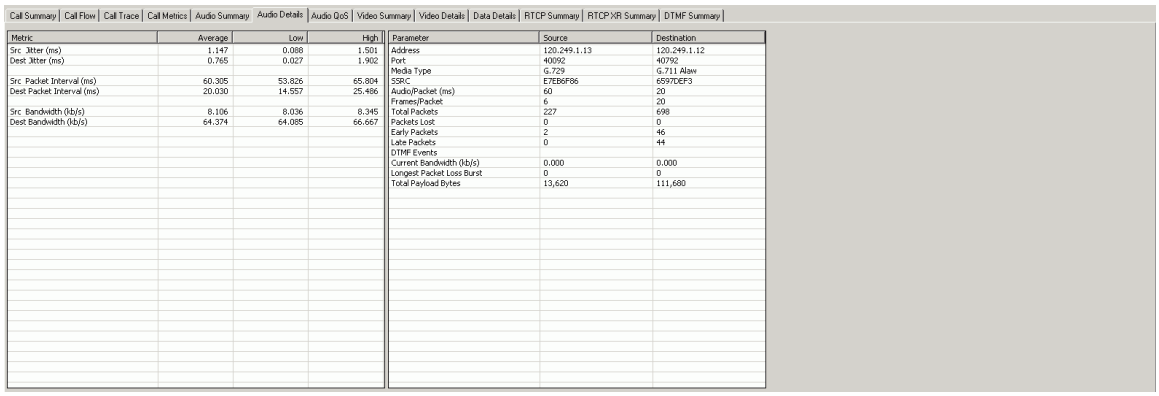
## Audio Summary




This sub-view provides Data Scopes of the jitter and interval measurements for the audio streams.

## Audio Details




This sub-view provides summary information including jitter and interval measurements for the audio streams. The high, low and current values for each stream as well as the stream type, the sender's IP address and port, the receiver's IP address and port, the number of packets lost and the DTMF sequences if present within the stream (RFC 2833 section 3 Named Telephony Events). This sub-view contains two panes.

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## Metrics Pane

Source Jitter (ms): The average, low, and high jitter measurements calculated for the source audio stream.
Destination Jitter (ms): The average, low, and high jitter measurements calculated for the destination audio stream.
Source Packet Interval (ms): The average, low, and high inter-arrival time of packets on the source audio stream.
Destination Packet Interval (ms): The average, low, and high inter-arrival time of packets on the destination audio stream.
Source Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the source audio stream.
Destination Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the destination audio stream.

## Parameters Pane

Address: The IP addresses for the source and destination channels.
Port: The port numbers for the source and destination channels.
Media Type: The codec type for the source and destination channels.
SSRC: The synchronization source for the source and destination channels.
Audio/Packet (ms): The length of audio time contained in each packet for the source and destination channels.
Frames/Packet: The number of audio frames contained in each packet for the source and destination channels.
Total Packets: The number of packets counted for the source and destination channels.
Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received for the source and destination channels.
Early Packets: The number of packets considered early as configured on the Edit Menu | Settings | Advanced Tab for the source and destination channels.
Late Packets: The number of packets considered late as configured on the Edit Menu | Settings | Advanced Tab for the source and destination channels.
DTMF Events: The value of the DTMF digits (RFC 2833) for the source and destination channels.
Current Bandwidth (kb/s): The bandwidth, in kilobits per second, calculated during the last second for the source and destination channels.
Longest Packet Loss Burst: The count of the longest sequence of lost packets for the source and destination channels.
Total Payload Bytes: The number of bytes in the payload portion of the packet for the source and destination channels.

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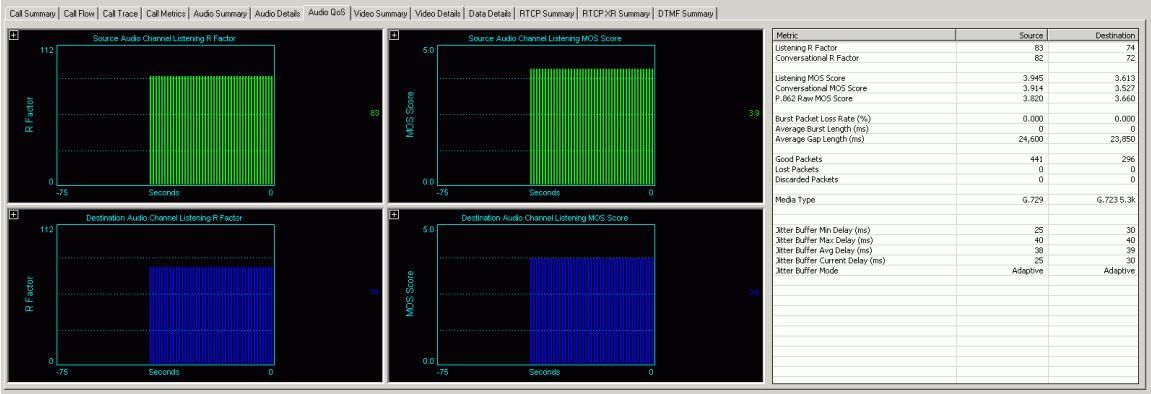
## Audio QoS




This sub-view provides a real-time display of the R-factor and MOS scores for each stream. The R-factor/MOS scoring feature is a non-intrusive measurement technique available for the TraceBuster call monitor. TraceBuster passively measures the characteristics of live VoIP calls and reports quality scores in real-time. The algorithm used to obtain the R-Factor/MOS quality scores accurately models the way that time-varying impairments, most notably burst packet loss and possible jitter buffer discards, affect perceived speech quality. This sub-view has three panes.

### Listening R Factor Pane

This pane displays the source audio (upper) and destination audio (lower) Listening R Factors in real-time.

### Listening MOS Score Pane

This pane displays the source audio (upper) and destination audio (lower) Listening MOS Scores in real-time.

### Metrics Pane

Listening R Factor: The current value of the Listening R Factor for the source and destination audio streams.
Conversational R Factor: The current value of the Conversational R Factor for the source and destination audio streams.
Listening MOS Score: The current value of the Listening MOS Score for the source and destination audio streams.

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Conversational MOS Score: The current value of the Conversational MOS Score for the source and destination audio streams.
P.862 Raw MOS Score: The current value of the P.862 Raw MOS Score for the source and destination audio streams.
Burst Packet Loss Rate (%): The packet loss rate encountered for burst conditions for the source and destination audio streams.
Average Burst Length (ms): The average burst length in milliseconds encountered for burst conditions for the source and destination audio streams.
Average Gap Length (ms): The average gap length in milliseconds encountered for burst conditions for the source and destination audio streams.
Good Packets: – the number of packets received for the source and destination audio streams.
Lost Packets: The number of network lost packets for the source and destination audio streams.
Discarded Packets: The number of discarded packets due to excessive delay or extremely early arrival detected for the source and destination audio streams.
Media Type: The codec type for the source and destination audio streams
Jitter Buffer Minimum Delay (ms): The minimum jitter buffer emulator delay in milliseconds occurring during a call for the source and destination audio streams.
Jitter Buffer Maximum Delay (ms): The maximum jitter buffer emulator delay in milliseconds occurring during a call for the source and destination audio streams.
Jitter Buffer Average Delay (ms): The average jitter buffer emulator delay in milliseconds occurring during a call for the source and destination audio streams.
Jitter Buffer Current Delay (ms): The current jitter buffer emulator delay in milliseconds for the source and destination audio streams.
Jitter Buffer Mode: The type of jitter buffer (adaptive of fixer) being used for the source and destination audio streams. This is configured on the Edit Menu | Settings | QoS Tab.

The quality scores for MOS range from 0 to 4.5 and the R factor measurements range from 0 to 105 depending on codec type. The guidelines for interpreting the R-factor and MOS scores are shown in the table below for the G.711 codec:

| **Desirability Scale** | **R-factor Range** | **MOS Range** |
|---|---|---|
| Desirable | 94 - 80 | 4.4 - 4.0 |
| Acceptable | 80 - 70 | 4.0 - 3.6 |
| Reach Connection | 70 - 50 | 3.6 - 2.6 |
| Not recommended | 50 - 0 | 2.6 - 0 |

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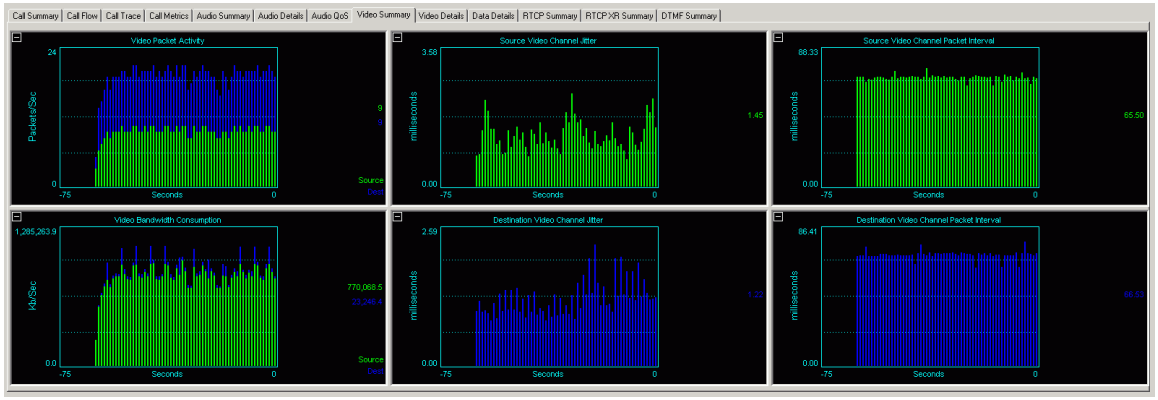
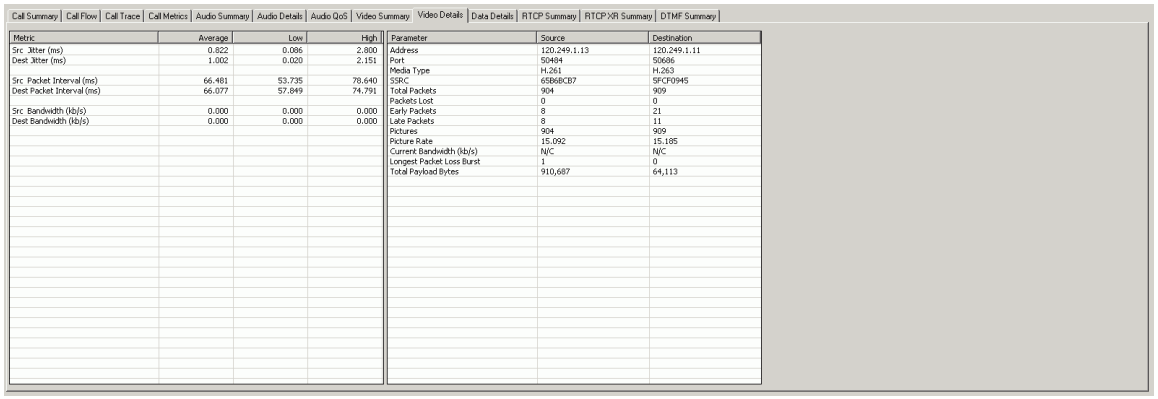
## Video Summary




This sub-view provides Data Scopes of the jitter and interval measurements for the video streams.

## Video Details




This sub-view provides summary information including jitter and interval measurements for the video streams. The high, low and current values for each stream as well as the stream type, the sender's IP address and port, the receiver's IP address and port, the number of packets lost, the number of pictures detected and the picture rate. This sub-view contains two panes.

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## Metrics Pane

Source Jitter (ms): The average, low, and high jitter measurements calculated for the source video stream.
Destination Jitter (ms): The average, low, and high jitter measurements calculated for the destination video stream.
Source Packet Interval (ms): The average, low, and high inter-arrival time of packets on the source video stream.
Destination Packet Interval (ms): The average, low, and high inter-arrival time of packets on the destination video stream.
Source Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the source video stream.
Destination Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the destination video stream.

## Parameters Pane

Address: The IP addresses for the source and destination channels.
Port: The port numbers for the source and destination channels.
Media Type: The codec type for the source and destination channels.
SSRC: The synchronization source for the source and destination channels.
Total Packets: The number of packets counted for the source and destination channels.
Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received for the source and destination channels.
Early Packets: The number of packets considered early as configured on the Edit Menu | Settings | Advanced Tab for the source and destination channels.
Late Packets: The number of packets considered late as configured on the Edit Menu | Settings | Advanced Tab for the source and destination channels.
Pictures: The number of picture start codes counted for the source and destination channels.
Picture Rate: The number of pictures per second calculated for the source and destination channels.
Current Bandwidth (kb/s): The bandwidth, in kilobits per second, calculated during the last second for the source and destination channels.
Longest Packet Loss Burst: The count of the longest sequence of lost packets for the source and destination channels
Total Payload Bytes: The number of bytes in the payload portion of the packet for the source and destination channels.

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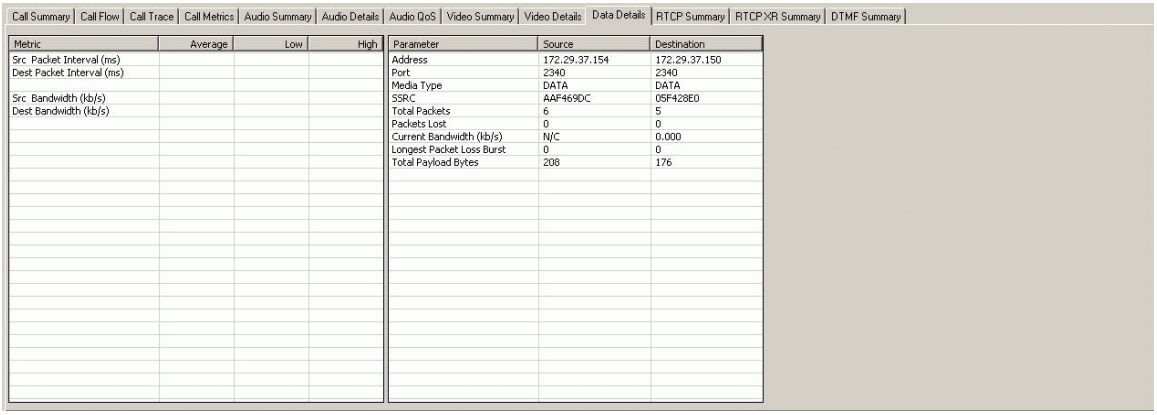
## Data Details




This sub-view provides summary information including interval measurements for the data streams, the high, low and current values for each stream as well as the stream type, the sender's IP address and port, the receiver's IP address and port, and the number of packets lost. There are two panes on this sub-view.

### Metrics Pane

Source Packet Interval (ms): The average, low, and high inter-arrival time of packets on the source video stream.
Destination Packet Interval (ms): The average, low, and high inter-arrival time of packets on the destination video stream.
Source Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the source video stream.
Destination Bandwidth: The average, low, and high bandwidth, in kilobits per second, calculated for the destination video stream.

### Parameters Pane

Address: The IP addresses for the source and destination channels.
Port: The port numbers for the source and destination channels.
Media Type: The codec type for the source and destination channels.
SSRC: The synchronization source for the source and destination channels.
Total Packets: The number of packets counted for the source and destination channels.
Packets Lost: The calculated number of packets lost by subtracting the number of packets expected (using the sequence numbers) minus the number actually received for the source and destination channels.

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Current Bandwidth (kb/s): The bandwidth, in kilobits per second, calculated during the last second for the source and destination channels.
Longest Packet Loss Burst: The count of the longest sequence of lost packets for the source and destination channels
Total Payload Bytes: The number of bytes in the payload portion of the packet for the source and destination channels.

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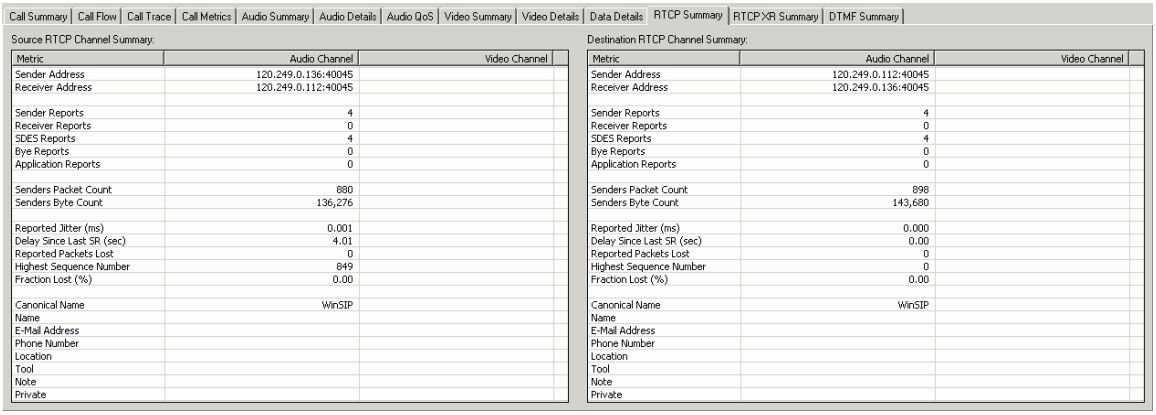
## RTCP Summary




| Metric | Audio Channel | Video Channel |
|---|---|---|
| Sender Address | 120.249.0.136:40045 | |
| Receiver Address | 120.249.0.112:40045 | |
| Sender Reports | 4 | |
| Receiver Reports | 0 | |
| SDES Reports | 4 | |
| Bye Reports | 0 | |
| Application Reports | 0 | |
| Senders Packet Count | 880 | |
| Senders Byte Count | 136,276 | |
| Reported Jitter (ms) | 0.001 | |
| Delay Since Last SR (sec) | 4.01 | |
| Reported Packets Lost | 0 | |
| Highest Sequence Number | 849 | |
| Fraction Lost (%) | 0.00 | |
| Canonical Name | WinSIP | |
| Name | | |
| E-Mail Address | | |
| Phone Number | | |
| Location | | |
| Tool | | |
| Note | | |
| Private | | |

| Metric | Audio Channel | Video Channel |
|---|---|---|
| Sender Address | 120.249.0.112:40045 | |
| Receiver Address | 120.249.0.136:40045 | |
| Sender Reports | 4 | |
| Receiver Reports | 0 | |
| SDES Reports | 4 | |
| Bye Reports | 0 | |
| Application Reports | 0 | |
| Senders Packet Count | 898 | |
| Senders Byte Count | 143,680 | |
| Reported Jitter (ms) | 0.000 | |
| Delay Since Last SR (sec) | 0.00 | |
| Reported Packets Lost | 0 | |
| Highest Sequence Number | 0 | |
| Fraction Lost (%) | 0.00 | |
| Canonical Name | WinSIP | |
| Name | | |
| E-Mail Address | | |
| Phone Number | | |
| Location | | |
| Tool | | |
| Note | | |
| Private | | |

This sub-view provides summary information that has been gathered from the RTCP packets that TraceBuster has analyzed for the audio and video streams that have been sent by both endpoints of the call. This sub-view has two panes that are identical except for source and destination.

### RTCP Channel Summary Pane

Sender Address: The IP address and port number of the sending RTCP channel.
Receiver Address: The IP address and port number of the receiving RTCP channel.
Sender Reports: The number of RTCP Sender Reports sent.
Receiver Reports: The number of RTCP Receiver Reports sent.
SDES: - the number of RTCP SDES Reports sent.
Bye Reports: The number of RTCP Bye Reports sent.
Application Reports: The number of RTCP Application Reports sent.
Senders Packet Count: The total number of RTP data packets transmitted by the sender since starting transmission.
Senders Byte Count: The total number of payload octets transmitted in RTP data packets by the sender since starting transmission.
Reported Jitter (ms): The jitter measurement calculated on the stream being received from the other endpoint.
Delay Since Last SR (sec): The delay, expressed in units of 1/65536 seconds, between receiving the last SR packet from the remote endpoint and sending this reception report block.
Reported Packets Lost: The total number of RTP data packets from the remote endpoint that have been lost since the beginning of reception.
Highest Sequence Number: The low 16 bits contain the highest sequence number received in an RTP data packet from the remote endpoint, and the

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most significant 16 bits extend that sequence number with the corresponding count of sequence number cycles.
Fraction Lost (%): The fraction of RTP data packets from the remote endpoint lost since the previous SR or RR packet was sent, expressed as a fixed point number with the binary point at the left edge of the field.
Canonical Name: A unique end-point identifier.
Name: The real name used to describe the source.
E-Mail Address: The email address is formatted according to RFC 2822.
Phone Number: The phone number (should be formatted with the plus sign replacing the international access code).
Location: The geographic user location.
Tool: The application or tool name.
Note: This is intended for transient messages describing the current state of the source.
Private: This item is used to define experimental or application-specific extensions.

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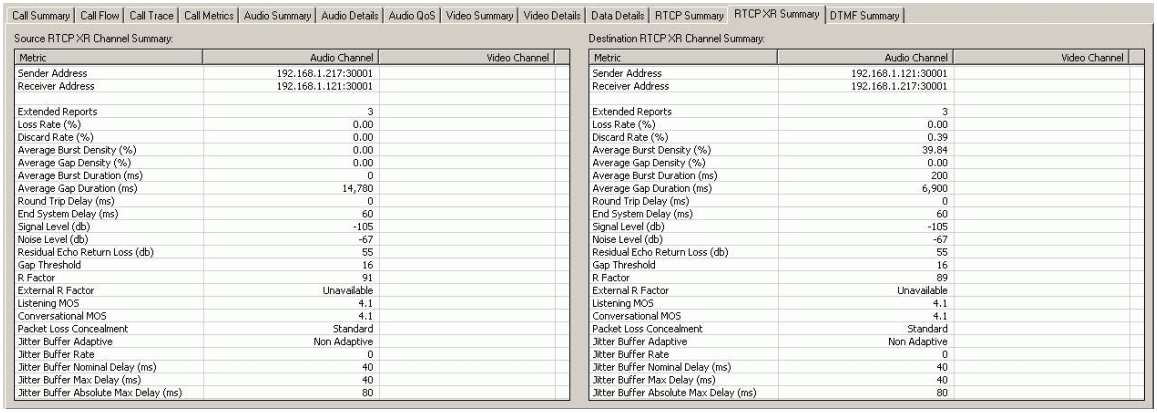
## RTCP XR Summary



Call Summary | Call Flow | Call Trace | Call Metrics | Audio Summary | Audio Details | Audio QoS | Video Summary | Video Details | Data Details | RTCP Summary | RTCP XR Summary | DTMF Summary

Source RTCP XR Channel Summary:

| Metric | Audio Channel | Video Channel |
|---|---|---|
| Sender Address | 192.168.1.217:30001 | |
| Receiver Address | 192.168.1.121:30001 | |
| | | |
| Extended Reports | 3 | |
| Loss Rate (%) | 0.00 | |
| Discard Rate (%) | 0.00 | |
| Average Burst Density (%) | 0.00 | |
| Average Gap Density (%) | 0.00 | |
| Average Burst Duration (ms) | 0 | |
| Average Gap Duration (ms) | 14,780 | |
| Round Trip Delay (ms) | 0 | |
| End System Delay (ms) | 60 | |
| Signal Level (db) | -105 | |
| Noise Level (db) | -67 | |
| Residual Echo Return Loss (db) | 55 | |
| Gap Threshold | 16 | |
| R Factor | 91 | |
| External R Factor | Unavailable | |
| Listening MOS | 4.1 | |
| Conversational MOS | 4.1 | |
| Packet Loss Concealment | Standard | |
| Jitter Buffer Adaptive | Non Adaptive | |
| Jitter Buffer Rate | 0 | |
| Jitter Buffer Nominal Delay (ms) | 40 | |
| Jitter Buffer Max Delay (ms) | 40 | |
| Jitter Buffer Absolute Max Delay (ms) | 80 | |

Destination RTCP XR Channel Summary:

| Metric | Audio Channel | Video Channel |
|---|---|---|
| Sender Address | 192.168.1.121:30001 | |
| Receiver Address | 192.168.1.217:30001 | |
| | | |
| Extended Reports | 3 | |
| Loss Rate (%) | 0.00 | |
| Discard Rate (%) | 0.39 | |
| Average Burst Density (%) | 39.84 | |
| Average Gap Density (%) | 0.00 | |
| Average Burst Duration (ms) | 200 | |
| Average Gap Duration (ms) | 6,900 | |
| Round Trip Delay (ms) | 0 | |
| End System Delay (ms) | 60 | |
| Signal Level (db) | -105 | |
| Noise Level (db) | -67 | |
| Residual Echo Return Loss (db) | 55 | |
| Gap Threshold | 16 | |
| R Factor | 89 | |
| External R Factor | Unavailable | |
| Listening MOS | 4.1 | |
| Conversational MOS | 4.1 | |
| Packet Loss Concealment | Standard | |
| Jitter Buffer Adaptive | Non Adaptive | |
| Jitter Buffer Rate | 0 | |
| Jitter Buffer Nominal Delay (ms) | 40 | |
| Jitter Buffer Max Delay (ms) | 40 | |
| Jitter Buffer Absolute Max Delay (ms) | 80 | |

This sub-view provides summary information that has been gathered from the RTCP XR packets that TraceBuster has analyzed for the audio and video streams that have been sent by both endpoints of the call. This sub-tab has two panes that are identical, one pane for each source and destination metrics.

### RTCP XR Channel Summary

Sender Address: The IP address and port number of the sending RTCP channel.
Receiver Address: The IP address and port number of the receiving RTCP channel.
Extended Reports: The number of RTCP Extended Reports sent.
Loss Rate (%): The fraction of packets lost since the beginning of the call.
Discard Rate (%): The fraction of packets discarded since the beginning of the call.
Average Burst Density (%): The fraction of packets within burst periods since the beginning of the call.
Average Gap Density (%): The fraction of packets within gap periods since the beginning of the call.
Average Burst Duration (ms): The mean duration, in milliseconds, of the burst periods since the beginning of the call.
Average Gap Duration (ms): The mean duration, in milliseconds, of the gap periods since the beginning of the call.
Round Trip Delay (ms): The most recently calculated round-trip delay, in milliseconds.
End System Delay (ms): The most recently estimated end system delay, in milliseconds.
Signal Level (db): The relative speech signal level expressed as the ratio of the signal level to a 0 dBm0 reference.

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Noise Level (db): The relative silence period noise level expressed as the ratio of the background noise level to a 0 dBm0 reference.
Residual Echo Return Loss (db): The residual echo return loss as the sum of the measured echo return loss (ERL) and the echo return loss enhanced (ERLE) of the echo canceller, expressed in dB.
Gap Threshold: The gap threshold, in packets.
R Factor: The voice quality metric for the call channel as measured in the monitored network segment.
External R Factor: The voice quality metric for the call channel as measured in an external monitored network segment.
Listening MOS: The estimated mean opinion listening quality score for the call channel.
Conversational MOS: The estimated mean opinion conversational quality score for the call channel.
Packet Loss Concealment: The packet loss concealment capabilities.
Jitter Buffer Adaptive: Adaptive or non-adaptive.
Jitter Buffer Rate: This represents the implementation specific adjustment rate of a jitter buffer in adaptive mode.
Jitter Buffer Nominal Delay (ms): The current nominal jitter buffer delay, in milliseconds.
Jitter Buffer Max Delay (ms): The maximum jitter buffer delay, in milliseconds, recorded for the call.
Jitter Buffer Absolute Max Delay (ms): The absolute maximum delay, in milliseconds, the jitter buffer can ever introduce to the call channel packet stream.

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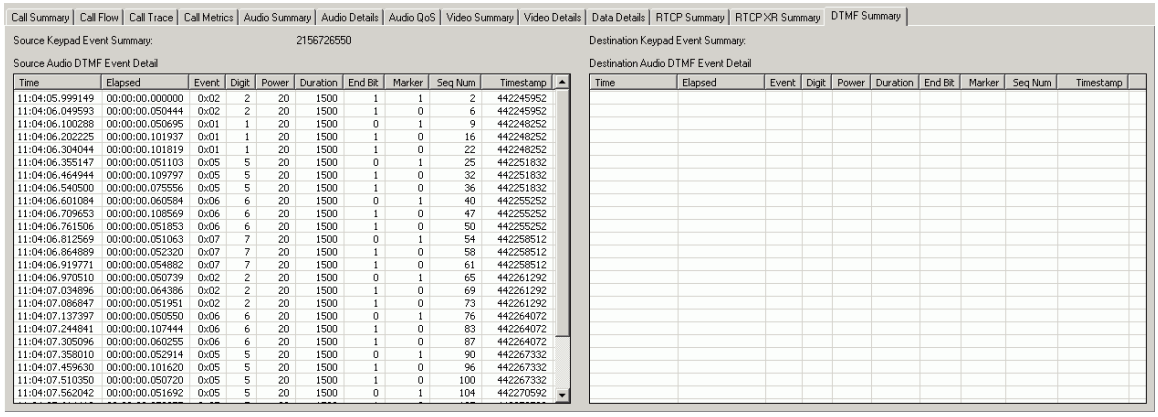
## DTMF Summary




| Time | Elapsed | Event | Digit | Power | Duration | End Bit | Marker | Seq Num | Timestamp |
|---|---|---|---|---|---|---|---|---|---|
| 11:04:05.999149 | 00:00:00.000000 | 0x02 | 2 | 20 | 1500 | 1 | 1 | 2 | 442245952 |
| 11:04:06.049593 | 00:00:00.050444 | 0x02 | 2 | 20 | 1500 | 1 | 0 | 6 | 442245952 |
| 11:04:06.100288 | 00:00:00.050695 | 0x01 | 1 | 20 | 1500 | 0 | 1 | 9 | 442248252 |
| 11:04:06.202225 | 00:00:00.101937 | 0x01 | 1 | 20 | 1500 | 1 | 0 | 16 | 442248252 |
| 11:04:06.304044 | 00:00:00.101819 | 0x01 | 1 | 20 | 1500 | 1 | 0 | 22 | 442248252 |
| 11:04:06.355147 | 00:00:00.051103 | 0x05 | 5 | 20 | 1500 | 0 | 1 | 25 | 442251832 |
| 11:04:06.464944 | 00:00:00.109797 | 0x05 | 5 | 20 | 1500 | 1 | 0 | 32 | 442251832 |
| 11:04:06.540500 | 00:00:00.075556 | 0x05 | 5 | 20 | 1500 | 1 | 0 | 36 | 442251832 |
| 11:04:06.601084 | 00:00:00.060584 | 0x06 | 6 | 20 | 1500 | 0 | 1 | 40 | 442255252 |
| 11:04:06.709653 | 00:00:00.108569 | 0x06 | 6 | 20 | 1500 | 1 | 0 | 47 | 442255252 |
| 11:04:06.761506 | 00:00:00.051853 | 0x06 | 6 | 20 | 1500 | 1 | 0 | 50 | 442255252 |
| 11:04:06.812569 | 00:00:00.051063 | 0x07 | 7 | 20 | 1500 | 0 | 1 | 54 | 442258512 |
| 11:04:06.864889 | 00:00:00.052320 | 0x07 | 7 | 20 | 1500 | 1 | 0 | 58 | 442258512 |
| 11:04:06.919771 | 00:00:00.054882 | 0x07 | 7 | 20 | 1500 | 1 | 0 | 61 | 442258512 |
| 11:04:06.970510 | 00:00:00.050739 | 0x02 | 2 | 20 | 1500 | 0 | 1 | 65 | 442261292 |
| 11:04:07.034896 | 00:00:00.064386 | 0x02 | 2 | 20 | 1500 | 1 | 0 | 69 | 442261292 |
| 11:04:07.086847 | 00:00:00.051951 | 0x02 | 2 | 20 | 1500 | 1 | 0 | 73 | 442261292 |
| 11:04:07.137397 | 00:00:00.050550 | 0x06 | 6 | 20 | 1500 | 0 | 1 | 76 | 442264072 |
| 11:04:07.244841 | 00:00:00.107444 | 0x06 | 6 | 20 | 1500 | 1 | 0 | 83 | 442264072 |
| 11:04:07.305096 | 00:00:00.060255 | 0x06 | 6 | 20 | 1500 | 1 | 0 | 87 | 442264072 |
| 11:04:07.358010 | 00:00:00.052914 | 0x05 | 5 | 20 | 1500 | 0 | 1 | 90 | 442267332 |
| 11:04:07.459630 | 00:00:00.101620 | 0x05 | 5 | 20 | 1500 | 1 | 0 | 96 | 442267332 |
| 11:04:07.510350 | 00:00:00.050720 | 0x05 | 5 | 20 | 1500 | 1 | 0 | 100 | 442267332 |
| 11:04:07.562042 | 00:00:00.051692 | 0x05 | 5 | 20 | 1500 | 0 | 1 | 104 | 442270592 |

| Time | Elapsed | Event | Digit | Power | Duration | End Bit | Marker | Seq Num | Timestamp |
|---|---|---|---|---|---|---|---|---|---|

This sub-view provides a detailed and organized tabular display for the active DTMF transmissions that occur during a call for both the source and destination side of the calls.

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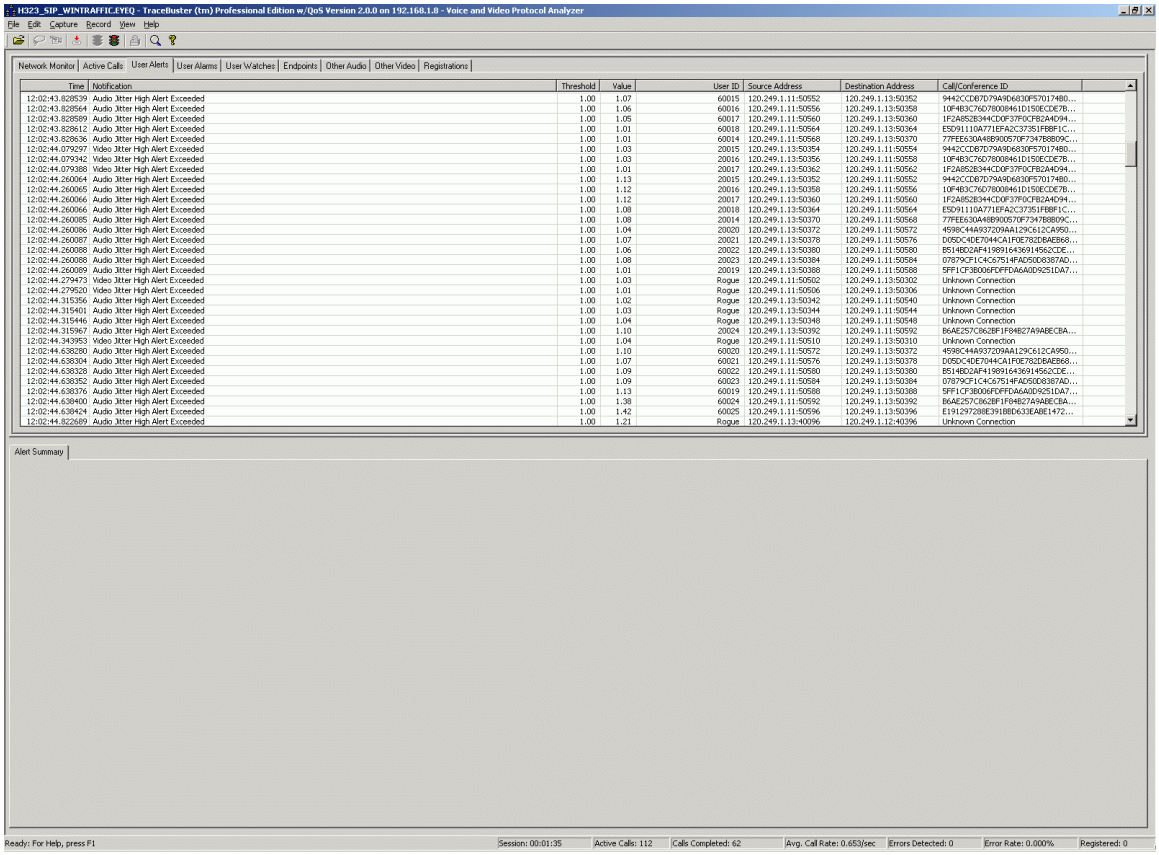
## User Alerts View




This view provides an active list of the alerts that have occurred during the test session. The notification list for the events that triggered the alerts is displayed in tabular form. Each alert is represented by an entry in the topmost report. This report contains the following columns:

Time: This is the time the Alert was detected.

Notification: An explanation of the Alert.

Threshold: The threshold value set by the user.

Value: The value that triggered the Alert

User ID: The SIP user ID or H.323 alias of the caller.

Source Address: The address of the call initiator (caller).

Destination Address: The address of the call receiver (party called).

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Call/Conference ID: The SIP or H.323 call ID associated with this call.

Various alert thresholds are set by the user for audio/video jitter, interval, packet loss, and R-Factor/MOS score measurements

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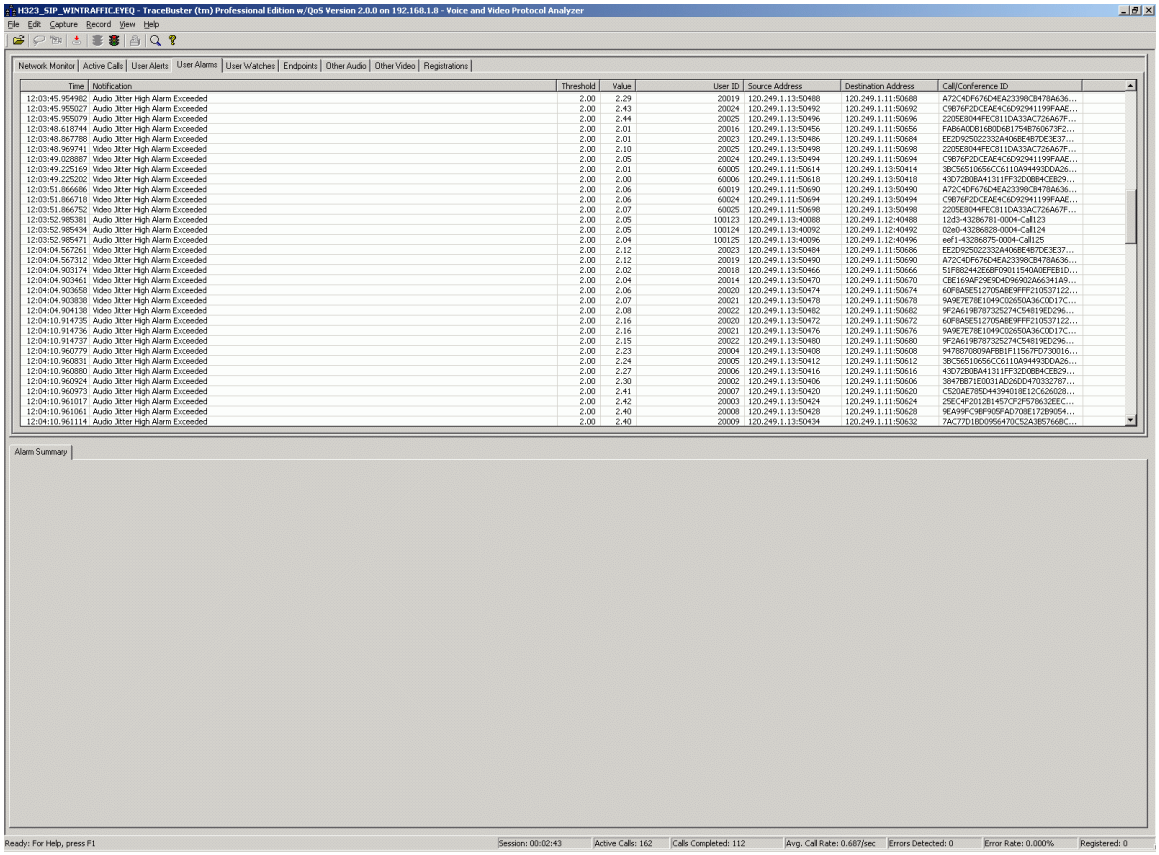
## User Alarms View




This view provides an active list of the alarms that have occurred during the test session. The notification list for the events that triggered the alarms is displayed in tabular form. Each alert is represented by an entry in the topmost report. This report contains the following columns:

Time: This is the time the Alarm was detected.

Notification: An explanation of the Alarm.

Threshold: The threshold value set by the user.

Value: The value that triggered the Alarm

User ID: The SIP user ID or H.323 alias of the caller.

Source Address: The address of the call initiator (caller).

Destination Address: The address of the call receiver (party called).

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Call/Conference ID: The SIP or H.323 call ID associated with this call.

Various alarm thresholds are set by the user for audio/video jitter, interval, packet loss, and R-Factor/MOS score measurements

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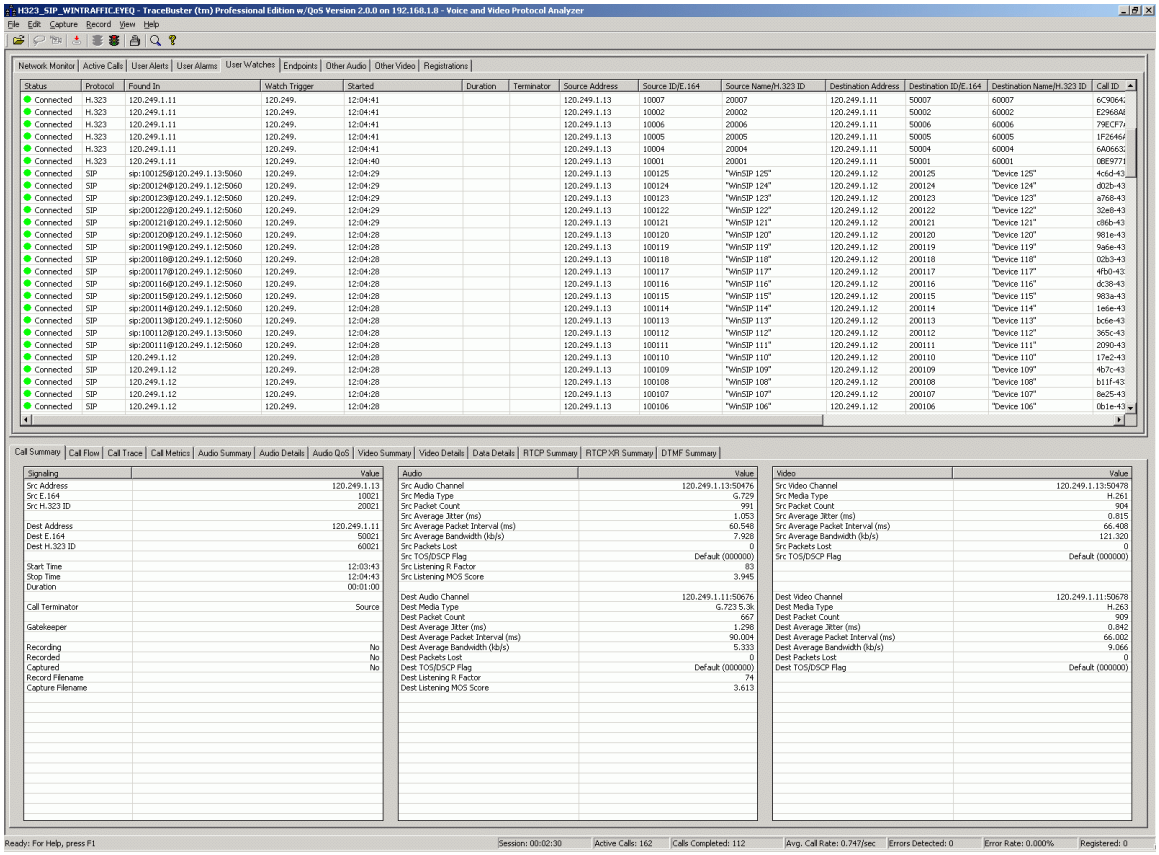
## User Watches View




The watch view is designed to provide an in-depth view of each VoIP call and that has been associated with a user-defined "watch" trigger. Each call is represented by an entry, which is updated once every second, in the topmost report. This report contains the following columns:

Call status: The current status of the call. These may be things such as connecting, ringing, connected, error, etc.

Protocol: The values for this field are SIP or H.323.

Found in: This field specifies which call element the value was found in.

Watch trigger: This field specifies what value caused the watch to be triggered.

Started: This is the time (local time) that the call was started.

Duration: The length of time the call is (or was) active.

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Terminator: The side that terminated the call (source or destination).

Source Address: The address of the call initiator (caller).

Source ID/E.164: The SIP user ID or H.323 E.164 alias of the caller.

Source Name/H.323 ID: The SIP display name or H.323 ID of the caller.

Destination Address: The address of the call receiver (party called).

Destination ID/E.164: The SIP user ID or H.323 E.164 alias of the party called.

Destination Name/H.323 ID: The SIP display name or H.323 ID of the party called.

Call ID: The SIP or H.323 call ID associated with this call.

Registered With: The gatekeeper's IP address, for H.323 calls, or the Proxy's IP address, for SIP calls.

Conference ID: The conference ID (H.323 calls only).

Each individual call has the following thirteen sub-views:

- Call Summary
- Call Flow
- Call Trace
- Call Metrics
- Audio Summary
- Audio Details
- Audio QoS
- Video Summary
- Video Details
- Data Details
- RTCP Summary
- RTCP XR Summary
- DTMF Summary

Please see the Active Calls tab for an explanation of these sub-tabs.

To display information about a particular call, select it in the watch list. Whenever a call is selected, it will remain "locked" in the view for as long as you wish to view its details.

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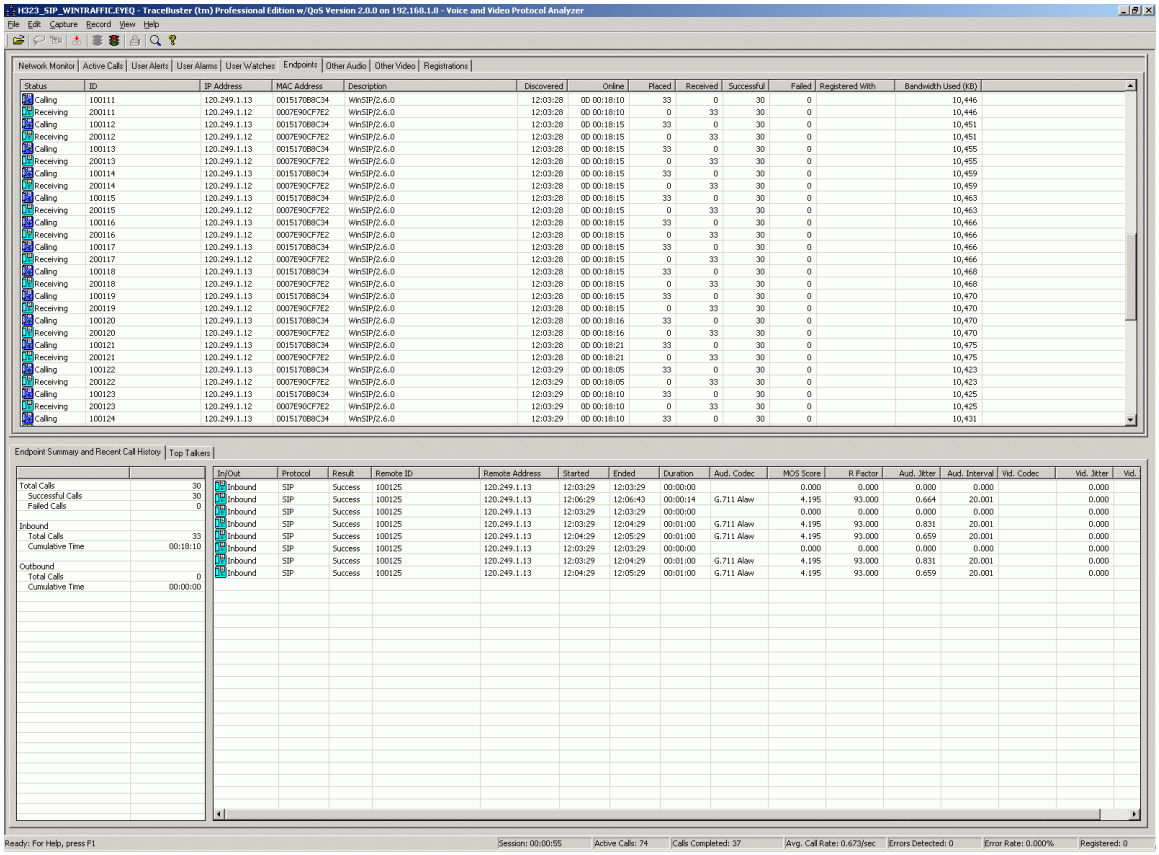
## Endpoints View




The Endpoint View shows a list of each endpoint that has participated in a VoIP call during this TraceBuster session. This view contains the following columns:

Status: Current status of endpoint, Inactive / Calling / Receiving.

ID: The E.164 alias of the endpoint (H.323) or Call ID (SIP)

IP Address: The IP address of the endpoint.

MAC Address: The MAC address of the endpoint.

Description: A readable text description (if available) of the endpoint.

Discovered: This is the time this endpoint was first observed by TraceBuster.

Online: The length of time this endpoint has been online.

Placed: The number of calls this endpoint has placed.

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Received: The number of calls this endpoint has received.

Successful: The number of calls for this endpoint without errors.

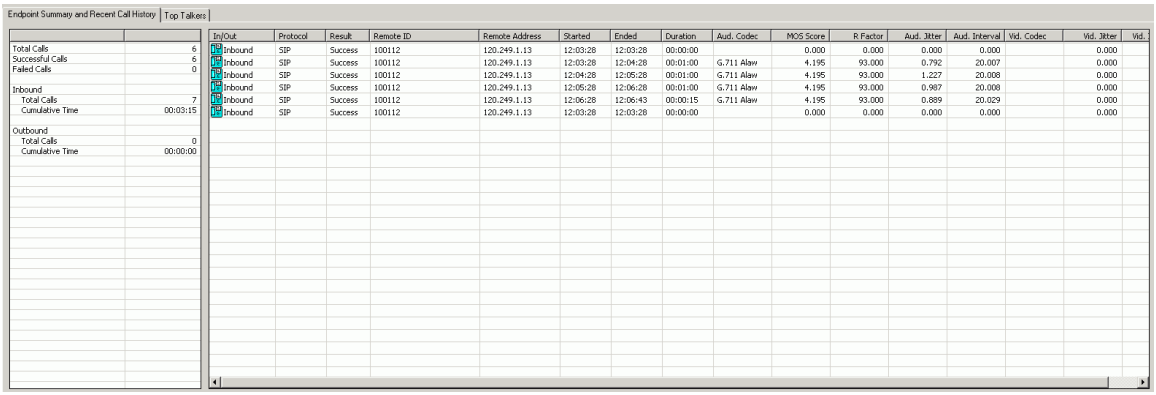
Failed: The number of calls for this endpoint with errors.

Registered With: The gatekeeper's IP address, for H.323 calls, or the Proxy's IP address, for SIP calls.

Bandwidth Used (KB): How many bytes of data that has been transferred.

The number of endpoints in the list is user configurable via Edit | Settings | Endpoints.

### Endpoint Summary and Recent Call History




The Endpoint Summary and Recent Call History view keeps a list of each call the endpoint has either placed or received.

This view contains the following columns:

In/Out: Whether the call was placed (Outbound) or received (Inbound).

Protocol: The protocol used for the call (H.323 or SIP).

Result: Either Success or Fail.

Remote ID: The E.164 alias (H.323) or Call ID (SIP) of the other endpoint.

Remote Address: The IP address of the endpoint.

Started: The time the call started.

Ended: The time the call ended.

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Duration: The call duration.

Audio CODEC: The type of audio codec this endpoint used.

MOS Score: The average MOS score of this endpoint's audio for the call.

R Factor: The average R Factor of this endpoint's audio for the call.

Audio Jitter: The average jitter of this endpoint's audio for the call.

Audio Interval: The average interval of this endpoint's audio for the call.

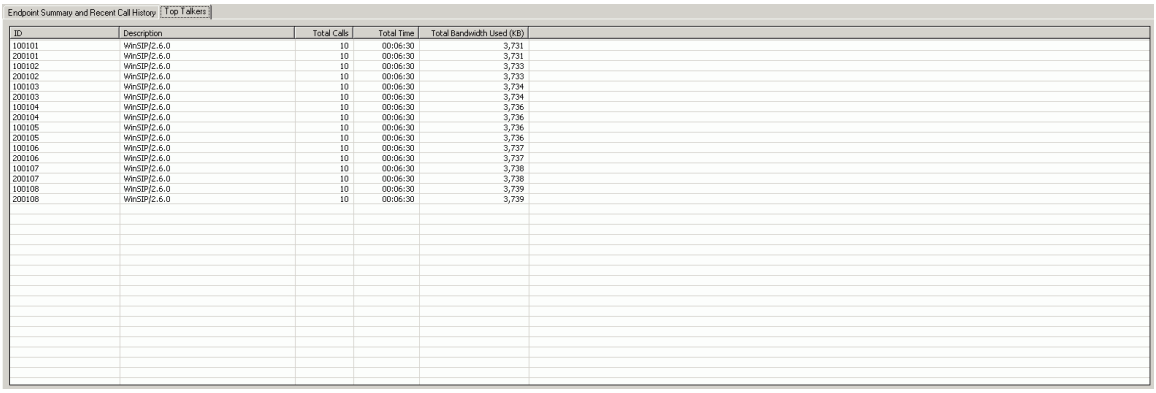
Video CODEC: The type of video codec this endpoint used.

Video Jitter: The average jitter of this endpoint's video for the call.

Video Interval: The average interval of this endpoint's video for the call.

The number of endpoint histories in the list is user configurable via Edit | Settings | Endpoints.

### Top Talker




| ID | Description | Total Calls | Total Time | Total Bandwidth Used (KB) |
|---|---|---|---|---|
| 100101 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,731 |
| 200101 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,731 |
| 100102 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,733 |
| 200102 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,733 |
| 100103 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,734 |
| 200103 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,734 |
| 100104 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,736 |
| 200104 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,736 |
| 100105 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,736 |
| 200105 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,736 |
| 100106 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,737 |
| 200106 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,737 |
| 100107 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,738 |
| 200107 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,738 |
| 100108 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,739 |
| 200108 | WinSIP/2.6.0 | 10 | 00:06:30 | 3,739 |

This view contains the following columns:

ID: The E.164 alias of the endpoint (H.323) or Call ID (SIP)

Description: A readable text description (if available) of the endpoint.

Total Calls: The total calls placed and received by this endpoint.

Total Time: The total time the calls lasted.

Total Bandwidth Used (KB): The total bytes transferred.

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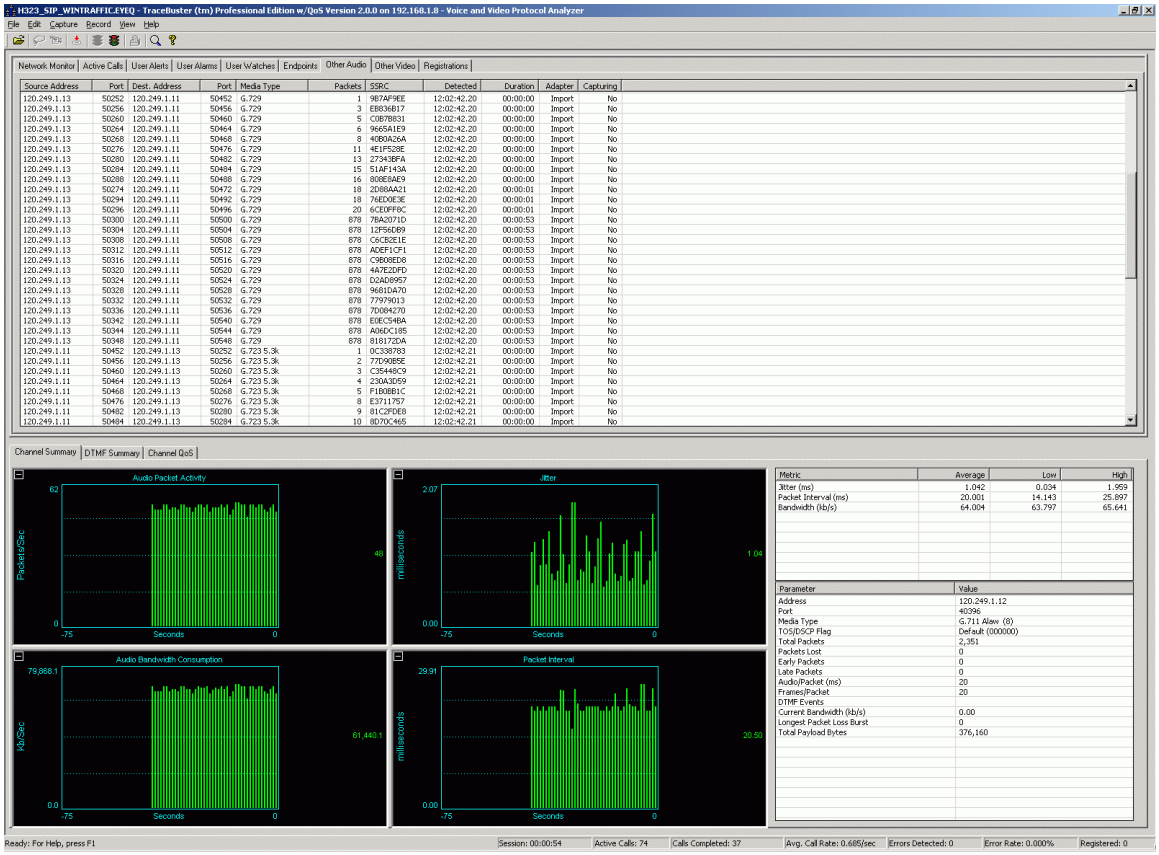
## Audio Channels View




This view contains the following columns:

Source Address: The IP address of the call initiator (caller).

Port: The port of the call initiator (caller).

Destination Address: The IP address of the call receiver (party called).

Port: The port of the call receiver (party called).

Media Type: The type of media flowing on this channel.

Packets: The number of packets sent on this channel.

SSRC: The synchronization source from the RTP header.

Detected: The time this stream was detected.

Duration: The length of time the call is (or was) active.

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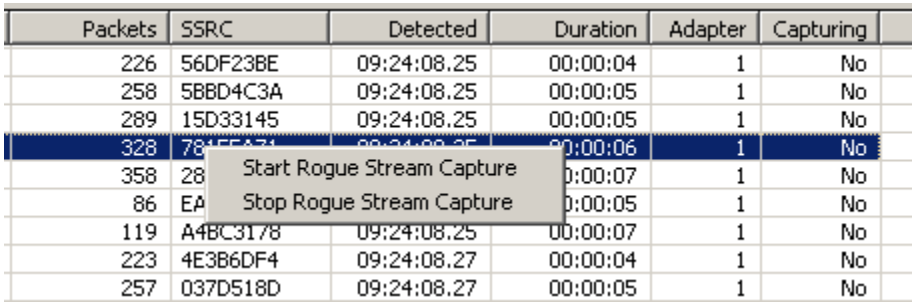
Adapter: The adapter (NIC) that received the packets.

Capturing: Whether or not this stream is being captured to disk.

The Audio Channels View shows a list of each audio RTP stream that is not identified with a VoIP call. The metrics that are calculated and displayed for audio streams that are related to VoIP calls are also done for these 'rogue' streams. To start capturing the data from one of these streams, right-click the mouse on that stream and select 'Start Rogue Stream Capture'. To stop capturing the data from one of these streams, right-click the mouse on that stream and select 'Stop Rogue Stream Capture'.




The 'Capturing' column reflects the status of the capture.

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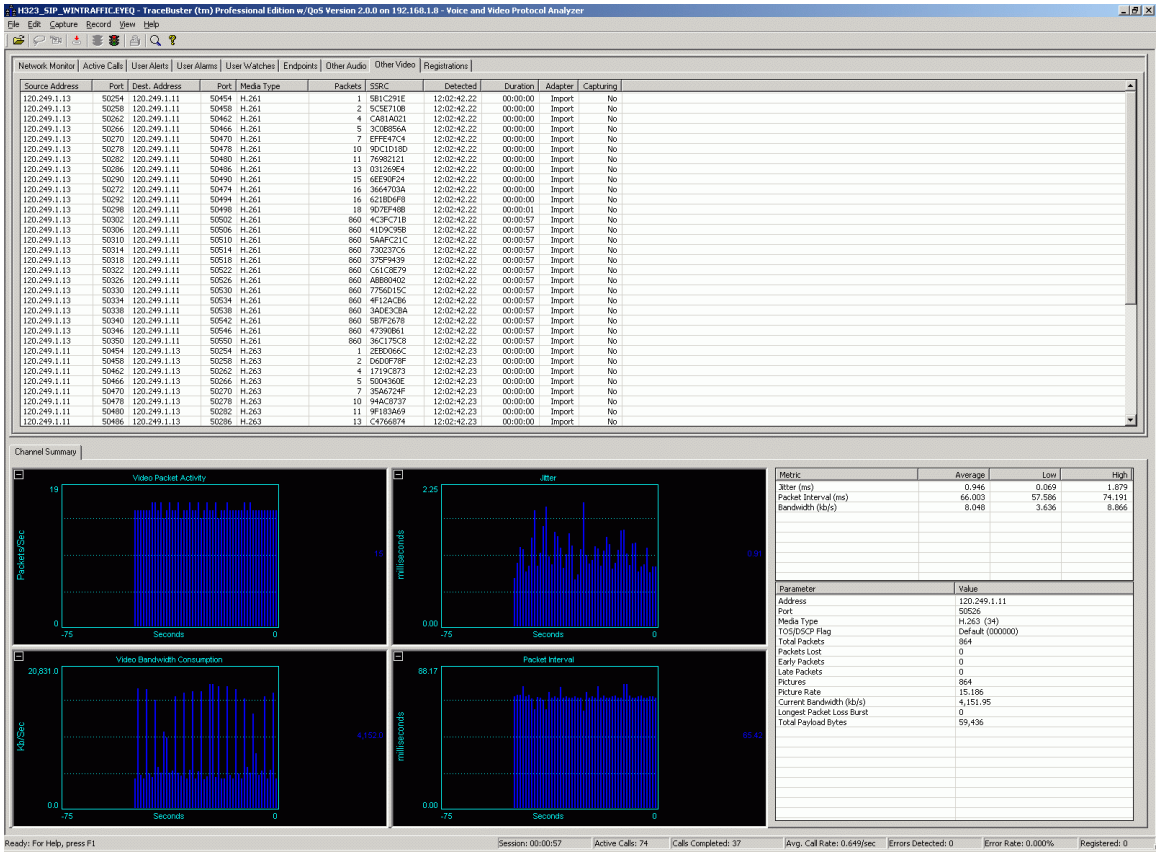
## Video Channels View




This view contains the following columns:

Source Address: The IP address of the call initiator (caller).

Port: The port of the call initiator (caller).

Destination Address: The IP address of the call receiver (party called).

Port: The port of the call receiver (party called).

Media Type: The type of media flowing on this channel.

Packets: The number of packets sent on this channel

SSRC: The synchronization source from the RTP header

Detected: The time this stream was detected.

Duration: The length of time the call is (or was) active.

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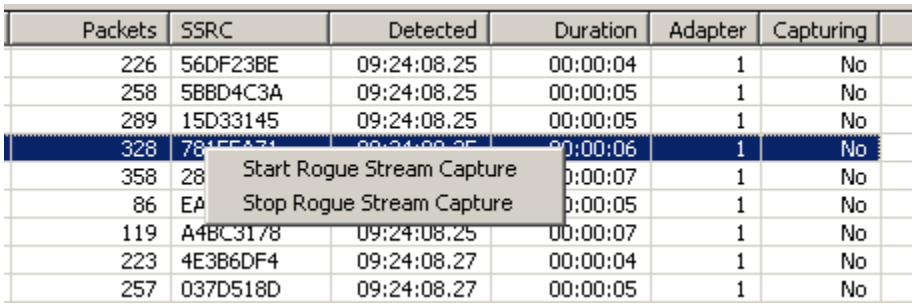
Adapter: The adapter (NIC) that received the packets.

Capturing: Whether or not this stream is being captured to disk

The Video Channels View shows a list of each video RTP stream that is not identified with a VoIP call. The metrics that are calculated and displayed for audio streams that are related to VoIP calls are also done for these 'rogue' streams. To start capturing the data from one of these streams, right-click the mouse on that stream and select 'Start Rogue Stream Capture'. To stop capturing the data from one of these streams, right-click the mouse on that stream and select 'Stop Rogue Stream Capture'.




| Packets | SSRC | Detected | Duration | Adapter | Capturing |
|---|---|---|---|---|---|
| 226 | 56DF23BE | 09:24:08.25 | 00:00:04 | 1 | No |
| 258 | 5BBD4C3A | 09:24:08.25 | 00:00:05 | 1 | No |
| 289 | 15D33145 | 09:24:08.25 | 00:00:05 | 1 | No |
| 328 | 78 | | 0:00:06 | 1 | No |
| 358 | 28 | | 0:00:07 | 1 | No |
| 86 | EA | | 0:00:05 | 1 | No |
| 119 | A4BC3178 | 09:24:08.25 | 00:00:07 | 1 | No |
| 223 | 4E3B6DF4 | 09:24:08.27 | 00:00:04 | 1 | No |
| 257 | 037D518D | 09:24:08.27 | 00:00:05 | 1 | No |

The 'Capturing' column reflects the status of the capture.

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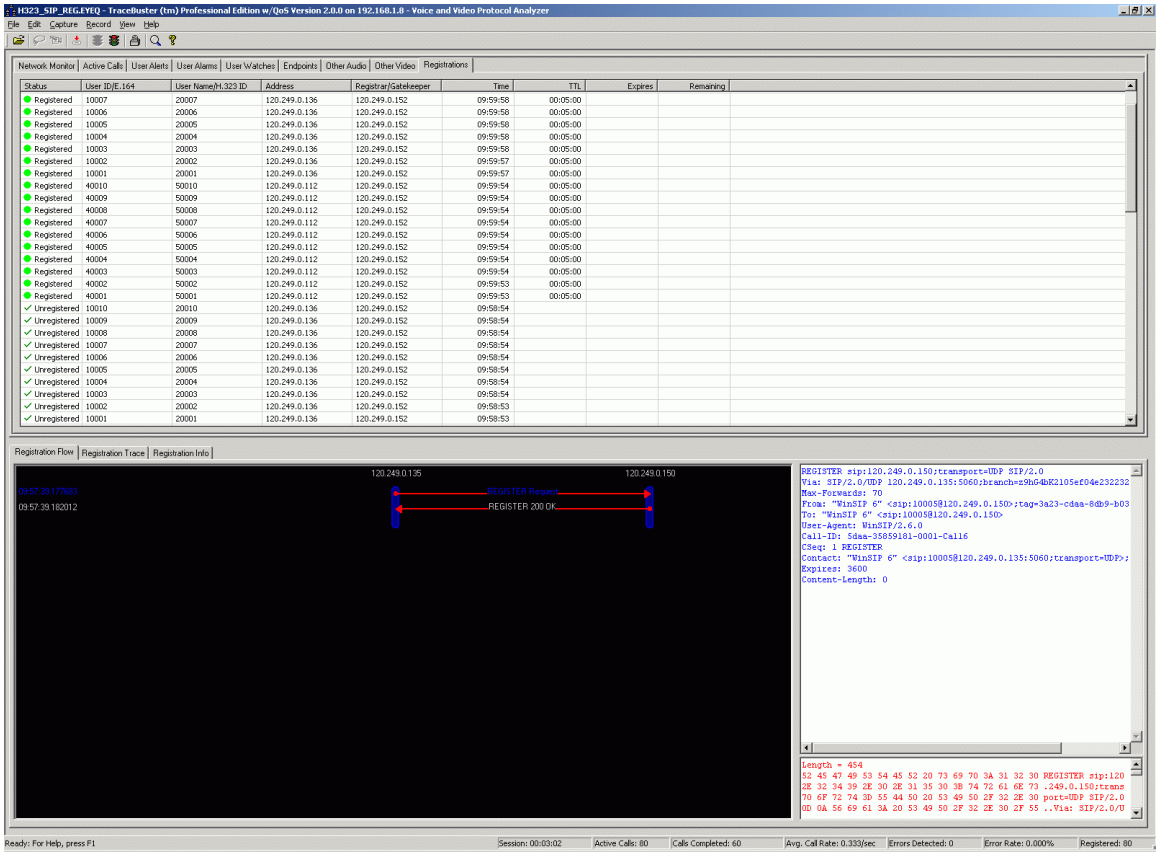
## Registrations View




The registrations view is designed to provide an in-depth view of each VoIP call registration and its status. Each call is represented by an entry, which is updated once every second, in the topmost report. This report contains the following columns:

Status: The current status of the entry. These may be things such as registering, registered, unregistered, etc.

User ID/E.164: The SIP user ID or H.323 E.164 alias of the registered party.

User Name/H.323 ID: The SIP display name or H.323 ID of the registered party.

Address: The address of the registered party.

Registrar/Gatekeeper: The address of the registrar to which the party is registered.

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Time: This is the time of the most recent registration for this party.

TTL: The registration's time-to-live value.

Expires: The time at which this binding expires.

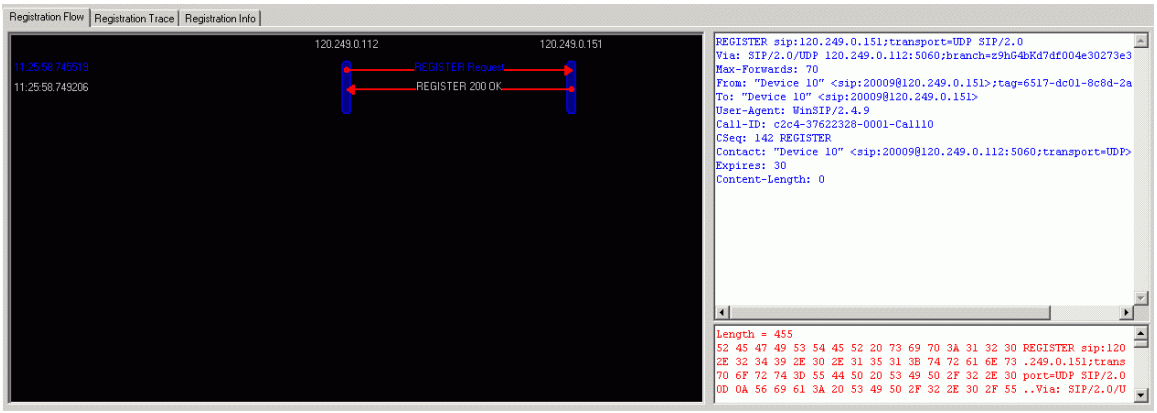
Remaining: The time until this binding expires.

Each individual registration has the following three sub-views:

- Registration Flow
- Registration Trace
- Registration Info

To display information about a particular registration, select it in the registration list. Whenever a registration entry is selected, it will remain "locked" in the view for as long as you wish to view its details.

### Registration Flow




This view provides a time-stamped ladder diagram view of the registration flow. Each "rung" in the ladder may be highlighted to display the decoded packet in both ASCII and hexadecimal representations.

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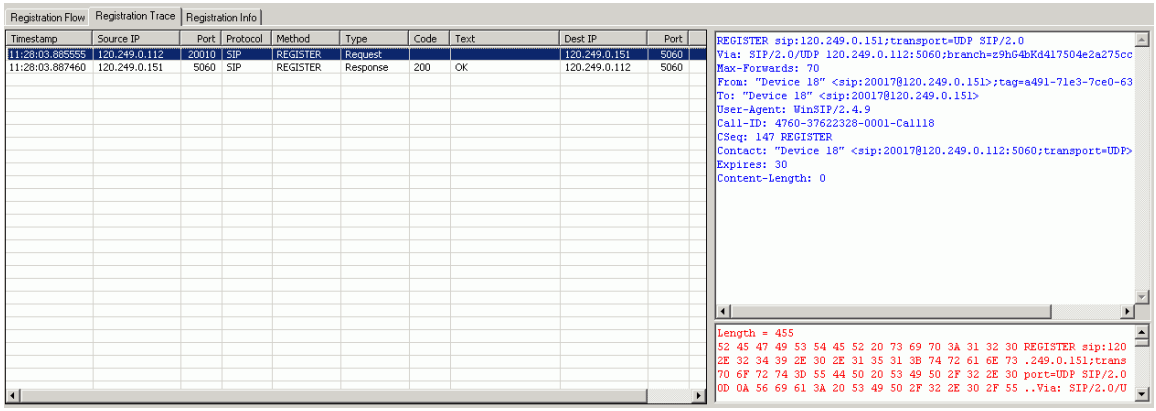
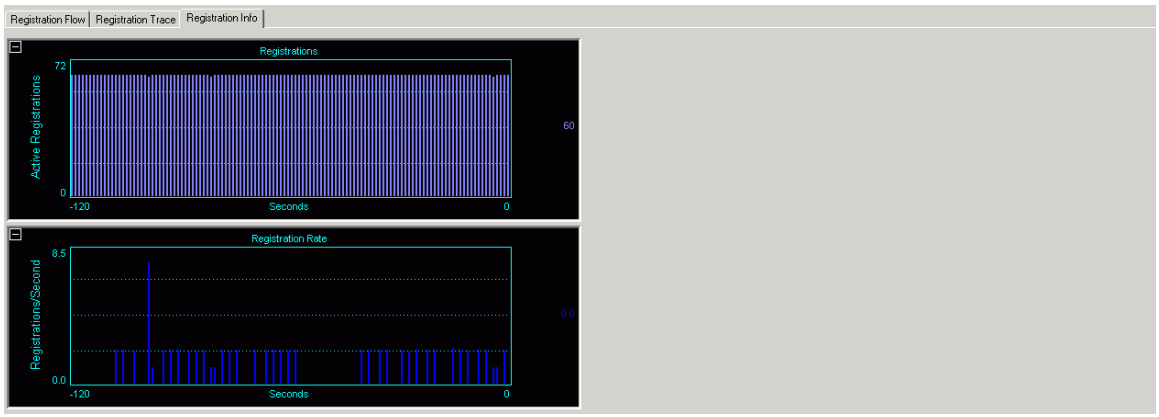
## Registration Trace




This view provides a time-stamped protocol specific report view of the registration flow. Each entry in the report may be highlighted to display the decoded packet in both ASCII and hexadecimal representations.

## Registration Info




This view provides an overall graphical representation of the number of registrations and the registration rate.

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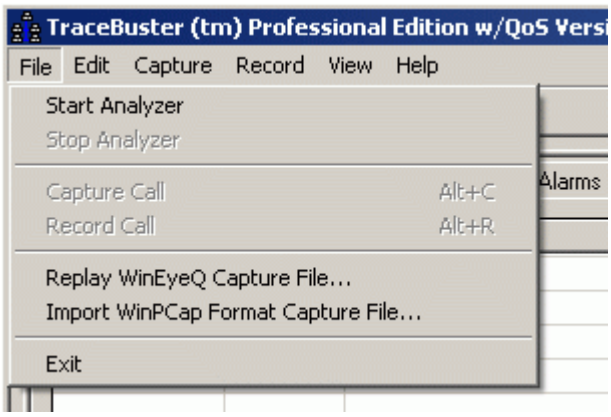
# TraceBuster Menu Commands

## File Menu




This menu contains the commands associated with running TraceBuster.

Start Analyzer: This command starts the analyzer on the currently selected adapter.

Stop Analyzer: This command stops the current analyzer session.

Capture Call: This command is only enabled when a call is in one of the completed states (completed, error, timeout, etc.). When enabled, this command will capture the selected call in TraceBuster's proprietary format to the specified file.

Record Call: This command starts recording the selected call. The signaling and subsequent media will be saved in TraceBuster's proprietary format to the disk.

Replay TraceBuster Capture File: This command loads a file captured in TraceBuster's format and replays it.

Import WinPCap Format Capture File: This command loads a file captured in WinPCap's format and replays it.

Exit: This command ends the TraceBuster session.

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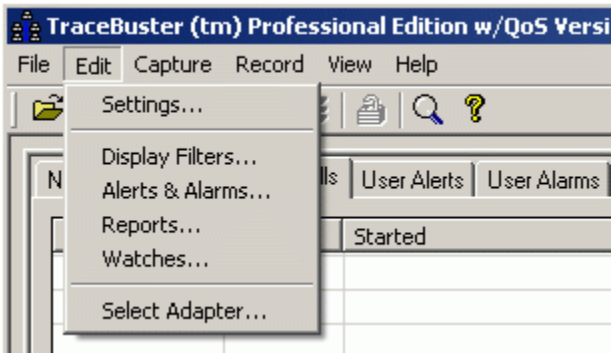
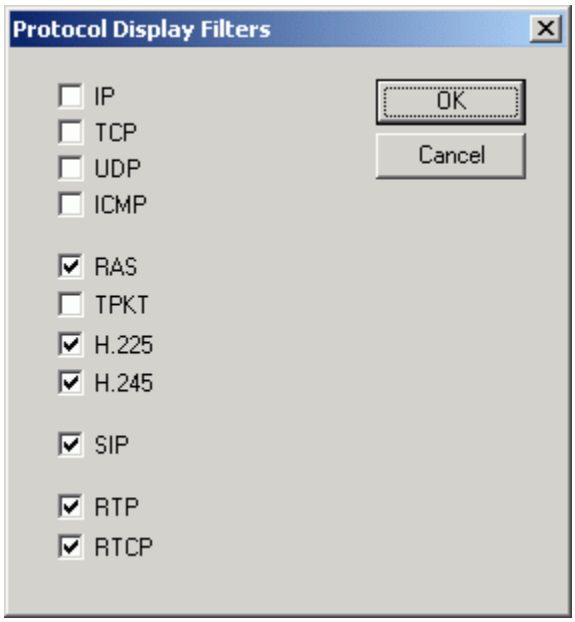
## Edit Menu




This menu allows you to configure settings, display filters, alerts, alarms, reports, watches, and adapters.

Settings: This command allows you to set the various settings of TraceBuster so that you can program the tool. See Configuration Settings for a detailed description.

Display Filters: This command allows you to select the protocol displayed.

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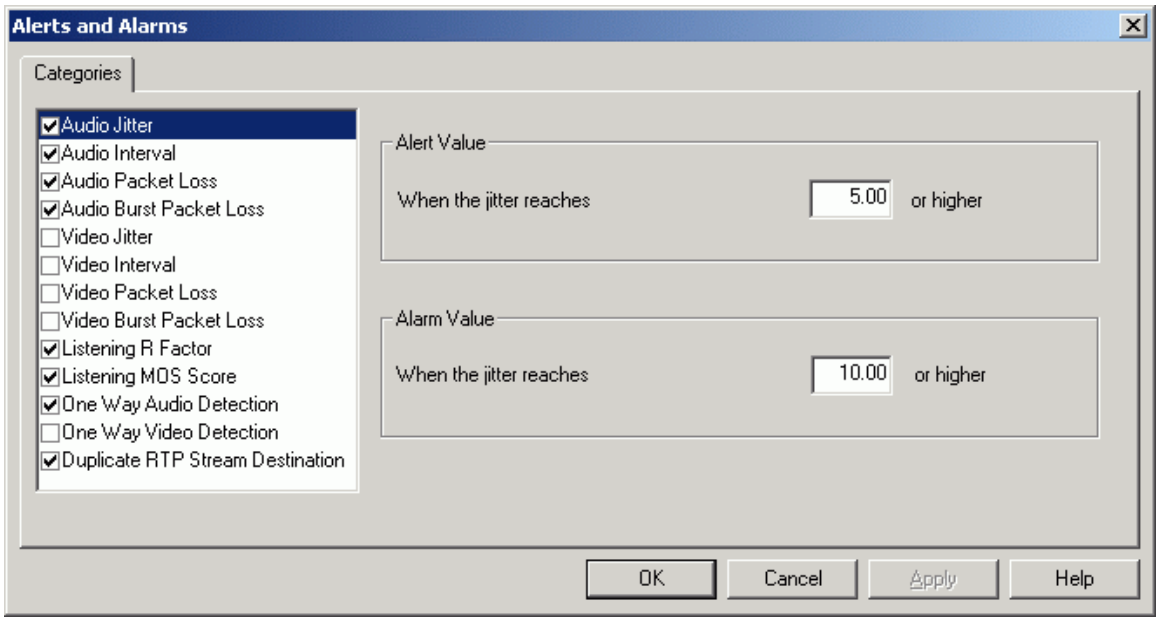
Alerts and Alarms: This command allows you to set the Alerts and Alarms that TraceBuster uses.




The categories of alerts and alarms are:

- Audio Jitter
- Audio Interval
- Audio Packet Loss
- Audio Burst Packet Loss
- Video Jitter
- Video Interval
- Video Packet Loss
- Video Burst Packet Loss
- Listening R Factor
- Listening MOS Score
- One Way Audio Detection
- One Way Video Detection
- Duplicate RTP Stream Detection

Reports: This command allows you to set logging, call, report and preferences settings. See Configuration Settings for a detailed description.

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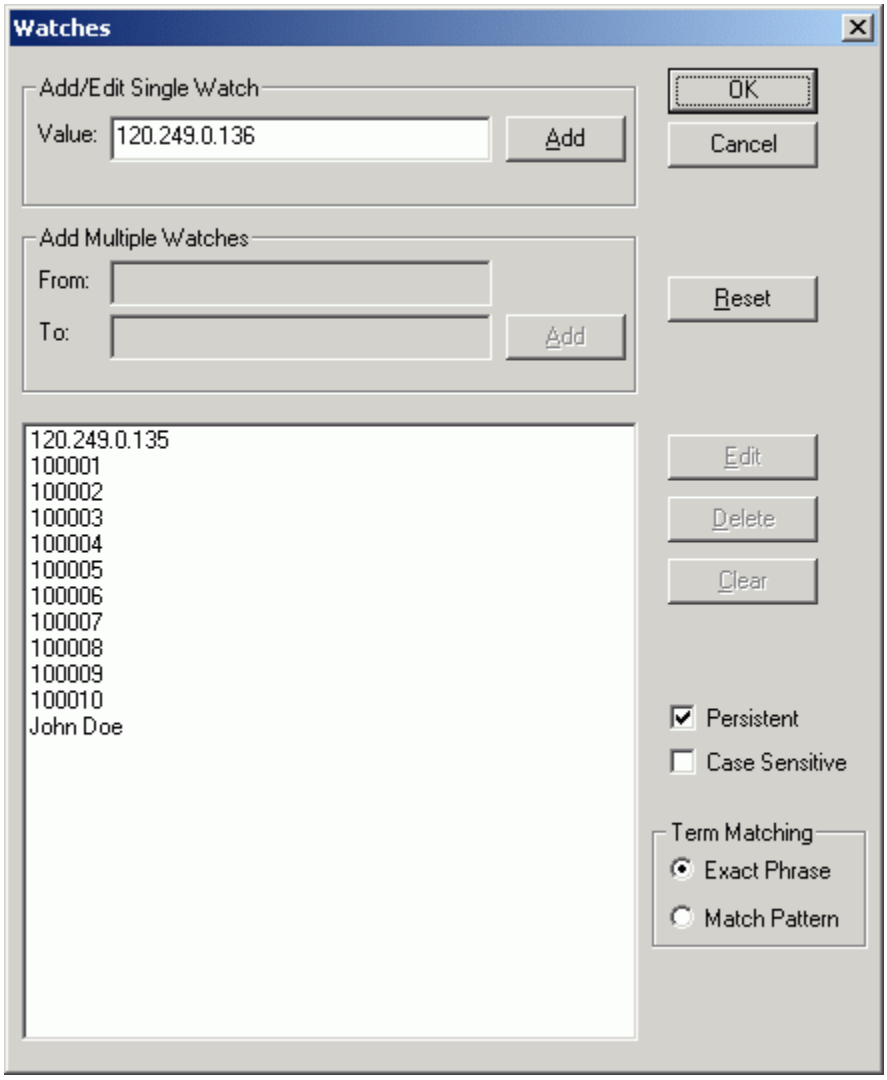
Watches: From this menu you can add single or multiple watches to TraceBuster. Watches are a stimulus that triggers TraceBuster to isolate and analyze any VoIP call that contains that watch. Watches are an extremely simple but powerful way of sifting through a 'haystack' of calls to find the 'needle' call that you are looking for. Calls that are found this way are added to the Watch View.




Add/Edit Single Watch: This is where a watch value is entered. This value can represent any field of any protocol message that TraceBuster examines. TraceBuster currently examines the following message fields:

- Source MAC Address, Destination MAC Address
- Source IP Address, Destination IP Address
- Call ID, Conference ID
- Source URI, Destination URI
- Registrar address, Gatekeeper address

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- Source User ID, Destination User ID
- Source E.164, Destination E.164, Source H.323 ID, Destination H.323 ID
- Calling Party Number, Called Party Number
- Call Reference Value, Q.931 Display Name

All the user must do is to add the text string of the value of the field he is looking for.

**Note:** No quotes are needed for strings that contain blanks.

Add Multiple Watches: This is where a range of watches can be added to the program, instead of adding each value separately.

Persistent: If persistent is selected, the watches that have been entered will be written to a file and reloaded the next time that TraceBuster is run. Otherwise they will be discarded when the program terminates.

Case Sensitive: If case sensitive is selected, the case (upper / lower) of alphabetic characters is considered in the compare. If case sensitive is true then the string "John" is not equal "john".

Term Matching: Exact Phrase or Match Pattern. This offers the user a 'wild card' method of comparing strings. For example, if you add "192.168.10." and have selected Exact Phrase', all fields examined must contain that string exactly. If you have selected Pattern Match, any field that contains "***192.168.10***" (where * can be any character) will match.

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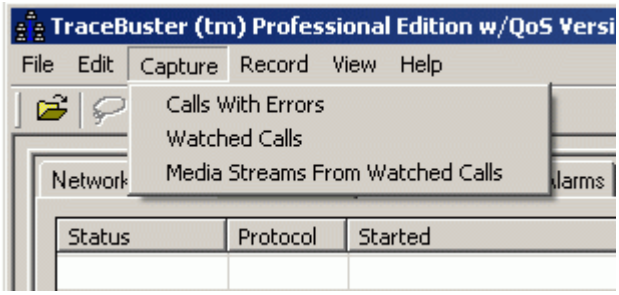
## Capture Menu



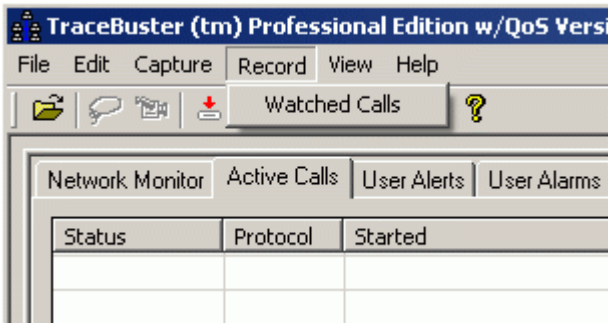

This menu toggles on and off the various capture options.

Calls with errors: Enables/disables capturing calls with errors.

Watched calls: Enables/disables capturing watched calls.

Media streams from watched calls: Enables/disables capturing media streams from the watched calls.

## Record Menu




This menu toggles on and off the various record options.

Watched Calls: Enables/disables recording watched calls.

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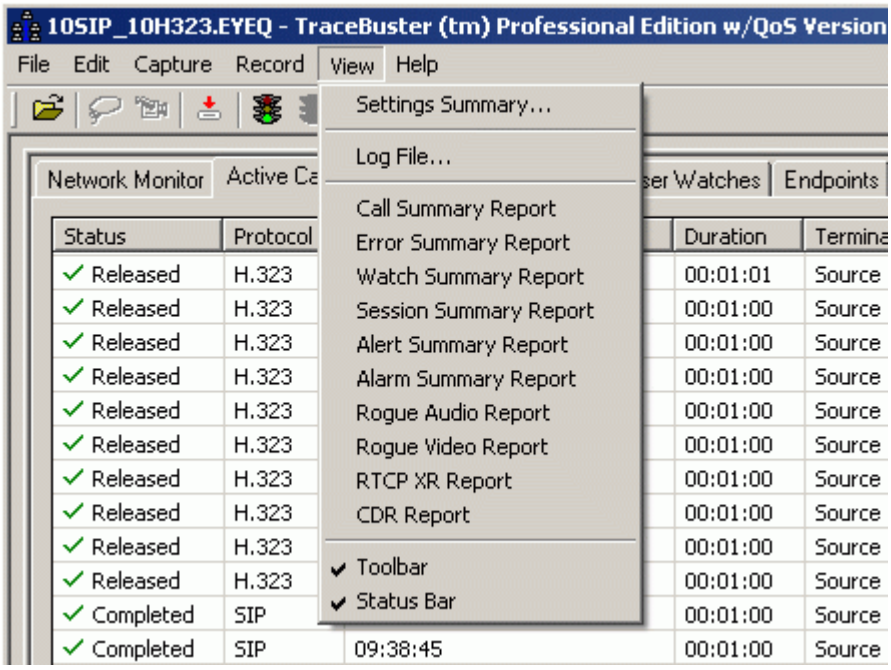
## View Menu




This menu allows you to view the settings summary, text based log file and the various reports that are available. It also allows the user to hide the toolbars and status bars.

Settings Summary: Shows the active settings for TraceBuster.

Log File: Text based data file of the results from the previous test.

Call Summary Report: The call summary report provides a single line entry for each call. Summary information including start time, end time, duration, ID's, addresses, packet counts, QoS metrics, etc. are displayed for each line item.

Error Summary Report: Shows the errors that have occurred during the test session.

Watch Summary Report: Shows the summary information that pertains only to the calls in the watch list.

Session Summary Report: Shows the high level summary information about the test session.

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Alert Summary Report: Shows the active alert messages, programmed threshold and measured values.

Alarm Summary Report: Shows the active alarm messages, programmed threshold and measured values.

Endpoint Summary Report: This report contains the information that is removed from the Endpoint View when the number of endpoints in the view exceeds the number of endpoints the user has elected to observe (via Edit | Settings | Endpoints).

Rogue Audio Summary: This report details the start time, end time, duration, QoS measurements, etc. of audio streams that TraceBuster has detected that are not associated with any VoIP call.

Rogue Video Summary: This report details the start time, end time, duration, QoS measurements, etc. of audio streams that TraceBuster has detected that are not associated with any VoIP call.

RTCP XR Report: This report captures the information from RTCP XR reports that are sent on the RTCP channel (if any).

CDR Report: Shows the call data records for all the monitored calls.

Toolbar: Shows or hides the toolbar.

Status bar: Shows or hides the status bar.

Peer Details: Brings up the Peers window.

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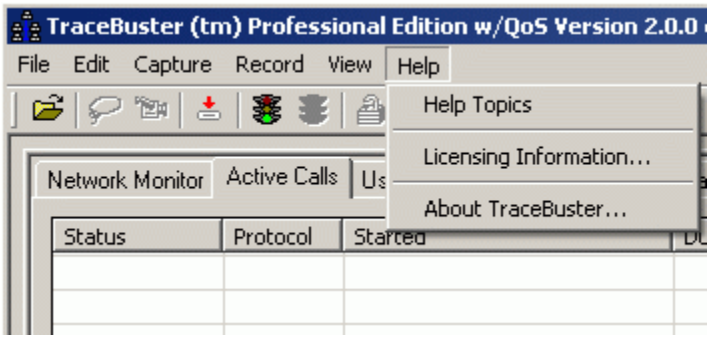
## Help Menu




This menu displays licensing and help information.

Help Topics: Provides user with on line assistance for operating procedures, configuration information and guidance.

Licensing information: Displays information about your TraceBuster license status. This is also where you can upgrade your license with optional features as they become available.

About TraceBuster: Displays information about this version of TraceBuster.

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## Toolbar Shortcuts

The toolbar contains shortcuts to the most commonly used application commands. The following commands are available:

Replay

Capture

Record

Import WinPCap Capture File

Start Analysis

Stop Analysis

Unlock display (de-select currently selected item)

Manage Watches

Help/About

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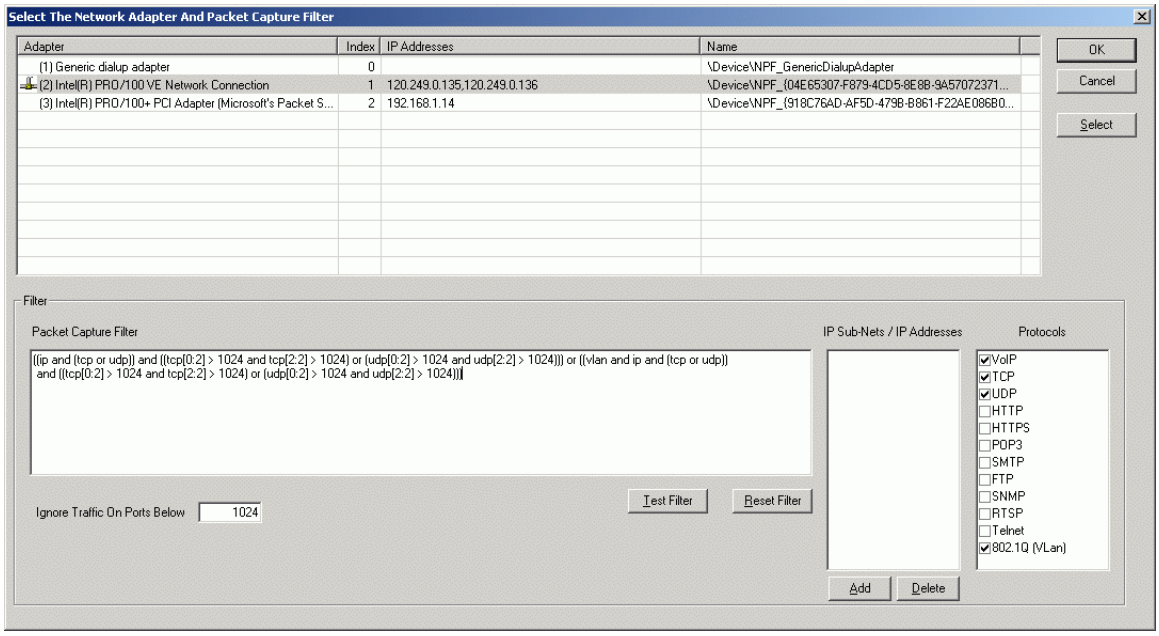
# Selecting the Network Adapter and Packet Capture Filter




The first step in preparing to run TraceBuster is to select the network adapter you wish to monitor. TraceBuster will automatically display the Select Adapter screen immediately after starting it for the first time. You may also access this dialog from the Edit | Select Adapter menu item.

### The Adapter

On the top part of the screen is a list of the Network Adapters that TraceBuster has discovered on your PC. Select the adapter you want to monitor by clicking the adapter line and then pressing 'Select' or by just double clicking the adapter line.

### The Filter

The bottom part of the screen is for the Filter. The Filter is used by the network driver (WinPCap) to decide which packets to send to TraceBuster and which ones to discard. There are four areas that are used set the Filter, The Packet Capture Filter textbox, The Sub-Nets / Addresses textbox, the Protocols box and the Ports textbox.

The Packet Capture Filter textbox is the actual Packet Capture Filter. It has been predefined to capture IP, TCP, and UDP packets from all IP addresses with port numbers greater than 1024 on normal and VLAN networks. You may change the Packet Capture Filter by editing the Filter textbox directly, or in combination with

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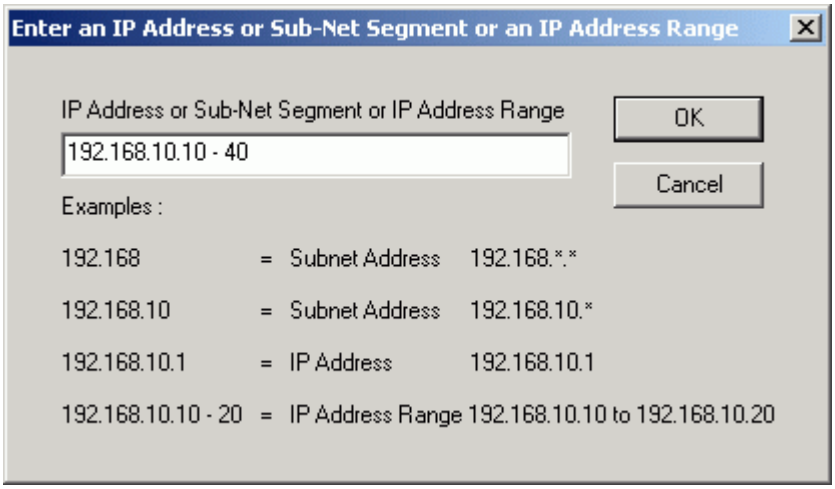
the other three textboxes. In case of an error, simply press the 'Reset Filter' button to start over.

The Sub-Nets / Addresses textbox allows the user to filter on selected IP Addresses or IP Subnets. Subnets / IP Addresses are added or removed from the filter from here.


If you click the 'Add' button, the following dialog is displayed:




Then enter an IP subnet address, or enter an IP address (or range of addresses), then click OK.

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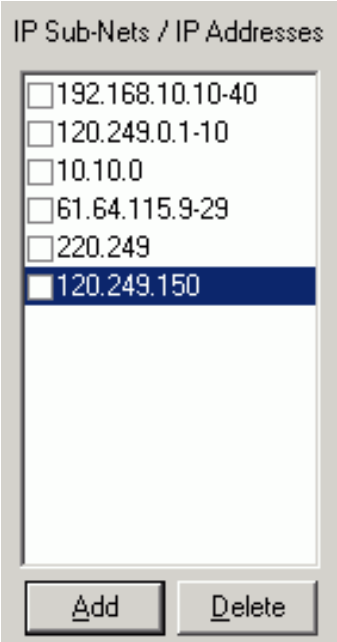
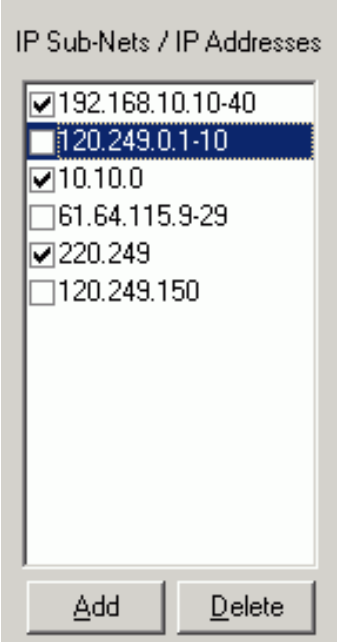
The new value is added to the list.




You may the use the check boxes to select / deselect the IP addresses you want TraceBuster to monitor:




The Subnets / IP Addresses will be added to or removed from the Packet Capture Filter.

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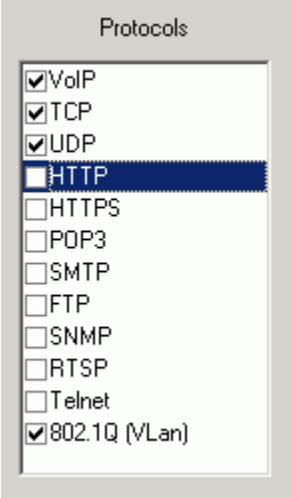
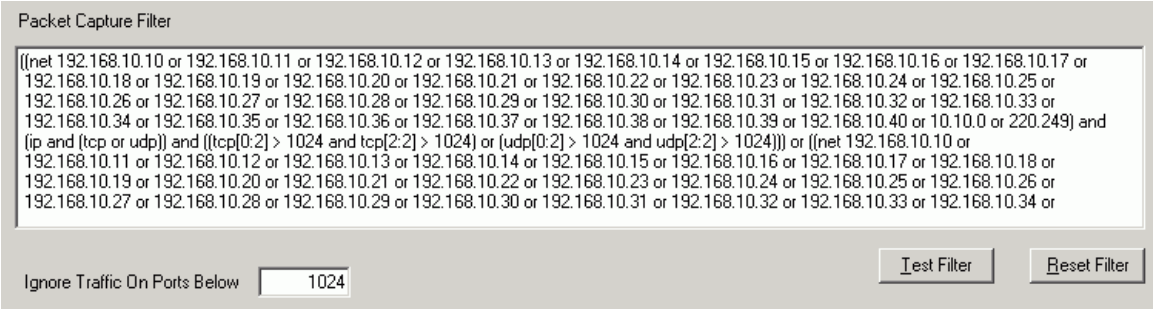
The Protocols textbox allows the user to selectively monitor VoIP and other network protocols.




By checking or un-checking these boxes, the indicated protocols are added or removed from the Packet Capture Filter.

The Ports textbox allows the user to selectively exclude packets from a range of port numbers.

The Packet Capture Filter textbox shows the combination of the Subnet / Addresses textbox, the Protocols textbox and the Ports textbox.




When you make changes to the Subnet /Addresses textbox, the Protocol textbox, or the Ports textbox, the Packet Capture Filter is automatically recalculated. To ensure that the filter has the correct syntax, you may press the Test Filter to check it.

**Note:** When you press the OK button on the Select Network Adapters dialog, the filter is always checked to ensure it is syntactically correct. If it is not correct, an error message is displayed.

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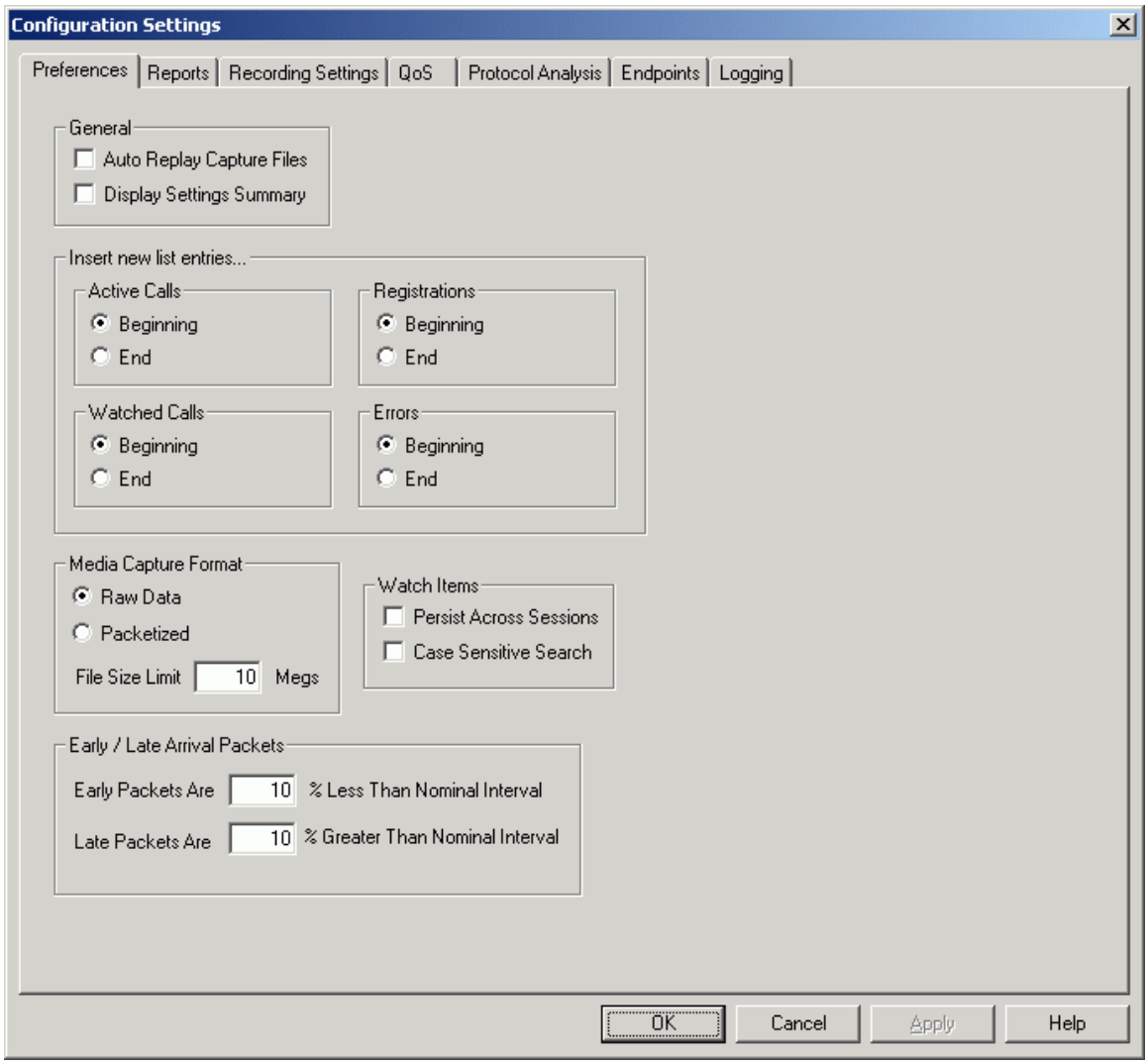
# Configuration Settings

## Preferences




The following preferences are available in TraceBuster:

General:

Auto Replay Capture Files: When checked this feature will load a capture file immediately after the capture is terminated.

Display Settings Summary: If checked, TraceBuster displays a summary of all the program settings in effect when the program is started.

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Insert new entries:

Active Calls: This option determines where new entries will be added to the active call list.

Watched Calls: This option determines where new entries will be added to the watched call list.

Registrations: This option determines where new entries will be added to the registration list.

Errors: This option determines where new entries will be added to the error list.

Media Capture Format:

Raw or Packetized Data: Choose the media capture format.

File Size Limit: Constraint placed on file size

Watch Items:

Persist Across Sessions: This option automatically reloads the previous session's watches when TraceBuster is started.

Case Sensitive Searches: This option makes watch item searches sensitive to case.

Early / Late Arrival Packets:

Early Packets Are: If the inter-packet arrival time is less than this percentage (of the nominal inter-packet arrival time) the packet will be counted as early. For an example, if the nominal inter-packet arrival time for a media stream is 20 milliseconds and the Early Packets factor is 50% then packets that arrive less than 10 milliseconds apart will be considered early.

Late Packets Are: If the inter-packet arrival time is greater than this percentage (of the nominal inter-packet arrival time) the packet will be counted as late. For an example, if the nominal inter-packet arrival time for a media stream is 20 milliseconds and the Late Packets factor is 50% then packets that arrive more than 30 milliseconds apart will be considered late

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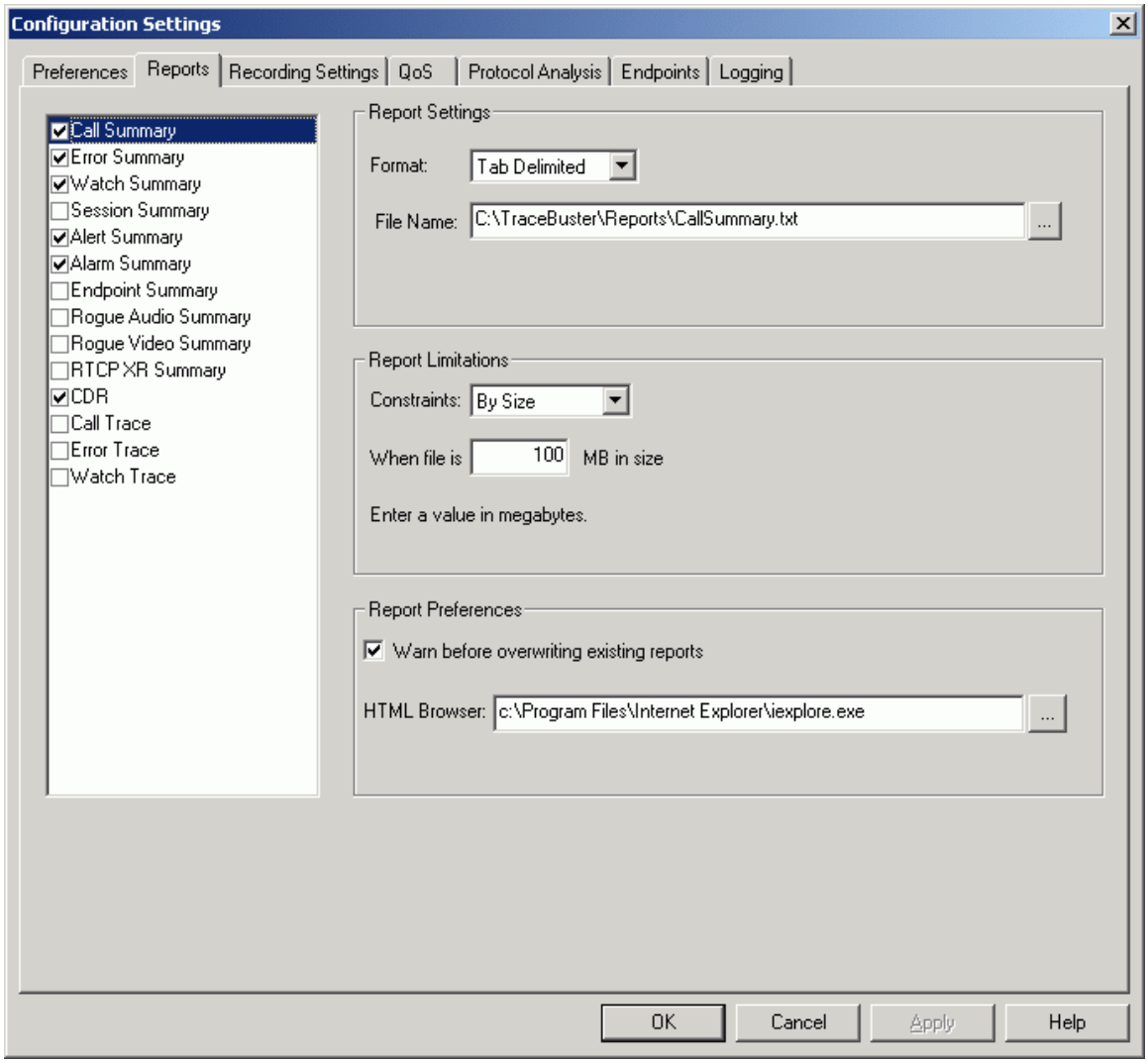
## Reports




The following reports are currently available in TraceBuster:

Call Summary Report: This report has a one-line-per-call format that details the call parameters, start time, end time, duration, QoS measurements, etc.

Error Summary Report: This report has a one-line-per-failed-call format that details the call parameters, start time, end time, duration, QoS measurements, etc.

Watch Summary Report: This report has a one-line-per-watched-call format that details the call parameters, start time, end time, duration, QoS measurements, etc.

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Session Summary Report: This report generates one-line-per-time-interval that details the number of calls passed / failed, network statistics, etc. The 'Time Interval' is set by the user.

Alert Summary Report: This report has a one-line-per-alert format that details the call metric, the alert threshold, and the actual value that triggered the alert.

Alarm Summary Report: This report has a one-line-per-alarm format that details the call metric, the alarm threshold, and the actual value that triggered the alarm.

Endpoint Summary Report: This report contains the information that is removed from the Endpoint View when the number of endpoints in the view exceeds the number of endpoints the user has elected to observe (via Edit | Settings | Endpoints).

Rogue Audio Summary Report: This report details the start time, end time, duration, QoS measurements, etc. of audio streams that TraceBuster has detected that are not associated with any VoIP call.

Rogue Video Summary Report: This report details the start time, end time, duration, QoS measurements, etc. of video streams that TraceBuster has detected that are not associated with any VoIP call.

CDR Report: This report has a one line per call format that summarizes the call information. Start time, end time, duration, IP addresses and ID's.

Call, Error and Watch Trace Reports: These reports provide a summary and packet-by-packet trace of the calls.

Report Settings:

> Format: Sets the file format that the report will be rendered in such as ASCII, HTML, or XML.
>
> File Name: Sets the name of the file when it is saved as well as the directory in which it can be found.

Report Limitations:

> Constraints: Sets how each report is separated. At a certain point the program will close one report and open a new one and start recording there. The trigger for this event can be set to Size, Interval, Time of Day, or None (which, if selected will hold all information in only one report file).
>
> Constraint Range: Based on the report constraints, the range sets the event trigger for when the file obtains the value specified in this field.

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Report Preferences:

Warn before overwriting existing reports: If this check box is selected, the user will be prompted if an existing file is about to be overwritten.

HTML Browser: Specifies the location of an HTML browser application to be used to open reports created in HTML format.

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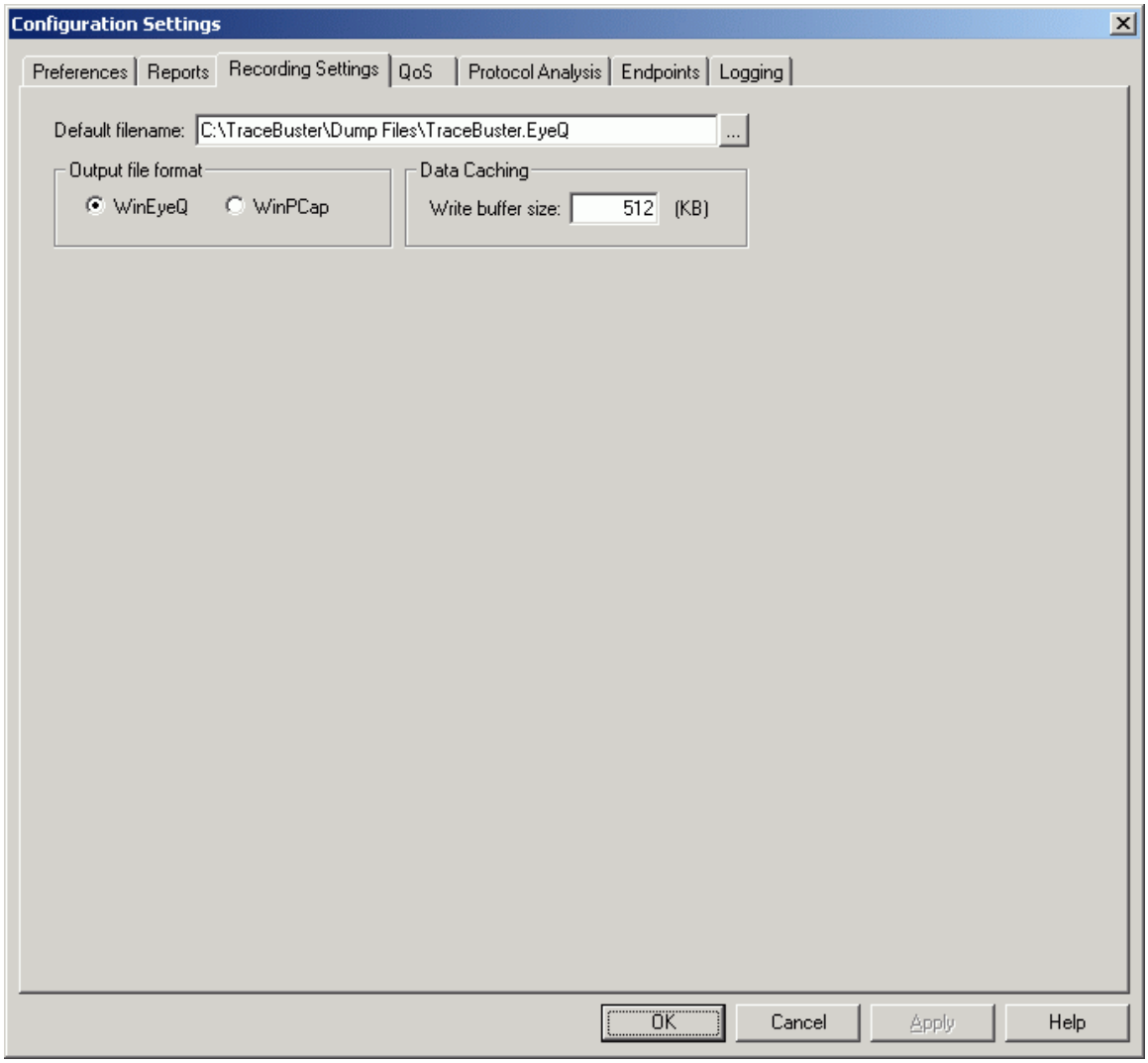
## Recording Settings




The following Recording Settings are available in TraceBuster:

Default filename: This is the name of the file where the captured packets will be stored.

Output file format: This specifies the format of the recorded file; WinEyeQ, a Touchstone Technologies proprietary format, or WinPCap, the 'libcap" format of WinPCap capture files.

Data Caching: This parameter specifies how the data will be buffered internally before being written to the disk. The optimal value is 512 KB.

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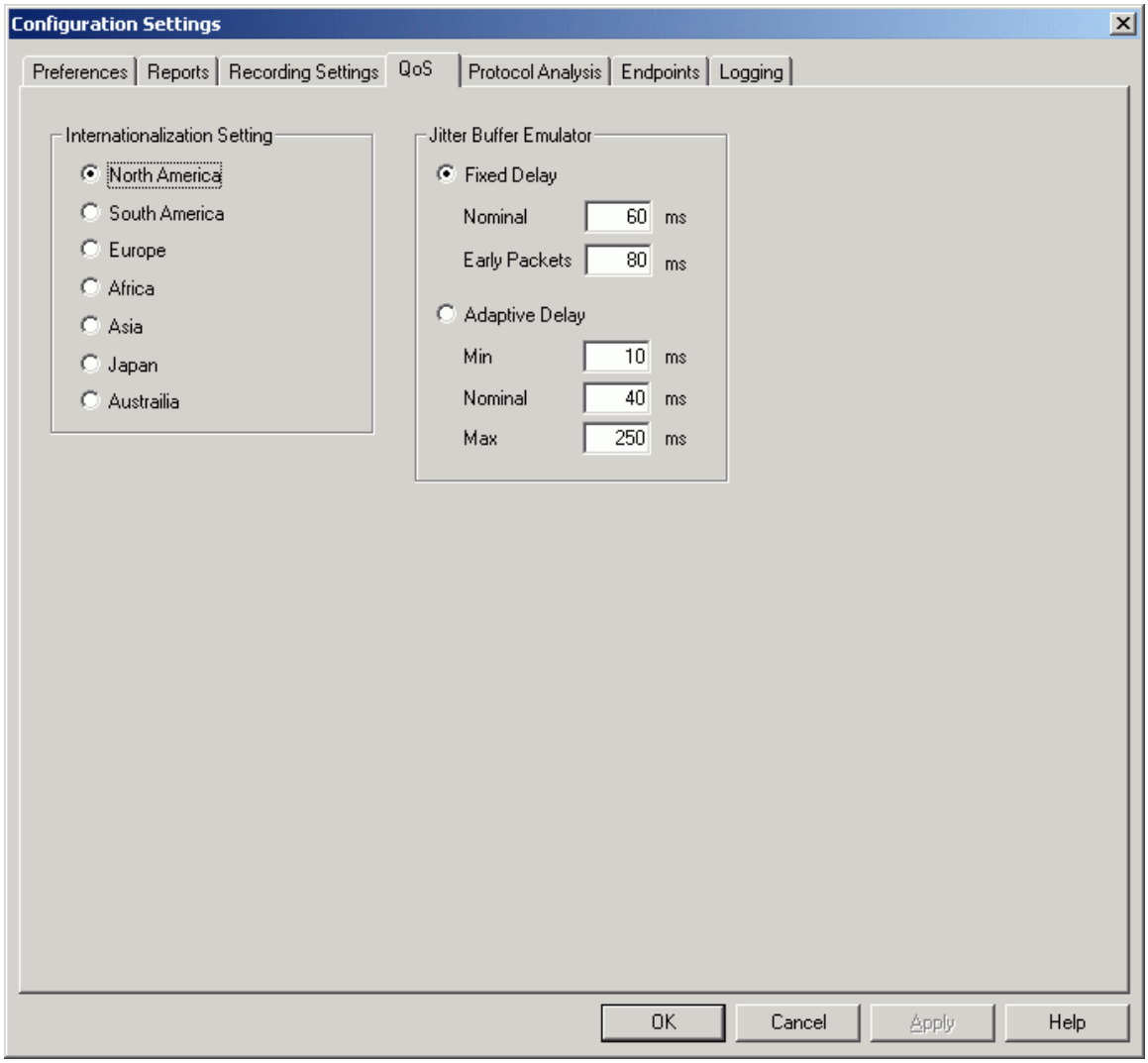
## QoS




The following QoS options are available for TraceBuster:

Internationalization Setting: Sets TraceBuster to generate quality metrics suitable for scales used in different countries.

Jitter Buffer Emulator: simulates the parameters of a jitter buffer. This allows TraceBuster to have greater accuracy when collecting and analyzing information on packet loss and call quality.

> Fixed Delay: Binds the jitter buffer with the nominal delay as its actual delay, and the maximum delay is the storage capacity of the jitter buffer in terms of packets.

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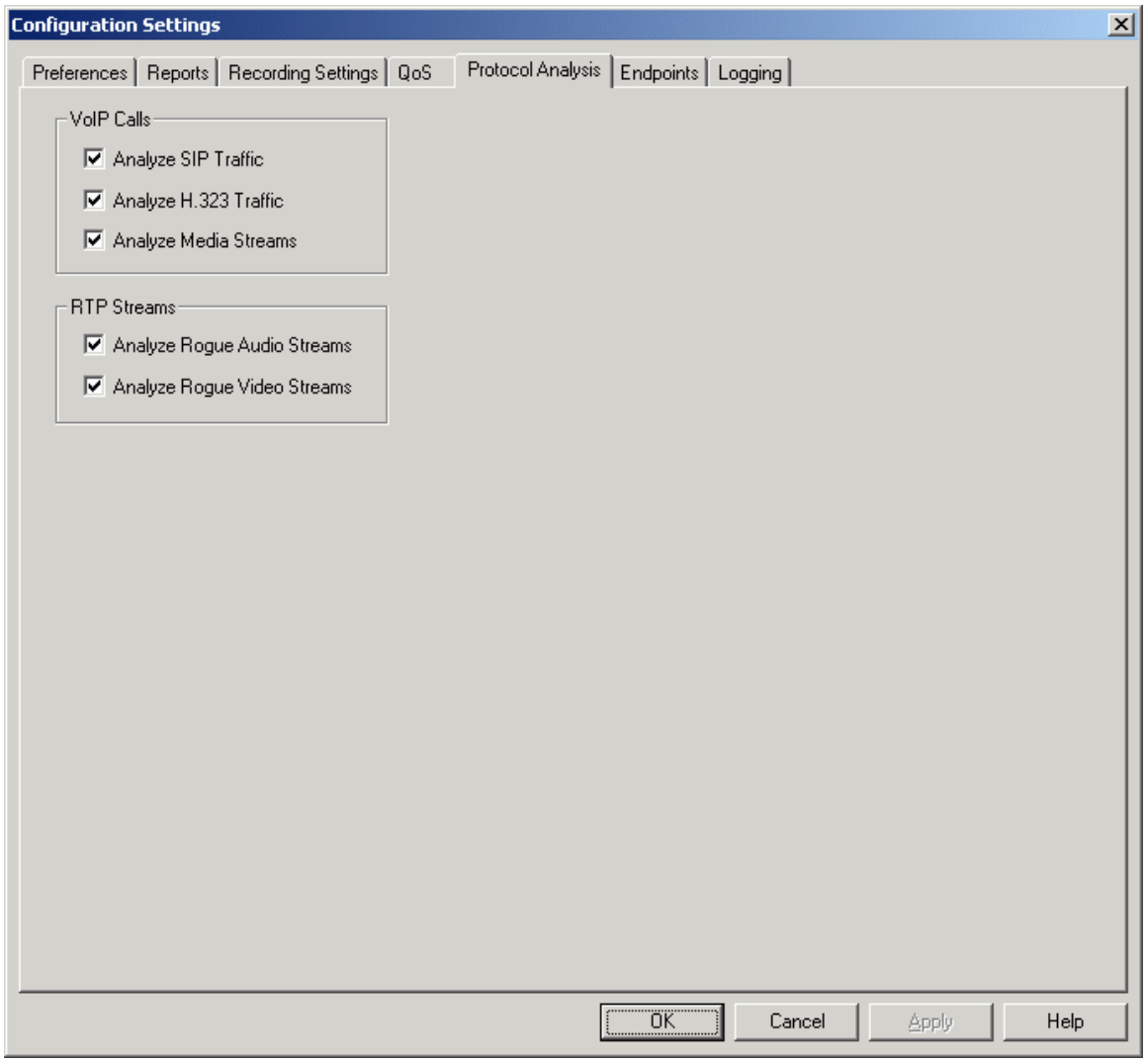
Adaptive Delay: Binds the jitter buffer so that the minimum accepted delay is equal to the minimum delay value, the nominal delay value is the minimum delay used by the program, the maximum delay sets the largest possible delay used by the buffer, and the maximum packet storage of the buffer is a set fraction of the maximum delay.

## Protocol Analysis




The following settings govern the kind of calls are handled:

VoIP Calls:

Analyze SIP Traffic: If checked, TraceBuster will analyze SIP calls.

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Analyze H.323 Traffic: If checked, TraceBuster will analyze H.323 calls.

Analyze Media Streams: If checked, TraceBuster will analyze audio and video streams.

RTP Streams:

Analyze Rogue Audio Streams: If checked, TraceBuster will analyze audio streams that are not associated with VoIP calls that TraceBuster is tracking.

Analyze Rogue Video Streams: If checked, TraceBuster will analyze video streams that are not associated with VoIP calls that TraceBuster is tracking.

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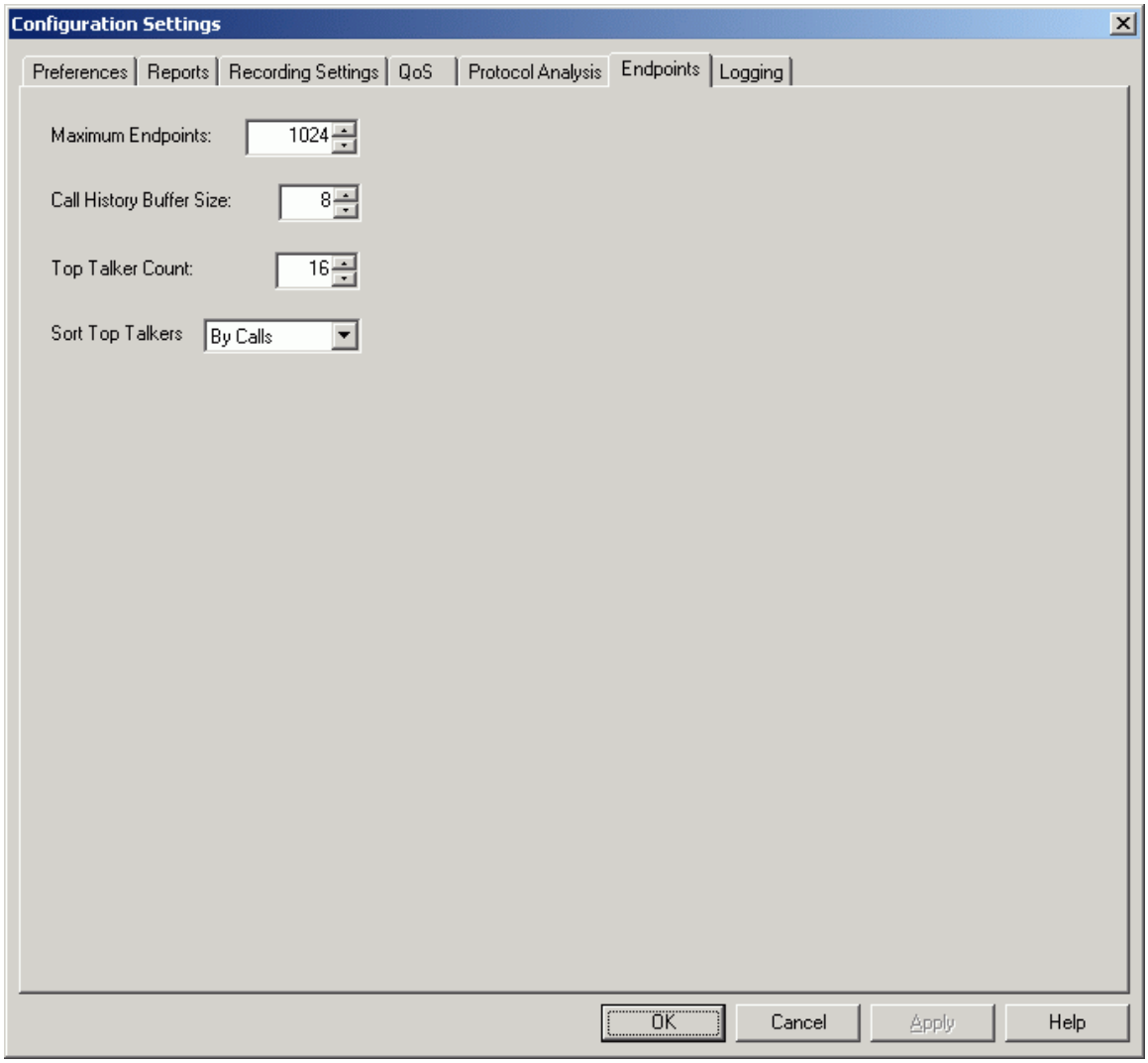
## Endpoints




The following endpoint options are available in TraceBuster:

Maximum Endpoints: The maximum number of endpoints that will be monitored on the Endpoint View.

Call History Buffer Size: The maximum number of calls each endpoint has placed / received that will be monitored in the Endpoint Summary And Recent Call History view.

Top Talker Count: The number of Top Talkers that will be added to the Top Talker screen.

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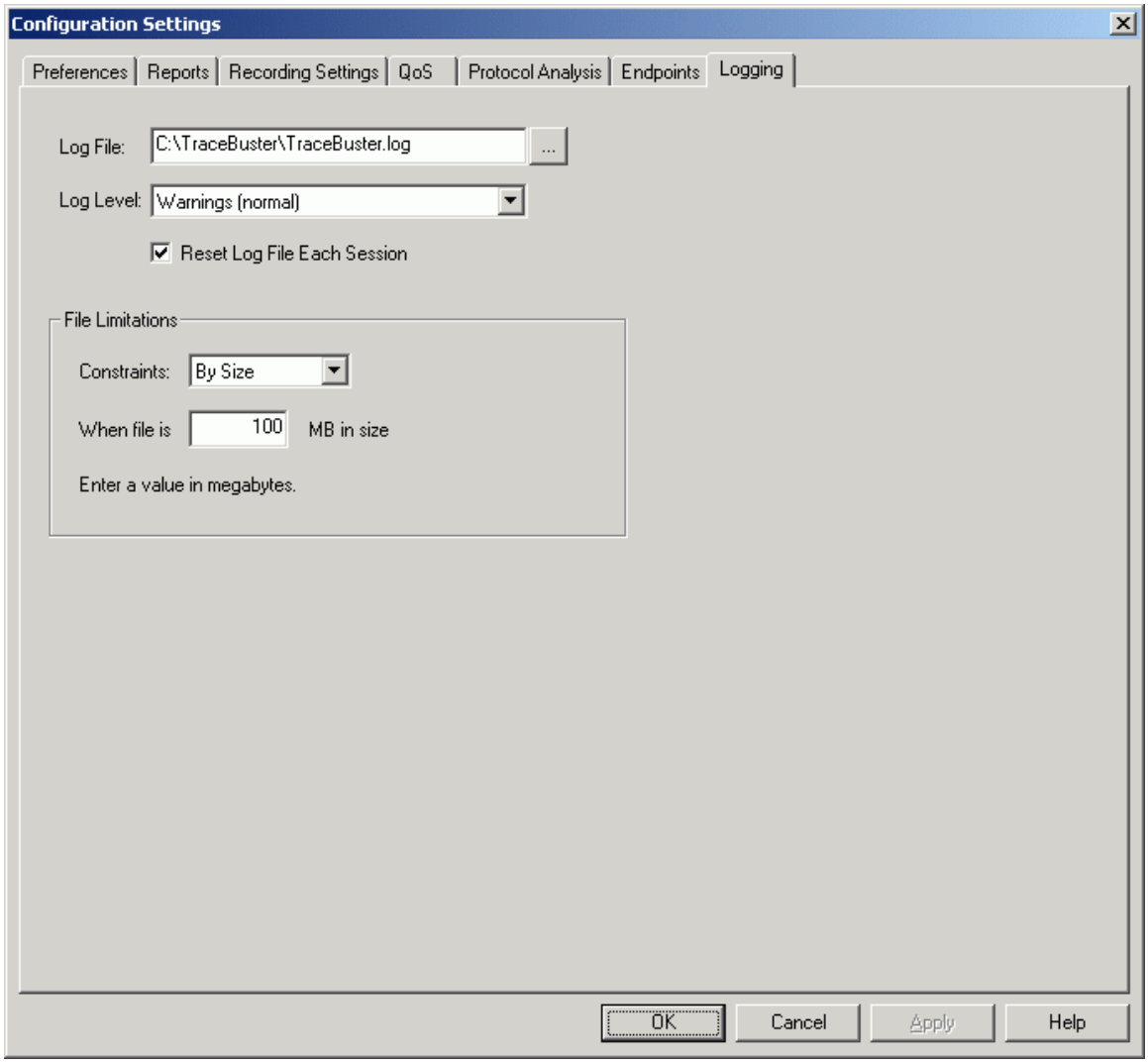
Sort Top Talkers: The way that the Top Talkers will be sorted:

- By the number of calls
- By the time those calls were connected
- By the amount of bandwidth used in those calls

## Logging




The second step in preparing to run TraceBuster is to review the settings. TraceBuster will display the following screen(s) when the Edit | Settings menu item is chosen.

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The following options are available to control the application's logging:

Log file: Enter the name and location of the log file you wish to use.

Log level: Select the level of verbosity you wish. The values are:

> All: The slowest and most verbose level.
> Trace: An extremely high level of detail.
> Debug: Standard troubleshooting level.
> Information: Medium verbosity.
> Warnings: Only warnings and errors.
> Errors: Errors messages only.

Reset log file each session: This feature keeps the log file constrained by resetting it after each clean exit. If the previous exit was not clean, the contents of the previous session are preserved.

Dump statistics: Sets a timer interval to dump the current statistics to the log file. If this value is zero, the function is disabled.

File Limitations:

> Constraints: Sets how the log file is separated. At a certain point the program will close one log file and open a new one and start recording there. The trigger for this event can be set to Size, Interval, Time of Day, or None (which, if selected will hold all information in only one log file).
>
> Constraint Range: Based on the log file constraints, the range sets the event trigger for when the file obtains the value specified in this field.

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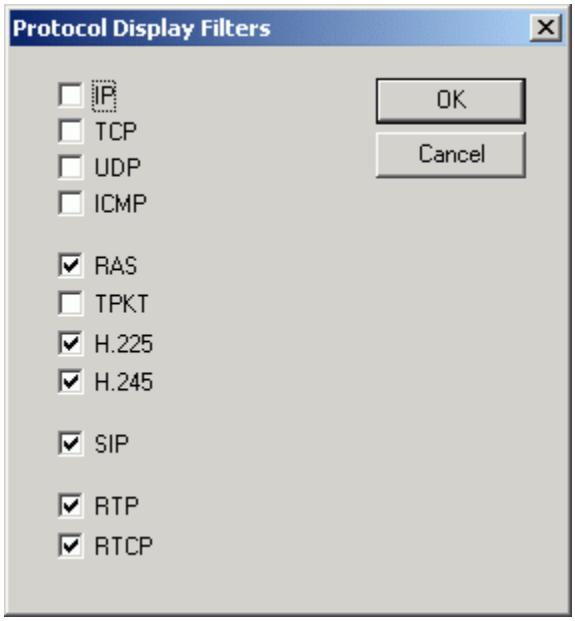
# Display Filters




TraceBuster will display the following screen when the Edit | Display Filters menu item is chosen. Select the protocols you want TraceBuster to display.

**Note:** Due to memory constraints, only the first few RTP and RTCP packets are display for each call.

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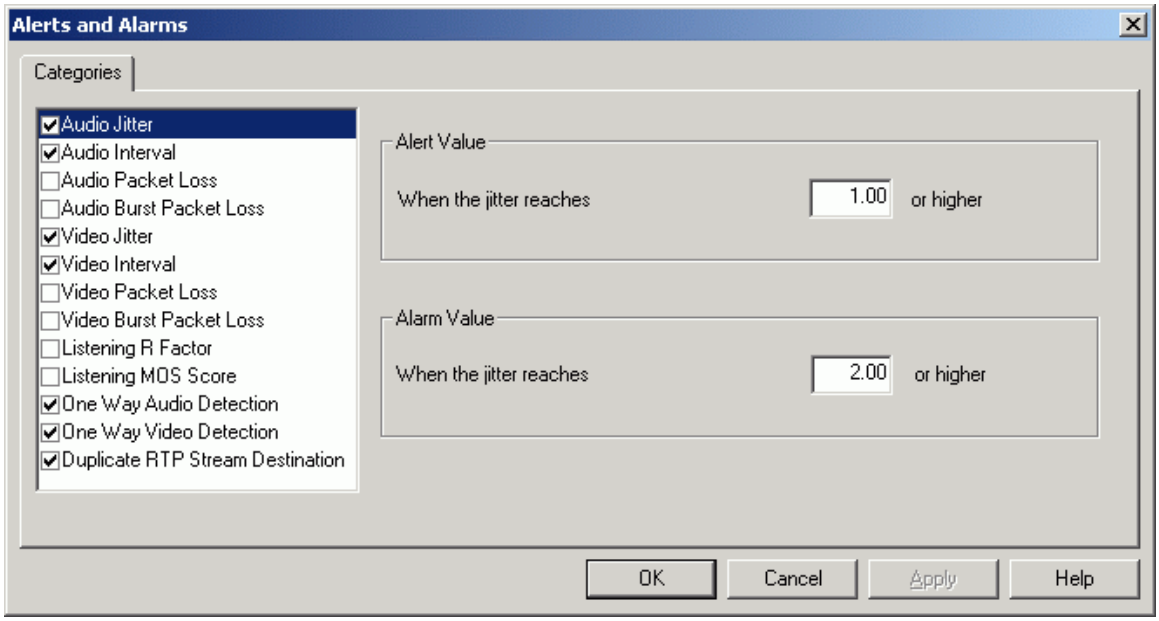
# Alerts and Alarms




Configurable alerts and alarms are available for the audio and video metric measurements that TraceBuster performs in real-time. The alert and alarm values are thresholds that are set by the user. The alert and alarm mechanism provides for a two stage detection of user settable limits. Alerts may be set for the following events:

Audio Jitter: When the jitter of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Audio Interval: When the time between receiving two successive packets (the interval) of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Audio Packet Loss: When the total number of packets lost of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Audio Burst Packet Loss: When the number of consecutive packets lost of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Video Jitter: When the jitter of a video stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

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Video Interval: When the time between receiving two successive packets (the interval) of a video stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Video Packet Loss: When the total number of packets lost of a video stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Video Burst Packet Loss: When the number of consecutive packets lost of a video stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Listening R Factor: When the listening R factor of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Listening MOS Score: When the listening MOS score of an audio stream exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

One Way Audio Detection: When a call that has audio flowing in only one direction exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

One Way Video Detection: When a call that has video flowing in only one direction exceeds the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

Duplicate RTP Stream Destination: When two media streams that have the same destination IP address and port number are detected and exceed the alert/alarm threshold, a message will be sent to the Alert/Alarm screen.

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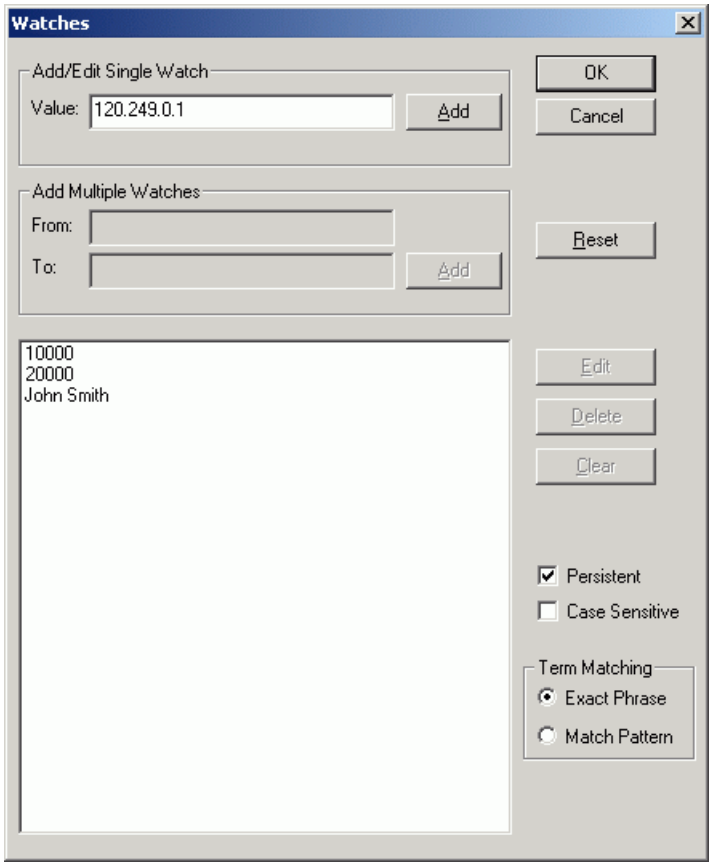
# Watches




The watch mechanism allows you to filter out specific calls based upon the value of various call elements or fields within a call. This powerful mechanism allows you to trap calls based upon call ID, IP address, E.164 alias, H.323 ID and most other fields where values are known ahead of time. You may add, edit and delete values associated with watches.

Watches may be designated as persistent (lasting across sessions) and case-sensitive by selecting the appropriate settings on the Edit | Preferences page from the options menu item. Also, you can specify the watch to match the value exactly or match a subset of the value. For example, if 'Exact' were selected, the watch 'Joe' would match the value 'Joe' but not the value 'Joey'. If 'Match Pattern' were selected, 'Joe' would match both 'Joe' and 'Joey'.

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# Appendix A

## Theoretical maximum MOS scores and R factors

The following chart contains the theoretical maximum values for Listening and Conversational MOS and R factor by codec type.

| Codec Name | MOS-LQ | MOS-CQ | R-LQ | R-CQ |
|---|---|---|---|---|
| G.711 U-law | 4.2 | 4.18 | 93 | 92 |
| G.711 A-law | 4.2 | 4.18 | 93 | 92 |
| G.722 64k | 3.88 | 3.84 | 94 | 93 |
| G.722 56k | 3.73 | 3.69 | 90 | 89 |
| G.722 48k | 3.53 | 3.48 | 84 | 83 |
| G.722.1 32k | 4.04 | 4.01 | 100 | 99 |
| G.722.1 24k | 3.91 | 3.91 | 96 | 95 |
| G.722.2 23.85k | 4.16 | 4.14 | 106 | 105 |
| G.722.2 23.05k | 4.16 | 4.14 | 106 | 105 |
| G.722.2 19.85k | 4.16 | 4.14 | 106 | 105 |
| G.722.2 18.25k | 4.09 | 4.09 | 103 | 102 |
| G.722.2 15.85k | 4.09 | 4.06 | 102 | 101 |
| G.722.2 14.25k | 4.06 | 4.04 | 101 | 100 |
| G.722.2 12.85k | 3.98 | 3.95 | 98 | 97 |
| G.722.2 8.85k | 3.73 | 3.69 | 90 | 89 |
| G.722.2 6.6k | 3.35 | 3.3 | 79 | 78 |
| G.723.1-5.3k | 3.61 | 3.57 | 74 | 73 |
| G.723.1-6.3k | 3.77 | 3.73 | 78 | 76 |
| G.726-16k | 2.82 | 2.77 | 57 | 56 |
| G.726-24k | 3.35 | 3.3 | 68 | 67 |
| G.726-32k | 4.04 | 4.01 | 86 | 85 |
| G.726-40k | 4.16 | 4.14 | 91 | 90 |
| G.728 | 4.04 | 4.01 | 86 | 85 |
| G.729/G.729B | 3.95 | 3.91 | 83 | 82 |
| G.729A/G.729AB | 3.91 | 3.88 | 82 | 81 |
| G.729E 8.0k | 3.91 | 3.88 | 82 | 81 |
| G.729E 11.8k | 4.11 | 4.09 | 89 | 88 |
| AMR NB 12.2k | 4.09 | 4.06 | 88 | 89 |
| AMR NB 10.2k | 3.91 | 3.88 | 82 | 81 |
| AMR NB 7.95k | 3.69 | 3.65 | 76 | 75 |
| AMR NB 7.4k | 3.61 | 3.57 | 74 | 73 |
| AMR NB 6.7k | 3.44 | 3.39 | 70 | 69 |
| AMR NB 5.9k | 3.25 | 3.21 | 66 | 65 |
| AMR NB 5.15k | 3.06 | 3.02 | 62 | 61 |
| AMR NB 4.75k | 3.02 | 2.96 | 61 | 60 |
| iLBC 13.3k | 3.88 | 3.84 | 81 | 80 |
| iLBC 15.2k | 3.95 | 3.91 | 83 | 82 |
| Speex NB 2.15k | 2.92 | 2.87 | 59 | 58 |
| Speex NB 5.95k | 2.92 | 2.87 | 59 | 58 |
| Speex NB 8k | 3.39 | 3.35 | 69 | 68 |
| Speex NB 11k | 3.88 | 3.84 | 81 | 77 |
| Speex NB 15k | 4.11 | 4.09 | 89 | 88 |
| Speex NB 18.2k | 4.11 | 4.09 | 89 | 88 |
| Speex NB 24.6k | 4.16 | 4.14 | 91 | 90 |
| Speex NB 3.95k | 2.41 | 2.36 | 49 | 48 |

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