The Trojan Room Coffee Pot

A (non-technical) biography

by [Quentin Stafford- Fraser](#)

Several people have asked about the origins of the [Trojan Room coffee pot](#). It started back in the dark days of 1991, when the World Wide Web was little more than a glint in CERN's eye. I was working on ATM networks in a part of the Computer Lab known as the [Trojan Room](#), (a name which, perhaps, causes some amusement to American readers). There were about fifteen of us involved in related research and, being poor, impoverished academics, we only had one coffee filter machine between us, which lived in the corridor just outside the Trojan Room. However, being highly dedicated and hard-working academics, we got through a lot of coffee, and when a fresh pot was brewed, it often didn't last long.

Some members of the 'coffee club' lived in other parts of the building and had to navigate several flights of stairs to get to the coffee pot; a trip which often proved fruitless if the all-night hackers of the Trojan Room had got there first. This disruption to the progress of Computer Science research obviously caused us some distress, and so *XCoffee* was born.

In the Trojan Room there were several racks of simple computers used in the testing of our networks. One of these had a video frame-grabber attached and was not being used at the time. We fixed a camera to a retort stand, pointed it at the coffee machine in the corridor, and ran the wires under the floor to the frame-grabber in the Trojan Room. Paul Jardetzky (now working in California) then wrote a 'server' program, which ran on that machine and captured images of the pot every few seconds at various resolutions, and I wrote a 'client' program which everybody could run, which connected to the server and displayed an icon-sized image of the pot in the corner of the screen. The image was only updated about three times a minute, but that was fine because the pot filled rather slowly, and it was only greyscale, which was also fine, because so was the coffee.

This system only took us a day or so to construct but was rather more useful than anything else I wrote while working on networks. It also made a better topic of conversation at dinner parties than ATM protocols. The first published record of *XCoffee* came when Bob Metcalfe wrote about it in *[Comm Week](#)* on 27th January 1992 after visiting the lab, and inspired by this success, there was talk of other monitoring applications using low-frame-rate video. Systems such as *XSandwichVan* and *XPrinterOutputTray* were mooted, but the elderly frame grabber eventually gave up the ghost, Paul and I moved on to other things, and the Trojan Room coffee pot would have sunk into obscurity had not [Daniel Gordon](#) and Martyn Johnson resurrected the system, treated it to a new frame grabber, and made the images available on the World Wide Web. Since then, hundreds of thousands of people have looked at the coffee pot, making it undoubtedly the most famous in the world.

I don't think the coffee's any better, though.

[Quentin Stafford-Fraser](#)

First published May 1995. See the [Coffee Pot Timeline](#)

Reference Manual

Notices

AudioTron Reference Manual, Version 3.0; May 2002

Important Safety Information

Your Turtle Beach™ AudioTron is designed and tested to meet the latest standards for safety of digital music technology equipment. However, to ensure safe use of this product, it is important that the safety instructions marked on the product and in the documentation are followed. Always follow these instructions to help guard against personal injury and damage to your product:

- Read and follow all instructions marked on the product and in the documentation before you operate your system. Retain all safety and operating instructions for future use. Do not use this product near water or a heat source such as a radiator. Set up the system on a stable work surface. The product should be operated only from the type of power source indicated on the rating label.

- Openings in the product case are provided for ventilation. Do not block or cover these openings. Make sure you provide adequate space, at least 6 inches (15 cm), around the system for ventilation when you set up your work area. Never insert objects of any kind into the ventilation openings.

- This product is equipped with a three-conductor power cord to make sure that the product is properly grounded when in use. The plug on this cord fits only into a grounding-type outlet. This is a safety feature. If you are unable to insert the plug into an outlet, contact an electrician to install the appropriate outlet. If you use an extension cord with this product, make sure that the total ampere rating on the products plugged into the extension cord does not exceed the extension cord ampere rating. Do not walk on the power cord or allow anything to rest on it.

- Do not spill anything on the product. The best way to avoid spills is to avoid eating and drinking near the product. To avoid electrical shock, always unplug all cables from product before cleaning the product.

- When the product is turned off, a small amount of electrical current still flows through it. The power cord should be unplugged from the wall outlet when the device is not used for extended periods of time.

- This equipment contains no user serviceable parts. Please refer all servicing to trained, qualified service personnel.

- Unplug the product from the wall outlet and refer servicing to qualified personnel if: (1.) The power cord or plug is damaged. (2.) Liquid has been spilled into the product. (3.) The product does not operate properly when the operating instructions are followed. (4.) The product was dropped or the cabinet is damaged. (5.) The product performance changes.

Caution

- Do not use this product in areas classified as hazardous locations. Such areas include patient care areas of medical and dental facilities, oxygen-laden environments, or industrial facilities.

- To reduce the risk of fire, use only No. 26 AWG or larger telecommunications line cord.

- Replace fuse only with a 5 x 20mm Slo-Blo® UL/CSA Cartridge Type Fuse matching the original equipment specifications.

Contacting Turtle Beach

AudioTron is a product of:	Voyetra Turtle Beach, Inc.	5 Odell Plaza Yonkers, NY 10701 USA
Technical Support:	Tel: (914) 966-2150	Fax: (914) 966-1093
Main:	Tel: (914) 966-0600	Fax: (914) 966-1102
Web Sites:	www.turtle-beach.com	

Technical Support

➔ *If you experience trouble with the operation of AudioTron, first look in the AudioTron Reference Manual or visit our on-line Knowledge Base.*

AudioTron User group

Turtle Beach monitors and maintains user groups which can be found by following the "Users Forum and Archives" link at http://www.turtle-beach.com/site/support/forums.asp. Here AudioTron customers discuss how they use their AudioTrons, request feature updates, and help each other with configurations.

Web-based technical support

The Turtle Beach web site provides AudioTron firmware updates, Frequently Asked Questions (FAQ) and a comprehensive Knowledge Base that includes the latest product information and troubleshooting tips.

AudioTron FAQ and Knowledge Base: The Knowledge Base is in the Support area of our web site. Go to the Turtle Beach web site (www.turtle-beach.com) and click on "Support", then "Knowledge Base". Under the "A" section, click on "AudioTron". This will bring up the list of articles.

AudioTron Firmware & Software Updates: Go to the Turtle Beach web site (www.turtle-beach.com) and click on "Support", then "FTP Files". Under the "A" section, click on AudioTron. This will bring up the list of files available for download (including firmware updates and other support files). Note that there is an icon at the top of the product page that lets you switch between the Knowledge Base (which is where you find the articles) and the FTP site (which is where you can download files).

Other Technical Support

➔ *Please include your Product ID, firmware version number and AudioTron Serial number in all correspondence with Technical Support.* **Note that all Technical Support correspondence is conducted in English.**

If you can't solve the problem by visiting our web site, contact Turtle Beach Technical Support as follows:

E-mail Tech Support: support@turtle-beach.com. Please allow at least 2-3 business days for a response.

Fax Tech Support: (914) 966-1093 Att: Tech Support. Fax a description of your problem to this number.

Phone Tech Support: (914) 966-2150 M-F, 9 a.m. to 5 p.m. EST (except public holidays.) Please note that all calls will be answered on a first-come, first-served basis. Because we cannot guarantee the length of time you will be on hold, we highly recommend you only use this option as a last resort. Times are subject to change without notice.

➔ *Because networks can be set up in so many different ways, Turtle Beach technical support cannot provide assistance on network troubleshooting. Please contact the manufacturer of your network hardware for assistance on getting the network running per the requirements in this manual.*

Warranty and End User License

Hardware Warranty

Voyetra Turtle Beach, Inc. ("VTB") warrants to the original end-user purchaser ("Purchaser") that the Turtle Beach AudioTron ("Product") will be free of defects in materials and workmanship for a period of one (1) year from the date of purchase by Purchaser ("Warranty Period"). If a defect should occur during the Warranty Period, Purchaser must obtain a Return Merchandise Authorization ("RMA") from VTB. Purchaser will be responsible for all costs incurred in returning the defective Product to and from an authorized VTB service center, or to the repair facility located at VTB's corporate headquarters. The RMA number must be clearly indicated on the outside of the package. Packages without an RMA number may be refused by VTB or its representatives and returned to Sender. The Product must be returned in the original packaging. A copy of the dated proof of purchase must be included with the defective Product.

In the event of a defect, Purchaser's sole and exclusive remedy, and VTB's sole liability, is expressly limited to the correction of the defect by adjustment, repair, or replacement of the Product at VTB's sole option and expense. This warranty does not cover, and VTB is not responsible for, damage caused by shipping, accident, problems with electrical power, misuse, neglect, fire, acts of God, useage not in accordance with product instructions, unauthorized modification or service of the Product or damage resulting from the use of the Product with hardware, software or other products not provided or specifically recommended by VTB.

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VTB's responsibility for malfunctions and defects in the Product is limited to repair and replacement as set forth in this limited warranty statement. Except as specifically provided herein, there are no other warranties expressed or implied, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose. In no event shall VTB be liable for indirect, incidental, consequential, or other damages including personal injury, lost profits and damages to property arising out of any breach of this warranty or otherwise.

The Product, including operating systems or applications programs, is provided on an "As Is" basis. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights. You may also have other rights, which vary from state to state.

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By installing the software included with the Product ("Software"), you acknowledge that you have read, understood and agree to abide by the terms and conditions of this End-User License Agreement ("Agreement"). If you do not agree with the terms of this Agreement, promptly contact the seller of this Software to arrange an appropriate remedy.

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Table of Contents

AudioTron Controls

AudioTron's main controls are illustrated below. For details on the Front Panel, Rear Panel and Remote Control functions, see the relevant sections in this manual.

Headphones jack

Transport controls for Play, Stop, Pause, next / prev song

2 x 40 character back-lit display makes it easy to select menu items, songs and options.

"Turn-and-push" control knob for navigating your song library and selecting menu items.

IR Sensor for remote control

CD-style controls for Random/ Repeat play, Mute, Options and Group.

Standby Power and LED

IR Remote control provides access to all major functions, including assignment of up to 20 presets of your favorite songs.

Rear panel

HPNA 2.0 and Ethernet connectors

Digital and analog audio outputs

Main power switch and fuse

AudioTron front and rear panels with Remote Control

Turning on AudioTron's Power

AudioTron has two power switches:

The **rear panel power switch** turns on the main AC power to the unit.

The **front panel Standby button** places AudioTron in a "sleep" state whereby the main power is still on, but the unit is in a "partial shutdown" mode that retains its temporary settings.

To Power-on AudioTron...

1. Insert the AC cable into AudioTron's rear panel AC receptacle. Plug the other end of the cable into an AC outlet.

2. Turn on the rear panel AC switch. Wait a few seconds, then press the front panel Standby button.

3. If AudioTron is properly connected to the network, it will search the network for PC hosts with song files. After finding the PC hosts, it scans for songs and catalogs the song names in its internal memory so they can be quickly accessed.

4. Once AudioTron is powered on, the unit should be turned on and off with the Standby button. This bypasses the network search process initiated by turning on the power with the rear panel switch.

➜ *If you will not be using AudioTron for an extended period of time, the AC power switch on the rear panel should be turned off.*

If AudioTron won't power on

✓ Check that the rear panel power switch is on.

✓ Be sure to press and hold the Standby button for a few seconds.

✓ Check that the power cord is seated properly in AudioTron's rear panel receptacle and in the AC wall outlet.

✓ Check for power in the AC outlet power by installing another known working electrical appliance (e.g. a lamp) into the same outlet to see if it operates.

✓ Check AudioTron's fuse (see the section **"Rear Panel Reference"**)

Power-On Messages

One or more of the following messages may appear while AudioTron is powering on:

Version x.x – Enet DHCP	Indicates the firmware version number and the type of network connection detected. For details on how to upgrade the firmware version, see the Reference Manual section called "**Updating AudioTron's Firmware**".
	If you connected an Ethernet cable and AudioTron's display indicates HPNA, check the network cable connection to AudioTron and check the network for proper operation.
Connecting to TurtleRadio	Indicates that AudioTron is searching for an Internet connection to download radio station URL locations from the TurtleRadio web site. The internet radio feature is disabled by default and may be enabled from the AudioTron web server "**TurtleRadio**" page.
Searching for Hosts **– xx% Complete**	Indicates that AudioTron has found the network connection and is searching for PCs on the network.
Searching Host x of x	Indicates the number of PCs detected on the network.
Searching for Music **Found xxxx Songs** **XXX Stations**	Indicates the number of songs found on the PCs in the network. After the song search is completed, the main menu is displayed and AudioTron is ready to play music. Internet Radio Stations are displayed after the number of local songs found.
Waiting for network: **xx secs**	*(DHCP Mode Only)* Indicates that AudioTron is trying to connect to the network. If a network connection can't be established after 120 seconds, AudioTron stops searching and displays "No Hosts Found" followed by "No Song Titles Found". Use the Setup Utility to help troubleshoot this problem.
No Song Titles Found	Indicates that no songs were found on the host, or that no host was found. Use the Setup Utility to help troubleshoot this problem, or check for the proper directory names and shares, as described in the **Reference Manual**.
No Hosts Found	Indicates that no PCs were found on the network. Reconnect the network cable into AudioTron's rear panel to make sure it "clicks" when inserted, or try another network cable. Use the Setup Utility to help troubleshoot this problem.

"Re-setting" AudioTron

AudioTron may be "reset" by turning the rear panel power switch off and on, waiting a few seconds, then pressing the Standby button. This would be necessary, for example, if AudioTron is behaving erratically, or if you have loaded new firmware.

Front Panel Controls

① Headphone Jack	Drives headphones. Volume is set with the control knob while a song is playing. When headphones are connected, the rear panel analog outputs will be muted. The digital audio output is not affected.	
② Standby button	After turning on the AC power with the rear panel switch, the front panel Standby button is used for turning the unit on and off. The rear panel AC switch shuts down the entire unit. Standby shuts down only the display and certain internal functions, with power maintained to the memory and processor.	
	The red light under the Standby button indicates that the rear panel AC Power switch is "on" and the unit is in "Standby Mode". The red light flashes when the remote control is used, indicating that the IR signal was received.	
	To reset AudioTron – Turn the back panel AC power switch off, then on. Wait a few seconds and press the Standby button to turn on the unit. This will initiate a complete start-up sequence where the unit searches for network hosts, songs, etc.	
	To "soft" reset AudioTron – Press the Standby button off, then on, to reset the audio outputs if there is no sound on the analog line and headphone outputs.	
③ Transport Buttons	**Play** – Starts playback of the currently selected Song or Playlist.	
	Stop – Stops playback of the current Song or Playlist.	
	Pause - Pauses playback if a Song is playing and resumes playback if a song is Paused.	
	Next >> Previous << - When a song is playing, these buttons select the next/previous song in the Play Queue. If clicked within the first 5 seconds of the currently playing song, AudioTron will skip back to the next (or previous) song. If the **Previous <<** button is clicked after the first 5 seconds of the currently playing song, AudioTron will return to the beginning of that same song. When these buttons are clicked in the Select menu, the display selection will skip to the beginning of the next/prev alphabetical category in the list, making it easier to navigate through long lists.	
④ Options Button	Activates "Options Mode". See the section entitled "Options Menu" for details.	
⑤ Repeat Button	Plays songs continuously when lit.	
⑥ Mute Button	Mutes the analog and digital audio outputs when lit.	
⑦ Random Button	Plays songs in random order when lit.	
⑧ Group Buttons	Group – When lit, activates Group Edit mode for deleting single songs in the Group List with the Clear Button. See the section entitled "Using Group Mode" for details.	
	Add - Adds the currently playing or selected song, album, list, etc. to the Group List.	
	Clear – Deletes all songs in the Group List when the Group Button is not lit and a song is not playing. Deletes individual songs in the Group List when the Group Button is lit.	
⑨ Infrared (IR) sensor	The infrared (IR) sensor receives commands from the remote control. The IR sensor is located next to the control knob, on the front of the unit.	
⑩ Control Knob	The operation of the control knob depends on the context in which it is used. Functions are described in the various sections of this manual.	
	While a song is playing, turning the knob adjusts the playback volume. Pressing the knob activates Song Position mode, whereby turning the knob changes the playback position (e.g. FF or Rewind). The default setting for volume and song position can be set in the Web Server "Settings" tab.	
	In certain menu operations, turning and pressing the knob initiates a selection.	

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Setting Options from the Front Panel

The **Options** button activates the Options Menu display. Turn the control knob to scroll through the available menu items and press the knob to select. Not all of the options are accessible from the front panel display and instead are accessed via the web server. See the web server **"Settings"** section for details.

The AudioTron Web Server can be used to lock the display options menu so that options cannot be changed from the front panel. This is useful, for example, if AudioTron is being used in a public place where you do not want anyone to change the options from the front panel.

NOTE: Any change made to an option listed with an **R** will not take effect until AudioTron is re-booted:

Check for New Music Files?	Checks for any new music files stored on PC music server (Host PC). Does not search for new host PCs.
Check for New Internet Stations?	Checks for any new radio stations added to the TurtleRadio site. See TurtleRadio section for details.
Set Clock Options	Allows you to configure the clock time and alarm functions
Bass Boost *(default = 0)*	Activates the Bass Boost control. Turn the knob to set the level in 1dB increments. Bass boost does not affect the S/PDIF digital output.
Treble Boost *(default = 0)*	Activates the Treble Boost control. Turn the knob to set the level in 1dB increments. Treble boost does not affect the S/PDIF digital output.
Set LED intensity *(default = 100%)*	Dims the LED intensity from 10% (lowest intensity) to 100% (maximum intensity) in increments of 10%. Note that this does not affect the LCD back-light intensity.
Display Network History *(press Options button to exit)*	Displays a series of character strings that indicate what happened when AudioTron logged on to the network. The display strings include: **Local IP Address = x.x.x.x** – The IP address that AudioTron is currently using. If static IP addressing is configured, this setting should be the same as the static version. If DHCP is configured, then this is the address that was assigned by the DHCP server. **AudioTron Name = Atronxxxxxx** – This is the name by which the AudioTron can be found on your network. **Local MAC address = x:x:x:x:x:x** – The local MAC (ethernet) address for AudioTron. **Local Net Mask = x.x.x.x** – The net mask that AudioTron is currently using. If static IP addressing is configured, this setting should be the same as the static version. If DHCP is configured, then this is the mask that was assigned by the DHCP server. **Local Gateway = x.x.x.x** – The gateway that AudioTron is currently using. If DHCP is configured, then this is the gateway that was assigned by the DHCP server. **Local DNS server = x.x.x.x** – This is the Domain Name Server that the AudioTron is using. If DHCP is configured, then this is the DNS that was assigned by the DHCP server. **Initial Search at x days x hrs x mins** – Indicates that the first search of the network occurred at this amount of time since AudioTron was booted. **Found TurtleRadio station server** – Indicates that AudioTron was able to communicate with the TurtleRadio server. **Found xxx stations** – Indicates how many new radio stations were found. **Host [hostname] found at IP x:x:x:x** – Indicates that the host was found at the indicated IP address. **Update Search at x days x hrs x mins** – Indicates when the last search for new music occurred. **Share [sharename] has xx new songs** – Indicates the number of new songs found on the indicated share. **[Sharename] - Share Access Denied** – Indicates that access to this share was denied because the share password was wrong. **[Sharename] – Error accessing share** – Indicates that there was a non-password related error accessing this share. **[Hostname] – Access to host denied** – Indicates that the NT username and password are incorrect. **[Hostname] – Error accessing host** – Indicates that there was a non-password related error accessing this host. **No Name for host at IP x.x.x.x** – Indicates that no name was found for a host found at

		that IP address, therefore TCP/IP was installed but File Sharing was not installed or not bound to TCP/IP. **Using TOC file for Share xxxxx** – Indicates that there is a "Table of Contents" file that the AudioTron is using to determine the contents of a network share.
R	Configure DHCP *(default = Enabled)*	**Enable** – For connecting AudioTron to a network with a DHCP server so that AudioTron will automatically accept a valid IP address from the DHCP server PC. **Disable** – For configuring AudioTron with a static IP address as described in the "Set IP Address" option (see below). **NOTE:** If DHCP is Enabled, the settings in **Select Network Interface, Set IP Address, Configure Subnet Mask** and **Configure IP Gateway** will be configured automatically. Any manually added settings in these menus will be ignored.
R	Select Network Interface	**Ethernet** – For connecting AudioTron to a 10BaseT-compatible Ethernet network. **Phone Line** – For connecting AudioTron to an HPNA 2.0 network.
R	Configure IP Address *(default = 192.168.0.10)*	If DHCP is disabled, lets you assign an IP address to AudioTron. A typical IP address is 192.168.0.xxx where the xxx setting ranges from 1 – 254 as determined by the Subnet mask (a "Class C" network IP address).
R	Configure IP Subnet Mask *(default = 255.255.255.0)*	If DHCP is disabled, lets you enter an IP Subnet Mask that should match the one on your network. A typical subnet mask setting for a Class C network is **255.255.255.xxx,** where the xxx setting ranges from 0 – 252 and sets the valid starting point for an IP address in the network. (e.g. 0 signifies a valid IP address range of 1 – 254.)
R	Configure IP Gateway *(default = 192.168.0.1)*	If DHCP is Disabled, sets the IP address of the network gateway (your host PC). This must match the setting on your host PC.
R	Restore Factory Defaults	Resets AudioTron to its original factory default settings and discards all user-customized changes. Re-start AudioTron for the default settings to take effect: Turn the rear panel power switch off and back on. Wait a few seconds and press the front panel Standby button. Once the start up procedure is completed, AudioTron will be operating with the original factory default settings.
R	Update Firmware	Updates the internal software ("firmware") from a file on the host PC. See the section entitled "Updating AudioTron's Firmware" for details.
	Button Test Diag	A diagnostic menu that is used for testing the operation of front panel buttons, control knob and remote control.

Rear Panel Connectors

① ETHERNET	Ethernet Network Connector - Use the included Category 5 Ethernet cable to connect this jack to a 10BaseT Ethernet network hub or switch. AudioTron will also work with a dual speed 10/100 hub, but will not work with a 100baseTX-only hub or switch.
② PHONE	When AudioTron is connected to an HPNA phone line network, this jack may be used to connect a telephone or to cascade a second AudioTron via the HPNA connection.
③ LINE	HPNA Network Connector – Connect the included telephone cable to this jack when using AudioTron on an HPNA home phone line network.
④ DIGITAL OUT	S/PDIF optical digital audio output - Connect to powered speakers or stereo receiver with an optical digital input. Connect with an optical TOSlink cable (not included).
⑤ ANALOG OUT	RCA Analog Line Outputs (L/R) - Connect to powered speakers or stereo receiver with RCA line input jacks.
⑥ AC Power Connector	Insert the female end of the included three-pin IEC power cord into this receptacle
⑦ AC Fuse	Receptacle for a 250mA Slo-Blo 250V mini-fuse. To Replace the fuse: Remove the electrical cord from the rear panel receptacle. Take a small flat-blade screwdriver and insert into notch. Gently pry out the fuse holder cover with the screwdriver. Take note of how the plastic was aligned in the holder. Take out the old fuse and replace with a new mini-fuse of the exact same type and rating (5 x 20 mm, 250mA or 1/4 Amp, 250V Slo-Blo® UL/CSA cartridge type). Put the fuse in the plastic holder and press the holder back into place on the AudioTron rear panel. Be sure to re-insert the holder in the same way it was originally installed.
⑧ AC Power Switch	Use this switch to power up AudioTron for the first time, or to turn off all power to AudioTron (this should only be necessary when you want to completely disconnect the unit or you need to perform a complete 'reset'). Once AudioTron is powered on, the rear panel power switch should be left on and the unit should be turned on and off with the Standby button. Turning AudioTron on and off with the Standby button avoids the network search process initiated by the "power on" sequence and retains AudioTron's temporary settings, so it's ready to play music with your custom configuration settings. If AudioTron is acting erratically, or if you want to rescan the network, "reset" the unit by turning the rear panel power switch off and on, wait a few seconds, then pressing the Standby button.

Remote Control

As with the buttons on the AudioTron front panel, most of the remote control's buttons activate a single function, while some serve multiple purposes depending on the active display.

➲ *The remote control functions may be checked by using the Options "Button Test Diagnostic".*
   See the Options Menu section for details.

Buttons that function similarly to the front panel controls

GROUP, ADD, CLEAR (Group Mode controls)	Equivalent to the front panel Group, Add and Clear buttons.
POWER	Equivalent to the front panel Standby button.
MUTE	Equivalent to the front panel Mute button. Silences the audio playback.
PLAY, STOP, PAUSE	Equivalent to the front panel transport buttons.
|◄| |►|	Equivalent to the front panel previous/next track buttons. When in Select modes, these buttons also scroll through lists in the same way as turning the Control Knob. The scrolling speed will increase as the buttons are held down longer.
VOL+ (volume up), **VOL–** (volume down)	Equivalent to the front panel Control Knob when in Play Mode (Volume Control).
RANDOM / REPEAT	Equivalent to the front panel Random and Repeat buttons.

Buttons not available on the front panel

FAVORITES	The 16 "Favorites" buttons work in conjunction with the **Add** FAV button to quickly activate favorite songs and lists by pressing one of the FAVORITES buttons. See the section Using "Favorites" Mode for details.
ADD FAV (Add Favorite)	This button is only active in the select screen (Select Mode). It prompts the user to select a favorite slot and saves the current selection type and entry into the Favorites slot you choose. See the section Using "Favorites" Mode for details.
JUMP + (jump forward) **JUMP–** (jump back)	When selecting from the menu, jumps forward or back to the next entry that does not begin with the same character (case insensitive) as the current Entry. Makes it easier to navigate through long lists of songs. While a song is playing, selects song position (like fast forward and rewind.)
PRESETS	These are 4 additional favorites buttons grouped into a separate area for quicker access. Use these buttons for assigning "favorites" you intend to use often.
TITLE, ARTIST, ALBUM, GENRE, LISTS	Equivalent to the categories in the main menu for selecting lists.
NET (Internet)	Activates Internet radio menu.

AudioTron Remote Control

Assigning "Favorites" to the Remote Control

The "Favorites" feature lets you assign a song, album, artist, genre, Internet radio station or playlist to the Favorites Buttons on the remote control so you can instantly play them with a push of a button.

The remote control includes a set of 20 user programmable buttons, grouped as 16 "FAVORITES" buttons (labeled 1 – 16) and 4 "PRESETS" buttons (labeled A, B, C and D). When one of these buttons is pressed, the current playing song (if any) is stopped and the songs associated with the button will be loaded into the Play Queue.

To assign the Favorites and Presets buttons on the Remote Control

1. Turn the knob to highlight **Title, Artist, Album, Genre, Net** or **Lists** in the display menu (or press the corresponding button on remote control). For example, to assign an album, select Album.

```
Title  Artist  Album   Genre   Net   Lists
Select by Album
```

2. Press the knob (or **Play**) and turn the knob to scroll album names.

```
Select by Album
Sting - Brand New Day
```

3. When the desired album is displayed, press the "**Add FAV**" button on the remote control. The display will prompt for the number of the Favorites button you wish to use.

```
Save Album: Sting - Brand New Day
As Favorite #?
```

4. Press one of the 16 "Favorites" buttons or one of the 4 "Preset" buttons on the remote control. For example, if you press button #1, the # sign in the display will change to a "1", indicating the number of the button pressed. From this point on, pressing Favorites Button 1 will load and play this album.

5. To re-assign a song or list to a button that has been assigned, follow the same process to overwrite the previous contents.

➲ *The Favorites buttons can also be assigned with the AudioTron web server. See the web server "Favorites" section for details.*

Using the "More songs like this" Feature

➲ *The "More songs like this feature" is activated from the web server Preferences screen, accessed by selecting Settings →Preferences in the AudioTron web server.*

The remote control "**More songs like this**" feature lets you easily play all songs by a particular artist, genre or album while listening to your music. When this feature is enabled via the web server **Preferences** screen, the remote control ARTIST, ALBUM, or GENRE buttons no longer operate as menu selection buttons. Instead, they will clear the play queue and load all songs corresponding to the category of the current song.

For example, if you're listening to a Jazz song and decide that you'd like to hear more Jazz songs , pressing the Genre button on the remote control will clear the Play Queue and load every Jazz song in your library. Or, if you're listening to a song by a particular artist and want to hear only songs by that artist, pressing Artist will clear all of the songs in the Play Queue and load all songs by that artist. Or, while listening to a song from a particular album, pressing Album will clear the Play Queue and load all songs from that album.

Playing your Music Library from the AudioTron Panel

Main Menu Display

AudioTron's **Main Menu** display (shown below) lets you find songs by **Title** (individual song titles), **Artist** (creator of the song), **Album** (the name of the CD the song came from), **Genre** (type of music), and **Lists** (User-defined Playlists). The **Net** menu item lets you select Internet radio stations if AudioTron is configured for Internet radio via the web server **Settings → TurtleRadio** page. The stations in the **Net** category are configured at the **TurtleRadio** web site, as described in the Setup Guide section entitled "**Configuring AudioTron to play Internet Radio.**"

Turn knob to highlight menu item

```
Title  Artist  Album   Genre   Net   Lists
Select by Play List
```

Press Play to select

Push knob to select
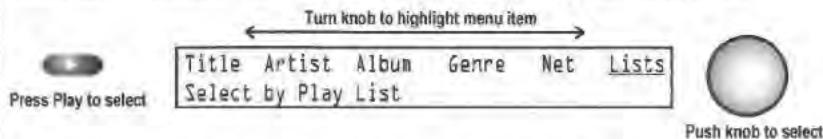
The categories Title, Artist, Album and Genre are part of the "song tag" created by AudioStation or other PC jukebox program used to transfer the song from a CD to the hard drive. When an entry from these categories is selected, AudioTron searches the music library for a song that matches the tag. If a song was entered without tag data, its file name (rather than song title) will be displayed when the Title category is selected and the file name will not appear when Artist, Album, or Genre are selected. For more information on Song Tags, see the section called "**Managing your Music Library with AudioStation**".

To select a category...

1. Turn the knob until the desired category flashes. Press the knob to select the category.

2. While making a selection, pressing STOP at any point will return to the main menu.

3. Pressing the **Play** button while a song is playing will activate the main menu so you can add more songs to the Play Queue. If no selections are made within a fixed timeout period, the song status display will return.

Song Playback Display

① ②
```
Monkey and the Hitman          0:33/3:33
Kitsch In Sync - Bang Bang - Pop     1/5
```
③ ④

Pressing the **Play** button starts song playback and displays the following information:

① **Song Title**	The song title appears in this field. If there is no Title embedded in the music file's tags, the song's file name will be displayed.
② **Play time/status**	Displays how long the song has been playing and the total time of the song. If the song is not playing, the current status is displayed:
	PAUSED – Indicates that the Pause button has been pushed and the song is paused. Press Pause or Play to resume playback.
	BUFFERING xx% – Indicates that AudioTron is transferring song data from the network into its internal song buffer.
	MUTED - If the MUTE button is pressed, the word MUTED will flash.
③ **Tags**	"Tags" are data embedded in the audio files that provide information about the song (e.g. title, artist, album name, genre.) If no tags have been entered for the song, the file name for the song will be displayed. If the song tags contain more information than can be displayed at one time, the display can be set to scroll as a "marquee". See the web server "**Settings - Preferences**" section for information on controlling the display settings from the web server **Preferences** screen.
④ **Play Queue Status**	Displays the current song number and total number of songs in the Play Queue (e.g. the first song in an album that contains 5 songs will display as "1/5")

Song Position Display

```
Setting Position  3:10/6:12
------------------|----------------------
```

To set the song position while a song is playing, press the remote control JUMP + or JUMP - buttons or press and turn the knob on the front panel. The display will indicate the song position and the song will continue to play while you move the cursor. After the cursor stops moving, the song will jump to the new position.

Note that the song position feature will show a percentage instead of the time with MP3 files encoded in VBR (Variable Bitrate) format.

➲ *The web server Settings→ Preferences screen lets you set the knob to default in the Song Position mode on power up, rather than default to the Volume function. See the Web Server section for details.*

Playback Volume Display

```
Gain
0 dB
```

Turning the knob while a song is playing or pressing the remote control volume buttons will momentarily display the volume setting. The volume control will only affect the rear panel analog outputs and headphones output. The S/PDIF digital output volume will not be affected by the volume control.

The volume setting indicates the "attenuation" of the maximum signal level. A setting of 0dB ("zero decibels") indicates that there is no attenuation (i.e. "full volume"). Turning the knob counterclockwise will attenuate the signal by -1dB steps. The volume setting is saved when the Standby button is turned off. When turned back on, the volume will return to the saved setting.

➲ *The Volume Control should be left at the 0dB (maximum) setting unless AudioTron is used with headphones or powered speakers that do not have a volume control. For best fidelity, the volume control on your stereo system or powered speakers should be used to control the playback level.*

Play Queue

Songs selected from the menu display are added to the "**Play Queue**", which is a list of songs to be played. By navigating through the song selection menu, you can add songs to the Play Queue while listening to other songs.

➲ *Contents of the Play Queue can be viewed and edited with the AudioTron web server.*

The currently playing song is at the beginning of the Play Queue. For example, if a song is playing and three songs are selected from the display menu, the Play Queue will contain four songs—the currently playing song and the three songs added to the queue. When the current song is over (or if the **Next Track** button is pressed before the song is over) the second song in the queue begins to play, followed by the third and then the fourth, until the queue is completed.

Pressing the **Random** button will cause the songs in the Play Queue to play in a random order. Pressing the **Repeat** button will cause the Play Queue list to start over after the last song has finished playing.

The Play Queue cannot be edited from the front panel and the contents are erased when the Stop button is pressed. You can, however, remove songs from the play queue from the web interface. To stop a song without erasing the Play Queue, press the **Pause** button.

Group List

A more permanent and editable play list can be created with the **Group List**. Pressing the **Add** button will add the displayed items to the end of the Group List. Selecting **<Group>** in the **Lists** menu plays the songs in the Group List. Songs may be added while a song is playing or while searching for songs in the display menu.

> ⮑ *The Group List may also be viewed and edited via the AudioTron web server.*

> ⮑ *If you do not clear the Group before adding songs to your custom play list, the songs will be added to those already in the Group.*

To clear the Group List...

1. Press **Stop** to activate the display menu.
2. To delete all of the songs from the Group List, press the **Clear** button.
3. To delete specific songs from the Group List, press the **Group** button (LED turns on), turn the knob to select the song, then press the **Clear** button to delete only the song in the display.

To add songs to the Group List...

1. To clear out the entire Group List or specific songs in the Group List, see above. Adding songs without first clearing the Group List will add the songs to those already in the list.
2. To add a song while it is playing, press the **Add** button on the front panel.
3. To add a song while searching for songs, press **Add** while the song title is on the display.
4. To add all of the songs from an album, by an artist, in a genre, or in a playlist to the Group List, press **Add** while the Album name, Artist name, Genre Name or Playlist Name is displayed.
5. To add multiple songs, repeat the steps above. For example, to add three songs from the same album to the Group List, press **Add → scroll → Add → scroll → Add**. Or to add all of the songs in the album, select ALL rather than the individual titles.

To play the Group List...

1. Press **Stop** to activate the menu display. Turn the knob to select **Lists** and press either the knob or the **Play** button to select.
2. Turn the knob to display **<Group>**, then press either the knob or **Play** button to load all of the Group List songs into the Play Queue. The Group List can also be edited with the web server.

> ⮑ *Turning off the AC power to AudioTron will delete the Group contents. Placing AudioTron in "Standby mode" will not delete the Group.*

Songs vs. Items

An important concept to remember when using AudioTron is the difference between "songs" and "items" when selecting what to play. AudioTron lets you select songs by searching for titles, artists, albums, genres and playlists. When you search for and add a "title" to the Play Queue, you effectively select one "item" that adds one song to the queue. However, if for example, you select an album with 12 songs, you would have selected an item that added 12 songs to the queue. Or if you select a genre with 300 songs, you would have selected an "item" that adds 300 songs to the queue.

The point to remember is that functions, which accept songs for playback (e.g. Play Queue, Group List and Favorites buttons), can accept single songs or "items" with multiple songs. For example, to create a Favorites button that would play all of your classical music, you'd add the "Classical" genre item to the Favorites button, rather than each song individually.

Turtle Beach

Simple Menu Mode
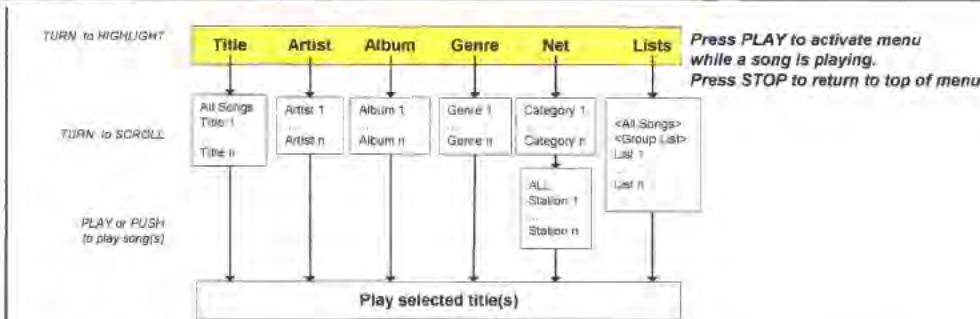
Simple Menu Tree

The AudioTron defaults to "**Simple Menu Mode**", which lets you select songs by category and then a group within that category. For example, selecting **Album** would let you find an album by name and play all of the songs on the album. Or, selecting Artist would let you play all of the songs by an artist. Only the Title menu item lets you find and play individual songs from the music library.

The flow chart shows the "tree" structure of Simple Menu Mode. The top of the tree shows the main menu selections (Title, Artist, Album, Genre, Net and Lists) while the boxes below each menu item show the corresponding categories.

Navigating the Menu Tree

To navigate in the menu tree, begin at the top by turning and pressing the knob to select the items below the menu. Then, turn the knob to scroll the items in the sub-menu and press to select the displayed item.
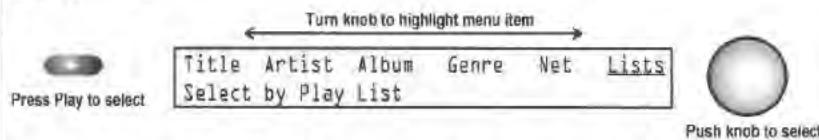
For example, selecting "Artist" presents a sub-menu listing all of the artists in the music library. Turning the knob scrolls the artist names and pressing the knob loads all of the songs by the selected artist into the Play Queue.

To play a single song

1. Turn the knob until the **Title** menu item selection flashes. Press the knob, then turn to select a song title from the song library. (NOTE: Pressing the **Next/Prev** buttons on the front panel or the **JUMP+** and **JUMP-** buttons on the remote control will skip to the first song in the next letter of the alphabet, which provides a quick way to scroll through a large library.)

2. When the desired title is displayed, press the **Play** button or push the knob to start playback. The song will be added to the Play Queue.

3. To load the song into the Group list, press the **Add** button when the title is displayed, before pressing **Play**.

When **Play** is pressed, AudioTron will transfer a portion of the song file from the PC Host to its internal memory buffer for playback. After the buffer is adequately filled, the song will play once, then stop. The "time indicator" on the right side of the display will advance as the song plays. To play the song repeatedly, press the **Repeat** button.

➪ *If there are multiple songs with the same name in the music library, AudioTron differentiates between them by adding a number in parentheses after the name of the song (e.g., "Song" and "Song -(1)".)*

To play songs by a particular Artist

1. Turn the knob until the **Artist** menu item flashes. Press the knob, then turn to select the Artist Name. (Pressing the <</>> buttons on the front panel or the **JUMP+** and **JUMP-** buttons on the remote control will skip to the first song in the next letter of the alphabet, which provides a quick way to scroll through a large library.)

2. When the desired artist is displayed, press the **Play** button or push the knob to start playback. The number of songs for the selected artist will be loaded into the Play Queue and the first song will begin to play.

3. To load the artist songs into the Group list, press the **Add** button when the artist name is displayed, before pressing **Play**.

To play songs from a particular Album

1. Turn the knob until the **Album** menu item flashes. Press the knob, then turn to select the Album name. (Pressing the <</>> buttons on the front panel or the **JUMP+** and **JUMP-** buttons on the remote control will skip to the first song in the next letter of the alphabet, which provides a quick way to scroll through a large library.)

2. When the desired album is displayed, press the **Play** button or push the knob to start playback. The number of songs for the selected Album will be displayed and the entire list of songs from the Album will be loaded into the Play Queue.

3. To load the Album songs into the Group list, press the **Add** button when the album name is displayed, before pressing **Play**.

To play songs of a particular Genre

1. Turn the knob until the **Genre** menu item flashes. Press the knob, then turn to select the Genre name. To scan by letter, press the next/prev track buttons. (Pressing the <</>> buttons on the front panel or the **JUMP+** and **JUMP-** buttons on the remote control will skip to the first song in the next letter of the alphabet, which provides a quick way to scroll through a large library.)

2. When the desired genre is displayed, press the **Play** button or push the knob to start playback of all the songs in the genre.

3. To load the genre songs into the Group list, press the **Add** button when the genre name is displayed, before pressing **Play**.

To play songs from a Play List

Play Lists are groups of songs created on the PC using a jukebox program such as AudioStation. For information on Playlists, see the section called "Managing your Music Library with AudioStation".

1. Turn the knob until the **Lists** menu item flashes. Press the knob, then turn to select the List name. The first list item, **<All songs>** will select all of the songs in the music library. The second item, **<Group>** is the list created by the Group buttons. The rest of the lists are the play lists created on the PC as M3U or PLS files.

2. When you find the desired play list, press the **Play** button or push the knob to start playback of the songs in the list.

To select with the Remote Control

1. Press the menu item you'd like to select (e.g. "**Genre**").

2. Press the |< and >| buttons to move through the selections, just like turning the knob. Press Jump + and Jump – to scroll to the next letter in the list.

Advanced Menu Mode

Press PLAY to activate menu while a song is playing.
Press STOP to return to top of menu.
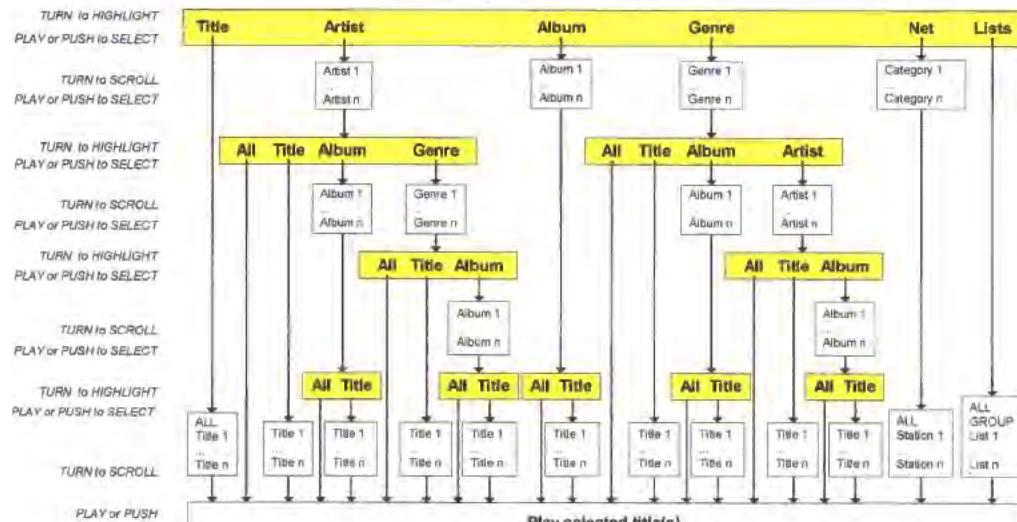
Advanced Menu Tree

Advanced Menu Mode provides a search mechanism significantly more advanced and versatile than Simple Mode, providing detailed control over selection of songs from the music library. For example, you could find an album by name, and play a single song on that album. Or, you could find an artist by name, then all albums by that artist, then a song on one of those albums.

➲ Advanced Menu Mode is enabled from the AudioTron web server **Preferences** screen

"Filtering" Selections in the Menu Tree

The flow chart above shows the "tree" structure in Advanced Mode. The top shows the main menu selections (Title, Artist, Album, Genre, Net and Lists), while the boxes below each menu item show the categories and paths for navigating the tree. For example, selecting "Artist" presents a list of all artists, as in Simple Mode. However, once the artist is selected, a sub-menu allows the selection of **All** (all songs by the artist), **Title** (single titles by the artist), Album (album titles by the artist), and **Genre** (genres by the artist). Once one of these items has been selected, another sub menu appears, and so on, until the bottom of the tree is reached. This effectively "filters" the music library by the criteria chosen in each part of the menu tree so that only songs matching the selected criteria will be listed in the display.

The menu tree shows how Advanced Mode lets you find songs by following a path beginning with the main menu at the top and ending with a list of song titles "filtered" along the path to the bottom. For example, a song on an album can be found by following one of two paths: **Artist → Album → Title** or **Album → Title**. Similarly, finding a song in a particular genre by an artist could be found by **Artist → Genre → Title** or by **Genre → Artist → Title**.

Navigating the other paths through the menu tree follows a similar pattern. Therefore, by referring to the above diagram of the menu tree, the following descriptions of how to navigate through the Title and Artist trees can be extrapolated to understand the paths in the other trees.

Advanced Menu Mode is enabled in the web server **Preferences** screen.

Selecting Songs by Title

To select all songs in the music library (Method 1)

Title Artist Album Genre Net Lists Select by Title	Turn knob to highlight **Title** in the display menu (or press **Title** on remote control.) Then press **Play** or push knob to select Title mode.
Select by Title (STOP to exit) <All Songs>	<All Songs> is highlighted as the first entry in the list. Press **Play** or push knob to select all songs.
Selected 2,572 Songs	All songs in the music library are added to the Play Queue.

To select all songs in the music library (Method 2)

Title Artist Album Genre Net **Lists** Select by Lists	Turn knob to highlight **Lists** in the display menu (or press **Lists** on remote control.) Press **Play** or push knob to select Title mode.
Select by List (STOP to exit) <All Songs>	<All Songs> is highlighted as the first entry in the list. Press **Play** or push knob to select all songs.
Selected 2,572 Songs	All songs in the music library are added to the Play Queue.

To select a song by Title

Title Artist Album Genre Net Lists Select by Title	Turn knob to highlight **Title** in the menu (or press **Title** on remote control.) Press **Play** or push knob to select songs by title.
Select by Title (STOP to exit) Anytime at All	To scroll songs, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump −** on remote control) to jump by letter. Press **Play** or push knob to play.
Selected 1 item	Selected song is added to the Play Queue.

Selecting Songs by an Artist

To select all songs by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump −** on remote control) to jump by letter. Press **Play** or push knob to select.
All Title Album Genre (STOP to exit) Play All for Sting 63 songs	The number of songs by this artist is shown at the bottom right. Press **Play** or push knob to select all songs by this artist.
Selected 63 items	All songs by this artist are added to the Play Queue.

To select a single song by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.

Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select.
All **Title** Album Genre (STOP to exit) Select Title for Sting 63 songs	Turn knob to highlight **Title** (or press Title on remote control.) Press **Play** or push knob to select a song by this artist.
Select Title for Sting A Thousand Years	To scroll songs, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select song.
Selected 1 Items.	The selected song by this artist is added to the Play Queue.

To select all songs on an Album by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select artist
All Single **Album** Genre (STOP to exit) Select Album for Sting 63 songs	Turn knob to highlight **Album** (or press Album on remote control.) Press **Play** or push knob to select a song by searching albums by this artist.
Select Album for Sting Brand New Day	To scroll albums, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select album.
All Title (STOP to exit) Play All for Sting: Brand New 10 songs	All is highlighted. The number of songs on this album is shown at the bottom right (10 songs). Press **Play** or push knob to select all songs on this album.
Selected 10 items	The 10 songs on this album are added to the Play queue.

To play a song on an Album by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select artist.
All Title **Album** Genre (STOP to exit) Select Album for Sting 63 songs	Turn knob to highlight **Album** (or press **Album** on remote control.) Press **Play** or push knob to select a song by searching albums by this artist.
Select Album for Sting Brand New Day	To scroll albums, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select album.
All **Title** (STOP to exit) Select Title for Sting: Brand New 10 songs	Turn knob to highlight Title. Press Play or push Knob to select a song on this album.
Select Title for Sting: Brand New Day A Thousand Years	To scroll songs on this album, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select song.
Selected 1 item	Selected song on this album is added to the Play Queue.

To play all songs in a Genre by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.

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Select by Artist (STOP to exit) Sting	To scroll artist names, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select.
All Title Album **Genre** (STOP to exit) Select Genre for Sting 63 songs	Turn knob to highlight **Genre** (or press **Genre** on remote control.) Press **Play** or push knob to select songs by Genre for this artist.
Select Genre for Sting Rock	To scroll genres by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select genre.
All Title Album (STOP to exit) Play All for Rock: Sting 63 songs	All Songs mode is highlighted. Press **Play** or push knob to select all songs in this Genre by this artist.
Selected 63 items	All songs in this genre by this artist are added to the Play queue.

To select a song in a Genre by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select.
All Title Album **Genre** (STOP to exit) Select Genre for Sting 63 songs	Turn knob to highlight **Genre** (or press **Genre** on remote control.) Press **Play** or push knob to select songs by Genre for this artist.
Select Genre for Sting Rock	To scroll genres by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select genre.
All **Title** Album (STOP to exit) Select Title for Rock: Sting 63 songs	Turn knob to highlight **Title** (or press **Title** on remote control). Press **Play** or push knob to select a song.
Select Title for Rock: Sting After the Rain Has Fallen	To scroll songs in this genre by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select song.
Selected 1 item	Selected song is added to the Play Queue.

To select all songs in a Genre on an Album by an Artist

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist (STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select.
All Title Album **Genre** (STOP to exit) Select Genre for Sting 63 songs	Turn knob to highlight **Genre** (or press **Genre** on remote control.) Press **Play** or push knob to select songs by Genre for this artist.
Select Genre for Sting Rock	To scroll genres by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select genre.
All Title **Album** (STOP to exit) Select Album for Rock: Sting 63 songs	Turn knob to highlight **Album** mode (or press Album on remote control.) Press **Play** or push knob to select an Album.
Select Album for Rock: Sting Brand New Day	To scroll albums in this genre by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump + / Jump –** on remote control) to jump by letter. Press **Play** or push knob to select album.

All Title　　　　　　　　(STOP to exit) Play All for Rock: Sting: Brand Ne 10 songs	**All** titles is highlighted. Press **Play** or push knob to select all songs on this album.
Selected 10 items	All songs on this album are added to the Play Queue.

To select a song in a Genre on an Album by an Artist:

Title **Artist** Album Genre Net Lists Select by Artist	Turn knob to highlight **Artist** in menu (or press **Artist** on remote control.) Press **Play** or push knob to select songs by Artist.
Select by Artist　　　　　　(STOP to exit) Sting	To scroll artists, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select.
All Title Album **Genre**　　(STOP to exit) Select Genre for Sting　　　　63 songs	Turn knob to highlight **Genre** (or press **Genre** on remote control.) Press **Play** or push knob to select songs by Genre for this artist.
Select Genre for Sting Rock	To scroll genres by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select genre.
All Title **Album**　　　　　(STOP to exit) Select Album for Rock: Sting　　63 songs	Turn knob to highlight **Album** mode. (or press Album on remote control.) Press **Play** or push knob to select an Album.
Select Album for Rock: Sting Brand New Day	To scroll albums in this genre by this artist, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select album.
All **Title**　　　　　　　　(STOP to exit) Select Title for Rock: Sting: Brand 10 songs	Turn knob to highlight **Title** (or press Title on remote control.) Press **Play** or push Knob to select a song.
Select Title for Rock: Sting: Brand New Da Big Lie Small World	To scroll songs on this album, turn knob (or press |< / >| on remote control). Press << / >> (or **Jump +** / **Jump –** on remote control) to jump by letter. Press **Play** or push knob to select song.
Selected 1 item	Selected song is added to the Play Queue.

➥ *The above techniques for selecting songs can also be used to add the selections to the Group List*
*by pressing the **Add** button when the song or item is displayed.*

Controlling AudioTron with the Web Server

Web Server Overview

AudioTron's extensive list of features cannot all be controlled from the limited number of buttons on the remote and front panel. Instead, we've provided an integrated "**web server**" that can be accessed from your PC's web browser. Once your AudioTron is configured, any PC on your network can be used to access the web server by simply launching your web browser (e.g. Internet Explorer or Netscape) and entering the IP address of your AudioTron, enabling you to communicate with the AudioTron from the PC.

After you've become accustomed to AudioTron's powerful set of features, you'll appreciate the convenience of using the AudioTron web server to control your song library and AudioTron settings.

➲ The AudioTron Web Server is incompatible with Netscape Navigator earlier than version 6.0.

➲ Ad blocking, cookie blocking or personal firewall programs may prevent the web server from communicating with the PC and therefore should be disabled.

Web server **running in the Windows Explorer Web browser**

➲ The web server also supports a "thin client" mode compatible with the smaller screen on a PocketPC device. This mode enables devices such as the Compaq iPaq to control AudioTrons from its web browser. For more information, see the section **"Using PocketPC devices with the Web Server."**

To access the Web Server

1. Activate the web browser on a PC connected to the same network as AudioTron.

2. Find the network name assigned to AudioTron by pressing the front panel **Options** button, selecting "**Network History**", and scrolling to "**AudioTron Name =**". After noting the name (e.g. Atron00096a), press the **Options** button to exit Options mode.

3. In your PC web browser screen, enter the AudioTron name the same way you'd enter an Internet Web site URL, and then press Enter on your PC keyboard. For example, if the AudioTron name is Atron00096a, enter http://Atron00096a. Note that you can also use AudioTron's IP address. (e.g. http://192.168.1.10) or use the link created by the Setup Utility.

4. If you attempt to access the web server Settings or Clock functions, the web browser will ask for a user name and password. Enter the default password "**admin**" for both. This password can be changed from the "**Settings Web Server**" screen and is useful if you want to prevent others from changing the AudioTron's settings without your permission.

➲ The "**Restore Factory Defaults**" button in the web server **Firmware** screen can be used to reset the password and user name to "admin".

5. After the username and password are entered, the browser will search for AudioTron at the address you've entered. When it finds AudioTron on the network, the AudioTron web server home screen will be displayed.

6. To make it easier to activate the web server from this point on, you can use the web browser's "Add to Favorites" setting to add the AudioTron address to your list of favorite URLs. Your web browser will also let you rename the "favorite" to something easier to remember, such as "AudioTron in Living Room".

Web Server Menu Selections

The gray area on the left side of the screen lists all of the web server screens. To access a screen, click the name in the menu list. The list is divided into three key sections:

- The **Music Selection Section** lets you play and access music files or Internet radio stations.

- The **Clock Section** lets you activate and set the clock/alarm features.

- The **Settings Section** lets you configure web server and AudioTron operation options.

You can also access Internet-based information by clicking on these key areas in the screen:

- Clicking on the **Turtle Beach logo** at the top of the screen will access the Turtle Beach web site.

- Clicking on the **TurtleRadio logo** at the bottom of the left menu will access the TurtleRadio web site.

- Clicking on the **Help on the Web** menu item will access the relevant help information from the Turtle Beach web site.

➲ *The **Music Selection** pages may be password protected by setting the check box in the Settings→ File Access screen.*

Music Selection

The **Home**, **Play Queue** and **Group List** screens work together with the **Music Selection** screens to let you select and play music. Because the web server runs on a PC screen, rather than being limited by the characters on the front panel display, selecting and playing songs is more intuitive. It's also easier to perform such tasks as assigning songs to the "Favorites" buttons on the remote control.

Home

This is the web server's main screen, which emulates the controls on the front panel. From here you can set volume, song position, mute, random, and repeat. You can also see what song is currently playing and what song is coming up next in the "Play Queue".

The **Sleep Timer** setting on this screen lets you automatically stop the music after a preset time, such as when you're listening to music before falling asleep.

Play Queue

Click on this menu item to see the list of songs selected for playback. From here you can jump to any song in the queue. Note that the song currently playing will be noted by a "← **Now Playing**" symbol next to the song, which corresponds to the "Playing" song shown on the Home screen. The next song in the list corresponds to the "Next…" song on the Home screen.

Group List

Click on the **Group List** menu item to see the songs you've entered into the Group List. Songs are added to the Group List by pressing the **Add to Group** button at the bottom of the song selection pages, or by pressing the **Add** button on the front panel.

The Group List works just like a playlist created with AudioStation or other music management program—except you can create the Group List from the AudioTron front panel or the web server. You can play the songs in the Group List either by pressing the "Play Group" button at the bottom of the screen, or by selecting the Group List from the Lists menu item, just as you would select any other playlist.

Music Selection Menu Items

The menu items under the heading "**Music Selection**" correspond to the main menu display options on the AudioTron front panel—Title, Artist, Album, Genre, Net and Lists. These menu items let you select songs from your music library, just as you would from the front panel—but with *much* more control over song selection. For example, click on **Title** to see all of the songs in your library listed by title, or click **Artist** to select songs by Artist name, etc. You can even assign songs to the "Favorites" button on the remote control by clicking on the **Favorites** menu item.

Clock / Alarm

AudioTron can be set to display the time and date as well as act as an alarm clock, complete with a "snooze" feature! Click on the Clock **Settings** menu item to set the clock options and click on the **Alarm** menu item to set the alarm functions.

```
 1:35   AM - Tue, May 07, 02
```
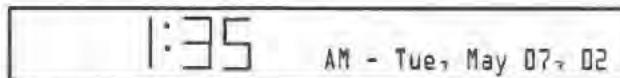
AudioTron Front Panel Clock Display

➲ *When the clock display is active, pressing the Stop button will display the main menu for song selection and pressing the Play button will display the last category selected in the menu.*

Settings

The menu items under the **Settings** heading let you configure the way AudioTron operates, search for songs in your music library, update AudioTron's firmware, search for Internet radio stations and more. Click on each menu item to see the available options and refer to the detailed descriptions in the following sections.

➲ *The **Settings** pages require a password to access. The default password (**admin**) may be changed from the **Web Server Settings** screen.*

AudioTron Reference Manual

Music Selection

Selecting Songs and Internet Radio Stations

The web server Home screen shows the name of the currently playing song and the next song in the queue. From here, you can control all of the play transport functions, and access the other web browser pages by clicking on the left panel menu items.

To play songs from the Web Server

1. The menu items under the **Music Selection** section correspond to the menu items on the AudioTron front panel display (in addition to Favorites.) Click on one of these menu categories to select songs as you would on the AudioTron display. For example, clicking on **Title** presents an alphabetical list of the Titles in your music library.

2. To find a song by Title, click **Title** to activate the **Title Selection** screen. Navigate by using the alphabet letters at the top of the screen, Note that if you have many songs beginning with a certain letter, the list will be separated into multiple pages that can be selected by using the numbers underneath the row of letters.

3. To immediately begin playing a song in place of the currently playing song, click **Play** to the left of each song Title.

4. To add songs to the Play Queue without stopping the current song, check the boxes next to the song titles and press the **Add to Queue** button at the bottom of the screen.

➲ *Note that the first of the Titles displayed on the Web Server is always the "All Songs" playlist, making it easy to simply play all your digital music.*

➲ *You can change the number of items displayed on each page by changing the Results per Page setting on the Web Server Preferences screen, or by clicking on the "results per page" setting at the bottom of each screen.*

In the above example, the "filtering" functions of Advanced Menu Mode are not used, because the **Title** menu path does not require filtering criteria. However, some of the other categories provide additional steps as described in the following example for selecting songs by **Artist**:

To select songs by Artist

1. Click on the **Artist** menu item to activate the Artist Selection screen, which lists the Artists in the music database sorted by alphabetical order. To find a particular Artist, click on the alphabet letters at the top of the screen. If there are many artists beginning with the selected letter, the results will be listed in multiple pages which can be accessed by using the numbers at the top of the page, or by using the **<<Previous** and **Next>>** links at the bottom of the page.

Music Selection
Title
Artist
Album
Genre
Net (By Category)
Net (By Station Name)
Lists
Favorites

Web server **Music Selection** menu

| Title | Artist | Album | Genre | Net | Lists |

Select by Album

Front panel main menu display

Web server **Title** Selection Page

Web server **Artist** Selection Page

2. To immediately begin playing all songs by an Artist in place of the currently playing song, click **Play** to the left of the check box.

3. To add all songs by an artist to the Play Queue, select the checkbox next to artist name, then click the "**Add to Queue**" button. These songs will play after the songs already in the queue are done playing.

4. To find songs from a particular **Album**, **Genre**, or **Title** by an Artist, click on the links to the right of the artist's name.

5. When selecting the **Artist** by Album, Genre, etc... the current selection will appear at the top of the screen. To clear the criteria and start over, click on the menu item on the left side of the screen to start over.

6. Follow this procedure for the Album and Genre categories that utilize the filter function.

*Web server **Album** screen*

*Web server **Genre** screen*

AudioTron Reference Manual

Play Queue

You can view and edit the songs in the Play Queue from the web server **Play Queue** screen, accessed by pressing the Play Queue menu item on the left.

The currently playing song will have a "**← Now Playing**" designation next to its label. To jump to another song, click on **Play** next to the title.

To remove a song or group of songs from the Play Queue, select the checkbox next to the item(s) and press the "**Delete from Queue**" button at the bottom of the screen.

Favorites

The 16 Favorites buttons (labeled 1 – 16) and 4 Preset buttons (labeled A – D) on the remote control can each be assigned to load preset song lists into the Play Queue. These 20 buttons can be assigned from either the remote control (with the **Add FAV** button) or from the web server **Favorites** screen.

The Favorites buttons may be assigned songs by any of the categories in the main menu, which includes individual title, artist, album, genre, or playlist. For example, you can assign a single song title or all of the songs by an artist to a Favorites button. The following example describes how to assign a Favorites button to load songs into the Play Queue:

To assign songs to the Favorites buttons

1. Click on the **Favorites** menu item to activate the Favorites screen, which shows the assignment of the 16 Favorites buttons and 4 Presets buttons.

2. To play any of the Favorites or Preset buttons which have music assigned, click on **Play** next to the check box.

3. For this example, lets assign an album to Favorite button #3. Click **Configure** in the line for Favorite #3, then select **Album** from the left menu to activate the Album selection screen.

4. Check the desired album from the list, then click the **Set Favorite** button at the bottom of the screen to assign all songs in that album to Favorite button #3. Now, pressing button #3 on the remote control will immediately play the songs from the assigned album.

5. Song titles, genres, artists, lists, and Internet radio stations may be assigned to the other buttons using a similar procedure.

Web server **Play Queue** Screen
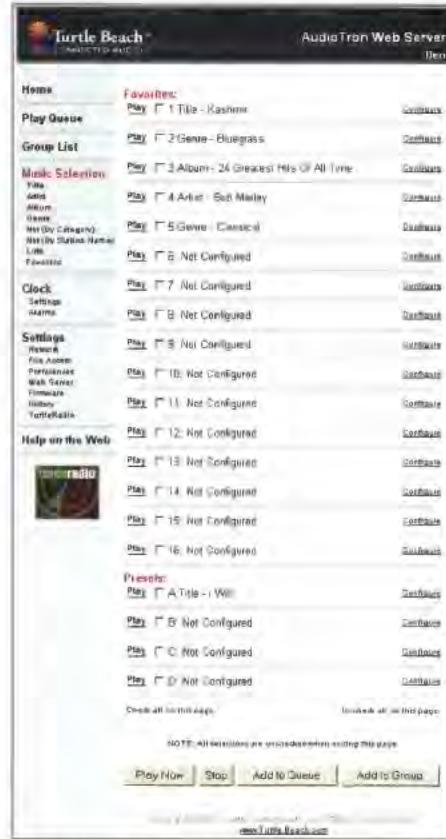
Web server **Favorites** screen

Group List

The Group List is a special play list to which you can add songs from the AudioTron front panel and remote control **Add** buttons or from the web server selection screens.

To play the songs in the Group List, select it from the **Lists** item on the main menu display or the **Lists** button on the remote control. The following example describes how to assign songs to the Group List from the web server:

To assign songs to the Group List

1. For this example, assume we'd like to add several songs to the Group List.

2. Click **Title** under the **Music Selection** menu to activate the Title screen. Select the check box next to the name of the desired songs.

3. Scroll to the bottom of each page with a checked song title and press "**Add to Group**."

4. When you're done, click on the **Group List** menu item to activate the Group screen. All of the selected songs should be listed in the screen.

5. To play the songs, press the **Play Group** button. You can also play the Group List by clicking on the **Lists** menu item and selecting **Group List** from the Playlist screen.

6. To remove specific songs, check the box next to the songs, then press **Delete from Group**.

7. To remove all songs, press **Clear Group**.

Web server Group List screen

Netflix, Inc.   Exhibit 1009

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Clock / Alarm

AudioTron is not only an amazing digital media playback device, but it can be one of the most accurate and configurable alarm clocks in your home!

Imagine waking up to your favorite MP3 playlist or Internet Radio, from an alarm that gets the exact time from an Internet time server! When the clock feature is enabled, the AudioTron front panel displays the time and date, along with any alarm settings you have configured.

```
 |:35   AM - Tue, May 07, 02
```

AudioTron clock display

When the Clock feature is activated, the AudioTron LCD display will look like the illustration above. If the alarms are set, they will be indicated above the date display.

➲ *Pressing the Stop button on the front panel will activate the main menu display for a brief interval. While the main menu is displayed, you can select and play music just as if the clock display were disabled.*

This section describes how to use the web server Clock Settings and Alarms screens to set the clock and alarms. Here's a quick overview of how they work:

1. To turn on the clock display, click on the **Clock → Settings** menu item to activate the **Clock Settings** screen. From there, select the **Display Mode** from the drop-down menu at the top.

2. Next, select where the clock gets its time and date and how they're displayed.

3. To set the alarms, click on the **Clock → Alarms** menu item to enter the **Alarm Settings** screen.

4. The **Snooze** function determines how long it will take the alarm to turn back after you've pressed any button or the knob on the front panel (except the Stop button).

5. The **Nap alarm** puts AudioTron into an "instant alarm" mode where it plays music once the Nap time setting is reached.

6. **Alarm 1** and **Alarm 2** work just like the alarm on a clock, where you can set the time and day for each one.

7. To change the alarm sounds, click on the **Change Alarm Sound** button under each alarm. This lets you navigate through your music library to find a specific song to play when the alarm sounds.

Clock - Settings

The **Clock Settings** screen displays the settings relevant to configuring the Clock feature. This screen is accessed by clicking on the **Settings** menu item under the **Clock** section at the left of the screen.

Clock Configuration

Display Mode: The clock feature can be enabled several different ways by selecting the options in the **Display Mode** pull-down menu settings and then pressing the "**Set Clock Config**" button:

- **Disable Clock:** This option turns off the clock feature.

- **Enable Clock using TurtleRadio:** This option turns on the clock feature and obtains the time from the TurtleRadio time server whenever you use the "**Search for New Stations**" feature in the TurtleRadio Settings screen. Although this is the easiest method of enabling the clock, the TurtleRadio server is not a true time server, so the actual time setting is accurate to only to 30-40 seconds as compared to the time obtainable from a true time server, as explained below.

- **Enable Clock using Manual Setting:** If your AudioTron is not connected to the Internet, or if you'd like to set your clock ahead or behind several minutes, you can use this setting to manually set the time, per the settings in the **Manual Time Setting** below.

Web server **Clock Settings** screen

- **Enable Clock using Time Server Setting:** This option uses the Internet Time Server Setting below to set the time using an Internet Time Server. This option requires an Internet connection and provides the most accurate time possible. A list of time servers is available at the Turtle Beach web site (click on the menu item "Help on the Web" for more information.)

Set Time Zone: This pull-down selection lets you set your time zone so the AudioTron clock can properly display the time in your area. Note that if you use the manual time settings, this step is not necessary.

Display Seconds: When enabled, pressing the "**Set Clock Config**" button will set the clock to display Hrs: Mins: seconds. When disabled, the display will indicate Hrs: Mins.

Display Time During Playback: When enabled, pressing the "**Set Clock Config**" button will cause the time to be displayed during music playback, except when changing songs or selecting a new item. When unchecked, the clock display will appear only when the unit is not playing digital music.

24-Hour Clock: When enabled, pressing the "**Set Clock Config**" button will set the clock to display in 24-hour format.

Daylight Saving Time: When enabled, pressing the "**Set Clock Config**" button will move the time forward one hour from the time it receives from a Time Server. Note that enabling this will not cause the AudioTron to automatically move the time forward or backward twice a year!

Clock - Alarms

The **Alarm Settings** screen displays the settings relevant to configuring the clock alarms. This screen is accessed by clicking on the **Alarms** menu item under the **Clock** section at the left of the screen. AudioTron can sound two traditional alarms (Alarm 1 and Alarm 2) and one "Nap Alarm."

For example, you can use Alarm 1 and Alarm 2 to wake yourself up in the morning, remind yourself about an appointment, or have AudioTron start playing "Auld Lang Syne" on New Year's Eve, while the nap alarm can be used if you'd like to have the AudioTron start playing music after a certain number of minutes or hours from the time you enable it.

Stopping the Alarm and Snoozing

When the alarm is sounding, pressing the knob on the front panel or any of the 16 Favorites buttons on the remote control will cause the unit to "snooze." Pressing the stop button will cause the alarm to stop playback.

➲ If an Alarm has been sounding for more than 30 minutes after the last time you hit Snooze, the AudioTron will turn off the Alarm automatically.

Web server Alarm Settings screen

Snooze Function Setting: This setting determines how long AudioTron will remain silent after the "Snooze button" has been pressed during alarm playback.

Nap Alarm

Nap Interval: This setting sets the time before AudioTron will start playing the **Current Nap Alarm** sound. For instance, if set to 1 minute, the unit will start playing the selected music one minute after the **Set Nap Alarm** button has been pressed.

Soft Wake: When enabled, the alarm will turn on gradually and increase in volume until reaching the specified volume level. Soft Wake will have no effect when using the digital audio output.

Change Alarm Sound: Pressing this button lets you select the song, group of songs, or Internet radio station that will play when the Alarm is triggered. To preview the alarm, press the "**Audition**" button next to the Alarm. To stop the preview, press the **Stop** button.

Alarm 1 and Alarm 2

The features of Alarm 1 and Alarm 2 are identical. The alarms operate independently. No settings will take effect until the **Set Alarm** button is pressed.

Enable: When checked, the Alarm is enabled (as indicated on the front panel display.)

Soft Wake: When checked, the alarm will turn on gradually and increase in volume until reaching the specified volume level.

Alarm Time: Selects the Alarm time (don't forget to specify AM or PM!).

Alarm Days: Specifies what days of the week you would like the alarm to sound. By default, Monday through Friday are selected.

Alarm Volume: Changing this value will specify a new volume setting for the alarm.

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AudioTron Reference Manual

Settings

Settings - Network

The web server **Network Settings** screen lets you configure AudioTron's network settings and is accessed by clicking on the **Network** menu item under the **Settings** section at the left of the screen.

Test Internet Connection: Press this button to check if AudioTron can access the Internet.

Use DHCP: If your network has a DHCP server, selecting this option will cause AudioTron to obtain its IP address information from the DHCP server.

Use Static IP Settings Below: Select this option if you do not have a DHCP server on the network or if you wish to specify your own network parameters. When this option is enabled, the settings in the sections "**Static IP Settings**" will take effect.

Static IP Settings

These settings will only be in effect if the "**Use Static IP Settings Below**" check box is selected. Press the "**Save Connectivity Settings**" button to activate the settings below:

Network Interface: Select **Ethernet** if AudioTron is connected to a 10BaseT Ethernet network or **Phone Line** if to an HPNA 2.0 network.

The settings for the following categories may be obtained from the AudioTron Setup Utility "**View Test Results**" screen:

IP Address: AudioTron's IP address.

Subnet Mask: IP Subnet Mask assigned to network.

Gateway: The IP address assigned to the network gateway. The gateway device provides Internet access to the network devices.

DNS Server: The IP address assigned to your network Domain Name Server (DNS). The DNS server finds Internet web sites by the name assigned to its IP address number.

Proxy Settings

Press the "**Save Proxy Settings**" button to activate the settings below:

Enable Proxy: If your network is using a proxy server, check this box, then enter the proxy address and port. Note that AudioTron will not support proxy server authentication.

Proxy address: The IP address of your proxy server.

Proxy port: The port of your proxy server.

Ping Host

This setting is useful for gateway (try to ping an IP) and DNS (try to ping a domain name) tests. Enter the IP address and press the **Ping Host** button to ping the device at that address.

Front Panel

"**Disable network config from front panel**" lets you disable the editing of network configuration settings from the AudioTron front panel. To activate, check the box and press the **Submit** button. This option is useful in situations where the AudioTron is in an area where the network settings may be inadvertently altered by a curious user, which in turn could make the unit inoperable.

*Web server **Network Settings** screen*

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Settings - File Access

The File Access Settings screen lets you configure features that relate to playback of the digital music files in your PC music library. This screen is accessed by clicking on the **File Access** menu item under the **Settings** section at the left of the screen.

Current number of files found: This is the number of music files found in your music library.

Check for New Files: Pressing this button causes AudioTron to search the PCs (i.e. "Hosts") on your network for new music files. Use this whenever you add music files to your music library or whenever you add PCs to your network.

File Playback: Check "**Enabled**" and click "**Save File Playback Settings**" to configure AudioTron to play songs from your music library. Disable this feature and enable the Internet radio function in the TurtleRadio Settings screen if you want to use AudioTron only as an Internet radio device.

➲ *If the File Playback option is disabled, AudioTron will not be able to play music from your music library.*

*Web server **File Access Settings** screen*

Additional Pre-buffering: AudioTron plays music files by transferring data from the PC hard drive to AudioTron's internal memory (called a "buffer") via the network. The music file is transferred to AudioTron as individual "packets" of data interleaved with other network data. AudioTron's buffer is designed to hold enough data packets to assure that any temporary loss of data from the stream will not cause the audio playback to stop, or drop out.

The "**Additional Pre-buffering**" option determines the size of the buffer. With a lower setting, the time between pressing the Play button and the start of the song will be shorter because the song will begin to play after a smaller percentage of the buffer is filled. With a higher setting, there will be more of a delay because the song will not play until a greater percentage of the buffer is filled.

If the buffer is too small, it may cause "dropouts" if increased network traffic causes the buffer to empty before new data arrives. If the buffer is too large, it may cause a noticeable delay between the time the **Play** button is pressed and the time the song begins to play.

Since MP3 and WMA music files are compressed, they require a smaller buffer than WAV files (which can be up to 10 times larger.) Therefore, WAV files will exhibit a longer delay between the time **Play** is pressed and when the song begins playing.

Windows 98/Millenium Share Password: If you password-protected shared directories that contain song files, enter the password here so AudioTron can access the songs. Press "**Save Share Password**" to load the password into AudioTron.

Windows NT/2000/XP User Name: Sets a "User Name" used when the host PC is running Windows NT 4.0, 2000, XP or Linux. Note that the user name is case sensitive. Default is "atron". Press "**Save**" to load the entry into AudioTron.

NT/2000/XP Password: Sets a "User Password" used when host PC is running Windows NT 4.0, 2000, XP or Linux. Note that the password is case sensitive. Default is "atronpass". Press "**Save**" to load the entry into AudioTron.

Click to configure share search options: Click on this option to activate the Shares Configuration screen described in the next section.

Share Search Options

The **Share Search Options** screen lets you configure the directories where AudioTron will search for music files. To access this screen, click on "**Click to configure share search options**" at the bottom of the **File Access Settings** screen.

➥ *For details on how AudioTron uses shared folders to find songs on your networked PCs, see the section entitled "**AudioTron and Shared Directories**".*

Share Search Mode

These three options determine where AudioTron will look for songs on your networked PCs after you press the "**Check for New Files**" button in the File Access Settings screen, or activate the "**Check for new music files**" option on the front panel.

To select one of these three options, check the option and then press the **Save Share Search Mode** button.

Option 1 - Search default folders in all shares: When this option is selected, AudioTron will only search for music files in shared directories with the specific names described in the section entitled "**AudioTron and Shared Directories**". Choose this option if you configured your music directories with the AudioTron Setup Utility and you do not have music files in directories with other names.

Web server Share Search Options screen

Option 2 - Search all folders in all shares:
When this option is selected, AudioTron will search for music files in every shared folder on every networked PC. If you have many shared folders, using this option could significantly increase the time to search for music. Thus, it is suggested that this option only be used if you have music files stored in many folders that would be too difficult to consolidate into the default folders in option 1.

Option 3 - Search all folders in shared folders listed below: When this option is selected, AudioTron will only search for music files in the folders listed in the **Configure Shares Manually** section below. Use this option if your music is stored in several shared folders with names that do not conform with the default folders in option 1.

Configure Shares Manually

This section, activated when option 3 is selected, lets you specify the shared folders with your music files so that AudioTron will search only those folders.

Clicking the **Search Network for Shares** button will activate a search for all of the shared folders on your network, which will be listed next to "**Found Shares**". After the search is done, you can either copy and paste the folder names from the list into the boxes below, or type the names directly into the boxes. Clicking the **Save Manual Search Settings** button will cause AudioTron to search only the listed folders when you press the "**Check for New Files**" button in the File Access Settings screen or activate the "**Check for new music files**" option on the front panel.

Turtle Beach

Settings - Preferences

The Preferences Settings screen lets you configure the way some of AudioTron's display and other functions operate. This screen is accessed by clicking on the **Preferences** menu item under the **Settings** section at the left of the screen.

Functional Preferences

Knob Default Function: Checking "**Volume**" will cause the knob to act as a volume control when turned while a song is playing. When the knob is pressed, it acts as "song position", letting you jump to a specific point in the song by turning the knob as the song is playing.

Checking "**Position**" will reverse these functions, so the knob powers up as a song position control and when pushed, controls volume.

Select Album by "Artist-Album": When enabled, the display will place the artist name prior to an album name.

Select Title by "Title-Artist": When enabled, the display will place the artist name after the song title.

*Web server **Preferences** screen*

Advanced Menu Mode: When enabled, turn on **Advanced Menu Mode** on the AudioTron front panel display. Un-checking will enable **Simple Menu Mode**. See the separate section in this manual explaining how these modes operate.

"More Songs Like This": When enabled, the remote control Artist, Album and Genre buttons will no longer operate as menu navigation buttons. Instead, pressing ARTIST, ALBUM, or GENRE, on the remote control will clear the existing play queue, and play only songs of the corresponding category. Note that this will not stop the currently playing song. See the separate section in this manual for more details on this feature.

Display Preferences

Display During Playback: Checking any of the four options will display the option during song playback. For instance, if Bitrate is enabled, the bitrate of the song will be displayed along with it's title.

Top Line Scroll: Continuous scrolls the top line of the front panel display continuously if the message is longer than the number of characters. **Once** will scroll the line once and stop. **Never** will truncate characters that do not fit in the display.

Bottom Line Scroll: Same as the **Top Line Scroll** option, except it applies to the bottom line of the display.

Message Timeout: Controls how long the temporary messages on the front panel will be displayed.

Settings - Web Server

The Web Server Settings screen lets you configure the way certain functions on the web server operate. This screen is accessed by clicking on the **Web Server** menu item under the **Settings** section at the left of the screen.

Refresh Time: Sets the data refresh time of certain web interface functions.

Results Per Page: Sets the default number of items to display on Music Selection, Play Queue and Group List screens.

AudioTron Location: Lets you assign a name to identify the AudioTron being controlled by the web server, making it easier to identify when multiple AudioTrons are on your network. The name will appear at the top right of each web server screen (e.g. in the illustration, the name "Den" has been assigned and appears at the top right.

Web Server Password: Lets you restrict access to the web server Settings pages by allowing access only with the proper password. The default password (**admin**) can be changed by entering a new password in this box. The password can be reset to the default **"admin"** by using the **"Restore Factory Defaults"** as described above, or from the AudioTron front panel Options.

Confirm Password: Retype the password into this box to make sure it's correct.

Password Protect Music Selection Pages: To also restrict access to the Music Selection pages, check this box and press the **Save Web Server Settings** button. This will effectively require a password to use any of the web server features.

➲ *If you disable the Front Panel Network settings from the Network Settings screen and forget your web server password, the unit must be returned to the factory for reprogramming, as there will be no way to retrieve the password from the web server or front panel options.*

Web server Settings screen

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AudioTron Reference Manual

🌴 Turtle Beach

Settings - Firmware

The Firmware Settings screen lets you update AudioTron's firmware, which you can download from the Turtle Beach web site. This screen is accessed by clicking on the **Firmware** menu item under the **Settings** section at the left of the screen.

➔ *See the section entitled "**Updating AudioTron's Firmware**" for more details on the firmware update process.*

Check for new Firmware: Press the **Search** button to initiate a search for the AudioTron firmware file on all of the directories accessible to AudioTron (as determined by the **Shares Access Settings** screen.)

Current Found: This will display the latest firmware version found in any of the directories accessible to AudioTron.

Current Installed: This displays the firmware version currently installed in the AudioTron.

Restore Factory Defaults: Clicking the **"Restore Defaults"** button will reset AudioTron to its original factory default settings and discard all user-customized changes. When using this option, turn the rear panel power switch off and back on to reset AudioTron.

Web server Firmware Settings screen

Update Firmware: If **Current Found** is a newer version than **Current Installed**, then press the Update Firmware button to load the newer version into AudioTron. After the update is complete, turn AudioTron off and back on with the rear panel power switch.

Netflix, Inc.   Exhibit 1009

Settings – Network History

The History screen displays the events that occurred when AudioTron logged on to the network, which is useful for troubleshooting network issues. This screen is accessed by clicking on the **History** menu item under the **Settings** section at the left of the screen.

Some of the information displayed includes:

Local IP Address = x.x.x.x: The IP address that AudioTron is currently using.

AudioTron Name = Atronxxxx: A unique name assigned to AudioTron that can be used in the web browser to access the Web Server.

Local MAC address = x:x:x:x:x:x: The local MAC (Ethernet) address for AudioTron.

Local Net Mask = x.x.x.x: The net mask AudioTron is using.

Local Gateway = xxx.xxx.xxx.xxx: The IP address of the node that connects AudioTron to the Internet for using Internet radio.

Local DNS Server = xxx.xxx.xxx.xxx: The address of the Domain Name Server that translates URLs to IP addresses.

Web server **Network History** screen

Initial Search at x days x hrs x mins:
Indicates that the first search of the network occurred at this amount of time since the AudioTron was booted.

Host [hostname] found at IP x:x:x:x: Indicates that the host was found at the indicated IP address.

Update Search at x days x hrs x mins: Indicates when the last search for new music occurred.

Share [sharename] has xx new songs: Indicates the number of new songs found on the indicated share.

[Sharename] - Share Access Denied: Indicates that access to this share was denied because the share password was wrong.

[Sharename] – Error accessing share: Indicates that there was a non-password related error accessing this share.

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Settings - TurtleRadio

The TurtleRadio screen displays the settings relevant to configuring the TurtleRadio feature. This screen is accessed by clicking on the **TurtleRadio** menu item under the **Settings** section at the left of the screen.

Total number of stations found: This shows the number of Internet radio stations found at the TurtleRadio web site, which represents the number of stations listed in the **Net (by Station Name)** screen.

Check for New Stations: If the AudioTron has access to the Internet via the network, pressing this button will connect with TurtleRadio.com and search for new Internet radio stations. The number of stations found will be indicated above the button.

➲ *To check if AudioTron can access the Internet via the network, use the **Check Internet Connection** feature on the Network screen.*

Visit TurtleRadio on the Web: If your PC has access to the Internet, clicking here will launch the TurtleRadio web site, where you can configure Internet radio stations for AudioTron, and sign up for TurtleRadio.

*Web server **TurtleRadio Settings** screen*

TurtleRadio Player ID: Enter your TurtleRadio Player ID to access your TurtleRadio station list. (The TurtleRadio Player ID is issued to you after registering at the TurtleRadio web site.) Press "**Save**" to load the entry into AudioTron.

Internet Radio Enabled: To activate the AudioTron Internet radio feature, check this box and press "**Save TurtleRadio Settings**".

➲ *Note that the Internet Radio feature is turned off by default from the factory*

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🌴 Turtle
Beach

Web Server "Thin-Client" mode

The AudioTron web server can run in a "thin client" mode compatible with the smaller screen on a PocketPC or certain other small web access devices.

To use a PocketPC to control AudioTron from the web server, the PocketPC must be connected to the network, either through a wireless link, such as an 802.11 interface, or an Ethernet interface with CAT-5 cable.

To access the web server from the PocketPC, enter the AudioTron name into the browser as you would on a standard PC. AudioTron will automatically detect the browser type and activate the "thin client" page style to format the web server screens for the smaller PocketPC screen.

You can also access the thin client page by typing in the AudioTron's IP address. For example, if AudioTron is assigned to the IP address 192.168.1.100, you'd enter the following into the browser:

http://192.168.1.100/index_thin.asp

Compaq iPaq PocketPC

Using a PocketPC as a Wireless Remote Control

The most useful application for running the web server from a PocketPC is to control AudioTron from a wireless Ethernet connection via an 802.11 Wireless Access Point (WAP) and a wireless network adapter for the PocketPC. This configuration turns the PocketPC into a remote control for every AudioTron on your network.
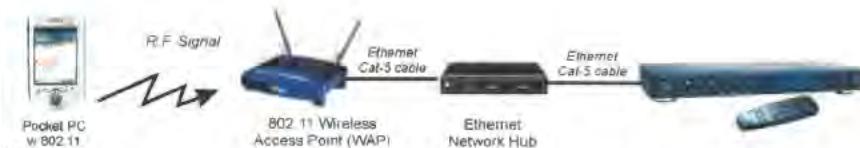
Controlling an AudioTron with a PocketPC RF remote

In this illustration, the wireless iPaq handheld device includes an 802.11 adapter, allowing it to communicate with the Wireless Access Point (WAP). The WAP is configured as a node on the network via a hub. This enables you to control AudioTron from the iPaq's browser from anywhere in your home.

For more information on creating a wireless access point to your network, visit www.linksys.com and www.compaq.com. For more information on the Compaq iPaq PocketPC device, visit www.compaq.com.

Maintaining your Music Library

Backing up the Songs in your Music Library

One of the advantages of a digital music library on a PC is that you can back-up your entire music collection and restore it should something happen to your originals. A music collection of 5,000 songs recorded in WMA or MP3 formats can consume more than 25GB of hard drive space, which is a significant amount of data. To play it safe, you should back up this data to other media just in case your music hard drive fails. After you've backed up the library, you can rely on incremental back ups for new music that has been added to the library since the initial full backup.

Backing up this data can be accomplished in a number of ways:

- **Tape Drive Backups:** Tape backup provides an inexpensive and convenient way to back up large amounts of data. A major advantage of tape is that you can store it in a fireproof box or off site. A disadvantage is that it is slower to back up and restore than, say, backing up to another hard drive.

- **Adding a second hard drive to one of your PCs:** Large-capacity hard drives have become cost-effective enough to use as a backup for a music library. Connecting a second large capacity drive to your music library PC lets you copy the library from the primary drive to the backup drive using Windows Explorer. When connecting the second drive, its best to use the secondary IDE bus that is not connected to the primary drive, since data transfer rates on drives connected to separate IDE cables are faster than drives connected to the same IDE cable. Although using a second drive is fast and convenient, the drawback is that it cannot be stored off site and it too can crash—although in most cases it is unlikely that both drives will crash simultaneously.

- **Adding a removable hard drive bay:** Placing the second drive in a removable drive bay lets you safely store the drive either off site or in a fireproof box, affording much of the same benefits of a tape backup with the speed of a hard drive.

- **Adding a Network Attached Storage (NAS) device to your network:** A NAS can be used to store your music library files on a drive that does not require a PC, so you can play your music with AudioTron without the need for a PC to be powered on. Of course, the data on the NAS drive also should be backed up, so one of the other methods for backing up the data should be implemented for the NAS.

- **Backing up your music files to Recordable Compact Discs (CD-R):** AudioStation can be used to burn data CDs from your music library. These data CDs not only provide backup for the library, but can also be used to play your music library on CD players compatible with MP3 and WMA file formats. Although slower than other methods, this serves the purpose of backup, off site storage, and a source of music while travelling. With a typical 640MB CD, backing up 25GB of music would require approximately 40 CDs.

Adding Songs or PC Hosts to your Music Library

Whenever you add songs or playlists to your music library, each AudioTron connected to the network must rescan the library so the internal database tables can be updated with the new data. Also, if you add PCs ("hosts") to the network, each AudioTron must rescan the network in order to recognize the new hosts. The network scan can be initiated either from the AudioTron front panel or from the web server as follows:

- **From the Front Panel:** Press the **Options** button to display "**Check for new music files?**" Press the control knob to select "**Yes**" to search the network for hosts, music files and playlists not already in AudioTron's local database. If new music files or hosts are found, they will be added to the database.

- **From the web server:** Go to the web server **File Access** page and click on the **Press to Check** button next to **Check for New Files**.

➲ *If there are multiple songs with the same name in the music library, AudioTron differentiates between them by adding a number in parentheses after the name of the song (e.g., "Song" and "Song - (1)".)*

Note that the "**Search for new music**" function does not remove songs or playlists that have been deleted from the music library, nor does it capture new tag information for previously logged songs. Refreshing the AudioTron database for these changes requires that you reboot AudioTron from the rear panel power switch so it re-scans for music and completely rebuilds its internal database.

If AudioTron fails to find music that you are certain is on one of the PCs in your network, run the **AudioTron Setup Utility** (as described in the Setup Guide) to determine if the files are accessible to AudioTron. For example, if the files are in directories that are not shared, AudioTron will not be able to access them. The web server provides several different options for setting up your music directories, and the AudioTron Setup Utility "**Fix It**" feature lets you easily configure a directory for AudioTron access, as described in the Setup Guide.

🐢 Turtle
Beach

Managing Your Music Library with AudioStation

➲ *See the AudioStation reference manual on the AudioTron CD for a detailed description of features.*

AudioStation is a valuable tool that lets you play audio CDs, transfer CD tracks to your digital music library, play songs from your music library, listen to Internet radio and manage your TurtleRadio stations. AudioStation's file management architecture closely resembles that of AudioTron, making it easier to manage your library than using other PC jukebox programs.

AudioStation can be used to build and manage your music library and Internet Radio station lists.

The tabs on the left of the main screen activate AudioStation's modes of operation:

- **CD Tab:** From here, you can play and record CDs from your PC's CD drive.

- **Music Library Tab:** From here, you can listen to your music library, burn custom CDs of your favorite songs and listen to Internet streaming audio configured in the Internet Tab.

- **Internet Tab:** From here, you can access the TurtleRadio web site to configure custom radio stations, as well as access music web sites for downloading music files.

AudioStation lets you easily manage and play your music library using similar "selection lists" as AudioTron, including:

- **All Tracks (equivalent to "Title" in AudioTron's selection display)** – Displays all tracks in the music database. In addition to MP3, WMA and WAV files (which are compatible with AudioTron) the All Tracks feature will display MIDI files and AVI movie files, which can be played on your PC with AudioStation.

- **Albums** – Displays songs grouped by CD title.

- **Artists** – Displays songs grouped by Artist name.

- **Genres** – Displays songs grouped by Genre.

- **TurtleRadio** – Just like the AudioTron **Net** main menu selection, this displays your custom Internet radio stations list downloaded from the TurtleRadio web site.

- **User Playlists (equivalent to "Lists" in AudioTron's selection display)** – Displays songs grouped into custom playlists.

Benefits of Using AudioStation

For AudioTron users, the benefits of using AudioStation instead of another PC jukebox program include:

- Guaranteed compatibility of tag and song formats of CDs ripped using AudioStation.

- Batch processing of tag data. For example, it's easy to change the artist name or genre of a large group of songs.

- CD tracks can be ripped to WAV format with proper tag information.

- You can listen to TurtleRadio stations, add stations to your custom station list and edit station names that are displayed in AudioTron.

- The AudioStation and AudioTron music database views are very similar, so it's easier to manage your music database.

Digital Music File Formats

AudioStation plays and records music files in MP3, WMA and WAV formats. MP3 and WMA compressed audio formats reduce the size of an audio file by removing some of the sounds determined to be "inaudible" by the encoder. Although the playback quality of these compressed audio formats is good enough for most listeners, some audiophiles can hear the difference between compressed and uncompressed audio. For this reason, AudioTron is capable of playing true CD-quality audio in uncompressed WAV format when used with an Ethernet network.

➲ *A unique feature of AudioStation is its ability to embed tag data into WAV files compatible with AudioTron.*

WAV format preserves CD-Quality audio, which is sampled at 16 bits 44.1kHz. Although this is the purest form of audio, it also takes up a significant amount of hard drive space (a typical three-minute song consumes more than 30MB of hard disk space.) Playback of uncompressed WAV audio will be most important for audiophiles who can discern the loss of dynamic range and other limitations of compressed audio formats. For these listeners, maximum fidelity will be achieved when playing WAV files through AudioTron's S/PDIF optical digital output.

MP3 (MPEG-1 Layer III) format uses a compression process that implements psychoacoustic principles to reduce the file size while preserving a high level of sound quality. Digital music files encoded using MP3 technology ("MP3 files") are very popular on the Internet, due to their combination of good sound quality and small file size (a three-minute song can be reduced to less than 3MB—a factor of 10 reduction as compared to WAV format.)

WMA (Windows Media™ Audio) format was developed by Microsoft as an alternative to MP3 for compressed digital audio. Similar in many ways to the equally common MP3 format, WMA offers equal sound quality in an even smaller file size.

In most cases, the MP3 or WMA formats offer acceptable listening quality, especially when recorded at the higher sample rate options. However, the following table lists some of the issues to consider when deciding which format to use for storing music files:

WAV format benefits	WAV format drawbacks
• Preserves all of the qualities of the original CD recordings by maintaining the original 16-bit, 44.1kHz standard used for CD recordings. MP3 and WMA formats remove audio information that is determined to be "inaudible" in order to compress the file size. • The highest fidelity is achieved when using AudioTron's optical digital output with uncompressed WAV format. • WAV format lets you burn high-quality custom CDs from your music library with AudioStation. Although you can also burn a CD from files saved in MP3 or WMA format, these compressed formats must be converted to uncompressed WAV format prior to creating the CD. This process will reduce the audio quality of the resulting CD.	• Typically, WAV format does not include song tags as do MP3 and WMA formats. So, AudioTron will only display the file name and can't display or sort songs by Title, Artist, Album, Genre, etc.. However, AudioStation lets you add tag information to WAV files so that they can be sorted and displayed just like WMA and MP3 formats. • WAV files cannot be transferred to portable digital audio players. Typically, these players are only compatible with MP3 and WMA formats. • WAV format can take up more than 10 times as much hard drive space as MP3 and WMA formats. • AudioTron does not support WAV format on an HPNA network. An Ethernet network is required for playback of WAV files.

Song Tags (Title, Artist, Album, Genre, etc.)

A song "tag" (also called an "Attribute" or "Track Property") refers to data embedded as a text header in the MP3, WMA or WAV file. The data includes information about the track (e.g. artist, title, genre, etc.) which can either be automatically obtained from the CDDB database or entered manually.

When recording CD tracks to the hard drive, the tag information can be viewed in AudioStation's **Track Information** dialog, accessed by right-clicking on a highlighted track and selecting **Track Information**.

AudioStation "Track Information" dialog shows Tag data.

The proper management of tag data is important for optimum use of AudioTron because it affects how songs are accessed in the main menu. For this reason, it is suggested that the track tag information be carefully checked each time a CD is converted to digital format, so the tag data will be consistent. For example, it is best to avoid entering artists as "The Beatles", "Beatles" and "Beatles, The", since this would create three separate categories for the same artist and make it difficult to find tracks by that artist.

Unfortunately, there are different versions of tag formatting, which can lead to incompatibilities among tag data when the music files have not been recorded using the same PC jukebox program, or when music is downloaded from the Internet. Using AudioStation as your CD recording software can avoid these issues by assuring consistency in tag data format. To modify groups of song tags, drag and drop the song files from the right side "playlist" screen into the appropriate category on the left side "library" screen and AudioStation will change the tag accordingly. This operates like a "batch editor" for tags and is useful for cleaning up inconsistent tags.

For more information on tags, check out the web site www.ID3.org.

➜ *AudioTron can display tag information saved in the Windows Media (WMA), MP3 ID3 version 1.0, 1.1 and 2.3 formats and WAV files tagged in AudioStation. Tags in other formats may not display properly.*

Security Features in WMA Music Files

The WMA file format provides a "security" feature that encrypts song files so they may be played but not copied. AudioTron cannot play music files encrypted with this security feature.

➜ *AudioTron cannot play songs recorded with the "secure" feature enabled. The security setting in Windows Media Player and AudioStation should be turned off before converting CD tracks to WMA files for use with AudioTron. Once recorded, a song's security feature cannot be turned off. The song must be re-recorded with the security option turned off.*

To turn off the WMA recording security feature in AudioStation

1. Activate the AudioStation "**Preferences**" dialog by clicking on **Options →Preferences**.

2. Click on the "**Digital Rights**" tab and uncheck the "**Secure my music when recording**" option.

3. Click the "**Apply**" button, then click on the "**OK**" button to exit.

AudioStation Digital Rights Tab.

Using AudioStation to Create Playlists

Playlists are custom song lists created in AudioStation (or other compatible PC jukebox program) and accessed from the AudioTron "Lists" menu category. Playlists are stored in the AudioStation Music Library tab under the "**User Playlists**" folder. When you click on this folder, it expands to show all of the custom playlists you've created. Clicking on a playlist will list all of the songs in the Playlist screen.

Library

User Playlists is the last category in the AudioStation Library Folders list

Playlists adhere to two types of formats, M3U and PLS, each compatible with AudioStation and AudioTron. AudioStation exports playlists to M3U playlist files, which can be read by most other PC jukebox players. M3U files are lists of 'pointers' to the locations of MP3 or Windows Media (WMA) files.

To create a User Playlist

1. Click on the **Music Library Tab**, then click on the + next to the "**User Playlists**" folder in the Library tree (on the left side of the screen). Right-click "**default**" and select **New Playlist**, or click on the **New Playlist** button above the Playlist pane (on the right side of the screen) in the Music Library tab window.

2. Drag-and-drop tracks from the Playlist screen on the right side to the User Playlist folder you've defined on the left side. For example, select **All Tracks** in the Library tree, then "drag and drop" tracks from the **Playlist** pane (on the right) to the Playlist folder in the **Library tree** on the left.

▪   *You can select a group of tracks by holding down the Control (Ctrl) key and left-clicking on the Tracks that you wish to select. Or, to select a group of consecutive Tracks, click on the first Track that you wish to select. Then hold down the Shift key and click on the last Track in the list that you wish to select. All Tracks between the first and last Tracks in the list will be selected.*

3. You can also add tracks to your playlist by highlighting the track and pressing "**Send To → User Playlists**". This will activate a "fly out" menu listing all of your User Playlists.

4   To re-order the tracks in a list, drag-and-drop the track to a new position in the list.

To add a Track to a User Playlist

To add more tracks to an existing User Playlist, highlight the track in the Playlist window on the right side and drag-and-drop it to the User Playlist folder in the Library tree in the left side.

To Import a Playlist

Playlists in M3U and PLS formats that were not created with AudioStation can be imported to the User Playlist folder with the **File Menu → Import Playlist** feature.

You can also add tracks to your playlist by highlighting the track and pressing "**Send To → User Playlists**".

AudioTron Reference Manual
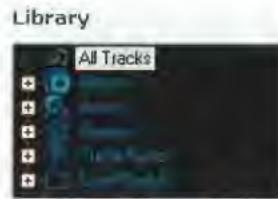
Using AudioStation to Manage Your TurtleRadio Station List

Entering your AudioTron TurtleRadio Player ID into AudioStation lets you play the same TurtleRadio stations with AudioStation. You can also manage the station list with AudioStation by adding stations and editing station names without having to re-visit TurtleRadio.

To enter the TurtleRadio Player ID, click **View → Preferences → TurtleRadio**. Then enter the Player ID used in the AudioTron web server **Access Controls** Tab.

AudioStation TurtleRadio List

The TurtleRadio station list is accessed from the AudioStation **Library Menu Tree** under the **TurtleRadio** folder. Clicking on the + sign next to the TurtleRadio folder will show the categories you've configured in the custom station list at the TurtleRadio web site. Clicking on a category shows the stations in the Playlist window, along with their source URL, as shown below.

AudioStation TurtleRadio list

When you've found a station URL from a broadcasting web site that you'd like to add to a category, click on **File → Open URL** and enter the URL into the **Open URL** dialog box.

To play the station on AudioTron, update your TurtleRadio list by clicking on "**Send To**" at the top of the playlist window, then select "**TurtleRadio**" from the drop down menu. This activates the "**Add Station**" dialog, which lets you enter station name, description and genre along with the URL.
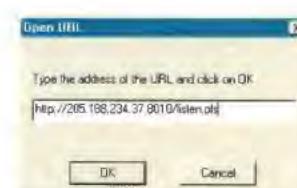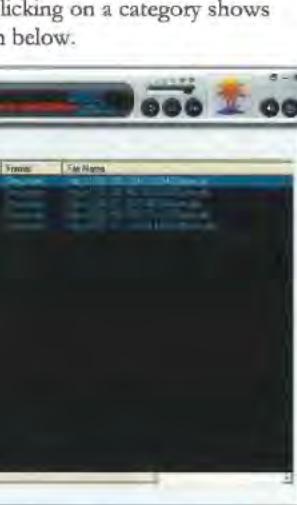
"Open URL" dialog box

"Add Station" dialog box

Turtle Beach

AudioTron and Shared Directories

Shared Directories

File directories (or "folders") can either be "shared" or "not shared". The files in a shared directory are available to other users on the network, while the files in an un-shared directory are only accessible on the PC where it resides. By limiting the extent to which other users can access your networked PC's file system (i.e. directories and files), the "sharing" setting lets you keep your files safe from unauthorized access and accidental modifications by other users. AudioTron can only access music files from shared directories.

➲ *The AudioTron Setup Utility lets you check how directory shares are set up on any PC accessible on the network.*

File sharing operates only when Windows is set to enable "File and Printer" sharing.

To set File and Printer sharing in Windows 98

1. Launch the Windows Control Panel (**Start → Settings → Control Panel**). Double click on the **Network** icon to launch the **Network Dialog**.

2. Click on the **File and Print Sharing** button.

3. In the dialog box that appears, check the options "**I want to give others access to my files**".

4. Close all of the windows and reboot your PC if prompted.

Each directory can be set as shared or unshared. All of the directories under a shared directory are automatically set as shared, so they don't have to be set individually.

To set up a shared directory

1. In the Windows Explorer directory window, right click on the directory name and select the "**Sharing**" option from the menu. If there is no "Sharing" option, see the above step to check for File and Printer Sharing settings in the Network dialog.

2. From the **Share Properties** screen, Select "**Shared As**". The "**Share Name**" is the name of the sub-directory you're setting as a "shared directory"

3. For "**Access Type**", select "**Read Only**".

4. Press "**OK**" to close the window.
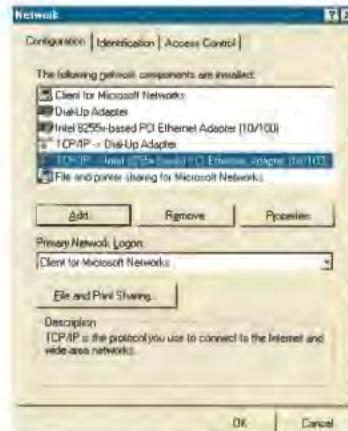
*Windows "**Network**" screen*
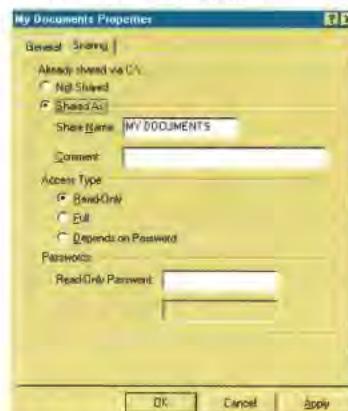
*Windows "**Share Properties**" screen*

AudioTron Shared Directories Default Settings

By default, AudioTron searches for music files (MP3, WMA and WAV) and playlists (M3U and PLS) in directories named **My Music**, **Music**, **Audio** and **My Documents\My Music** that reside *under* a shared directory. This restriction is imposed in order to accelerate the search for music files on large hard drives and multiple PCs.

➲ *A "**Nested Share**" condition occurs when the directories under a shared root directory are also shared. This case should be avoided, since AudioTron will list the same songs multiple times if they're located in nested shares. Note that the AudioTron Setup Utility can check for and correct "nested shares".*

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As an example of why AudioTron provides this directory restriction, consider the case where drive C: is shared and the conditions were not imposed. If AudioTron were to look in the root share (in this case C) as well as in every directory below the root share, it would search the entire hard disk for music files. A large hard disk full of non-music files, such as programs and data, would take a very long time to search from one end to the other. For this reason, AudioTron ignores all directories other than those with specific names under the root, thereby significantly reducing the search time for logging all of the files in a large music library.

Once the search is completed, AudioTron keeps a local database of the file names in its internal memory so it does not have to search the drives each time a song list is requested. If more songs are added later on, the "Search for New Music" menu in the Options display and web server can be used to add only the new file names to AudioTron's local directory, which saves the time of logging all of the music files it already knows about. If songs are deleted from the network drives, AudioTron must be re-booted in order to remove the files from its internal database.

In the following examples, AudioTron would find music stored in the shaded directories:

Shared Directory Example 1

- AudioTron will not find music in C:\ because it is not under a shared directory.

- AudioTron will not find music in C:\AudioTron because it is the root share.

- AudioTron will not find music in C:\My Documents because it does not follow the naming convention.

- AudioTron will find music in C:\AudioTron\My Music, C:\AudioTron\Audio, C:\AudioTron\Music and C:\AudioTron \My Documents\My Music because they follow the naming convention and reside under the shared directory \AudioTron.
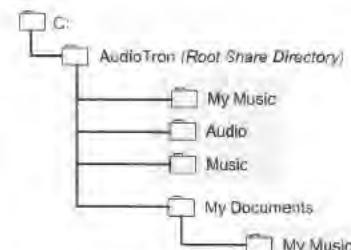
Example 1

Shared Directory Example 2

- AudioTron will not find music in C:\ because it is not under a shared directory.

- AudioTron will not find music in C:\AudioTron because it is the root share.

- AudioTron will not find music in C:\My Music because it is not under a shared directory (even though it follows the naming convention.)

- AudioTron will find music in C:\AudioTron\My Music because it resides under a shared directory and follows the naming convention.

- AudioTron will find music in C:\AudioTron\My Music\MP3Music, C:\AudioTron\My Music\WMAMusic and C:\AudioTron \My Music \WAVMusic because they reside under C:\AudioTron\My Music.
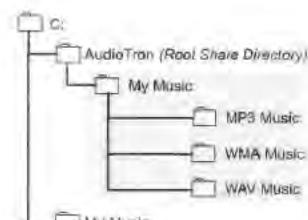
Example 2

Shared Directory Example 3

- AudioTron will not find music in C:\ because it is the root share. AudioTron will not find music in C:\My Programs or C:\My Documents because they do not follow the naming convention.

- AudioTron will find music in C:\My Music, C:\Audio and C:\My Documents \My Music because they follow the naming convention and reside under a shared directory.

- AudioTron will find music in all directories under C:\My Documents \My Music, even though they do not follow the naming convention (because they reside under C:\My Documents\My Music.)
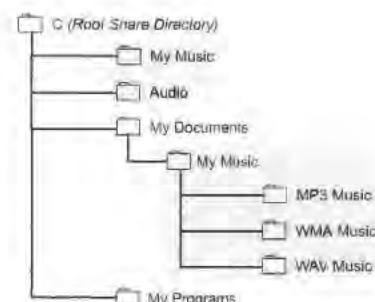
Example 3

Overriding AudioTron's Default Directory Settings

Web Server Shared Directory Features

The AudioTron web server lets you select how you'd like AudioTron to search for music files in shared directories on your networked PCs.

Search default folders in all shares: This option will only search for music files in shared folders that adhere to the AudioTron default restrictions described in the previous section.

Search all folders in all shares: This option will search for music files in all shared folders on all networked PCs found by AudioTron. Note that in systems with many files in shared folders, this option could result in long search times when searching for new songs.

Search all shares in shared folders listed below: This option lets you see which shared folders have been detected by AudioTron and then enter those which should be searched for music files.

These options are selected on the web server **Share Search Options** screen, accessible by clicking on the option "**Click to Configure Share Search Options**" in the File Access Settings screen.

AudioTron Setup Utility Index Files

The Setup Utility can be used to automatically find folders with music files and place "**index files**" in those folders. When AudioTron finds index files during a music file search, it identifies the directory with the index file as a music directory and logs the music and playlists in the directory listings of the Configure Shares Manually section of the Shares Search Options screen. Note that these folders still must be shared in order to allow AudioTron to access its files.

To activate the Index File feature, run the Setup Utility main menu option called "**Check Local Computer for Music Files**" or "**Check Remote Computer for Music Files**". On the **Search Results** screen that lists the directories for the PC searched, press the "**Fix it**" button to place index files in the directories where music files were found.

Directories with music accessible to AudioTron will be identified with the Play triangle ▶. To remove the index files from all directories, run the Setup Utility **Advanced Options** and check "**Remove index files from local computer**".

*Web server **File Access Settings** screen*

*Web server **Shares Search Options** screen*
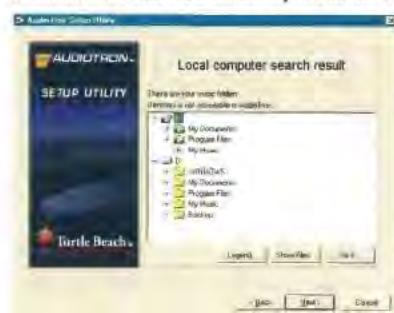
Setup Utility directory search results

Troubleshooting Tips

⤷ *For an up to date list of troubleshooting questions and answers, please visit*
http://www.turtle-beach.com/wb/audiotron/faq.htm

Song Playback Issues

Song "skips" while playing

Under conditions of extremely heavy use, your network might be unable to provide an adequately sustained rate of digital audio data to AudioTron while playing music. For instance, if the music server PC is being used for high-overhead tasks (e.g. playing a PC game, accessing the Internet, transferring files, etc.) it could interfere with the task of sending music over the network. If this happens for a period of time that causes AudioTron's internal music buffer to become empty, it is possible for the music to skip due to data loss. To reduce the possibility of this, try the following:

✓ Minimize usage of the music server PC while AudioTron is accessing music files stored there.

✓ De-fragment the hard drive of the host PC to minimize file transfer time.

✓ Use a dedicated PC for music storage so it will not be used for other tasks while playing music.

✓ Try a larger buffer threshold to allow more buffer to be filled before the music starts playing. See the Options Menu and web server sections to set the "**Prebuffer Threshold**".

✓ WAV files use uncompressed data and therefore require as much as 10 times more data to travel over the network than do MP3 and WMA files. Also, WAV files can be used only with Ethernet networks. Try using MP3 or WMA to see if the skipping problem goes away.

✓ **If you're running an HPNA network…** Be sure you do not have a line filter on the PC's HPNA interface or the AudioTron's HPNA connector. Also, if the PC has a modem, try connecting the HPNA interface and modem to the phone line with a splitter, rather than in series with each other.

✓ If only certain songs skip, try playing them on your PC with AudioStation to see if the song is damaged. If it skips on the PC, it will also skip on AudioTron. If the song is problematic, try re-recording the song from the original CD to make a new copy.

✓ As a last resort, power off AudioTron from the rear panel power switch, wait a few seconds and power it on again. This will rescan the music library and reset the AudioTron's processor.

Pauses between songs

AudioTron eliminates pauses between tracks during playback, which preserves the natural playback of song medleys. AudioTron accomplishes this "gap-less" playback by buffering the currently playing song while simultaneously buffering the beginning of the next track in the Play Queue. Two things can interfere with this process, and create a delay between tracks:

▪ Unusually high network traffic, which could interrupt the data packet stream and prevent proper filling of the buffer.

▪ Songs that are less than 1 minute in length do not provide enough data to finish buffering the next song before the current song is over.

Note that if you're listening to two songs that have zero silence between them on the original CD, you may hear a slight 'pop' as the AudioTron MP3 codec shuts down and then opens again for the next track. This pop does not occur with WAV files because no codec is used to decompress the audio stream. It will not occur in most songs, as they have a small buffer of silence at the beginning and/or end of the song.

Certain songs won't play at all, or display the message "CLOSED"

The "CLOSED" message indicates that the PC host has denied access to the music file, making it impossible for AudioTron to play the file. Some of the possible causes include:

✓ If the PC on which the file is stored is in "power save" mode, AudioTron will display "closed" until the PC is ready to transfer the file. This should only happen when the PC "wakes up" from the sleep state.

✓ Some MP3 and WMA files have odd sample rates that are incompatible with AudioTron. If the song was obtained from the Internet, it is possible that it was created in one of these non-standard rates and is not recognized by AudioTron. This is usually not a problem with songs created from a CD with AudioStation.

A song plays on the analog outputs but not on the S/PDIF digital output

✓ Songs will only play through the optical S/PDIF output if the digital audio file was stored using one of the standard S/PDIF sample rates of 32 kHz or 44.1 kHz. AudioTron does not support playback of uncompressed WAV files recorded with a sampling rate of 48 kHz. See the "**Product Specifications**" section in the Setup Guide for details on supported sample rates.

✓ When converting your CD collection to the PC hard drive in WAV format, set the recording rate to 44.1 kHz, which matches the sampling rate used on the CD. Re-sampling to a different rate usually results in decreased sound quality and may be incompatible with the S/PDIF output.

✓ Songs downloaded from the Internet from an unknown source may not have compatible S/PDIF sample rates and might only play out of the analog outputs.

Delay between the time the Play button is pressed and the time the music starts playing

✓ When you press the "Play" button, AudioTron first downloads a portion of the song file from the PC before it can start the music. Therefore, there will be a short delay caused by the digital file stream being transferred from the PC to the AudioTron. This is indicated by the message "Buffering" on the Display Panel when the track is first selected.

✓ Try changing the "Pre-buffer threshold" as described in the Options Menu and web server sections. A shorter threshold will cause the song to start playing sooner, but could result in audio dropouts in heavy network traffic situations.

✓ Because they are not compressed, WAV files require the transfer of more data into the buffer before playback can begin, and therefore will exhibit a longer delay than WMA and MP3 files.

✓ If the PC on which the song resides is in "energy-saving" mode and has been idle long enough for the hard drive to shut down, there will be an extra delay after pressing Play while the hard drive starts up and begins to access the song file. This will only occur on the first song.

Music Library Issues

AudioTron doesn't list some songs in the music library

✓ Use the Setup Utility to see which directories can be accessed by AudioTron. If you have music in directories that are listed as inaccessible, either move them to accessible directories or use the "Fix it" feature in the Setup Utility to place an index file into the directory so AudioTron will recognize it.

✓ Check the password setting on the shared directories. If you have a password set, then it must also be set on AudioTron.

✓ Check that "file and printer sharing" is enabled in the network control panel.

✓ AudioTron will list but won't play WMA music files with the "security" option set. Use AudioStation to see if the songs have been recorded in "secure mode".

✓ If the songs are stored on a Host PC running "firewall" software, it must be set to "pass" AudioTron's IP address or it will be treated as an "unauthorized user" and be blocked from accessing the PC.

Some song titles appear twice in the display

✓ Two songs with different file names but the same Title tag information will be displayed as the same song twice (e.g. Song (1) Song (2)) because the tag information for "Title" is the same. The same applies to a song with the same title saved in different formats (e.g. WMA, MP3 or WAV).

✓ If, after checking your song library to confirm there's only one version of the song, try re-setting AudioTron with the rear-panel power switch. This will reset the internal memory and cause it to re-scan the network for songs.

✓ Nested shares can also cause double-occurrences. For instance, if songs are stored in C:\My Documents\My Music and both the C: drive and \My Music are set as shared directories, the music files in \My Music might be displayed twice. The Setup Utility can check for this.

Internet Radio Issues

AudioTron has trouble connecting to Internet radio stations

Try pinging a web site by name and by IP address from the web server **Network Settings** page. If you are able to ping the web site by IP address, but not by name (i.e. you can ping 192.233.80.9, but not novell.com) then investigate your network DNS Server setup. If you are unable to ping a web site by IP, investigate your network gateway setup.

Internet radio stations play erratically

There are many things that can affect the quality of playback of an Internet radio station, some of which may be out of your control. If radio stations of similar bitrates play fine, it is most likely a problem with the station broadcasting. If stations of similar bitrate are also skipping, change your preferences at www.turtle-radio.com to only allow lower-quality streams. If the stream is only occasionally skipping, try pausing the stream for several seconds, then continuing.

A station plays on the analog outputs but not on the S/PDIF digital output

Stations will only play through the optical S/PDIF output if the digital audio stream uses one of the standard S/PDIF sample rates of 32 kHz or 44.1 kHz. The TurtleRadio web site lets you restrict station lists to those which support the S/PDIF sample rates.

Network Issues

General Network Troubleshooting Tips

✓ **Regardless of whether you're using HPNA or Ethernet, AudioTron requires a network that is running the TCP/IP protocol.** If your AudioTron isn't working, yet your network is running fine, it may be that the network is not set to use the TCP/IP protocol.

✓ **If your network has a DHCP ("Dynamic Host Control Protocol") Server...** An IP address can either be assigned to AudioTron automatically by one of the devices in the network (called a "DHCP Server"), or you can "hard code" an address into AudioTron (called "Static IP" addressing.) If your network has a DHCP server, AudioTron defaults to a setting whereby it will automatically accept an assigned IP address from a DHCP server.

✓ **If you're using a DSL or cable modem with a router/hub...** Many router/hubs (e.g. the Etherfast Cable/DSL Router from Linksys) also act as DHCP servers. Check with the manufacturer of the device to see if this is the case for your router/hub device. You should also check with the manufacturer to see if there's an update for the device's firmware.

✓ **File sharing...** AudioTron has special requirements for the directories in which your digital music files are stored. These directories must be called **Music, Audio\My Music** or **My Documents\My Music** and must be located *under* a shared directory. Simply *sharing* these directories will not allow AudioTron to find the music files. The Setup Utility can help you properly configure the directories on your PC. For a description of AudioTron's directory restrictions, see the section "**AudioTron and Shared Directories**".

AudioTron doesn't work with a specific Router or Hub

Some router/hubs need a firmware update to operate properly with AudioTron:

SMC Hub: Version 1.8x firmware works with AudioTron using Static IP addressing. It works intermittently as a DHCP server—sometimes AudioTron finds a host but no host name and it often cannot find files on shared PCs. The firmware update to 1.90 seems to correct the DHCP server and file share problems and can be found on the SMC web site: www.smc.com.

Linksys 4 Port Router/Hub: Version 1.35 firmware works with AudioTron using Static IP addressing and intermittently as a DHCP server. Sometimes it finds a host but no host name and it rarely can find files on shared PCs. The firmware update to v1.37 corrects this and is available on the Linksys web site www.Linksys.com.

If AudioTron is connected directly to your computer using an Ethernet or HPNA interface (Win98 and Win ME only)

✓ **Make sure TCP/IP is installed for your adapter:** Double-click on the "Network" icon in the Windows control panel. In the installed network component list box, search for "TCP/IP -> *your adapter name*". If TCP/IP is not installed, click on the "Add" button, select "Protocol", then click on "Add" again. Select "Microsoft" from the list box on the left and select "TCP/IP" from the list on the right. Click the "OK' button. Restart your computer if you were prompted to do so.

✓ **Make sure "Client for Microsoft Networks" is installed:** Double-click on the "Network" icon in the Windows control panel. In the installed network component list box, search for "Client for Microsoft Networks". If "Client for Microsoft Networks" is not installed, then click on the "Add" button, select "Client", then click on "Add" again. Select "Microsoft" from the list box on the left and select "Client for Microsoft Networks" from the list box on the right. Click the "OK' button. Restart your computer if you were prompted to do so.

✓ **Set up your adapter to use static IP addressing.** Double click on the "Network" icon in the Windows control panel, then select "TCP/IP -> *your adapter name*" component, and click on "Properties". In the "IP Address" tab, select "Specify an IP address" radio button, and type "192.168.0.1" as the IP address, and "255.255.255.0" as the subnet mask. In the "Bindings" tab, make sure "Client for Microsoft Networks" and "File and printer sharing for Microsoft

Networks" are checked. Click the "OK' button. Restart your computer if you were prompted to do so.

✓ In AudioTron options menu, disable DHCP, and set the IP address, and subnet mask as explained above.

AudioTron displays "No Hosts Found" when first turned on

➲ *The AudioTron web server "History" screen can be used to check many of the network settings. See the web server section for details.*

When powered up from the rear panel power switch, AudioTron will search the network for hosts after the Standby button is pressed. If AudioTron is in DHCP mode and does not find a host after searching for two minutes, it will display "**No Hosts Found**". If this occurs, check the following:

✓ Reconnect the network cable to make sure it "clicks" when inserted.

✓ Try another network cable to make sure the problem is not due to a defective cable.

✓ If AudioTron is connected to a hub, try another hub.

✓ Make sure the host PC is powered on.

✓ If you're using DHCP, make sure that only one computer is configured as a DHCP server. If you are using a "smart" hub that acts as a DHCP server, make sure that none of the host computers are configured as DHCP servers.

✓ Try re-setting your cable/DSL router so it re-scans the network for new nodes.

✓ If you're using Static IP, use the AudioTron Setup Utility to check that AudioTron's IP address settings don't conflict with another PC or another AudioTron on the network.

✓ If your PC is running "firewall" software, it should be configured to pass AudioTron's IP address. Check the software manufacturer's instructions on how to set this.

✓ If you're using a 4-port LinkSys Etherfast Cable/DSL router, check that the firmware is version 1.37 or higher. Firmware versions lower than 1.37 may have a problem providing DHCP and IP address access to AudioTron if the Linksys is used as a hub for your network.

If you're using an HPNA network

✓ Make sure AudioTron is connected to the same phone line as your HPNA network. Try hooking up two phones to the jacks you're using for AudioTron and an HPNA-connected PC. If you can't talk on the two phones using the same jacks and cables, then the HPNA network won't be able to communicate between the PC and AudioTron.

✓ If you have DSL service, make sure the DSL line filter is not between AudioTron or your PC's HPNA interface or it could affect the HPNA network signals and cause performance problems.

✓ Do not connect a telephone line filter between AudioTron's HPNA jack and the wall phone jack. Transient protection is built into the AudioTron phone jack.

AudioTron Reference Manual

Audio Troubleshooting Procedure

```
┌─────────────────┐
│   Press PLAY    │
└─────────────────┘
         │
         ▼              What happened?
┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐
│ Display indicates│  │ You can hear the │  │ Display does not │
│ the song is      │  │ song playing     │  │ respond.         │
│ playing, but     │  │                  │  │ No sound.        │
│ there is no      │  │                  │  │                  │
│ sound.           │  │                  │  │                  │
└─────────────────┘  └─────────────────┘  └─────────────────┘
         │                    │                    │
         ▼                    ▼                    ▼
┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐
│ Is the Mute     │  │   No problem.   │  │ Reboot AudioTron │
│ button on?      │  │                 │  │ and start over   │
│                 │  │                 │  │ in the setup     │
│                 │  │                 │  │ procedure.       │
└─────────────────┘  └─────────────────┘  └─────────────────┘
         │
         ▼
┌─────────────────┐
│ Can you hear the │
│ song from        │
│ headphones       │
│ plugged into the │  Note:
│ headphone jack?  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ Turn the Standby │
│ button off and   │
│ on.              │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ Are the audio    │
│ outputs properly │
│ connected?       │
└─────────────────┘           input.
         │
         ▼
┌─────────────────┐
│ Do any other     │  when originally converted from CD.
│ songs play?      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ If none of these │
│ actions solve    │
│ the problem, see │
│ the Appendix for │
│ troubleshooting  │
│ tips.            │
└─────────────────┘
```

Updating AudioTron's Firmware

Turtle Beach periodically releases new updates for the AudioTron firmware to implement feature enhancements, bug fixes, and operational modifications. The firmware updates may be obtained at the Turtle Beach web site (www.Turtle-Beach.com) and transferred to the AudioTron either from the web server or from the front panel display, as described in this section. The firmware version number in your AudioTron can be found as follows:

- The firmware version is displayed on the front panel whenever AudioTron is powered on from the rear panel AC power switch.

- The firmware version is displayed on the front panel when the Options button is pressed.

- The firmware version is displayed in the web server Firmware Settings screen.

CAUTION:

➲ *Do not turn off AudioTron's AC power or disconnect its network connection before the firmware download is completed! Removing the power while the firmware is being transferred to AudioTron from the PC could cause the AudioTron "boot loader" to be inadvertently deleted and will render the unit inoperable. If this occurs, AudioTron will no longer start up and will require factory service to reload the firmware.*

To update the firmware from the web server

1. Launch the AudioTron web server, per the instructions in the Web Server section of this manual. Click on the **Settings Firmware** menu option to activate the **Firmware** screen.

2. Note the **Current Installed** version, which indicates the version number of the firmware installed in the AudioTron.

3. Check for firmware updates at the Turtle Beach web site. If the version number posted at the Turtle Beach web site is higher than the version number displayed in the Current Installed Version, download the firmware file from the web site. Unzip the file to any subdirectory that contains shared music files (e.g. My Music, Audio, Music) so that AudioTron can find the firmware file.

➲ *AudioTron firmware files have a .Nb0 extension and are typically formatted with a name such as **atron20122.nb0**, which represents firmware version 2.01.22.*

Web server **Firmware** screen

4. On the **Firmware** screen, click on the **Search** button to begin a search for the firmware file. After the search is completed, check if **Current Found:** indicates that the version number found during the network search matches the version number downloaded from the Turtle Beach web site. If not, then make sure the file was copied to a directory accessible to AudioTron (e.g. a directory used for storing music library files), then try the search again.

5. If the **Current Found** version is newer than the **Current Installed** version (i.e. a higher number), then click the **Update Firmware** button and wait for the updating process to complete (AudioTron's display should indicate that the firmware is being updated.)

6. After the firmware update is completed, the AudioTron display reads "**Please power cycle to activate**". Turn the back panel power switch off then back on, to reset AudioTron.

7. Check if the firmware version number has been updated from the original setting either by noting the version number displayed on start-up, or by checking the web server home screen as described above. Note that the new version number will not be displayed until AudioTron is reset.

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To update AudioTron's firmware from the front panel

1. Press the Options button to display the version number of the firmware. The display will look similar to the following illustration, with the firmware version number shown on the top row.

2. Check for firmware updates at the Turtle Beach web site. If the version number posted at the Turtle Beach web site is higher than the version number displayed in step 1, download the firmware file from the web site. Unzip the file to a subdirectory that contains your shared music files (e.g. My Music, Audio, Music) so that AudioTron can find the file.

➡ *AudioTron firmware files have a .Nb0 extension and are typically formatted with a name such as **atron20122.nb0**, which represents firmware **version 2.01.22**.*

3. If the Options LED is not lit, press the Options button. Turn and press the knob to select the "**Update Firmware**" option. Turn and press the knob to select "**Yes**".

```
Select Option - Version 2.0.0
Update Flash
```

4. Once AudioTron finds the firmware file, it will transfer the file from your PC to the internal FLASH RAM, as noted on the display. A successful transfer will display the messages "ERASING", "PROGRAMMING" and "VERIFYING". The new version number will not be displayed until AudioTron is reset, as described below.

5. If these messages are not displayed, it indicates that AudioTron did not find the firmware file and the update did not occur. In this case, check that the firmware file is located in a shared directory that is accessible to AudioTron (such as a directory with music files that have been known to operate with AudioTron.) Once the file location is confirmed, try re-setting AudioTron from the rear-panel power switch to initiate a full network rescan and repeat the update procedure from step 4 above.

6. After the firmware update is completed, the AudioTron display reads "**Please power cycle to activate**". Reset AudioTron with the rear panel power switch.

7. Check if the firmware version number has been updated from the original setting either by noting the version number displayed on start-up, or by checking the web server home screen as described above. Note that the new version number will not be displayed until AudioTron is reset.

Network Basics

Many books have been written about the subject of networking. Therefore, this section is only intended to provide a brief overview of how AudioTron works in a home network environment and covers only those issues essential to setting up a proper network for using AudioTron.

Overview of Home Networks

A Home Network lets you transfer files between PCs as well as share hardware (e.g. printers, scanners, etc.) and Internet connections among several users. If you don't have a network, you can set one up with a network starter kit, which typically includes all of the hardware and software you'll need for a small network. Be sure to get a kit that supports the Windows Plug and Play (PnP) standard, which makes it easier to install the driver software.

The rate at which data is transferred on a network is measured in Megabits per second ("Mb/s"). The higher the data transfer rate, or Mbs, the faster data will be transferred between devices on the network.

Many different types of network standards have been developed, some of which are more widely accepted than others. Each standard uses different types of connections and protocols (the language of networks) to communicate between devices. AudioTron is compatible with Ethernet or HPNA (Home Phone Line) network technologies and the TCP/IP protocol. Wireless and power line networks are not compatible with AudioTron.

HPNA (Home Phone Network Alliance) Networks

An **HPNA** network uses standard analog phone lines, so in most cases you won't have to add wiring to your home. There are two versions of HPNA:

- **HPNA 1.0** transfers data at a maximum rate of 1 Mb/s

- **HPNA 2.0** operates at rates up to 10 Mb/s.

AudioTron is designed to work with HPNA 2.0, and will not work reliably on HPNA 1.0.

An HPNA network does not affect your phone line or Internet connection. You can transfer data on the network and make phone calls at the same time, even though the network and your phones are using the same wires. HPNA is incompatible with digital phone lines that are sometimes used with multi-line phone systems. To find out more about HPNA visit http://www.homepna.org.

Ethernet Networks

Ethernet is a well-established networking standard, so it has a wide variety of components that are relatively inexpensive. Like HPNA, there are two types of Ethernet:

- **Regular Ethernet** (referred to as 10BaseT) runs at 10Mb/s.

- **Fast Ethernet** (referred to as 100BaseTX) runs at 100Mb/s.

AudioTron is compatible with 10BaseT Ethernet and is incompatible with networks that can run only 100BaseTX Ethernet. Ethernet networks that automatically switch between these two speeds (referred to as "10/100BaseT") are also compatible with AudioTron since they support both data rates.

Ethernet requires special cable (called "CAT-5" or "CAT-5e") used exclusively for transmitting the Ethernet signals between devices. When connecting Ethernet devices together, you'll need an Ethernet "Hub", which distributes the Ethernet signal between multiple devices and controls the network "traffic". There are many types of hubs available, and some have enhanced features, such as built-in switches that intelligently route data in the network to optimize transfer speeds.

Many computer stores have inexpensive hubs and CAT-5 cables in fixed lengths with connectors already mounted on each side, making it relatively easy to wire an Ethernet network in your home.

HPNA vs. Ethernet for AudioTron

Although increased speed of an Ethernet network is not necessary for operating your AudioTron (except in the case of WAV file playback), it does improve file transfer speed between PCs in your network. If you don't mind wiring your home with CAT-5 cable, you can enjoy the benefits of faster data transfer offered by Ethernet networking. If you cannot wire your home with CAT-5 cables, HPNA 2.0 provides an easy way to set up an adequate network that is compatible with AudioTron. The only drawback over an Ethernet network is HPNA's inability to handle WAV file playback on AudioTron. Playback of MP3 and Windows Media (WMA) compressed formats will not be restricted.

Setting up either type of network will require a Network Interface Card (NIC), which is available from several manufacturers as cards that install inside your PC, or external network adapters that connect to a USB (Universal Serial Bus) port.

Network Terminology

TCP/IP Network Protocol

The "language" used to transfer data between devices in a network is called the "network protocol" and includes acronyms such as TCP/IP, IPX/SPX and NetBEUI. AudioTron uses **TCP/IP (Transmission Control Protocol/Internet Protocol)** to communicate over a network, therefore your network must be set up to use TCP/IP for compatibility with AudioTron.

➡ *The AudioTron Setup Utility can be used to check if your network is running TCP/IP. See the Setup Utility section in this manual for details.*

To check if your network is running TCP/IP in Windows 98

1. Launch the Control Panel by clicking **Start → Settings → Control Panel**. Double click on the **Network** icon to launch the **Windows Network** screen.

2. In the Network Dialog, click on the listing for your Ethernet or HPNA network interface card (NIC). Then, click on Properties and in the Bindings Tab, check that TCP/IP and File Sharing are enabled.

3. If TCP/IP is not installed, refer to the Windows Help for instructions on how to set up the network with TCP/IP.
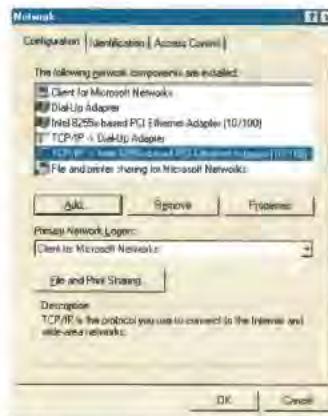
"Windows Network" screen

IP (Internet Protocol) Addresses and Sub-net Mask

Each device connected to the network (PCs AudioTrons, etc.) is referred to as a "node" and each node is identified by a unique **IP Address**. The IP address is determined in part by a **sub-net mask** number that is used to derive the address of the entire network.

An IP address can be thought of as the "phone number" of each node (i.e. device) on the network. Within the same area code, no two people have the same phone number. If two calls are made to the same number at the same time, both callers will get a busy signal and no communication can take place. Similarly, with IP addresses each computer and each AudioTron on the network is regarded as a node that must each have a unique **IP address** ("phone number"). The network must also have its own "area code", which is derived from its **Sub-net Mask**.

➡ *The AudioTron Setup Utility can find the IP address settings for the AudioTrons and PCs on your network.*

Setting up AudioTron's IP Address

The AudioTron Setup Utility can help you set up AudioTron's IP address, found on the web server's **Connectivity** tab. An IP address can be assigned manually, which is called "**Static IP Addressing**", or automatically by a "**DHCP Server**", which is a PC or other device on the network that manages IP addresses for all nodes. The Setup Utility can determine if a DHCP server is available on your network, or if AudioTron requires a Static IP address.

DHCP (Dynamic Host Client Protocol) Server

The easiest way for a device to get an IP address is to have it automatically assigned one by another device, such as a PC or router, so you don't have to do it manually. If you're using a cable modem or DSL, the cable/DSL routers typically act as DHCP servers. You can also configure a PC as a DHCP server, as described in any good home networking manual.

➔ *If you have a Cable/DSL router installed on your network, use the Cable/DSL router box as the DHCP server, not a PC. A network cannot have more than one DHCP server.*

Gateway and DNS Server

In order to provide the Internet radio function, AudioTron must be able to access the Internet on your network. If your network is configured for "**Internet Connection Sharing**", the device that provides a connection between the network and the Internet connection (i.e. dial-up, DSL or cable modem) is called a "**gateway**". The gateway is connected to another device called a "**DNS Server**" that determines the connection between a URL (Universal Resource Locator) such as www.TurtleRadio.com, and the IP address for that URL. Thus, when AudioTron plays Internet radio stations, the gateway provides AudioTron a link to the Internet from the network and the DNS Server finds the location of the stations based in AudioTron's station list.

➔ *The Setup Utility can find IP addresses for the gateway and DNS devices on your network.*

Routers and Internet Connection Sharing

A "**router**" is a network device that forwards or "routes" TCP/IP data between your network and the Internet. Routers are typically separate boxes that connect to your network and the Internet. However, Windows 98 S/E (and higher) provides a feature called "**Internet Connection Sharing**" ("**ICS**") which lets a PC connected to the Internet act as a simple router and DHCP server. On the Internet side of a router, all of the TCP/IP data seems to be going to a single IP address, while on the network side, the router distributes the data to each node on the network, each with a distinct IP address.

Using ICS on a PC can be a daunting task because if something goes wrong, there is little user interface to help you troubleshoot. Also, if the ICS PC host crashes, every PC and AudioTron on the network will lose its Internet connection. Sharing a cable or DSL modem on an ICS host PC will also require two Ethernet adapters in the PC, and figuring out which one is connected can be complicated. For this reason, its much easier to set up a separate hardware router on your network.

Firewalls

A Firewall is "security" software that keeps outsiders from breaking into your network. Firewalls are primarily used to prevent "hackers" from accessing your PC hard drive while you're on the Internet. The greatest risk of this is when the IP address for your Internet connection is static, such as when using a DSL or cable modem. Since these devices typically maintain the same IP address to the outside world, and are always on, they make it easier for hackers to return to the same address until they've figured out a way to "break in". For this reason, a firewall is typically used between the DSL or cable modem to prevent unauthorized users from accessing your network from the outside.

➔ *If a firewall is running on a network PC that contains music for AudioTron, the firewall should be set to pass AudioTron's IP address. Otherwise, it will treat AudioTron as an "unauthorized*

*user" and prevent it from accessing music files in the PC's Shared directories. To do this,
follow the instructions supplied with your firewall product.*

Passwords

AudioTron uses two kinds of passwords, which can be set via the web server: One is for protecting
"shared directories" on Windows 98/Me and the other is used in conjunction with a network running
on Windows NT, XP or 2000.

AudioTron can save only one password, so you can only use a single password to protect all your
shared music directories in Windows 98/Me. When password protecting your shared directories, set
the password in the AudioTron web server Options "Share Password" setting.

AudioTron also requires a password if your music server is running Windows NT, XP or 2000. These
Network Operating Systems treat all devices accessing the PC as a "User". Each user requires a user
name and user password, so AudioTron will need one as well. The user names and passwords set in
the Windows Network Control Panel for the music server PC should match those in AudioTron's
web server **File Access** page.

➲ *Passwords are case sensitive! The password "MYPASS" is a different password than
"MyPass" or "mypass".*

Checking Network settings with "Winipcfg.exe"

Windows 98 includes a network diagnostic program called
Winipcfg.exe which may be run from the Windows
"Start" menu ("Start → Run → Winipcfg"). This program
may be used to find the IP Address, Subnet Mask, and
other relevant TCP/IP settings for each PC on your
network.

When the dialog box appears, click on the "pull down"
menu to select your network interface card (in this case an
Intel 82557-based Ethernet PCI card). Then note the IP
Address, Subnet Mask and Default Gateway settings. The
IP address setting for AudioTron should not conflict with
the IP addresses for any of the PCs on your network. The
Subnet Mask and Default Gateway settings on AudioTron
should match the settings on your network PCs.

Winipcfg screen

If your network is running a DHCP server, the IP addresses will be assigned by the DHCP server.
You can reassign the IP address by pressing the Release All button, followed by Renew All. Typically,
this would be done on each PC when you add a new PC to the network. More information on this
procedure can be found in the Windows Help file, or in a Windows reference manual.

In Windows NT, XP and 2000, the utility IPCONFIG.EXE may be run from the DOS prompt to
obtain the IP configuration settings.

➲ *Note that the AudioTron Setup Utility can also provide most of the information for your
network settings.*

Setting AudioTron's IP Address

To assign an IP address with a DHCP Server (on HPNA or Ethernet)

1. Plug AudioTron into the HPNA or Ethernet network connection and make sure the PCs and network hubs are all turned on.

2. Turn on AudioTron from the rear panel power switch, wait a few seconds, then press the front panel Standby button. When powering on, AudioTron will automatically detect if it is connected to the network through an HPNA or Ethernet interface and choose the appropriate interface.

3. When the display indicates the type of network connection detected (Ethernet or HPNA), make sure it corresponds to the type of network you're using. For instance, if you connected an Ethernet cable and AudioTron's display indicates it has detected HPNA, the cable is either not connected properly or the Ethernet network may not be operating properly.

4. Once AudioTron detects the network connection, it will begin searching the network for a DHCP server and may display "**Waiting for Network**". This could take up to 120 seconds, so wait until it's done.

5. If AudioTron finds the DHCP server and it assigns AudioTron an IP address, it will display "**Searching for Hosts**" and search for all of the host PCs on the network.

6. If AudioTron finds music files on any of the PC hosts, it will display "**Found xx Hosts**" (where xx is the number of PCs it found) and search for music files. After it's done finding songs, the main menu will appear and AudioTron will be ready to play music. From this point on, you should turn AudioTron on and off with the Standby button. Turning off the rear panel power switch will erase the internal database of song titles and the network scan procedure will be repeated the next time AudioTron is powered on.

7. If "**No Hosts Found**" is displayed, check the suggestions for "**No Hosts Found**" in the Troubleshooting Tips" section. If, after rebooting AudioTron "**No Hosts Found**" is again displayed, restore AudioTron's default settings as described below.

To restore AudioTron's default settings

1. Press the **Options** button. Turn the knob until the "**Restore Factory Defaults**" is displayed.

2. Press the knob to display the "**No/Yes**" menu screen. Turn and press the Knob to select "**Yes**" to restore the factory default settings.

3. Reboot AudioTron to repeat the DHCP process.

4. If "**No Hosts Found**" is again displayed, it is possible that your network does not have a DHCP server (or if it does, AudioTron can't find it.) In this case, you must manually assign an IP address using the Static IP address procedure as described below. You can check for a DHCP server on the network by running the Setup Utility.

To assign a Static IP Address from the front panel

1. **Find the addresses of the PCs in your network:** Run the Setup Utility from the AudioTron CD to find the IP address, Subnet IP Mask and gateway address for each PC in your network. These numbers will be used in a later step.

2. **Choose an IP address that doesn't conflict with the IP Addresses of the PCs in your network:** Choose an IP address for AudioTron that won't conflict with any of the IP addresses you found in Step 1. For example, if there are two PCs with the first set to IP address 192.168.0.1 and the second set to 192.168.0.2, then choose a number for AudioTron that's at least 10 higher than the highest IP address already assigned. (e.g. 192.168.0.12 in this example). Choosing a number that's significantly higher than any of the other IP Addresses (but no higher than 254) will help assure that AudioTron won't conflict with other IP Addresses

3. **Select the network type (Ethernet or HPNA):** Press the **Options** button on the AudioTron front panel and turn the knob to display "**Select Network Interface**". Press the knob to select, then turn and press the knob to set the network interface as either **Ethernet** or Phone Line **HPNA**, so that it matches your network installation.

Turtle
Beach

4. **Disable DHCP:** Press the **Options** button on the AudioTron front panel and turn the knob to display "**Configure DHCP**". Press the knob to select, then turn and press the knob to "**disable**" DHCP. Note that disabling DHCP will cause AudioTron to ignore the IP address, Subnet Mask and Gateway Settings assigned by a DHCP server.

5. **Set the IP Address:** Press the **Options** button on the AudioTron front panel and turn the knob to display "**Configure IP Address**". Press the knob to select, then turn and press the knob to enter the **IP address**, **subnet mask**, **gateway** and **DNS server** settings obtained from the Setup Utility.

6. **Set the "Sharing" Password (Optional)**: If you have password-protected your Shared directories, go to the web server **File Access** page and enter the password in the "**Windows 98/Millenium Share Password**" setting. Then press "**Save Share Password**". This will enable AudioTron to access the shared directories. *Note that passwords are case sensitive.*

7. **Set the NT/2000/XP User Name and Password (NT/XP and Win2K only)**: If you're running an NT 4, XP or Win 2000 network, the NT User Name and Password should match those set in AudioTron. In the web server **File Access** page, enter the password for NT/XP/2K and click on the "**Save NT/2000/XP Settings**" button. *Note that passwords and user names are case sensitive.*

Turtle
Beach

Regulatory Compliance Information

For United States users: FCC Part 15

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio or television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio and television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

Declaration of conformity

Responsible party: Voyetra Turtle Beach, Inc. 5 Odell Plaza, Yonkers, NY 10701 (914) 966-0600 Fax: (914) 966-1102 www.turtle-beach.com

Product: AudioTron Digital Music Player

This device complies with Part 15 of the FCC Rules. Operation of this product is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution

Changes or modifications not expressly approved by Voyetra Turtle Beach could void the FCC compliance and negate your authority to operate the product.

For United States users: FCC part 68

The AudioTron HPNA interface complies with Part 68 of the Federal Communications Commission (FCC) rules. On the HPNA interface card is a label that contains the FCC registration number and Ringer Equivalence Number (REN) for this device. If requested, this information must be provided to the telephone company. An FCC-compliant telephone line cord with a modular plug is required for use with this device. The HPNA interface is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68-compliant. See installation instructions for details.

The Ringer Equivalence Number (REN) is used to determine the number of devices which may be connected to the telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most areas, the sum of RENs should not exceed five (5). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company. If this device causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. The telephone company may request that you disconnect the equipment until the problem is resolved. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of this equipment. If this happens the telephone company will provide advance notice in order for you to make necessary modifications to maintain uninterrupted service.

Connection of the phone line interface to a party line service is subject to state tariffs. Contact the appropriate state public utility commission, public service commission or corporation commission for information.

For Canadian users: ICES-003

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par Industrie Canada.

DOC notice (for products fitted with an IC-compliant modem)

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operation, and safety requirements. The Department does not guarantee the equipment will operate to the users' satisfaction. Before installing this equipment, users should make sure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. Users should make sure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pie system, if present, are connected together. This precaution may be particularly important in rural areas. The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five (5).

Warning!

- To avoid electrical shock or equipment malfunction do not attempt to make electrical ground connections by yourself. Contact the appropriate inspection authority or an electrician, as appropriate.
- To reduce the risk of fire, use only No. 26 AWG or larger telecommunications line cord.

Using the Rio Receiver (and other unimportant info)

Chris Uriarte, *chrisjur@cju.com*
Originally Published: November 22, 2001; Last Updated: January 5, 2001
This review was featured on Slashdot on November 23, 2001. View the article, comments and flames here.

[**Update: January 2002:** Since this article hit Slashdot, I've received a number of emails from some helpful people. I had the opportunity to chat with a member of the Rio development team that worked on the original product. It appears that SonicBlue is working hard to add new features to the client software and firmware. Two months after purchasing the Rio, I still love it and my friends are still jealous.]

What is it?

The RIO receiver is a small devices that allows you to play your digital MP3 and WMA music through any stereo system. It attaches to an Ethernet network or a HPNA (phone line) network, allowing it to access digital music files stored on a Windows PC. It's manufactured and sold by SonicBlue [http://www.sonicblue.com], the people who bought the Rio [http://www.riohome.com] line of digital music equipment from Diamond. The same device is re-branded and sold by Dell [http://www.dell.com] as the Dell Digital Audio Receiver The street price for the unit is about US$200. You can find out more about it at its website [http://www.riohome.com/products/receiver.htm]. Here's a picture for your viewing enjoyment:

(Picture Says: "Click me for a giant-sized view")

What are the tech specs?

Without going into the nitty gritty details, here's some tech specs on the unit:

- Unit measures 9"x9"x3"; contains small LCD screen, a few buttons and a jog dial on the front.
- 74MHz ARM7 Cirrus processor
- Runs a tiny version of Debian Linux
- 4MB of DRAM
- 512KB of flash memory
- CS8900 based 10MB ethernet interface
- Broadcom HPNA interface. HPNA is some ass-backwards networking setup that allows you to run data over your home phone lines - be afraid, be very afraid! [**Update: December 2001:** OK, I admit, I was too harsh on the HPNA. A lot of people have written me to say that the HPNA works just fine.]
- One set of standard RCA audio output jacks
- One set of standard speaker connectors

Why buy it?

The advantage of purchasing the unit is that it gives you access to your digital audio collection through any stereo in your house that's close enough to a phone line or ethernet port on your home network.

Why I bought it.

Let me set the stage by saying that I have over 500 CDs and that I am addicted to music. One day, I realized something important: my music collection was taking over my life. It was getting too large to handle and my fickle nature makes me want to listen to many different types of music in a relatively short period of time. CDs tend to get stale very quickly when they are in my CD player. After having, what alcoholics sometimes refer to as, "a moment of clarity", I realized that it was time to get my act together. I discovered that my car contained 70 CDs - it was a $30,000 CD holder that happened to also be able to get me back and forth to work. There were about 100 CDs laying around in my home office and about 30 in my office at work. There were numerous CDs

stuck in changers and players and CD holder and travel pouches and attache bags and just about everywhere I could put them. I was out of control. My girlfriend was about to stage an intervention when I told her that I was going to buy a third CaseLogic car visor CD holder - which I somehow thought I could rig into place, despite the fact that my car, like most others, only has two sun visors. It was bad, and I needed help. One day, I had a vision - If I made my music collection digital, I could access it from anywhere - my stereo, my car (through a car MP3 player), on the road (through a portable MP3 player), at the office, etc. I really hated my trusty Sony CD 200-disc changer, which I know has swallowed a number of CDs that I've been looking for the last 5 years. I had a dream about being able to "dial up" my music - without having to know which slot it lived in or figuring whether it was even in my house at all. I thought the Rio Receiver could help me fill these dreams. (I know, It's sad. One day I'll seek professional help.)

Where to buy it.

When I was first searching for it (November 2001), the unit was somewhat difficult to find. There were only about five online retailers carrying it, and most were out of stock. I settled on the dependable, but expensive, Crutchfield [http://www.crutchfied.com], where I purchased it for $179. Note that I have seen street prices as low as $156. Check out CNET's price comparison service [http://shopper.cnet.com/] to try to hunt one down.

What do you get with it?

The box it's packaged in is roughly the size of a toaster over. Open it up and you'll find:

- the Digital Audio Receiver itself
- Home PNA adapter card - *(Note: It appears that some models do no include the PNA adapter. That's good...avoid it at all costs)*
- Remote Control
- 2 "AA" batteries
- one 6" RCA stereo patch cord
- one 6'6" telephone cord *(probably only included if you get the HPNA card)*
- one 12' 6" telephone cord *(ditto)*
- one 6' 6" AC power cable
- one CD containing the necessary server software installation and owner's manuals
- lots of cardboard, styrofoam, plastic, foam and other things that kill the environment. Crutchfield is also sure to pack the receiver box in a larger box small enough to hold a child - however, the child would never survive after suffocating from the grotesque amount of styrofoam peanuts inside.

It comes with a "quick start" sheet, which is good enough to actually get it up and running pretty quickly. The full documentation is on the CD-ROM, or available on the Rio website in the Support section. However, the full documentation is scarce on juicy details, although worth a quick read.

Setting it Up

Assuming that you already have an Ethernet network in place, all you need to do is the following:

1. Install the Windows software. Reboot (of course). Run the software and specify drives and directories that contain your MP3 and WMA files. Sit back for a minute and let it catalog your files.

2. Plug the unit in. Hook up the RCA jacks to your stereo. Plug Ethernet cable in the back. Turn the unit on.

3. Select your artist/album/playlist from the LCD screen and start playing music.

The whole setup process literally took me less than 10 minutes, most of which was spent chasing runaway styrofoam peanuts across my hardwood floors.

What does the Windows Software Do?

Yes, you must - I repeat - you MUST use the Windows software for this thing to work (see notes on the Linux

hack below, however). The software is not exactly what I would call "feature filled". The software has two purposes in life:

1. Catalog the digital music files on your computer system.
2. Communicate with the Digital Audio Player.

That's it. And you don't have options to play with those two either. It is truly as if SonicBlue had a meeting and said, "What is the absolute, minimal amount of work we can do to make this piece of software work?". It then appears that they took that list of minimums and cut it in half. It is barebones, to say the least.

Those who own other Rio products may be use to getting some type of CD ripping or digital file management software with players. This, however, doesn't include anything like that.

The Windows software, dubbed the "Audio Receiver Manager", doesn't actually allow you to manage anything. It does manage to discretely sit in your system tray and is loaded when you startup and log into windows. Since I always keep my main computer on and logged in, it's not a big deal to me, however, the audio manager will not start until you log into windows (i.e. enter your username password, if you get prompted for one). I'd like to see this made into a Windows NT/2000 service for the next release. [**Update: November 25, 2001:** Scott Alfter wrote me to tell me about FireDaemon [http://www.firedaemon.com], which essentially turns any Windows program into a WinNT/2000 service. I downloaded it and got it running in under a minute. It works great with the Rio Audio Receiver Manager and solves the problem I described above.]

Basically, you tell the software where on your system to look for MP3/WMA/M3U files. You have the ability to specify entire drives, which can be very slow, or individual folders. You must update the database every time you want to make new music available to your receiver. During the import process, the Audio Manager must stop playing music - apparently it has difficulty walking and chewing gum at the same time.

Here's some screenshots of the Windows program:
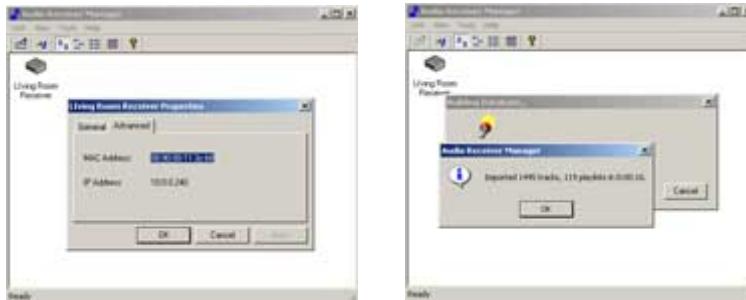
(*Click for larger images*)

A Note on Image 2 above: The Audio Manager shows that it imported about 1500 tracks and 120 playlists in 16 seconds. This particular import was run on a folder of MP3s that was already imported, so it ran rather quickly. When I first ran the import on this folder, it actually took close to 40 seconds to import all the tracks (not bad at all). However, this was done on a rather speedy Athlon 1.33Ghz with 768MB RAM and 7200 RPM drives. Your mileage may vary. The Rio documentation, for example, shows a screenshot of an import that was smaller, which took a considerably longer amount of time.

Things that particularly suck about the Windows-based Audio Receiver Manager software:

- It is pretty much un-configurable. Choose your DHCP range and choose your folders to scan, that's it.
- There's no sort of "preferences" available to save your settings, which would be nice. Even though I only search for MP3s under one directory (D:\MP3, for example), it always defaults to search the entire C: and D: drives. I then have to remove and re-select D:\MP3 EVERY TIME. This is maddening.

- Somehow, SonicBlue thought it would be helpful to have this thing search your MusicMatch and RealJukebox playlists - I can certainly see the value to this feature. However, you don't have the ability to disable searching these programs and the internal track lists and playlists are imported from these programs every time you update your database. This causes duplicate track and artist names to appear on your Receiver. For example, if you tell the receiver to search D:\MP3 for your of your tracks and you have previously imported the track names into Real Jukebox, all your tracks will be duplicated when you bring them up on the Receiver's LCD. This is fine if you want to "manage" all your music from RealJukebox, but I don't. Even after removing the tracks and playlists from RealJukebox, there were still dupes....I finally just uninstalled RealJukebox (it's a piece of junk, anyway). If you use MusicMatch, it will only import your MusicMatch playlists, which can be handy at times - but it's all or nothing....if you create playlists in MusicMatch, they will ALL show up on the Receiver, as you don't have any choice to exclude specific playlists.
- As mentioned before, the software sits in the system tray and is launched from your Startup folder. Therefore, if your machine reboots or you log out of Windows 2000/NT/XP, the Audio Manager software is not running - so no music for you.

Playing your Music From the Receiver

When it comes down to doing what it is meant to do, the Rio Receiver does a very good job. It's very easy to navigate through your music collection, even if you have a large number of tracks, artists and albums. I have close to 150 albums worth of digital music and I can easily find what I'm looking for in a few seconds.

Music selection is done using a simple jog-dial knob on the front of the unit. You have the ability to search for music by artist, album, song title, genre or m3U playlist. All this information is determined by the ID3 tags [http://www.id3.org] contained within your MP3 files - therefore, it's VERY important that all of your MP3 files are embedded with at least the artist, album and song title. (See my "Tips and Tricks" below for details on this). The Rio DOES NOT CARE about the organization of your directory structure - all it wants to know is the contents of your ID3 tags.

Overall Quality and Performance

Overall, the sound quality is very good. Of course, sound quality greatly depends on the bitrate used to encode your digital music files. I encode all my MP3s at 192 bits using LAME [http://www.mp3dev.org/mp3/] - the quality is excellent. The Receiver just takes a digital stream of the music files over the network and decodes it, so there is no loss in quality due to the network transfer or any weird types of streaming protocols. At 192bits, no one can tell that the music is sourced from am MP3 file.

The unit has a 10-second buffer, just in case there are any network slowdowns. I wanted to figure out just what it would take to make the thing stop or skip or do whatever it may do if the network gets really busy. So I wrote a simple Perl script to transfer a 200MB file between my Windows box and my Linux box over HTTP using 15 simultaneous threads (i.e. 15 downloads occuring at the same time). This is, of course, way more than what I normally see on my home LAN, which is usually just comprised of me and my girlfriend surfing the web (mostly me, of course). I should note that my home network uses a NetGear 10/100 Hub (not a switch) and a Linksys 10MB in the Living room - so the effective throughput will never exceed 10MB (not including protocol overhead). With 2 Skinny J's *The Whammy* playing in the background, I started the network torture test. Despite the fact that my Linux box's four-year-old hard drive protested, the Rio Receiver didn't skip a beat (no pun intended). So I think you can be pretty sure that this thing will work well, even in a busier network environment.

Did you say it runs Linux?

Yes, it runs Linux. Many people tend to get very aroused about this these days. I am a Linux advocate, as I like to advocate any technology that helps you work or play better, but I'm not a Linux zealot. But for the more curious, the unit has already been hacked, although it appears to be a bit more difficult to do than it should be. Jeff Mock has put together a wonderful collection of information [http://www.mock.com/receiver/] related to hacking the Receiver. Even though I was greatly tempted see what you can do with the thing, I figure I bought it to do what it does best - play music. I'm happy with its feature set and don't feel the need to crack it open. If this

unit gets more popular and there are a number of good hacks available out there, you may see more people trying ot hack it.

What Operating Systems Does it Work With? (Do I have to use Windows?)

The Rio Audio Receiver Manager software officially supports Windows98, 98SE, 2000 and ME. Although not listed, I'm sure it also works on XP, as the application nothing more than simple HTTP and UDP server. [**Update (November 25, 2001):** My friend, Roy Tucker, confirms that the Audio Receiver Manager software runs on XP. So blame him when it blows up your PC.] It will not run on Windows95 or WindowsNT 4.0.

There are a few efforts underway to make the unit work with non-Windows servers. The first is a home-grown project put together by Jeff Mock [http://www.mock.com/receiver]. Jeff has done an excellent job at reverse engineering the Rio's protocols and has put together a number of scripts that allow you to use a Linux machine as the file server. At this time, his software does not support playlists, but after looking at the code and the protocols, it is probably an easy thing to add Be aware, though, installation of Jeff's code is not a trivial task you need to have knowledge about Linux, Apache and Perl and there's not a lot of "HOW-TO" documentation available (who has time to document, anyway?...especially for open-source projects that don't pay the bills?). It took me about 40 minutes, but I got Jeff's scripts running. Again, he did a great job with this.

Second, there's an open source project called Digital Audio Server [http://sourceforge.net/projects/das/], which I have not tried out. It looks as if it might be a bit more complete and simpler to use than Jeff's solution.

There's a third project called Jreceiver [http://sourceforge.net/projects/jreceiver/], which is open source servlet-based audio server built to support network-based MP3 players like the Rio. However, it appears to be quite immature at this time. It's completely servlet-based, but does not support Tomcat, which is a major drawback, in my opinion.

Are there competitors?

Yes, in fact there is one generally-available competitor that I am aware of: The Turtle Beach Audiotron [http://www.audiotron.net/audiotron.asp]. I like this particular product a lot. Had it not been for the Rio's attractive $150 street price, I probably would have bought the Audiotron. There are a few major differences in the way that these boxes operates. First, the Audiotron is a full-size (but thin) stereo rack component, so it can blend nicely into your existing system. Second, the Audiotron accesses music over a simple SMB share, so you can simply export a folder from your Windows or UNIX box and make it available to the Audiotron. There's no server-side software required. Third, you can actually READ the LCD display on the Audiotron from a distance greater than 10 inches. Forth, the Audiotron has a TOSLINK optical output, which is nice to have. Last, but not least, the Audiotron comes with a suite of useful software, including a web-based front-end. The street price for the Audiotron, however, is about double the price of the Rio. You can read Rob Malda's review of the Audiotron on Slashdot [http://slashdot.org/article.pl?sid=01/10/12/1423233].

Tips, Tricks and Things to Be Aware Of

- **Use ID3 Tags** - as mentioned before, the Rio gets all it's track, artist and album info from the ID3 tags embedded in the MP3 file, so make sure you ID3 tag your MP3s. The easiest way to ID3 tag your MP3s is to do it when you rip them from the CD using a good ripping program with CDDB/FreeDB integration (Check out Audiograbber [http://www.audiograbber.com-us.net]). If have existing MP3s that are not tagged, MusicMatch [http://www.musicmatch.com] does a good tagging job for no cost. Musicmatch will also identify all the MP3s on your system that are not tagged.
- **Use RealJukebox *or* simple file system management** - the Rio Audio Receiver Manager WILL import all tracks and playlists you have setup in RealJukebox and you don't have any say over it. Therefore, you should manage your MP3s through RealJukebox or not use RealJukebox at all. If you search for MP3s on your hard drives AND have a RealJukebox tracklist built, you will get duplicate track entries when you bootup the Rio. [**Update, November 25, 2001:** If you delete RealJukebox from your system, the playlists will not be removed in the un-install process. Therefore, you need to manually go into the RealJukebox directory (e.g. C:\Program Files\RealJukebox) and remove all the folders. Note that if you are running the

Rio Audio Receiver Manager, you will get a sharing violation when you try to remove these folders, so shut the Rio software down first]

- **Listening to Full Albums** - There's only one way to listen to full albums the way they were intended to be heard on the CD: create an m3u playlist for the album. If you simply choose "Albums" through the Rio controls, it will list out the unique album names on the system (without the artist name attached to it). If you choose an album, the Rio plays through tracks in the album in alphabetical order - not in the order they appear on the CD. The solution is to create an m3u playlist for each album and then access the album through the "Playlists" option on the Receiver. Again, a good CD ripping program should create these playlists for you when the rip is complete.
- **Album Playlists help if they include Artist Names** - Some CD ripping programs will create m3u playlists and name the file after the album you just ripped. The Rio displays playlists according to their file system name. Therefore, if you don't have the artist name in the playlist file name, you may have a tough time identifying and finding the album playlist your are looking for. The solution is to name your playlists in some format like "Artist-Album.m3u". Sadly, my favorite software, Audiograbber, does not let you configure the file name format of the playlists. So I [wrote a Perl script that goes through your MP3 directories and renames the playlists] to "Artist-Album.m3u" format IF you organize your MP3's in the following fashion:

```
+/MP3-Root-Directory
        +/Artist-Name
                +/Album-Name
                        /Track.mp3
                        /Track.mp3
                        /Track.mp3
                        etc.
```

I think this is the typical way most people organize their MP3's, so the Perl script may be helpful. Also, since I think Playlists are so important, I wrote a [Perl script that hunts out any album directories that DO NOT contain playlists] and prints them out for you. (BTW, if you didn't know this already, you need to install [Perl] [http://www.cpan.org] on your machine for these to work).

- **The LCD Screen is Small** - You need to be pretty close to the unit to read the LCD, so choosing tracks from a distance is impossible. This used to piss me off, but I figured that with the old way, I would have to dig out another CD anyway (and chances were that CD I was looking for was MIA).
- **Tiny Gaps Between Songs** - the Rio inserts an every-so-tiny gap between tracks...so small you don't really notice it. I consider this a good thing. For live albums and albums with songs that continue onto the next track without a gap, everything sounds like it did on the CD...the Rio does an excellent job with this. I tested Jerry Seinfeld's *I'm Telling You For the Last Time* (a live comedy album), 311's *Live* album (a live concert album) and Rx Bandit's *Progress* (a traditional studio album where the first 5 tracks flow into the next track) - all of them sounded great. [**Update: January 2002:** A kind reader points out the the small gaps are actually encoded into the MP3 files and points to a discussion here regarding gapless playback]

Final Thoughts and Impressions

At $150 street price, this thing is a no-brainer. Despite some of my gripes, it does what its supposed to do and does it well. I highly recommend it. I no longer require a CD player in my den. Everything gets ripped to MP3 and then played on the Rio. If you already have a home network in place and a lot of digital music, it's pretty much just plug-and-play. I've already enjoyed using the Rio for the short time that I've had it and I'm sure that I will get much more enjoyment out of it in the future. Good job, SonicBlue.

For the tech weenies:

How does it work? (Warning: very useless technical information follows...you may want to stop here.)

Given my particular background, I was more interested in how the Receiver actually gets music from the central PC. After further analysis, I became convinced that the great Rube Goldberg was the chief architect of Rio. I thought the whole thing could have been made a lot simpler, especially compared with the file-sharing simplicity of the Turtle Beach Audiotron (see "Competitors" above).

So I set out to determine the protocols used between the Receiver and the Windows server. I figured that if I could reverse engineer these protocols, I could write my own server software to circumvent the lack of features in Rio version - including getting the server to run on Linux. So I started running Etherpeek sniffs of my network and began analyzing the traffic flow between the Receiver and my PC. I was about a half hour into it when I first discovered Jeff Mock's great "Hacking the Rio Receiver" page [http://www.mock.com/receiver]. Jeff did a far better job that I did in my first 30 minutes, so I used his notes to compare what I sniffed (btw, Jeff, your 100% right on...awesome work). The result of Jeff's sniffing efforts produced a set of scripts that allow you to run a Linux version of the server software (available for download on his site).

Basically, the protocol is simple, but there's a lot of little steps to actually get to the point where the music starts playing. Here's a quick overview:

- When the box boots, it sends out a DHCP request ("please, someone give me an IP address"). The Rio Audio Manager software on the PC responds to DHCP requests only for the RIO. This is based totally on MAC address, as I was able to send a spoofed DHCP request using the Rio's MAC from my Linux box. FYI, on the Windows side, I always limit the DHCP IP scope to exactly 1 address, which essentially gives the Rio a static IP. [**Update: January 2002:** Rio's developers have told me that there the software isn't looking for a MAC address, but a magic cookie contained in the Rio's DHCP request packets. I was able to get a response from the Audio Manager software only after completely capturing and replaying the Rio DHCP request from my Linux box. However, a DHCP request MAC src spoof from my Linux box did not work, which supports this fact.] Jeff relies on the OS to do the DHCP stuff - not his server software. You can, however, configure dhcpd to always dish out the same IP to a single MAC address, if you so desire.
- After the Receiver is happy with it's IP address, it sends out an SSDP request on UDP 21075 ("someone please tell me where my server is") with the request string "^upnp:uuid:1D274DB0-F053-11d3-BF72-0050DA689B2F\n{Source MAC Address}\n". The Audio Manager responds with the IP address and port of the Windows server. It tends to use TCP Port 12078 on the server side. It actually sends back an URL to an .xml file (http://serverip:12768/descriptor.xml)...the important part is the port 12768, which will be used as the status port between the receiver and server.
- The receiver actually does an NFS mount of /tftpboot on the server and grabs a basic Linux file system - sort of like an XTerm. It then reboots a second time, this time bootstrapping with the downloaded kernel. Jeff points out something interesting that I initially missed: the Receiver does an NFS mount of /tftpboot - it does NOT use TFTP to download the boot image from /tftpboot, as you would normally see with diskless clients.
- When you first scroll through a list - such as "Artists", the box issues a HTTP query to the app port specified in the SDDP response that looks something like: "GET /query?artist=". The server responds with an HTTP response with a standard HTTP 200 header, Content-type, Content-length, etc. a a response string that looks like "ArtistA.1=61,0,0:ArtistB.1=32,0,0......etc." You can start to see that the software assigns a unique index number to each item in the list, starting with 1, assigned in alphabetical order. Once you select an artist, for example, it will then make a subsequent query for the tracks associated with that artist ("http://10.0.0.25:12078/results?_extended=1&artist=Artist"). The server returns a similar list of tracks, each also having a unique track ID number. Once a track is selected, using its unique ID number, the Receiver asks for the tags associated with the mp3 file ("http://10.0.0.25:12078/tags/240", for example).
- From that point on, it's time to actually play the music. This accomplished by streaming the data over HTTP, gracefully shooting a flow of TCP PSH's and ACK's across your network. The receiver requests the unique track id over HTTP a la http://10.0.0.25:12078/content/240.
- While alive and active, the Receiver and the server software start to miss each other and send UDP status packets out to each other about every five seconds. Basically, the server says "State? (What's going down?)" and the receiver replies with it's current state, which includes its MAC address, the current song it's playing and an associated timecode.
- It should be noted that once you sniff the format of these queries, you can simply just insert them into any old web browser to see the results the server sends back. Type in "http://10.0.0.25:12078/query?artist=", for example, and you'll get a list of all the artists in the database. Doing something like "http://10.0.0.25:12078/query?artist=c" returns all artists starting with C - this might be useful in building

some type of music search engine or something. Doing something like "http://10.0.0.25:12078/results?
_extended=1&artist=Ash" will return all songs associated with the artist Ash. To see all playlists, it sends
"http://10.0.0.25:12078/content/100?_extended=1" and to view a specific playlist, it sends
"http://10.0.0.25:12078/content/5e90?_extended=1", where 5e90 represents the unique playlist ID it was
sent when it queried all the playlists. You get the drift....this isn't exactly rocket science. Given this simple
protocol, you can easily write a browser-based frontend to the Windows-based Audio manager software.

I figured that if I wanted to write a web-based front-end for the Audio Manager software, I would need to figure
out which port the server is running on. So I created a trivial perl script that mimics the Receiver, sending out a
direct SSDP query to the Windows server, which is happy to return the all-important port number that the server
software happens to be running on. Once you have that port, you can issue any of the HTTP queries above via a
regular web browser or with any piece of code you may just create. Interesting note: by sending out the SSDP
request from my Linux box, the Linux box now shows up as a "New Audio Receiver" in the Audio Receiver
Software. This causes the server software to send my Linux box a UDP "status" query every five seconds (too
bad my Linux box isn't answering).

Lots more that can be done with this...if you have the time and can think up a good use for it.

As a side not, if you're looking for a front-end to your MP3 collection and you're using Apache, take a look at
Lincoln Steins's Apache::MP3 [http://www.modperl.com/Songs/], for use with mod_perl. I use it and love it. It
gets me access to my entire music collection anywhere that I have an Internet connection.

PCT

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(54) **Title:** METHOD AND APPARATUS FOR UNIVERSALLY ACCESSIBLE COMMAND AND CONTROL INFORMATION IN A NETWORK

(57) **Abstract**

A method and system for performing a service on a home network, by: connecting a first and a second home device to the home network; providing a database including a plurality of application interface description data objects, where each application interface description data object includes information in a structured format for commanding and controlling of a home device by one or more other home device connected to the network; the second home device accessing a first application interface description object for the first home device in the database; the first home device accessing a second application interface description object for the second home device in the database; sending control and command data from the first home device to the second home device utilizing the second application interface description object over the network; and sending control and command data from the second home device to the first home device utilizing the first application interface description object over the network. Whereby, the first and second home devices perform said service.

Full A/V Control Model
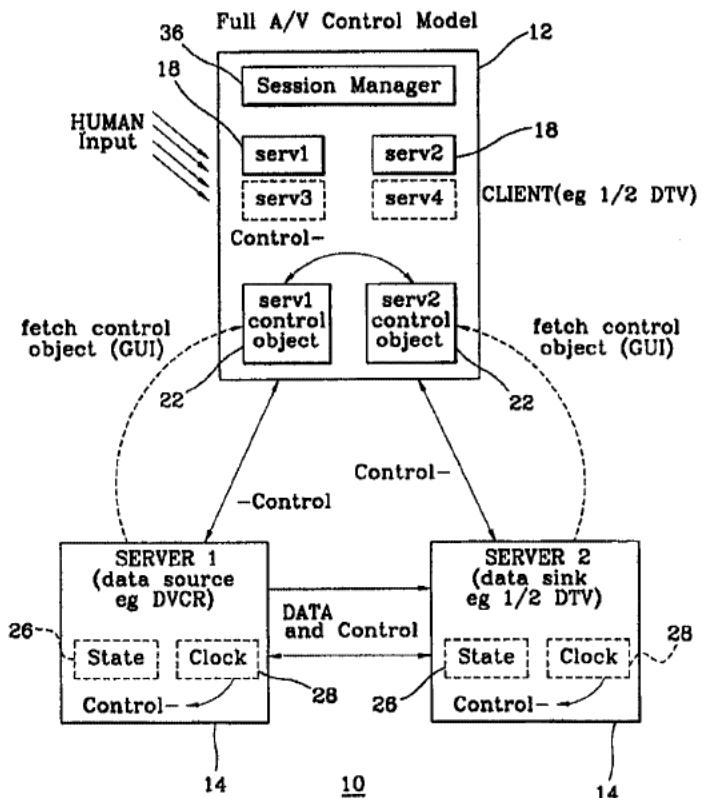
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CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
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Method and Apparatus for Universally Accessible Command and Control Information in a Network

5   **Technical Field**

The present invention relates to the field of network systems, and more particularly, to home network having multiple devices connected thereto.

Background Art

10   A network generally includes a communication link and various devices with communication capability connected to the communication link. The devices include computers, peripheral devices, routers, storage devices, and appliances with processors and communication interfaces. An example of a network is a home network for a household in which various devices are

15   interconnected. A usual household can contain several devices including personal computers and home devices that are typically found in the home. As such the term "device" typically includes logical devices or other units having functionality and an ability to exchange data, and can include not only all home devices but also general purpose computers. Home devices include

20   such electronic devices as security systems, theater equipment, TVS, VCRs, stereo equipment, and direct broadcast satellite services or (DBSS), also known as digital satellite services (DSS), sprinkler systems, lighting systems, micro waves, dish washer, ovens/stoves, washers/dryers, and a processing system in an automobile.

25

In general, home devices are used to perform tasks that enhance a homeowner's life style and standard of living. For example, a dishwasher performs the task of washing dirty dishes and relieves the homeowner of having to wash the dishes by hand. A VCR can record a TV program to allow

30   a homeowner to watch a particular program at a later time. Security systems protect the homeowner's valuables and can reduce the homeowner's fear of unwanted entry.

Home devices, such as home theater equipment, are often controlled using a single common control unit, namely a remote control device. This single common control unit allows a homeowner to control and command several different home devices using a single interface. Thus, may
5 manufacturers have developed control units for controlling and commanding their home devices from a single interface.

One drawback associated with using the remote control unit to command and control home devices is that it provides static and command
10 logic for controlling and commanding each home device. Another drawback associated with using remote control units is that known remote control units cannot control a plurality of diverse devices, and more particularly, cannot control a plurality of devices having different capabilities to communicate with each other in order to accomplish tasks or provide a service.
15

In conventional network systems a user provides commands using a remote control unit or device control panel. Once the user ceases, there is no controller unit or device in the network to provide commands for automatic operation. After a user initially controls and commands a first set of devices,
20 conventional systems do not provide a mechanism for the first set of devices to automatically communicate with a second set of devices in the network as necessary in order to accomplish tasks without direct user control and command of the second set of devices. Further, conventional systems do not provide an efficient method for various network devices to obtain information
25 about other network devices in the network for command and control.

There is, therefore, a need for a method and a system which provides dynamic control and command devices in a home network. There is also a need for such a method and system to provide the ability to control a plurality
30 of diverse devices having different capabilities to communicate with each other in order to accomplish tasks or provide a service. There is also a need for such a method and system to provide the ability for various network

devices to automatically command and control other various network devices. There is also a need for such a method and system to provide universally accessible command and control information for inter-device communication.

5   **Summary of the Invention**

The present invention satisfies these needs. In one embodiment the present invention provides a method and system for performing a service on a home network, by: connecting a first and a second home device to the home network; providing a database including a plurality of application

10   interface description data objects, where each application interface description data object includes information in a structured format for commanding and controlling of a home device by one or more other home devices connected to the network; the second home device accessing a first application interface description object for the first home device in the

15   database; the first home device accessing a second application interface description object for the second home device in the database;   sending control and command data from the first home device to the second home device utilizing the second application interface description object over the network; and sending control and command data from the second home

20   device to the first home device utilizing the first application interface description object over the network. Whereby, the first and second home devices perform said service.

In one version of the invention, the first home device stores first

25   application interface data therein, and the second home device stores second application interface data therein. The database is formed by querying the first and second home devices to transfer said application interface data for the first and second home devices to the database device. The database can be stored in a database device and connected to the network for universal

30   access by network devices. In that case, the first application interface description object for the first home device can be provided from the data base to the second home device over the network. Further, the second

application interface description object can be provided from the data base to the first home device over the network.

Further, three or more home devices can be connected to the network, wherein at least one home device accesses the database to query the application interface description objects of a plurality of home devices for sending command and control data to the plurality of home devices over the network. Each application interface description object can include data in a structured format. The structured format can include XML format.

Brief Description of the Drawings

These and other features, aspects and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying drawings where:

Figure 1 shows a block diagram on an embodiment of a network according to one aspect of the present invention;

Figure 2 shows the block diagram of Figure 1 in an example device control and communication scenario;

Figure 3 shows a block diagram of an example home network system according to the present invention which includes a plurality of client and server devices;

Figure 4 shows a block diagram of example embodiments of a client device and a server device of Figure 3;

Figure 5 shows example embodiments of client devices;

Figure 6 shows example embodiments of server devices;

Figure 7 shows a block diagram of two example networked server devices capable of communication with, and control of, one another;

Figure 8 shows a block diagram of an example architecture of an audio/video (A/V) model including examples of a source server device, a sink server device and a client device in a network;

Figure 9 shows another example audio/video (A/V) model;

Figure 10 shows an example capabilities data table for a network

device;

Figure 11 shows an example attribute data table for a network device;

Figure 12 shows an example configuration of building blocks for generating command messages among networked devices;

5   Figure 13 shows another example configuration of the building blocks of Figure 12 for generating command messages;

Figure 14 shows three examples of interaction among networked client and server devices;

Figure 15 shows an example block diagram for definitions of API

10   extensions of networked device interfaces;

Figure 16 shows an example architecture for a server device application accessing the interface description document of another server device;

Figure 17 shows another example inter-device control architecture

15   between a controller server device and a controlled server device;

Figure 18 shows an embodiment of an XML protocol providing a Web standard common middleware layer in a communication stack at the API level between networked devices;

Figure 19 shows another embodiment of server device to server device

20   command and control architecture;

Figure 20 shows the relationship between a device interface library and consumer electronics definition data base for home devices;

Figure 21 shows hierarchal form of an embodiment of a device interface definition;

25   Figure 22 shows an example of layers in device interface definition of Figure 21;

Figure 23 shows a command transmission and interpretation process between a sender and receiver device; and

Figure 24 shows an example table of a partial list of packet types and

30   formats for providing translation services according to an aspect of the present invention.

Detailed Description of the Invention

In one aspect, the present invention provides inter-device communication in a network such as a home network. As home devices become more intelligent and can share information, inter-device
5   communication allows a user to interconnect devices in a network to take advantage of the information sharing capabilities of those devices. As such, inter-device communication plays a crucial role in affording a user with the ability to fully and flexibly utilize the networked devices.

10   Referring to Figure 1, in an embodiment of the present invention, a network 10 includes at least one client device 12 and at least one server device 14 interconnected via a communication link 16. The communication link 16 can include a 1394 serial bus providing a physical layer (medium) for sending and receiving data between the various connected home devices.
15   The 1394 serial bus supports both time-multiplexed audio/video (A/V) streams and standard IP (Internet Protocol) communications. In certain embodiments, a home network uses an IP network layer as the communication layer for the home network. However, other communication protocols could be used to provide communication for the home network.
20

             Each client device 12 may communicate with one or more server devices 14 in the network 10. Further, each server device 14 may communicate with one or more other server devices 14, and one or more client devices 12, in the network 10. Each client device 12 can include a user
25   communication interface including input devices such as a mouse and keyboard for receiving user input, and a display for providing a control user interface for a user to interact with the networked devices. The user interface can include a graphical user interface (GUI) display 18 for providing information to the user. Referring to Figure 2, as defined herein, each server
30   device 14 provides a service for the user, except control user interface, and each client device 12 provides control user interface for user interaction with the network 10. As such, only client devices 12 interact directly with users,

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and server devices 14 interact only with client devices 12 and other server devices 14. Example services can include MPEG sourcing/sinking and display services.

5   Figure 3 shows a block diagram of an example home network 10 that includes a plurality of client devices 12 and a plurality of server devices 14. Each server device 14 may include hardware as a resource in the network for providing services to the user. Further, each server device 14 may store a server or service control program 20 for controlling the server hardware, and 10   include a graphical control object (GCO) user interface description 22 for user interface with the server control program 20 as shown in Figure 4.

          For control between a controlling client device 12 and a controlled server device 14, the client device 12 accesses the GCO 22 of the server 15   device 14 by, for example, transferring the GCO 22 from the server device 14 to the client device 12 over the network. The client device 12 then uses the transferred GCO 22 to create a control user interface GUI 18 for the user to communicate with the control program 20 of the server device 14 from the client device 12 over the network. The user provides command and control to 20   at least the control program 20 of the server device 14 from the client device 12.

          Storing the GCO 22 of each server device 14 in the server device itself may reduce the processing and storage requirements of the client devices 12 25   in networks with several server devices 14. Further, storing the GCOs 22 in the server devices 14 may allow each server device 14 to provide its own GUI look and feel to the user, and allows for modification or updating of the GCOs 22 without modifications to client devices 12.

30   Referring to Figure 4, to provide command and control between a client device 12 and the server device 14, in one embodiment, the client device 12 can include a renderer 24 for displaying a GUI 18 using a GCO 22

stored in the client device 12 or transferred to the client device 12 over the network from a desired server device 14. For example, in an initial device selection phase, the client device 12 can fetch the GCO 22 of at least one server device 14 over the network, and the renderer 24 displays a GUI 18

5   using the GCO 22 for controlling the server device 14. Preferably, the GUI 18 is customized to the server device 14 and can include a built-in command set for controlling the server device 14.

In addition, the GUIs 18 of various server devices 14 may include

10   commonalities such as: (1) a common GCO model type for the client device renderer 24 to display GUIs 18, (2) common communication protocols for transferring the GCOs 22 from various server devices 14 to the client device 12, and (3) common communication protocols for GUI interaction from the client device 12 to the control program 20 of the corresponding server device

15   14, wherein the client device 12 does not require a built-in knowledge of a particular server device 14 being controlled.

Referring still to Figure 4, a server device 14 may include one or more server control programs 20 to control the server hardware for providing a

20   service. The GUI interface 18 from the GCO 22 of the server device 14 provides interface to the server device control programs 20. The server device 14 may also include control state data 26 indicating the control status of the server device 14 and server device hardware in providing a requested service.

25

For example, the control state data 26 can include the status of control information in the GUI 18 for the server device 14, such as timer setup for a recording action in a VCR server device. The control state data 26 is stored in the controlled server device 14, and displayed to a user through the GUI 18

30   of the server device 14 at the controlling client device 12, for user control of the server device 14. Preferably, the controlling client device 12 for displaying the GUI 18 of the server device 14 does not retain knowledge of the control

state data 26 for the controlled server device 14.

Each server device 14 can be controlled by one or more client devices 12. As such, the control state data 26 stored in the server device 14 includes status of the information in the GUI 18 of the server device 14 at each of the controlling client devices 12. For example, when the user controls a server device 14 using a first client device 12, upon completion of the user control, the information in the GUI 18 of the server device 14 at the first client device 12 is saved by the server device 14 in the control state data 26 of the server device 14.

Alternatively, while the user is interacting with the GUI 18 of the server device 14 at the first client device 12, the control state data 26 of the server device 14 is updated with the information in the GUI 18 of the server device 14 at the first client device 12, and upon completion of user control, the control state data 26 is retained in the server device 14. When the user controls the server device 14 using a second client device 12, the control state data 26 is made available to the user via the GUI 18 of the server device 14 at the second client device 12 for further control. The user can also use the first client device 12 at a later time to control the server device 14, whereupon the control state data 26 is made available to the user via the GUI 18 of the server device 14 at the first client device 12 for further control. The server device 14 can also include a clock 28, or maintains the current time, to allow time delay action based on time or clock input from a user, as described below.

A client device 12 and a server device 14 can be physically bundled together as one unit such as a DTV. In that case, the server device 14 includes a control program 20 for controlling the server hardware, and the client device 12 provides control user interface to the server control program 20 for control and command of at least the server hardware. Figure 5 shows examples of client devices 12 that may include: (1) a PDA(RemoteC) for

displaying a GUI, (2) a DTV(STB) for displaying a GUI and including a sink
server comprising audio and/or video program streak destination server, and
(3) a PC for displaying a GUI and including at least one server device for
providing multiple services. Hardware and executables in a DTV or PC client

5   device can also be controlled by other client devices. Figure 6 shows
example server devices 14, including: (1) a DVDP SmartCard as a source
server device, (2) an Audio Amplifier as a sink server device, (3) a DVCR as
either a source or a sink server device, and (4) a Management Server for
managing remote server devices. The Management Server can be included

10   in a DBS-STB, Cable TV-STB, or ATSC-STB, for example. Such devices
include a Management Server for local control or management of the internal
workings of the STB. Further, external servers accessed through an external
network can be utilized by local client devices for services such as
Video-on-Demand, Enhanced-TV, and Internet commerce, for example.

15

        Referring to Figure 7, communication and control between two server
devices 14 is accomplished by the control programs 20 of the server devices
14 communicating command and control data therebetween. A server device
14 can control one or more other server devices 14 over the network. And, a

20   server device 14 can be controlled by one or more server devices 14, and by
one or more client devices 12. Further, a user can utilize a client device 12 to
control and command a first set of server devices 14, and the first set of
server devices 14 can automatically command and control a second set of
server devices 14 without user involvement, as necessary to perform services

25   to the user.

        For example, for automatic time-delay operation, a user can "log on" to
a client device 12 to control a first set of server devices 14 and specify
desired services. The user then "logs off" from the client device 12. The first

30   set of server devices 14 perform communication and control among
themselves, and at a later time, one or more of server devices 14 in the first
set automatically control a second set of server devices 14 as necessary to

collectively provide the desired services without user involvement.

5

10

15

Figure 7 shows example embodiments of two server devices 14 capable of communication with, and control of, one another. Each server device 14 includes a control program 20, a clock 28 and control state data 26 described above. Each server device 14 can also include a GCO 22 for the server device 14 to be directly controlled by a client device 12. However, a GCO 22 does not need to be included in a server device 14 that is not directly controlled by a client device 12 and only communicates with other server devices 14. Each server device 14 also includes a command language (CL) interface 30 and a library of commands. The library of commands includes the commands that the server device 14 utilizes to send and receive information for providing its service. However, a command language is not necessary for user control as shown in Figure 4 and described above.

20

25

30

Figure 8 shows an example audio/video (A/V) model including a source server device 14, a sink server device 14 and a client device 12 in the network. The source server device 14 includes a control program 20 for controlling data stream source hardware 32 of the source server device 14, and the sink server device 14 includes a control program 20 for controlling data stream sink hardware 34 of the sink server device 14. In an example operation, a user utilizes the client device 12 to control the source server device 14 to start the data stream source hardware 32, and to control the sink server device 14 to start the data stream sink hardware 34. Upon initiation of data transfer from the data stream source hardware 32 to the data stream sink hardware 34, the user can relinquish the client device 12. Alternatively, the user can program the initiation of the data transfer for a future time and relinquish the client device 12. Thereafter, the data stream source hardware 32 of the source server device 14 and the data stream sink hardware 34 of the sink server device 14 automatically initiate the data transfer at the time programmed by the user.

For example, the data stream source hardware 32 can include a
Tuner-Access Device such as a Direct Broadcast Satellite (DBS). A DBS is a
multi-channel alternative to cable television and provides cable-like television
programming directly from satellites on small (18 inch to 3-foot diameter)

5   satellite dishes. With DBS, several standard analog television signals are
digitally compressed onto a single satellite transponder thereby allowing up to
200 or more channels receivable with a dish pointed at a fixed position in the
sky. The data stream sink hardware 34 can include a Digital Video Cassette
Recorder (DVCR) which comprises s digital VCR that is able to decode

10 compressed digital video signals on playback. The user provides command
and control data including "time-delay record" event data for the DVCR and a
"time-delay select a program" event data for the Tuner-Access Device. After
the time-delay, the Tuner-Access Device selects the desired program, and
sources program data to the DVCR which receives and records the program

15 data without further control actions from the user.

Figure 9 shows another example audio/video (A/V) model including at
least a source server device 14 SERVER1, a sink server device 14 SERVER2
and a client device 12 in the network 10. The client device 12 includes a

20 session manager 36 with a user interface for displaying selection information
for a user to select and control the server devices 14 SERVER1, SERVER2
and other server devices 14 such as SERVER3 and SERVER4 (not shown).
The selection information can include iconic symbols designated as Serv1,
Serv2, Serv3 and Serv4 in the session manger 36 for a user to select the

25 server devices 14 SERVER1, SERVER2, SERVER3 and SERVER4,
respectively. The source sever device 14 SERVER1 can include a DVCR
and the sink server device 14 SERVER2 can include a 1/2DTV.

In one example operation, upon selection of the server devices 14

30 SERVER1 and SERVER2, the client device 12 transfers the GCO 22 of each
server device 14 to the client device and displays a corresponding GUI 18 for
each of the server devices 14 SERVER1 and SERVER2. The user can

-13-

interact with the GUI 18 of each server device 14 to provide command and control to the corresponding server device 14 for service. Each server device 14 can provide service alone or in combination with other server devices 14. Further, the session manager 36 transfers control state data 26 between the

5   GUIs 18 of the server devices 14 in the client device 12 as necessary for the corresponding server devices 14 to perform a service. Based on the user command and control information, two or more of the server devices 14 can communicate command and control information therebetween to provide a user requested service.

10

       The session manager 36 can include a software agent which functions to access and display available home network services provided by various server devices 14 in the network 10. The software agent can additionally match the capabilities of various server devices 14 in the network 10 and

15   display selection information for only those server devices 14 that have compatible capabilities. Further, the session manager 36 can match the selections made in the GUI 18 of one server device 14 to the selections in GUI 18 of another server device 18 to help the user provide meaningful command and control information to the server devices 14.

20

       In another example operation, the session manager 36 executes the software agent which searches the network and discovers the server devices 14 connected to the network. The software agent also accesses capabilities data stored in each server device 14 to determine the capabilities of the

25   server devices 14 and provide information about those capabilities to the user. The session manager 36 then displays the selection icons Serv1, Serv2, Serv3 and Serv4 for the server devices SERVER1, SERVER2, SERVER3 and SERVER 4 as shown in Figure 9.

30   The session manager 36 initially enables all the selection icons Serv1, Serv2, Serv3 and Serv4 to allow the user to select from among all four selection icons. After the user selects the server device SERVER1 by clicking

-14-

on the Serv1 selection icon, the session manager 36 determines that the server devices SERVER3 and SERVER 4 are incompatible in capability with the server device SERVER1. As such, the session manager 36 disables the selection icons Serv3 and Serv 4 for server devices SERVER3 and

5   SERVER4, respectively. The user can then click on the icon Serv2 to command and control the server device SERVER2.

        As the user interacts with the GUI 18 of a selected server device 14, control and command information input by the user into each GUI 18 provide

10   additional capabilities information which affect further server device selections by the user. For example, if a VCR server device 14 is selected, further action by the session manager 36 in enabling or disabling selection icons for other server devices 14 is affected by a user decision to play or record.

15   Each server device 14 in the network has one or more service capabilities as discussed above by way of example with reference to the server devices in Figure 9. Each service capability includes sourcing or sinking of information. For example, a TV has the sinking capability of receiving video and audio streams, a VCR device can source (transmit) and

20   sink (receive) video and audio signals, and a PC may be able to transmit and receive video, audio and data. Each sourcing capability has a complementing, and compatible, sinking capability. Similarly, each sinking capability has a complementing, and compatible, sourcing capability. For example, a video output capability of one device is complemented by a video

25   input capability of another device.

        Since each device 14 can be a source or sink for several different services on the network, each device 14 stores a capabilities data table (Capabilities Table 1) as shown by example in Figure 10. The first column of

30   Table 1 identifies the service capabilities of a device 14, and the second column identifies whether the device 14 is a source or a sink for a corresponding service in the first column. Using the capabilities data Table 1,

new services can be implemented while maintaining compatibility with older devices. For example, if a new service is developed that is compatible with an older service, both the new and the old service can be entered into the capabilities data Table 1 for a device implementing the new service, whereby

5   the implementing device remains compatible with older devices using the old service.

In one implementation, a Device Manager conducts a matching or comparison of device source and sink services. For example, the Device

10   Manager can be implemented as a software agent to compare the capabilities or properties of various devices 14 and locate devices 14 with matching capabilities. For example, in a case where the service is a media stream from a first device 14 across the network to a second device 14, the Device Manager compares the capabilities of the first and second devices 14 to

15   assist the user in making a sensible selection of the second device 14 which is compatible with the capabilities of the first device 14. The following is an example list of service capabilities for an embodiment of a server device 14:

        Stream_format_video_dv
        Stream_format_video_mpeg2tpt
20   Stream_format_video_dsstpt
        Stream_format_video_mpeg2pes
        Stream_format_video_mpeg210801-tpt

Each device 14 can further store an attribute data table (Attribute

25   Table 2) including pertinent attributes of the device, shown by example in Figure 11. A name and a value define each attribute within Table 2. Though character lengths are shown in Table 2, they are not required. The attribute data is available to other devices 14 on the network 10 to facilitate interoperability and to store device information. For example, a Device Page

30   as described below uses the Attribute Table 2 to store the device name. Other fields can be added to the attribute data Table 2 as necessary.

In the user-to-client device control model described above, attribute data can be displayed on the GUI page of the server device 14 at the client

device 12. Alternatively, a second level device information home page can be
utilized to display said attribute data. Further, the attribute data in the form of
a text or Extensible Markup Language (XML) file can be accessed by a
software agent. For the device-to-device control model, the attribute data for
5   the controlled device is stored in the device interface application interface.

The Device Location attribute field in the Attribute Table 2 is used to
store the location or group for each device 14. The Device Type attribute
field specifies the device type, such as VCR, DVD, DTV, Camcorder, PC,
10   Security System, etc. for the particular device 14. The Device Type attributes
field is used to select a default device icon to represent the device within the
Device Page if the device itself does not supply one. The Attribute Table 2
can include multiple entries for the Default Source and the Default Sink
attributes fields. Each such entry represents a different default source or sink
15   device 14 for each data type handled by the device 14.

Preferably, the capabilities and attributes data are packaged into
structured data using a hierarchical language. This provides a common
method of retrieving the capabilities and attributes data that are used for other
20   purposes such as in GCO transfer and server device-to-server device control.
As an example, the attributes data can include the following structured data
format:

```
        <DEVICEATTRIBUTES>
25              <ATTRIBUTE name=DeviceManufacturer value="Samsung
Inc.">
                <ATTRIBUTE name=Manufacturer URL
value=www.samsung.com>
                <ATTRIBUTE name=ManufacturerIcon value="logo.gif">
30              <ATTRIBUTE name=DeviceName value="Samsung DSS">
                <ATTRIBUTE name=DeviceModel value="SCH1900">
                <ATTRIBUTE name=DeviceType value=DDS>
                <ATTRIBUTE name=DeviceLocation value="Livingroom">
                <ATTRIBUTE name=DeviceIcon value="device.gif">
35              <ATTRIBUTE name=DeviceAddress value=105.144.30.17>
        </DEVICEATTRIBUTES>
```

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As an example, the capabilities data can include the following structured format:

```
<DEVICECAPABILITIES>
     <CAPABILITY type=MPEG2 value=Source>
     <CAPABILITY type=MPEG2 value=Sink>
     <CAPABILITY type=MPEG3 value=Source>
     <CAPABILITY type=MPEG3 value=Sink>
</DEVICECAPABILITIES>
```

5

10

An application interface language is utilized to allow different server devices 14 to perform device-to-device control, including sever device-to-server device control. The application interface language includes command languages, and can be described using XML, as detailed below. The control program 20 of one server device 14 remotely controls the control program 20 of another server device 14 over the network, without using GUIs 18 or user involvement. An example of device-to-device control is automatic operation. A user initially provides control through a client device 12 for a desired service, and subsequently two or more server devices 14 automatically communicate and control one another without further user interaction to provide the service.

15

20

Referring to Figures 12 and 13, preferably a standard application interface language is utilized to allow interoperability among various control programs 20 in various server devices 14. In one embodiment, the standard application interface language includes the following building blocks: (1) functional specification of service 40 such as in a service function database, (2) a block where elements of a message are composed 42, (3) industry standard format 44, (4) message compression 46, and (5) message string construction 48 to output structured message data.

25

30

Figure 12 shows an example configuration of the building blocks to perform the function of generating command messages. Each message item is composed from the functional specification of service and standardized by selecting an industry standardized compressed form (Hex) label for the

35

message item. A group of such message items are assembled to create a complete command string. Existing command languages such as CAL and AV/C operate as shown in Figure 12. However, such command language mechanisms specify binary or hex code messages and system operation on

5   physical devices on the physical interface, and are based on hardware specifications. Therefore, such command languages may be less desirable for a network layer based control mechanism where a control system specification includes naming, addressing, device capability discovery, communication language and command messages at the application level

10 software level, where one software application program 20 in a controller device 14 locates and controls another software application 20 program in a controlled device 14 over the network 10. Said control mechanism is more suitable for devices such as digital appliances including appliances (e.g., DVCR) as well as multi-purpose, multi-application devices such as

15 computers.

        Figure 13 shows a preferred example configuration of the building blocks of Figure 12 to perform the function of generating command messages. In Figure 13, the positions of the industry standard format 44 and

20 the message compression 46 are different than in Figure 12. A number of textual standard forms are selected from the functional specification service 40 to make a complete message. Later the message may be compressed by a lower layer of the protocol stack. Figure 13 represents a method of performing service or device command and control for consumer electronics

25 (CE). Message composition can be defined by the XML standard syntax and compression can be performed by another protocol layer such as HTTP. A command interface language is utilized at the application software 20 interface level, rather than lower hardware levels. As such, the network protocol stack is governed by commands in said language, and each of a

30 controller device 14 and controlled device 14 can be viewed as integrated components of the network for message transmission therebetween.

Referring to Figure 14, three different instances of interaction among client devices 12 and server devices 14 are shown. In the first instance "A", a human user communicates with a remote service application "S". The user utilizes a browser in a client device 12 as the user interface, wherein the

5   browser controls service programs 20 in the service application "S" and receives response in Hyper Text Markup Language (HTML) or XML formats. A secondary server is included with the browser to accept XML based asynchronous command message postings. For example, for a DVCR the secondary server 14 can accept command messages such as "VCR FAILED:

10   TAPE BROKE." A software agent including a browser can be utilized to display the command messages for a user in the browser's GUI for later attention by the user and control of the DVCR. Preferably, an XML based client device 12 includes an HTTP1.1 server capability to respond to command initiated elsewhere for server device to server device command

15   and control.

In the second instance "B", the user is replaced by a software client control program 50. The software client control program 50 generates XML based command postings to the service application "S" and receives back

20   XML command postings. And, in the third instance "C", the software client control program 50 is replaced by an application such a server device control program 20, wherein commands and responses are exchanged between two service applications 20. In that regard, instance "B" is a special case of instance "C" with a null service.

25

An application interface language based on XML is used for control between a first server device 14 and a second sever device 14 (device-to-device or service-to-service) for devices or services that are world wide web (Web) enabled and Internet enabled. The application interface language is

30   based on the Web standard, middleware layer. In one embodiment, device-to-device control includes remotely controlling the control program 20 or Application, in one server device 14 from another server device 14 in the

network 10. As such, the interfaces (API) to such Applications 20 are made available over the network using API extensions. Preferably, the API extensions utilize a standard format, such as an XML-based interface, to provide overall interoperability.

5

Referring now Figure 15, there is shown block diagram definitions of API extensions for a first *Application A*, designated as *Service A*, and a second *Application B*, designated as *Service B*, communicating over the network 10. For example, the *Service A* can be the control program for a first server device *A* in the network, and the *Service B* can be the control program for a second server device *B* in the network. The server device *B* sends commands to the server device *A*. For this example, the first and second service devices *A* and *B* can include CE devices.

15   Referring to the API extensions for the *Service A*, the first upper-most block 52 provides a comprehensive definition or data base of CE objects and methods using English words to describe CE devices. The comprehensive definition or data base can also be in C, XML or other formats capable of representing objects and their respective methods. The comprehensive definition or data base utilizing XML is termed XCE definition. The second block 54 provides a format for representation of an API in XML form for all devices 14, designated as an interface data type definition INTERFACE.DTD.

A software agent, designated as *Tool A*, utilizes a subset of the XCE definition for *Service A*, and uses the interface data type INTERFACE.DTD for *Service A* to create an XML form document, INTERFACE-A.XML. The document INTERFACE-A.XML describes the objects and methods supported by the *Service A* according to the document type definition INTERFACE.DTD for *Service A*. Other data type definitions can also be used to create the INTERFACE-A.XML document.

The software *Tool A* also creates a look-up table 56 to convert from

XML messages from *Service B* on the network interface, to API definitions for *Service A*, programmed in C for example, and complied to executable binary. Preferably, the look-up table 56 is created at compile time, whereby during run-time, incoming XML form method messages (commands) from *Service B*

5   are converted to the API format created by the complied application C code for *Service A*. The look-up 56 table provides run-time translation of XML object method calls from *Service B* into device native language calls for *Service A*. The look-up table 56 is complied with the device control program 20 for local execution on the server device *A* for *Service A*.

10

The INTERFACE-A.XML can be used by *Service A* for validity checks if it encounters an error in a received message. The INTERFACE-A.XML can also be used by a foreign Application such as *Service B* to determine the message format for *Service A* before communicating with *Service A*.

15   Further, if a message from *Service B* to *Service A* causes an error, *Service B* can access the INTERFACE-A.XML document to diagnose the error.

Referring to the API extensions for the *Service B*, the first block 58 provides a comprehensive definition or data base of CE objects such as the

20   XCE definition for *Service A* above. The next block 60 provides a language definition for making XML form method (command) calls to remote API services or devices such as the API for *Service A*. The language definition is a document type definition Method Request CALL.DTD which describes interaction with objects on the network.

25

A software agent, designated as *Tool B*, utilizes at least a subset of the objects and methods in the XCE definition for *Service B* and the CALL.DTD document, to generate a look-up table 62 for converting commands from a complied C program code for *Service B* into XML form method requests. As

30   such, the look-up table 62 provides conversion between a method invoked by *Service B* (e.g., "PLAY") and the XML document or message that carries the method call across the network interface to *Service A*, for example. The

subset of the XCE definition used by software *Tool B* depends on the extent and nature of use of the network. For example, the subset can be selected to provide global or restricted use of all available services on a home network.

5   Therefore, the API extensions provide for communication between various devices on the network using XML. In the example above, the program code 20 for *Service B* generates method calls to an API, and the API calls are converted to XML form to comply with the Web/Internet standard XML for inter-device communication. The XML method calls (messages) are

10   sent to *Service A* over the network, and *Service A* reconverts the XML method calls from the network interface to program code API definitions for *Service A*. This conversion and re-conversion provides Web/Internet compatibility for diverse devices in the network with program code APIs which would otherwise require binary compatibility between different devices.

15   Examples of the XML interface blocks utilizing the block diagrams in of Figure 15 are shown below.

```
       ------------------------------------------------------------------
            interface.dtd
20
            rules for describing an object interface in xml
       ------------------------------------------------------------------


25     <!ELEMENT    paramater    #PCDATA>
       <!ATTLIST    paramater
                    Type         CDATA #REQUIRED
                    >

30     <!ELEMENT    method       (#PCDATA, (parameter)+)>

       <!ELEMENT    method       (#PCDATA, (method)+)>

       ------------------------------------------------------------------
35          interface.h

            example object interface in c
       ------------------------------------------------------------------

40     /* object */

       typedef struct Stream {
              int id;
```

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```
};

/* methods */

void StreamPlay (int id, int speed);
void StresmStop (int id);


------------------------------------------------------------------
        interface.xml

        the same object in xml using ruels of interface.dtd
------------------------------------------------------------------


<object>Stream
        <method>Play
                <parameter type="int">id</parameter>
                <parameter type="int">speed</parameter>
        </method>
        <method>Stop
                <parameter type="int">id</parameter>
        </method>
<object>


------------------------------------------------------------------
        call.dtd

        rules for describing a c function call in xml
------------------------------------------------------------------


<!ELEMENT    parameter    #PCDATA>
<!ATTLIST    parameter
             value        CDATA #REQUIRED
             >

<!ELEMENT    method       (#PCDATA, (parameter)+)>
<!ELEMENT    object       (#PCDATA)>
<!ELEMENT    call         (object,method)>


------------------------------------------------------------------
        controller.c
        example controller command in c
------------------------------------------------------------------

.

.

.

StreamPlay (0x01ae, 500);

.

.

.

------------------------------------------------------------------
        call.xml
```

```
        the same command in xml using call.dtd
------------------------------------------------------------------------

        <!-- example to play a stream -->
5

        <call>
                <object>Stream</object>
                <method>Play</method>
10              parameter value="500">speed</parameter>
        </call>
```

Further, the above provides examples of interface definitions
INTERFACE.DTD and CALL.DTD used to create description documents of
15   available services, INTERFACE.XML, described above. The CALL.DTD
definition includes a rule set for generating method call or function call
message such as XML Remote Procedure Call (RPC) or XMLRPC
messages. The CALL.DTD definition describes an output interface of a
controller service 14. In a home network, for example, INTERFACE.XML
20   represents the services available on the home network. The available
services are a subset of the entire services in the CE space.

In a One-Touch-Record (OTR) scenario, a user is in control of a
Tuner-Access-Device such as a Satellite STB. The user controls the tuning
25   using an Electronic Program Guide (EPG) such as a graphical user interface
representation of program listings. OTR record provides the user with a
service including selection of a future program from the EPG for recording
without the user accessing the VCR graphical user interface to program the
VCR for a Time Delayed Recording. OTR automates the control of the VCR.
30   Below is an example control list of actions in OTR.XML: (1) StreamOpen =
play the selected program stream output to the network from a Satellite STB;
for OTR this control is local to the STB device; (2) StorageOpen = open a
storage service; and (3) StorageRecord = Send the Record command across
the network to the VCR.

35

```
------------------------------------------------------------------------
        call.dtd
```

```
        rules for describing a c function call in xml
------------------------------------------------------------------------

    <!ELEMENT    parameter    #PCDATA>
 5  <!ATTLIST    parameter
                 value        CDATA #REQUIRED
                 >


    <!ELEMENT    method       (#PCDATA, (parameter)+)>
10  <!ELEMENT    object       (#PCDATA)>
    <!ELEMENT    call         (object,method)>


------------------------------------------------------------------------
        interface.dtd
15
        example for describing an object interface in xml
------------------------------------------------------------------------

    <!ELEMENT    parameter    #PCDATA>
20  <!ATTLIST    parameter
                 value        CDATA #REQUIRED
                 >

    <!ELEMENT    method       (#PCDATA, (parameter)+)>
25  <!ELEMENT    object       (#PCDATA, method+)>


------------------------------------------------------------------------
        interface.xml

30      this document describes various CE services offered -a
        subset of the whole CE space.
------------------------------------------------------------------------

    <?xml version="1.0"?>
35  <!DOCTYPE interface SYSTEM "interface.dtd">

    <object>Stream
            <method>Open
                    <parameter type="int">id</parameter>
40                  <parameter type="int">channel</parameter>
            </method>
            <method>Close
                    <parameter type="int">id</parameter>
            </method>
45  </object>
    <object>Control
            <method>Set
                    <parameter type="int">id</parameter>
                    <parameter type="int">level</parameter>
50      </method>
    </object>

    <object>Storage
            <method>Open
55                  <parameter type="int">id</parameter>
```

```
                <parameter type="int">channel</parameter>
        </method>
        <method>Record
                <parameter type="int">id</parameter>
 5      </method>
        <method>Play
                <parameter type="int">id</parameter>
                <parameter type="int">speed</parameter>
        </method>
10      <method>Stop
                <parameter type="int">id</parameter>
        </method>
        <method>Close
                <parameter type="int">id</parameter>
15      </method>
</object>`

<object>Display
        <method>Open
20              <parameter type="int">id</parameter>
                <parameter type="int">channel</parameter>
        </method>
        <method>Render
                <parameter type="int">id</parameter>
25      </method>
        <method>Blank
                <parameter type="int">id</parameter>
        </method>
        <method>Control
30              <parameter type="int">id</parameter>
                <parameter type="int">cid</parameter>
                <parameter type="int">level</parameter>
        </method>
        <method>Close
35              <parameter type="int">id</parameter>
        </method>
</object>


40 <!-------------------------------------------------------------------------
        otr.xml

        an xml representation of one touch record

45      c representation:

        StreamOpen (100,2);/* play a stream (pushed by satellite feed
*/
        StorageOpen (24,2);/* open a storage service */
50      StorageRecord (24);/* record the stream */


   --------------------------------------------------------------------

        <?xml version="1.0"?>
55      <!CODTYPE interface SYSTEM "call.dtd">
```

```
        <call>
              <object>Stream</object>
                    <method>Open</method>
                          <parameter value="100">id</parameter>
  5                       <parameter value="2">channel</parameter>
        </call>
        <call>
              <object>Storage</object>
                    <method>Open</method>
 10                         <parameter value="100">id</parameter>
                            <parameter value="2">channel</parameter>
        </call>
        <call>
              <object>Storage</object>
 15                   <method>Record</method>
                            <parameter value="100">id</parameter>
        </call>
```

As discussed above in relation to Figure 15, a first device *B* can

20   access the INTERFACE.XML document of a second device *A* to examine the

device capabilities and API interface details of the second device *A* and

determine supported functionality and command details of the second device

A. In particular, the first device *B* can determine overlapping, and therefore

useable, methods supported by first device *B* and the second device *A*.

25   Figure 16 shows an example wherein a first server device *B* including an

Application B accesses the INTERFACE-A.XML document of a second server

device *A* including an *Application A*. The first server device *B* includes a

INTERFACE-B.XML document for comparison with that of a INTERFACE-

A.XML document in the second server device *A*.

30

In one scenario, the first server device *B* wishes to control the second

sever device *A* in the network. The INTERFACE-A.XML document of the

second device *A* is transferred from the second server device *A* to the first

server device *B* and used by *Application B* to query the capabilities and API

35   interface methods of the second server device *A*. This allows the first server

device *B* to control the second server device *A* utilizing XML remote

procedure calls XMLRPC. In another scenario, the first server device *B*

performs the above steps after attempting to communicate with the second

server device *A* at least once, and failed to establish communication. Yet in

another scenario the first server device *B* queries the INTERFACE-A.XML document in the second server device *A* remotely without transferring the INTERFACE-A.XML document to the first server device *B*.

5   Upon examining the contents of the INTERFACE-A.XML document, the first server device *B* can create commands for sending to the second server device *A* in XML format as described above. Generally, the first server device *B* can interpret at least a portion of the contents of the INTERFACE-A.XML document that overlaps with a subset of the XCE definition used by

10   the first and second server devices *B* and *A* as described above. If the first server device *B* is unable to interpret a portion of the contents of the INTERFACE-A.XML document, then the first server device *B* can ignore that portion, or fetch an application to assist it in interpreting that portion, by translation as described further below.

15

          Referring to Figure 17, another example device-to-device or inter-device control between a controller server device 14 and a controlled server device 14 is shown. The controller device 14 includes a controller application *E* and the controlled device 14 includes an application executable *C*. The

20   controlled device 14 further includes INTERFACE-A.XML, the application interface description *A* of the application *C*. Application *E* accesses the application interface description *A* in the controlled device 14 to query the capabilities and API interface methods of the controlled server device 14. Application *E* then commands and controls application *C* using XML remote

25   procedure calls to control hardware or service *D* of the controlled device 14. A scheduler device can be a case of a controller device 14, driven by time of day such as Time-Delay-Record controller in a VCR.

          In a first example, the application *E* accesses the application interface

30   description *A* by remote query over the network. In a second example, the application *E* accesses the application interface description *A* by transferring a copy of the application interface description *A* from the controlled device 14

to the controller device 14. The application E then queries the interface description A locally. In a third example, the application interface description A is transferred to a library device 64 which provides library space for interface descriptions, and the application E remotely queries the interface

5   description A in the library. The library device 64 stored the address (URI) of the associated applications available for direct control action and responses.

Referring to Figure 18, the XML protocol provides a Web standard common middleware layer in a communication stack 66 at the API level

10   between applications 20 of various devices 14 in the network. In each device 14, applications at the top of the communication stack send and receive communication messages over the network, and communicate with software layers in the device stack that locally control the device hardware or service software for the device.

15

A first XML layer API, designated as XML Layer OUT 68, is used for sending messages, and a second XML layer API, designated as XML Layer IN 70, is used for receiving messages. The XCE definition and the XML definition of a method call, namely the document type definition CALL.DTD

20   described above, are used to create the XML Layer OUT 68. Further the XCE definition and the XML definition for a method call, namely document type definition INTERFACE.DTD described above, are used to create the XML Layer IN 70. For example a controller application utilizes the XML Layer OUT 68 and a controlled application utilizes the XML Layer IN 70.

25

Referring to Figure 19, another embodiment of server device-to-server device command and control architecture is shown. An XML-based control architecture is utilized for device-to-device (service to service) control for Web and Internet enabled devices or services. A first device A can remotely

30   control an application 20 in a second device B over the network using XML command messages. The interface to each device includes interfaces to the applications in the device, and is described in XML format. Said interfaces

can be extended and made available on the middleware layer for retrieval and interpretation by other devices over the network, as described further below.

Each of the server devices A and B includes hardware and software
5   for controlling other server devices over the network and for being controlled
by other server devices over the network. In Figure 19, the home network
device A is a controller device or module, and the home network device B is a
controlled device or module. Each of the devices A and B includes a local
Device XML Interface 72 comprising an interface document
10   INTERFACE.XML and a document type definition INTERFACE.DTD. The
INTERFACE.XML document includes a description of the objects, methods
and parameters supported by the corresponding device 14. The
INTERFACE.DTD document can be used for validity checks specific to the
XML interface of the device, as described above.
15

Each of the devices A and B also includes an XML parser 74,
comprising program code for parsing and validating XML messages, such as
XML interface and XMLRPC commands. The XML parser 74 is similar to
said XML Layer IN 70 described above with reference to Figure 18. Further,
20   each of the devices A and B includes an XMLRPC encoder and decoder
(codec) 76 for encoding method names and parameters of an outgoing call in
an XMLRPC message, and for decoding an incoming XMLRPC message
after it is parsed, to retrieve the method name and parameters therein. The
XMLRPC codec 76 is independent of the device XML interface 72 and of the
25   device-to-device control architecture, thereby allowing use of different
XMLRPC formats without changing other aspect of the device to device
control architecture.

An Interface Fetcher comprising program code, is utilized by each of
30   the devices A and B to fetch the device interface of another device directly
from another device or from a home network Interface Library 80. When a
device 14 is a controller device, a controller application program code 82 in

the controller device 14 effects command and control of other devices 14 over the network, by supervising software and hardware in the controller device 14 such as the XML parser 74, the interface fetcher 78 and the XMLRPC codec 76. When a device 14 is a controlled device, a controlled application program

5   code 84 in the controlled device 14 supervises software and hardware in the device 14 for the device 14 to be controlled by other devices 14. A Home Network Device Web server 86 in each of the devices A and B manages communication between the devices over the network. An XML to Native Lookup Table 88 in each of the devices A and B is used by the controlled

10 application 84 to convert information in XMLRPC messages (e.g., method name, parameters name and type) to native interface of the device (e.g., native method name, parameters name and type). Said table 88 is not used when the names of methods and parameters in XML messages and the native interface of the device are the same.

15

Each of device the devices A and B further includes one or more Handlers 90, wherein each Handler 90 includes a pointer from within the controlled application 84 to a native implementation of one specific device functionality. In most devices, native implementations of device functionality

20 include binary code at run-time. The binary code can be generated from higher level languages at compile time, including C and Java, for example. As such, consumer electronics manufacturers can add more Handlers 90 for new functions without affecting existing Handlers and function implementations. A hardware service 92 in each of the devices A and B

25 includes native implementations of device functions. Each of the devices A and B also includes a Native Interface 94 which comprises the API of native implementation of the device functions.

Further, a Network Object Request Broker such as a Home Network

30 Object Request Broker (HNORB) 79 and Interface Library (IL) 80 provides a middleware layer 98 for the home network 10. As shown in Figure 19, the middleware layer 98 can be located in a third device 96 or in a separate

control hub. The HNORB 79 includes a software agent for use by one device 14 to discover the existence of other devices 14 connected to the network 10. The HNORB software agent organizes device names into a naming hierarchical tree structure, organizes device interfaces into said searchable 5   Interface Library, and provides device interfaces to a device requesting interface information.

The middleware layer, comprising the HNORB 79 and the IL 80, can be connected directly to the Internet, such that selected home devices can be 10   accessed from outside of a local home network 10. The middleware layer 98 in one local home network can be connected to the middleware layer 98 in other local home networks over the Internet to provide an integrated network comprising two home networks 10. In that case, authorized users with the appropriate stream encryption can access a DVD changer in the user's 15   primary home, from a TV in the user's secondary home to play a video and view it on the TV.

To use the Interface Library 80, at least one HNORB&IL should be running on the local home network 10. More than one HNORB&IL may also 20   be available. For example, a cable modem, several DTVs, and a central home hub can all have their own HNORB&IL software agents. To locate the HNORB&IL, a device 14 sends a broadcast message over the local home network. The first HNORB&IL to respond to the device 14 is utilized by the device 14. Once a HNORB&IL is located, the device 14 and the HNORB&IL 25   can establish a point-to-point Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) connection for registration, interface request and fetch, and device lookup services. If a UDP protocol is not available, a TCP protocol can be used for high bandwidth connections such as IEEE 1394. HTTP-based XMLRPC can also be utilized for device to HNORB&IL 30   communications. For example, a device 14 can remotely call a "register" method of HNORB to pass the device interface as one or more parameters, or, a XMLRPC call can retrieve a partial or entire device interface from the IL

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as a XMLRPC response or return value.

As aforementioned, more than one HNORB&ILs can run in a local
home network 10 simultaneously, wherein each HNORB&IL recognizes a
5   subset of available devices and one HNORB&IL can communicate with other
HNORB&ILs to locate the devices 14 it can not find. Multiple HNORB&ILs on
one local home network 10 can locate each other automatically by using
broadcasting messages, such as UDP or TCP. In this case, multiple HNORBs
construct a distributed object request broker, while multiple Interface Libraries
10   80 construct a distributed interface library. To provide fault tolerance, if one of
the HNORB&IL should terminate unexpectedly, all devices registered with this
HNORB&IL are notified and said devices can automatically register with
another available HNORB&IL.

15   Each device interface has an associated consistent, unique logical
name. Other devices can use said consistent, unique, logical name to
recognize and access a device, even after said device's location or real
network address has changed. The mapping of the logical names and real
device addresses are handled by a software agent for naming service in
20   HNORB. Preferably, a standardized naming method is utilized. More
preferably, a hierarchical naming structure is used to organize device names
into a hierarchical tree. This hierarchical structure can be expressed using "/",
similar to that in a file system. The structure can be generated by different
methods, such as by different service types as a home/MPEG2/TV; or by
25   different locations, such as home/livingroom/VCR. Several naming trees may
coexist for performance and efficiency.

In the example command and control between the controller server
device A and the controller server device B in Figure 19, the middleware layer
30   98 is in the third device 96 or can be in a separate central hub. The grayed
blocks show the device elements used for the specific command and control
process depicted in Figure 19. In an example operation scenario, after the

devices A and B become available and accessible over the network, each device registers/submits itself and its XML interface to the central HNORB and IL middleware layer 98. If a central HNORB and IL middleware layer is not available, then each device broadcasts a message over the local home

5   network to announce itself.

The controller application 82 of the device A attempts to query all or part of the device interface of the controlled device B. If an Interface Library 80 is not available, the controller device A can request and fetch the device

10 interface of the controlled device B directly from the controller device B by first sending a request to device B over the network, and then receiving the XML interface of device B from the device B. However, if an Interface Library 80 is available, the controller device A can request all or part of the device interface of the controlled device B from the Interface Library 80. The software agent

15 of HNORB obtains the XML device interface of the device B from the Interface Library 80 structure and sends it back to the controller device A.

Once the controller device A receives the XML device interface of the controlled device B, the controller application of device A uses the XML

20 parser 74 of device A to parse and interpret the device interface of the device B. The XMLRPC codec 76 of device A then generates desired XMLRPC command messages using the parser results. The XMLRPC command messages are sent to the controlled device B over the network. Upon receiving said XMLRPC command messages, the controlled application 84 of

25 device B uses the XML parser 74 of device B to parse and interpret the received XML command messages. The XMLRPC codec 76 of device B then decodes the parser results to obtain the method call information in the command message, including a method name and parameters for the device B functions to perform requested services.

30

The controlled application 84 of device B then uses the XML to Native Lookup Table 88 and Handlers 90 in the device B to access and launch the

native function implementations of device *B* through the native interface of device *B*. If a function generates any responses or return values, said responses or return values are encoded into XML or XMLRPC messages and sent to the controller device *A*. Further, the middleware layer HNORB and IL

5   can provide the controller device *A* with a reference to the controlled device *B*, whereby the device *A* can generate remote calls to the device *B* native functions just as calls to the local device *A* native function.

Preferably, a standard XMLRPC format is utilized so that all devices

10   can interpret and decode RPC calls over the network. Because the device interface of a controlled device 14 can be queried and examined by a controller device 14, preferably a simplified XMLRPC format with sufficient device interface information is utilized to improve efficiency. The following example shows two possible formats of XMLRPC calls for One Touch Record

15   (OTR) and Time Delayed Record (TDR) operations.

EXAMPLE I:
XML RPC call, example format including detailed tag and interface
     information:
20   1. Example of OTR call:
        <?xml version="1.0"?>
        <call>
                <object>DVCR1.record</object>
                <method>timeDelayedRecod</method>
25   <parameters>
                                <name>channel</name>
                                <value><int>4</int></value>
30
                                <name>recordTime</name>
                                <value><time>2:10:30</time></value>
                </parameters>
35   </call>

     2. Example of TDR call:
        <?xml version="1.0"?>
        <call>
40   <object>DVCR1.record</object>

termed a CE data base 102. The comprehensive definition or database can be in C, XML or other formats capable of representing objects and their respective methods and parameters. The comprehensive definition or database utilizing standardized XML vocabularies is termed XCE definition or data base 104.

Controller and controlled applications 82, 84 are programmed using a standard interface subset of the XML based XCE data base 104. Each device interface is stored with said applications 82, 84 in XML form. Although the XCE data base 104 need not be in XML, said subset interface produced at compile time is in XML in an embodiment of the invention, as described above in reference to Figure 15.

In Figure 20, for embedded appliances 14, the information designated as 'Manufacturer' information is built-in to the appliances 14 at manufacture time, and the information designated as 'Home Network' is part of the operational run time aspects of the appliance in the network. Device XML interfaces 72 designated as *1 ... N* for *N* devices 14, are branches of the data in a standardized XCE data base 104. A Home Network Interface Library (HNIL) 106 provides a collection of the device interfaces of available devices 14 connected to the home network. The Home Network Interface Library 106 is a subset of the totality of the XCE data base 104.

In Figure 16, a device interface was transferred from a device *A* to a device B for an *Application B* in device *B* to examine the contents of the interface for the device *A*. As detailed above, a device interface includes a description of the objects, methods, parameters supported by a device, and is referred to as INTERFACE-A.XML for a device *A* for example. A Device XML interface 72 is a device interface in XML format. The content of the XCE data base 104 is a service oriented structure which provides device interfaces.

Referring to Figure 20, the XCE database 104 also includes a standardized XCE Interface Document Type Definition (DTD) for CE devices, which provides a standardized set of rules for using XML to represent CE devices 14. The DTD or its subsets can be used for validity checks. A

5   software agent designated as Manufacturer Tool 108, filters and utilizes a subset of the standardized XCE definition 104 for a specific CE device, and uses the standardized XCE Interface DTD to generate an XML device interface 72 of the CE device, for example INTERFACE.XML and INTERFACE.DTD. The document INTERFACE.XML includes a description

10   of the objects, methods and parameters supported by a specific device according to the standardized XCE Interface DTD. The document INTERFACE.DTD is a subset of the standardized XCE Interface DTD, and can be used for validity check for the XML interface of the device. Other document type definitions can also be used to create the INTERFACE.XML

15   document.

The XML interfaces 72 of the CE devices, including said XML interface document and said DTD document, are stored in a universally accessible library such as the home network Interface Library 106. A software agent

20   110 collects the device interfaces 72 of all accessible devices 14 over the network and places them into the searchable structured Interface Library 106 along with the device name/address information. The Interface Library 106 is a subset of the XCE database 104 and the process of generating the Interface Library 106 is similar to that of rebuilding part or all of the XCE

25   database 104. The Interface Library 106 can function as a collection of device interfaces 72 of all devices 14 in the home network, or as a cache depending on availability of storage space, wherein only the most recently used device interfaces 72 are stored therein. In cases where a device 14 updates its device interface 72 due to an event, such as disk change in a DVD player,

30   part of the device interface 72 is updated based on an event service.

Referring to Figure 21, preferably the device interface definition 72 of

each device 14 has a hierarchical form. This is because for a home device 14, the device interface definition 72 can be lengthy. Typically, one or few functions such as a single function for Time Delayed Recording, are accessed at a time, and therefore only a small portion of the device interface

5   72 is used. Rather than rendering the entire device interface 72, it is more efficient to render only a portion of he device interface 72. By using hierarchical device XML interface, a controller device 14 can request partial device interface 72 of a controlled device 14 by specifying the desired function categories or functions in a request for the XML device interface from

10   the controlled device 14 or from the HNORB and IL middleware layer 98. In the latter case, the HNORB and IL middleware layer 98 sends back the desired portion of the device interface 72.

        Referring to Figure 21, the hierarchical device interface structure can

15   include four layers, including: (1) a first layer 112 for XML interface of each home network, listing current available devices, (2) a second layer 114 for general XML interfaces of each device, listing function categories, (3) a third layer 116 for specific XML interface of each function category for a device, and (4) a fourth layer 118 for specific XML interface of each function in a

20   function category.   Inside the home network, only the three lower layers 114, 116 and 118 are utilized, and outside the home network the first layer 112 is utilized.

        Figure 22 shows said layers 112, 114, 116, 118 and corresponding

25   interface examples. The interface in each layer is linked to upper or lower layer (if available) through links such as XLink or XPointer, which provide two-way linking. XLink includes a package of hyperlinking functionality that has two parts: (1) an XLink component which allows links in an XML documents to be recognized as such, and (2) an XPointer component which allows links to

30   address into precise sub-parts of an XML document. As such, XLink governs how links are inserted into XML documents, wherein the link may point to data such as a GIF file. Further, XPointer governs a fragment identifier that

-40-

can go on a URL when linking to an XML document, from anywhere (*e.g.,* from an HTML file).

5   In a typical command and control model for a server device 14 to control another server device 14 according to the present invention, a first device 14 attempts to query the device interface of a second device 14 at the second interface layer 114. After selecting function categories (FC), the first device 14 queries the interface layer 116 of a specific function category in the second device 14, such as Record Category. Further, the first device 14 can

10   query the interface layer 118 of a specific function, such as OTR or TDR, to make calls to said functions. The hierarchical or tree structure makes finding of an interface function more efficient and saves network bandwidth. An example interface file structure and layers can be:

        First layer 112 -   HN1.xml
15   Second layer 114 - VCR1.xml
        Third layer 116 -   VCR1_RecordCategory.xml
        Fourth layer 118 -   VCR1_RecordCategory_OTR.xml

        Similarly, the home network Interface Library 106 is preferably

20   hierarchical and can be structured in a variety of ways such as by different service type of devices or by different locations such as rooms. Said hierarchical structure is the interface of a local home network 10 to other home networks or the Internet.

25   An example hierarchical device interface definition 72 which can be implemented in XML syntax is shown below.

```
consumer (document_file, doc)
     +----document_file<server_home.dtd, server_auto.dtd>
30      +----doc (services_home, server_auto, server_samsung_web_site,
avc_commands, cal_commands,,)
          +----services_home (xml_utility, client, server_av, lighting,
comms, hvac, utility, security, appliances, convenience,,)
          +----xml_utility (download_DTD_file,,)
35      +----client (acknowledge, attention, error, post_message,
sound, stop_schedule, stop_all,,)
```

```
                +----sound (alarm, ring, buzz,,)
              +----server_av (controls_gen, source, sink)
                +----controls_gen (ping, process_infor, setup,,)
                   +----process_info (s/w_id, h/w_id)
 5                   +----h/w_id (ser_no, manuf, model, class,,)
                     +----s/w_id (ser_no, exe_name, version,,)
                   +----setup (clock,,)
                     +----clock (hours, minutes, seconds)
                +----source (service_id, media, rate, protocol,
10  stream_format, controls_av,,)
                +----sink (service_id, media, rate, protocol, stream_format,
    controls_av,,)
                   +----service_id (url,,)
                   +----media (tpt_stream, ram, disk, tape,,)
15                   +----disk (name, number,,)
                   +----rate<value>
                   +----protocol (61883/1394, UDP/IP/Ethernet,,)
                     +----61883/1394 (isoch_ch_no)
                   +----stream_format (video, audio,,)
20                   +----video (dv, mpeg2tpt, dsstpt, mpeg2pes,
    mpeg1080l-tpt,)
                     +----audio (mpeg3, ac-3, midi,,)
                   +controls_av (flow_control, tune, timer_record,
    ui_control,,)
25                   +----timer_record (tune, flow_control)
                     +----flow control (play, stop, goto, record,,)
                       +----play (time_params)
                       +----record (time_params)
                         +----time_params (now, start, duration, end,,)
30                   +----tune (send_epg, channel,,)
                     +----channel (number, id, time_params,,)
                     +----ui_control (display, acoustic)
                     +----display (brightness, contrast, color/tint,
    horiz_size, vert_size,,)
35                     +----acoustic (volumn, base, treble, balance, fade,)
          +----lighting (sensors, lights, send_epg)
             +----sensors (living_room, sky,,)
             +----lights (rooms_up, rooms_down, yard,,)
                +----rooms_up (bed1, bed2, bed3, bed4,,)
40                   +----bed1 (lamp, dimmer,,)
                     +----dimmer<value>
                +----rooms_down (family, kitchen, living, dining, soho,
    garage,,)
                +----yard (front, back)
45      +----comms (homehub, intercom, telco,)
          +----homehub (send_device_list, send_configuration,
    send_snmp_mib,,)
             +----intercom ()
             +----telco ()
50      +----hvac (controls_gen, controls_havc,,)
          +----controls_hvac (a/c, heat, temp, humidity,)
             +----temp (low, high, hysteresis,,)
        +----utility (meters, energy_mgmt,,)
          +----meters (water, gas, electric,,)
55           +----water<value>, gas<value>, electric<value>
```

```
        +----security (sensors, send_epg, alarm,,)
            +----sensors (peripheral, motion,,)
                +----peripheral (rooms_up, rooms_down,,)
                +----motion (room_down, yard,,)
5           +----appliances (microwave, range, oven, fridge, freezer,
coffee, toaster, washer, dryer, water_heater,,)
                +----microwave (send_epg, controls,,)
                +----fridge (temp,,)
                +----water_heater (temp)
10          +----convenience (window, curtain_open, door/gate, pool/spa,
bath, fountain, lift, jacuzzi,,)
                +----curtain_open<value>
            +----server_auto (message, server_auto_ford_explorer_98,,)
                +----server_auto_ford_explorer_98 (mileage, maintenance,,)
15          +----mileage <data>
            +----maintenance <data>
        +----server_samsung_web_site (message, service, help,,,)
        +----avc_commands<,,,command_string,,,>
            +----service_id url,,)
20      +cal_commands<,,,command_string,,,>
            +----service_id (url,,)
```

Said hierarchical device interface definition 72 can include the following fields:

'document file' name, provides name of the document type

definition (DTD) file that can be used by an XML parser 74 for verification of

legality and correctness of the XCE database 104 or part of the XML version

of the XCE database 104. There can be several DTD files for different parts

of the XCE structure, wherein said DTDs are different from the document type

definitions for the RPC.CALL and INTERFACE.DTD for communication.

'doc' name, provides the top level name of the area of coverage

of capabilities, attributes, communication and control interface.

'Services_home', provides area for home automation, consumer

electronics, utility, etc.

'Server_auto', for an automobile in the garage and shows

message interface available for one or more automobile types. For example,

server_auto_ford_explorer_98' is the interface for a particular automobile.

This allows access to mileage and maintenance interfaces of the automobile,

and can also be used for remote access by an automobile manufacturer or

garage for direct checking and remote diagnostics, for example.

'server_samsung_web_site', provides for communicating with a

manufacturer Web site outside the home. Includes interface for message,

service, help, etc.

'AVC_commands' and 'CAL_commands', provides for legacy devices capable of interpreting AV/C and CAL languages, for example. This portion of the structure identifies commands in said languages, where the commands are tagged and carried in XML. As such, the contents are not XCE (Web) objects, and protocol converter applications can be utilized to interface to the original CAL or AV/C application software.

In the above description, 'Services_home' provides the main structure including A/V consumer electronics. A branch of the structure is expanded in detail for a particular example of a video services sink, and stream destination (e.g., DVCR) control interface. The control interfaces in a typical home network can include:

'xml_utility', provides details for supporting utility network functions such as downloading an updated DTD file, interface file, program file, etc.

'client', describes the interface details of a client device 12 including a Web browser. For example 'acknowledgment' indicates the controller's acceptance of acknowledgment of a message or command sent out.

'server_av', provides control and capacity interfaces for all audio and video services available, including STB, DVCR, DTV, DVD, AUDIO, etc.

'lighting', provides an interface to a home automation lighting controller, and includes sensors, lights, etc.

'comms', provides control interfaces to communications devices, typically for utility purposes or remote management of the devices' set-up or parameters, or for restoring configurations.

'hvac', provides interfaces for remote control of the HVAC system, and can be used for control of said system from outside the home by the utility company, for example, to turn the home's HVAC system off during peak load periods of the day. Further, said interface can be used for controlling the HVAC system from within the home, by an appliance for device

based controller to provide a more sophisticated control mechanism than thermostat control.

'utility', provides interface for reading utility meters for the home, for example.

5   'security', provides interface for security sensors and alarm settings. As such, using the interface, applications running on a home network device can have access to the sensor and detector devices around the home for monitoring and controlling of the those devices.

'appliances', provides interfaces for kitchen, utility and general

10   home appliances, including, for example, providing remote control or monitoring temperature settings or other controls and parameters from a controller device. In one scenario, a microwave appliance can scan bar code information on the packaging of a food item and access a manufacturer database to obtain cooking time of the food for a given microwave system

15   type. Such integration of appliances using device to device command and control provides many control scenarios for providing services such as automatically pausing a dishwasher and muting a TV when a phone is picked up in the kitchen or family room.

'convenience', provides interfaces to devices for providing

20   convenience services such as interface to a curtain, window, blinds or whirlpool controllers, for example.

In the above description, 'server_av' is part of the structure for the control interfaces for A/V appliances offering A/V stream service, and is subdivided into 'controls-gen', 'source' and 'sink' capabilities.

25   'controls-gen', provides interface for device manufacturer attributes and general utility interfacing such as ping testing the presence of the device. Further, manufactured-in attributes such as software and hardware identification and version information can also be included. A device supplying this interface returns data providing name or identification

30   for said software without effecting any control actions. An interface to set the time of day clock can also be included.

'sink', provides interface for the media stream service devices.

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The structure is organized based on service offered (i.e. video stream record and replay) rather than particular device names such as VCR. For example, a Tuner and a DVD player are both video program stream sources for the network with video program formats, and can be controlled, such as started

5   and stopped. Differences in control of particular devices are addressed by the lower layers of the definition structure.

'source' provides interface similar to the 'sink' interface.

Referenced above, 'service_id' or 'application_interface_id' includes

10   the name, address or Web address or URL location of one or more devices 14. Because the XCE database 104 comprises the totality of agreed upon interfaces, typically a Dynamic Host Configuration Protocol (DHCP) software agent executes to assign an address and a default name to each device, and the address and a default name are added the interface of the service or

15   device. The software agent 110 then collects device interfaces 72 which include subset or 'device partial XCE' definitions from all the devices locally connected to the home network to generate a 'network partial XCE'. Additional relevant external interfaces can be added to the structure for external control. For example 'service_id' can be a name/address in a

20   received structure or in a network Interface Library 106 including entries from the software agent according to the device interfaces of the devices connected to the network. Thereafter, a user can search for a service in the database and access an application whose interface includes a particular data branch of the library using said name/address. As such, the network can

25   include multiple identical services distinguished by said name/address information.

'media', provides interface for the type of media including, for example, transport stream from a tuner, RAM from a PC DRAM, disk for CD or DVD,

30   and tape. The media can be named and identified, and a controller device can search the XCE data base to identify the media currently provided on the network. When a new media such as DVD disk is provided on the network,

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that portion of the device interface 72 identifying the program material on the disk is changed accordingly. As such, the entire device interface 72 need not be transferred and only the relevant portion is transmitted to the XCE data base. On receipt of an attention signal, the library software agent 110 can

5   fetch the new update and place it in the proper place in the interface library 106. The addition of the disk media is similar to adding a service to the network or connecting another appliance to the network.

'rate', provides a value for data stream rate for a device interface, such as 6 Mbits/Sec or 19.2 Mbits/Sec, for example.

10   'protocol', identifies the protocol used for said data stream. If more than one protocol is provided, for example 61883/1394 or UDP/IP, then a desired protocol can be selected.

'stream_format', provides packet format and/or compression standard for digital stream audio and video split. If more than one format is provided, a

15   desired format can be selected via an interface message. A controller application 82 can examine the available formats to determine if there are compatible ones.

'controls_av', provides the main control interface for A/V media appliance.

20   'Flow_control', provides data stream controls such as: PLAY, STOP, GOTO, RECORD, etc as methods for a particular device. The methods do not change for embedded appliance, except for PC software, for example. The controls can include time parameters for delayed operation.

'Tuning', provides interface for tuning control. A controller device 14

25   can send a request to the interfaces of a controlled device 14 to send back an Electronic Program Guide (EPG) data structure described above.

'UI control', provides control interface to a controlled application 84 to control adjustments for display such as brightness and contrast, and for audio, such as volume and bass.

30   'Timer_record' provides interface for set-up data for a controller application 82 to implement delayed time recording. Direct channel tune information and flow control (time_aparams) information can be utilized.

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The above description can apply equally to client devices 12. An alternative syntax XCE definition or database for the CE space can be utilized. The alternative syntax XCE data base includes full service descriptions including home automation, appliances and automobile, for example. In cases where a service object provides flexibility and parameters for control, a control method is utilized to control the object as desired. Example commands in the AV/C and CAL command languages including binary and hex data strings are shown below.

```
consumer (document_file, doc)
         +----document_file<server_home.dtd, server_auto.dtd>
         +----doc (avc_commands, cal_commands, services_home,
server_auto,
server_samsung_web_site, server_auto_ford_explorer_98,,)
             +----avc_commands<...command_string...>
             +----cal_commands<...command_string...>
             +----services_home (client, av, lighting, comms, hvac,
utility, security,
appliance, convenience,,)
                 +----xml_utility (download_DTD_files,,)
                 +----client (acknowledge, attention, error,
post_message, sound,
stop_schedule, stop_all,,)
                     +----sound (alarm, ring, buzz,,)
                 +----server_av (source, sink)
                     +----source (service_id, media, rate, protocol,
stream_format,
controls_gen, controls_av,,)
                     +----sink (service_id, media, rate, protocol,
stream_format,
controls,,)
                         +----service_id (url,,)
                         +----media (tpt_stream, ram, disk, tape,,)
                             +----disk (name, number,,)
                         +----rate<value>
                         +----protocol (61883/1394,
UDP/IP/Ethernet,,)
                             +----61883/1394 (isoch_ch_no)
                         +----stream_format (video, audio,,)
                             +----video (dv, mpeg2tpt, dsstpt,
mpeg2pes,
mpeg1080i-tpt,)
                             +----audio (mpeg3, ac-3, midi,,)
                         +----controls_gen (ping, process_info,
setup,,)
                         +----controls_av (flow_control, tune,
timer_record,
ui_control,,)
                             +----process_info (s/w_id, h/w_id)
```

```
                                            +----h/w_id (ser_no, manuf, model,
class,,)
                                            +----s/w_id (ser_no, exe_name,
version,,)
                                        +----setup (clock,,)
                                            +----clock (hours, minutes,
seconds)
                                        +----time_record (tune, flow_control)
                                        +----flow_control (play, stop, goto,
record,,)
                                            +----play (time_params)
                                            +----record (time_params)
                                        +----tune (send_epg, channel,,)
                                                +----channel (number, id,
time_params,,)
                                                    +----time_params (now,
start, duration, end,,)
                                        +----ui_control (display, acoustic)
                                            +----display (brightness,
contrast,
color/tint, horiz_size, vert_size,,)
                                            +----acoustic (volume, bass,
treble,
balance, fade,)
                        +----lighting (screen, light, send_epg)
                        +----sensors (living_room, sky,,)
                        +----lights (rooms_up, rooms_down, yard,,)
                            +----rooms_up (bed1, bed2, bed3, bed4,,)
                            +----rooms_down (family, kitchen, living, dining,
soho,
garage,,)
                            +----yard (front, back)
                                +----bed1 (lamp, dimmer,,)
                                    +----dimmer<value>
                    +----comms (netman, intercom, telco,)
                        +----netman (send_device_list,
send_configuration,
send_snmp_mib,,)
                        +----intercom ()
                        +----telco ()
                    +----hvac (controls_gen, controls_hvac,,)
                        +----controls_hvac (a/c, heat, temp, humidity,)
                            +---temp (low, high, hysteresis,,)
                    +----utility (meters, energy_mgmt,,)
                        +----meters (water, gas, electric,,)
                            +----water<value>, gas<value>,
electric<value>
                    +----security (sensors, send_epg, alram,,)
                        +----sensors (peripheral, motion,,)
                            +----peripheral (rooms_up, rooms_down,,)
                            +----motion (rooms_down, yard,,)
                    +----appliances (microwave, range, over, fridge,
freezer, coffee, toaster,
washer, dryer, water-heater,,)
                        +----microwave (send_epg, controls,,)
```

```
                    +----fridge (temp,,)
                    +----water-heater (temp)
              +----convenience (window, curtain_open, door/gate,
pool/spa, bath,
fountain, lift,,)
                         +----curtain_open <value>
              +----server_auto (message, mileage, maintenance,,)
                    +----mileage<date>
                    +----maintenace<data>
```

In another aspect, the present invention provides for use of existing command language implementations for device-to-device command and control in a network. Devices can include internal objects and APIs which, at run time, create binary strings according to existing transport mechanisms. In that case, in order to provide XML remote procedure calls (XML RPC) from one device 14 to another device 14 in the network, the exiting application interface implementation is replaced with calls to the XML service API. As such, the original implementation is equivalent to a wrapper for the XML service API. Figure 18 also shows applications created using other command languages such as CAL or AV/C in dashed lines, with their interface implementations replaced with a wrapper in the XCE/XML service API. Examples for changing from CAL command language to XML RPC format are shown below.

```
------------------------------------------------------------------------
existing implementation:

void DeviceCALCommand (int command) {
        .
        .
        /*
        create CAL formatted byte string to represent this
        object/method and output to the wire
        */
        CreatCALFormattedByteString(command);/*   different for
                                             every protocol */
        SendCALByteString();     /* different for every protocol
*/
}
------------------------------------------------------------------------
wrapping the XML Service API call:

void DeviceCALCommand (int command) {
```

```
{
         /*
         replace CAL implementation with calls to the XML
ServiceAPI
         */
         CreateXMLMessage (command);    /* always the same */

         sendXMLMessage ();             /* always the same */
}
```

Referring to Figure 23, in another aspect, the present invention provides a standard command protocol and control language translation for inter-device communication between disparate devices in a network. For different devices to share information, the information must be in a format that a requesting device can interpret. And, for a device 120 to control another device 22, the two devices must use a common language in order to interpret one another's commands. The present invention provides a common identification format for data and command protocols.

In one embodiment, a method of common presentation or packaging of data and command protocol is provided, whereby a receiving device 122 can determine the native format of transmitted data. If the receiving device 122 can interpret that native format, then it can accept the data directly. Otherwise, the receiving device 122 can request a translator device 124 or application to translate the data into a desired format which the requesting device 122 can interpret. The translator device 124 or application determines the native format of the original data, translates the data into said desired format, and sends the translated data to the requesting device 122.

The requesting device 122 then processes that data as though the data had originally been provided in the requesting device's native language format by the sending device 120. The requesting device 122 can also send a response back to the sending device 120 in the requesting device's native format, or send a response by proxy through the translator device 124 or application for translation into the native format of the sending device 120. The translation method can be utilized for information including command

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protocols, data files and audio/video streams.

For devices that do not utilize the common format described above, the present invention provides for translation of data including command protocols to, and from, such non-compliant devices. For example, when a non-compliant device 120 sends data to a compliant device 122, the compliant device 122 can translate the data based on a determination of the native format of the data. For example, the compliant device 122 can examine the data for particular bit patterns within the data. When a compliant device sends data to a known non-compliant device, the compliant device can translate the data before transmission based on a determination of the native format of the non-compliant device.

An example implementation can be for a home network which supports the IP and HTTP protocols. The home network can be connected to the Internet to obtain applications and services of various types for desired functionality. As such, the common format method can be made compatible with Internet protocols and procedure for operation over the Internet and the home network.

One example of providing a common data format is utilizing XML to create a package for the data for transmission over the home network. The data can include command protocol, streaming audio or video, graphics or applications. The data is 'wrapped' with a standard header identifying the native format of the data and contents of the package, in XML form. The header allows unique identification of the data type the data portion of the XML code, whereby the data can be translated if necessary and provided to appropriate applications upon receipt.

Under the Web standard, the identification process is performed by browsers using file name extensions to identify the type and contents of a file transmission. The browsers then launch appropriate plug-in modules to

process the file. In the home network, XML is utilized to identify data transmissions which provides all home network transmissions over IP with a common identification method as described above.

5   Alternatively, a software layer can be provided in the home network protocol stack to uniquely identify the contents of all data transmissions over the home network. The software layer can be used instead of XML. The common format and identification principles of the present invention apply equally in either embodiment using XML or said software layer as
10   identification methods.

In Figure 23, upon receipt of a data package transmission, the receiving device 122 examines the XML identity header of the data package to determine the format of the data therein. If the data is in a format
15   recognizable by the device 122, the XML identity header information is discarded and the device processes the data directly. Otherwise, the device 122 converts the received XML package into an XML translation request package and sends the request package and the data to the translation server device 124.
20

The translation server device 124 translates the data and converts the translated data into an XML translation response package. The translation server 124 then transmits the response package back to the requesting device 122. In case of a translation error, the translation server 124 can
25   provide a translation response error condition to the requesting device 122. Upon receiving the translated data, the requesting device 122 processes the translated data in the response package.

Example of an XML data package or packet can be:
30   <IDENTITY type=format=AV/c>...packet data ...<\IDENTITY>

Example of a translation request package or packet can be:
                <TRANSLATION REQUEST type=Command format=CAL>
                <IDENTITY type=Command format=AV/C>...packet data

```
...</IDENTITY>
    <\TRANSLATION REQUEST>
```

5
Example of a translation request package or packet can be:
```
        <TRANSLATION RESPONSE type=Command
format=CAL>...packet              data ...
        <\TRANSLATION RESPONSE>
```

10
Example of a translation response error condition package or packet can be.
```
        <TRANSLATION RESPONSE type=Command
format=CAL>...packet data ...
        <ERROR condition=Unrecognized command>Translation could
not be                     performed<|ERROR>
```
15
```
        <\TRANSLATION RESPONSE>
```

Further, Table 3 in Figure 24 includes a partial list of package or packet types and formats.

20   To provide translation services, a translation server 124 is identified in the network during network configuration in a manner similar to that of DHCP servers. The translation server 124 broadcasts its IP address to all devices in the network for a period of time after the network is configured. All devices 120, 122 compatible with the translation services store the IP address of the
25   translation server 124 as it is broadcast over the network during network boot up.

Alternatively, the requesting device 122 can broadcast a translation request over the home network. All translation servers 124 in the network
30   that receive the translation request can respond to the translation request by sending a translation response to the requesting device 122. The requesting device 122 then selects one translation server 124 among the responding translation servers. In one example, the requesting device 122 selects the first translation server 124 that responds to the translation request. In
35   another example, the translation servers 124 can negotiate among themselves and/or with the requesting device 122 for the selection of a translation server 124 for satisfying the translation request.

In another embodiment of the invention, multiple translation servers 124 are utilized to fulfill all translation requests. For example, a single translation server 124 may not have the capability to translate all requests. In such cases, it is necessary to identify the address of each translation server

5   124 and the type of translation service each translation server 124 can provide. Each device 120, 122 can store a list of all translation server IP addresses and a corresponding list of the types of translation services each translation server 124 provides, and optionally the associated translation application.

10

For efficiency, if a sending device 120 wishes to send data to a receiving device 122 which is known to use a different native format than that of the sending device 120, the sending device 120 can send the data to the receiving device 122 by proxy through a translation server 124. The sending

15   device 120 transmits a command to the translation server 124 similar to the translation request command and includes the address of the receiving device 122 as the destination for the translated data.

In cases where a receiving device 122 requires translation of a data

20   stream, the sending device 120 can route the data stream directly to a translation server 124, and the translation server 124 in turn transmits the translated data to the receiving device 122 as described above. Alternatively, the sending device 120 can send the data stream to the receiving device 122, and the receiving device 122 then routes the data stream to the translation

25   server 124 for translation and return of the translated data back to the receiving device 122.

In the description herein, the control mechanism is based on the Hypertext Transfer Protocol (HTTP 1.1) which provides an application-level

30   protocol for distributed, collaborative, hypermedia information systems. HTTP is a generic, stateless, object-oriented protocol in wide use for many tasks. A feature of HTTP is the typing and negotiation of data representation, allowing

systems to be built independently of the data being transferred. Preferably, the network protocol used by devices and applications on the home network is IP (Internet Protocol). However, other protocols can also be utilized.

5   Although the present invention has been described in considerable detail with regard to the preferred versions thereof, other versions are possible. Therefore, the appended claims should not be limited to the descriptions of the preferred versions contained herein.

What is claimed is:

1.   A method for performing a service on a home network, the method comprising the steps of:

(a)   connecting a first home device to the home network;

(b)   connecting a second home device to the home network;

(c)   providing a database including a plurality of application interface description data objects, each application interface description data object including information in a structured format for commanding and controlling of a home device by one or more other home devices connected to the network;

(d)   the second home device accessing a first application interface description object for the first home device in the database;

(e)   the first home device accessing a second application interface description object for the second home device in the database;

(f)   sending control and command data from the first home device to the second home device utilizing said application interface description object for the second home device over the network; and

(g)   sending control and command data from the second home device to the first home device utilizing said application interface description object for the first home device over the network;

whereby the first and second home devices perform said service.

2.   The method of claim 1 wherein the structured format includes XML format.

3.   The method of claim 1 wherein step (c) includes connecting a database device to the network, wherein the database device stores said database.

4.   The method of claim 3 wherein:

(i)   the first home device stores the first application interface

data therein;

(ii)   the second home device stores the second application interface data therein; and

(iii)   step (c) includes an initial step of forming said database

5   by steps including querying the first and second home devices to transfer said application interface data for the first and second home devices to the database device.

5.   The method of claim 1 wherein step (d) includes providing the

10   first application interface description object for the first home device from the database to the second home device over the network.

6.   The method of claim 1 wherein step (e) includes providing the second application interface description object for the second home device

15   from the data base to the first home device over the network.

7.   The method of claim 1 further comprising connecting three or more home devices to the network, wherein at least one home device accesses the database to query the application interface description objects

20   of a plurality of home devices for sending command and control data to the plurality of home devices over the network.

8.   The method of claim 1 wherein each application interface description object includes data in a structured format.

25

9.   A network system for providing a service, comprising:

(a)   a physical layer, wherein the physical layer provides a communication

medium than can be used by devices to communicate with each other;

30   (b)   first home device;

(c)   a second home device;

(d)   a database including a plurality of application interface

description data objects, each application interface description data object including information in a structured format for commanding and controlling of a home device by one or more other devices connected to the network; wherein:

5   the second home device includes application control means for accessing a first application interface description object for the first home device in the database and sending control and command data from the second home device to the first home device utilizing said first application interface description object; and

10   the first home device includes application control means for accessing a second application interface description object for the second home device in the database and sending control and command data from the first home device to the second home device utilizing said second application interface description object;

15   whereby the first and second home devices perform said service.

          10.   The network system of claim 9 wherein the structured format includes XML format.

20   11.   The network system of claim 9 further comprising a data base device storing said database.

          12.   The network system of claim 11 wherein:
          (i)   the first home device stores first application interface
25   description object therein;
          (ii)   the second home device stores second application interface description object therein; and
          (iii)   said database base device forms said date base by querying the first and second home devices to transfer said first and second
30   application interface description objects, respectively, to the database device.

          13.   The network system of claim 9 wherein the control application

means of the second home device obtains the first application interface description object for the first home device from the database.

14.   The network system of claim 9 wherein the control application means of the first home device obtains the second application interface description object for the second home device from the data base.

15.   The network system of claim 9 further comprising three or more home devices, wherein at least one home device accesses the database to query the application interface description objects of a plurality of home devices for sending command and control data to the plurality of home devices over the network.

16.   The network system of claim 9 wherein each application interface description object includes data in a structured format.

17.   The network system of claim 9 wherein the structured format includes XML format.

FIG. 1

Building Blocks or Modules

10

FIG. 2

Control System

```
        18    12                          16            14    20
         ┌─────────────┐                          ┌─────────────┐
         │     GUI     │   Commands               │   Service   │
HUMAN ───│             │──────────────────────────│   Control   │
         │             │ --Communications--       │   Program   │
         └─────────────┘                          └─────────────┘
            CLIENT                                    SERVER


        20    14                          16            14    20
         ┌─────────────┐                          ┌─────────────┐
         │   Service   │   Commands               │   Service   │
         │   Control   │──────────────────────────│   Control   │
         │   Program   │ --Communications--       │   Program   │
         └─────────────┘                          └─────────────┘
            SERVER                                    SERVER
```
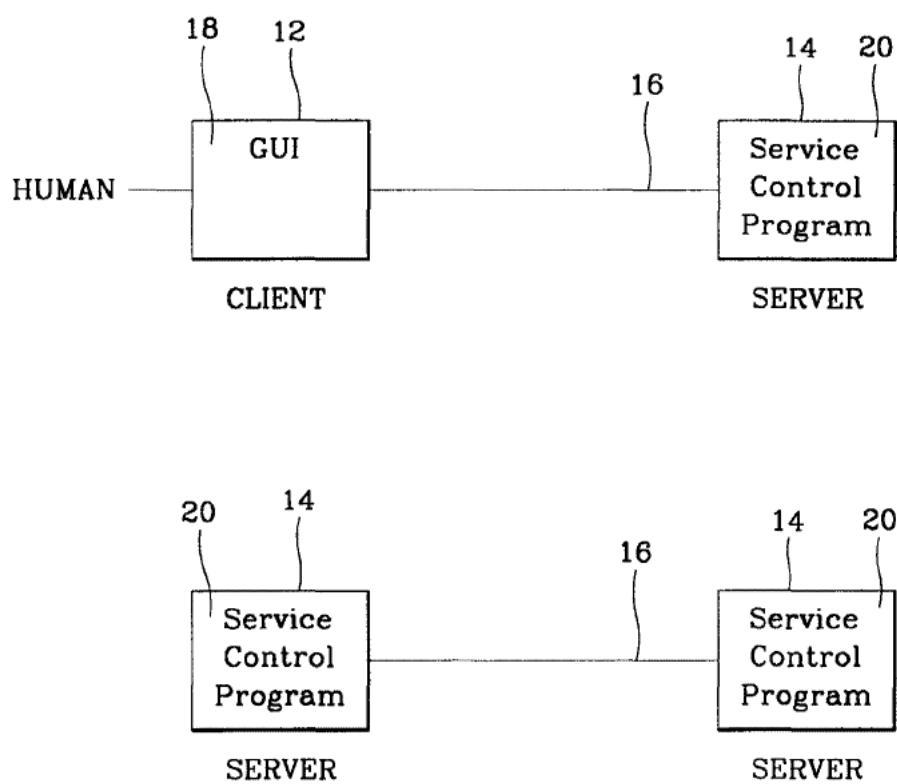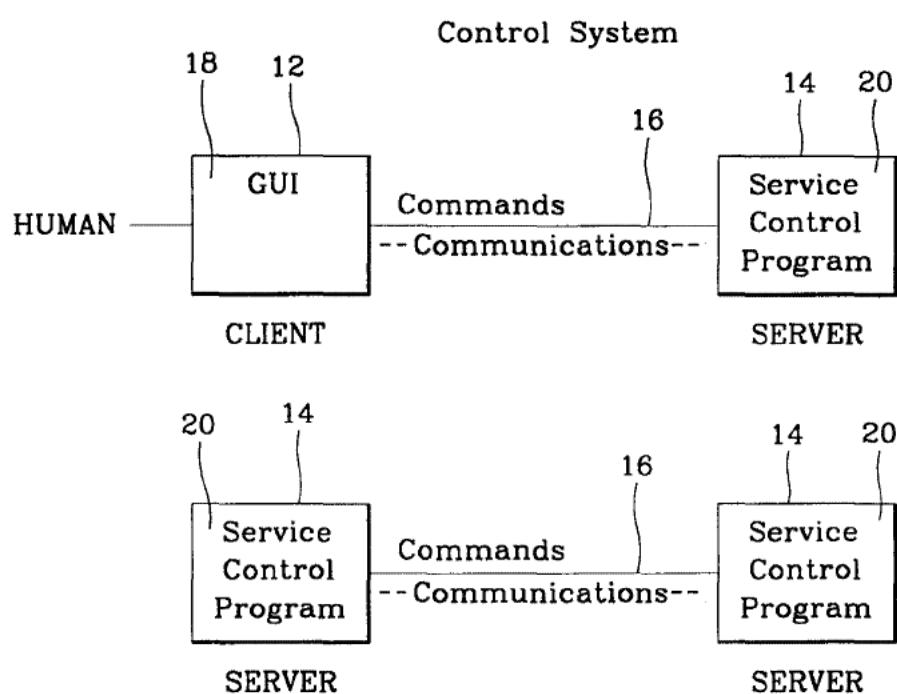
<u>10</u>

FIG. 3

Multiple Client Multiple Server Home Network Control Model

FIG. 4

Module Elements GUI Control

FIG. 5

Boxes with Clients

FIG. 6

Boxes with Server(s)

DVDP
Smart Card

AUDIO
AMPLIFIER

DVCR

| Service | SOURCE SERVER | ~14 |

| Service | SINK SERVER | ~14 |

| Service | SOURCE OR SINK SERVER | ~14 |

| Service | BOX MANAGEMENT SERVER | ~14 |

REMOTE SERVERS

| Service | Service | | Service | ~14 |

DBS Access Device
Cable TV Access Device
ATSC Access Device
Internet Access Device

FIG. 7

Module Elements for Server/Server CL
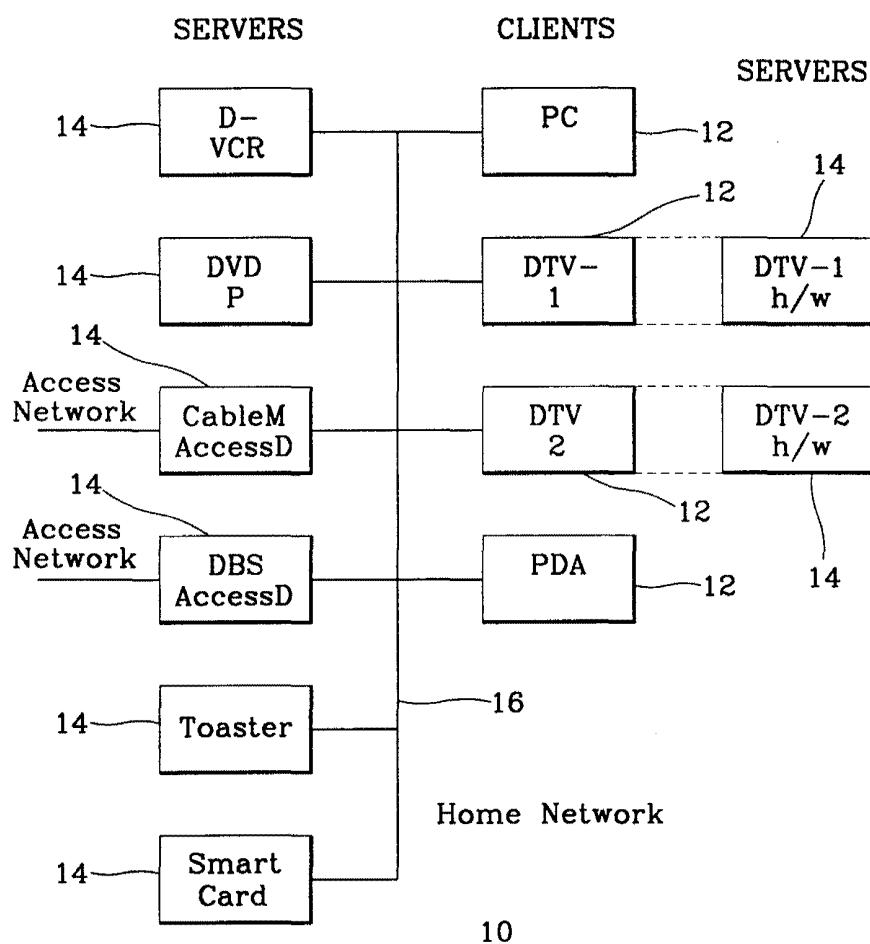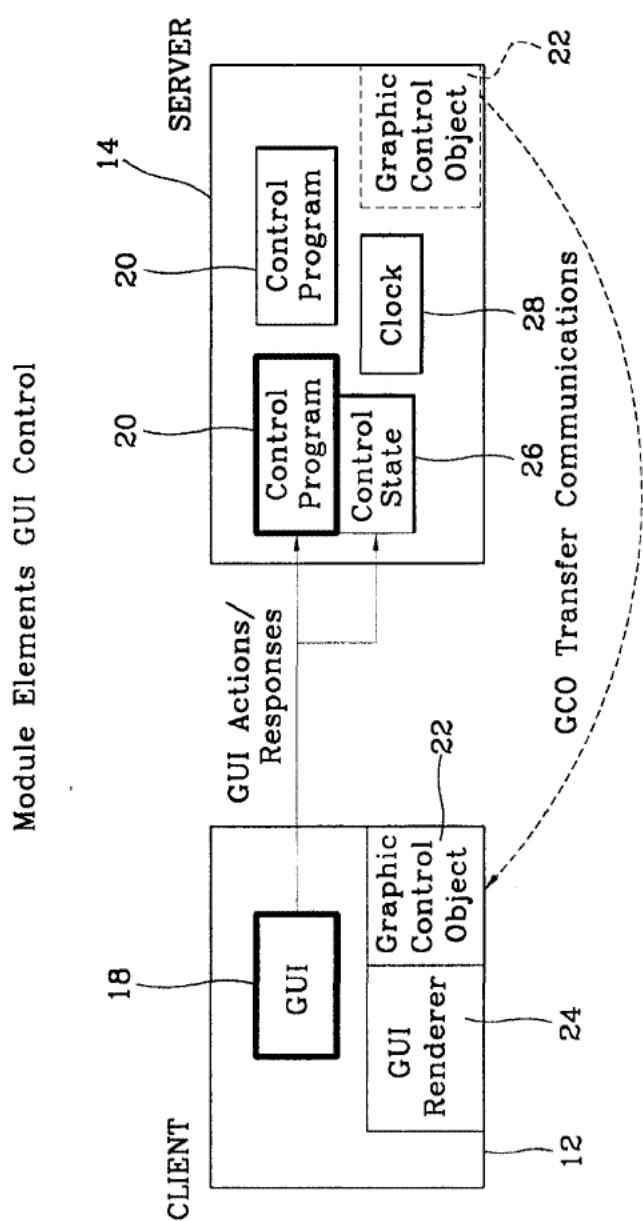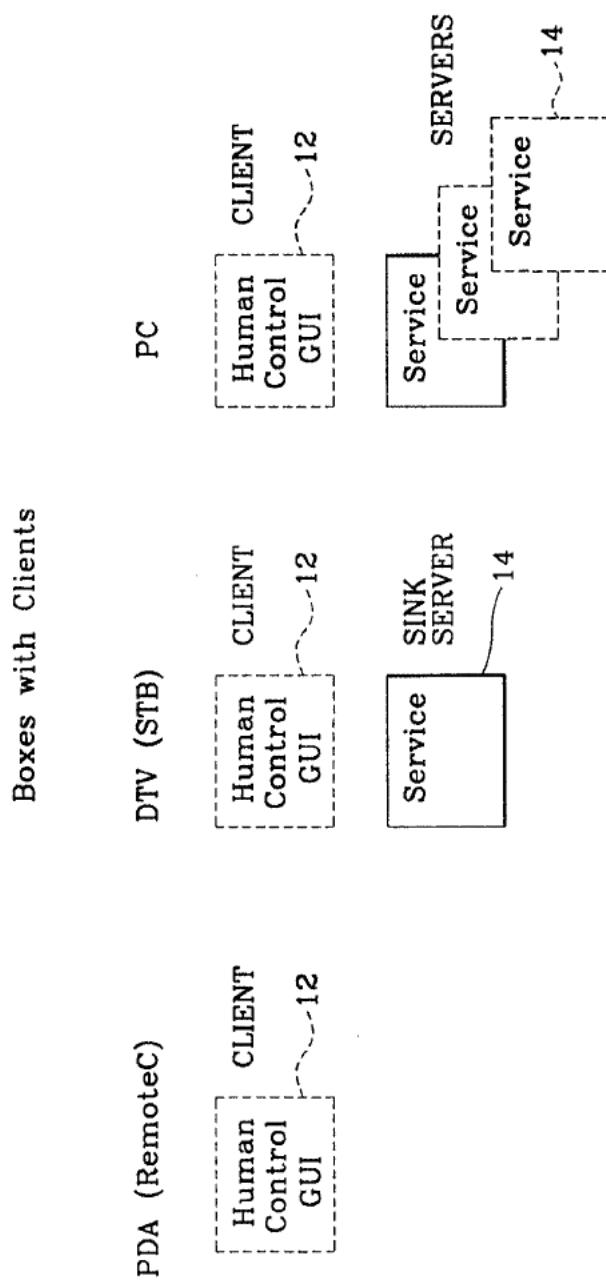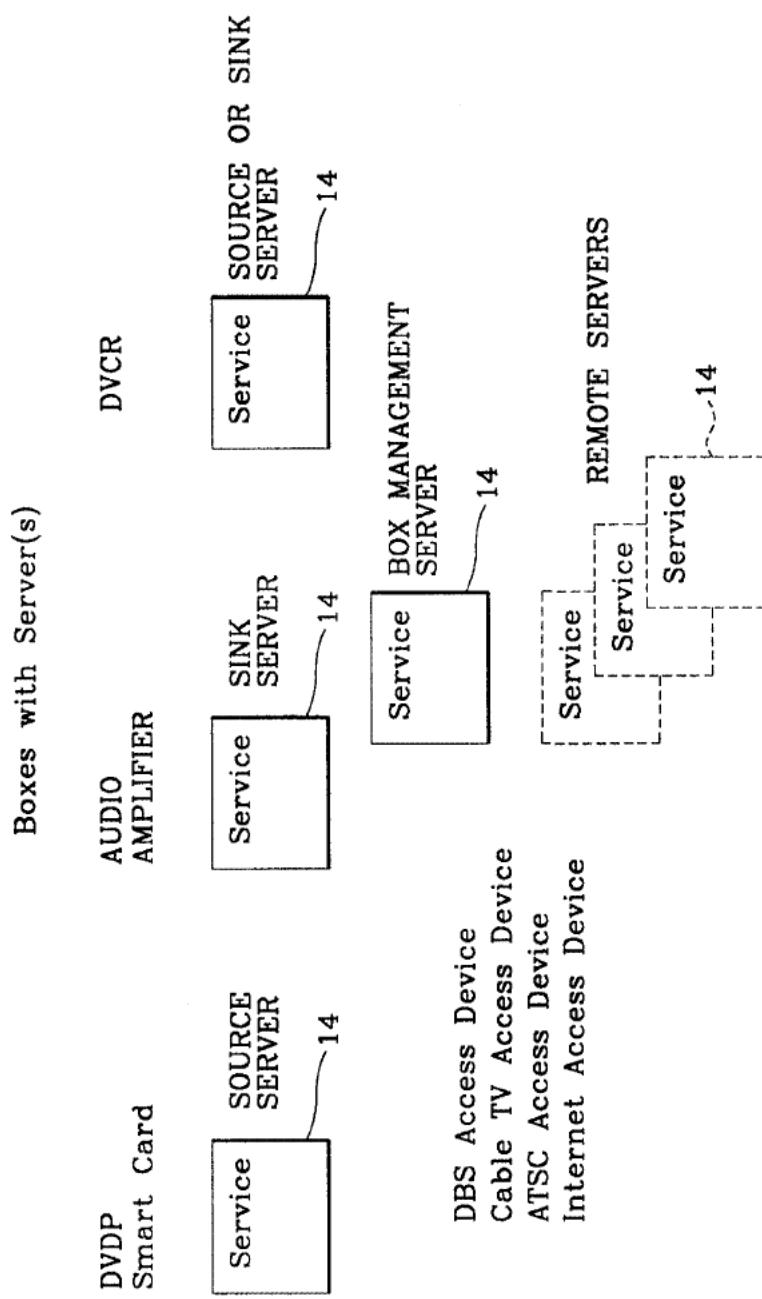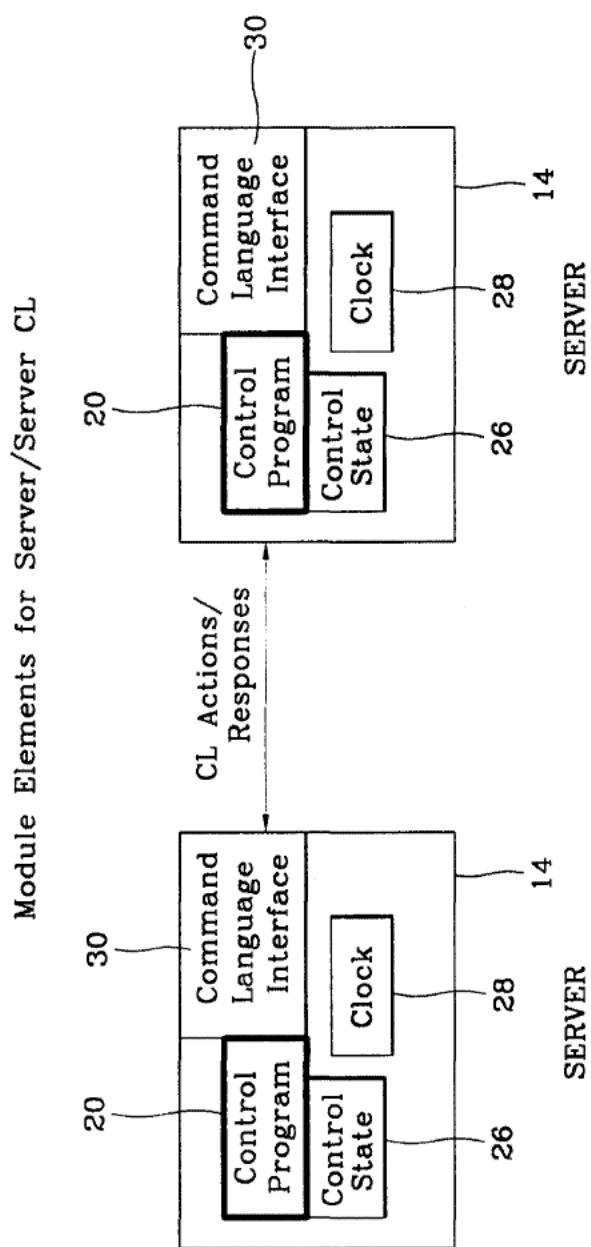
FIG. 8

Basic A/V, Client/Server/Server, Model

FIG. 9

Full A/V Control Model
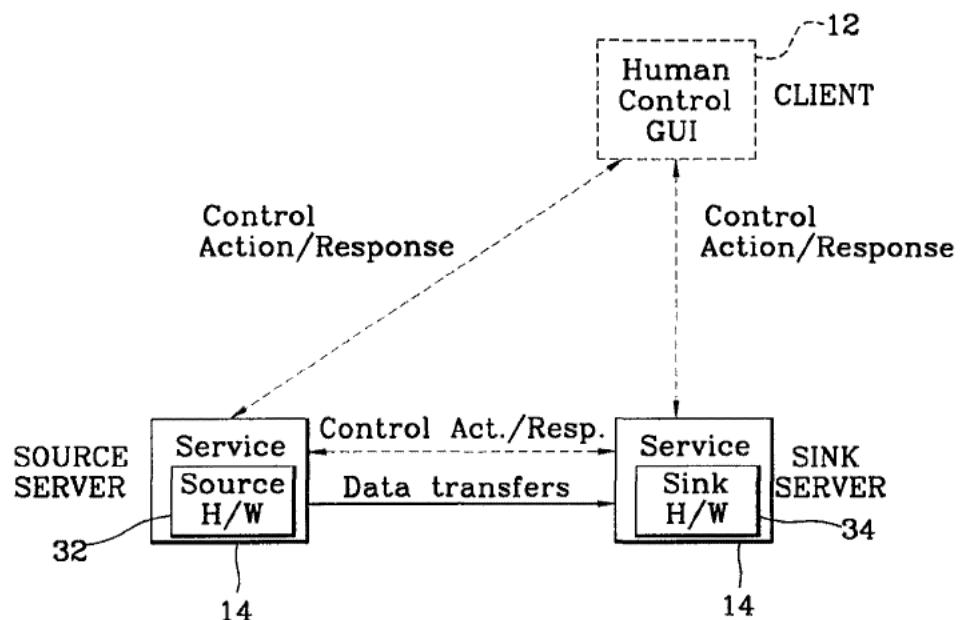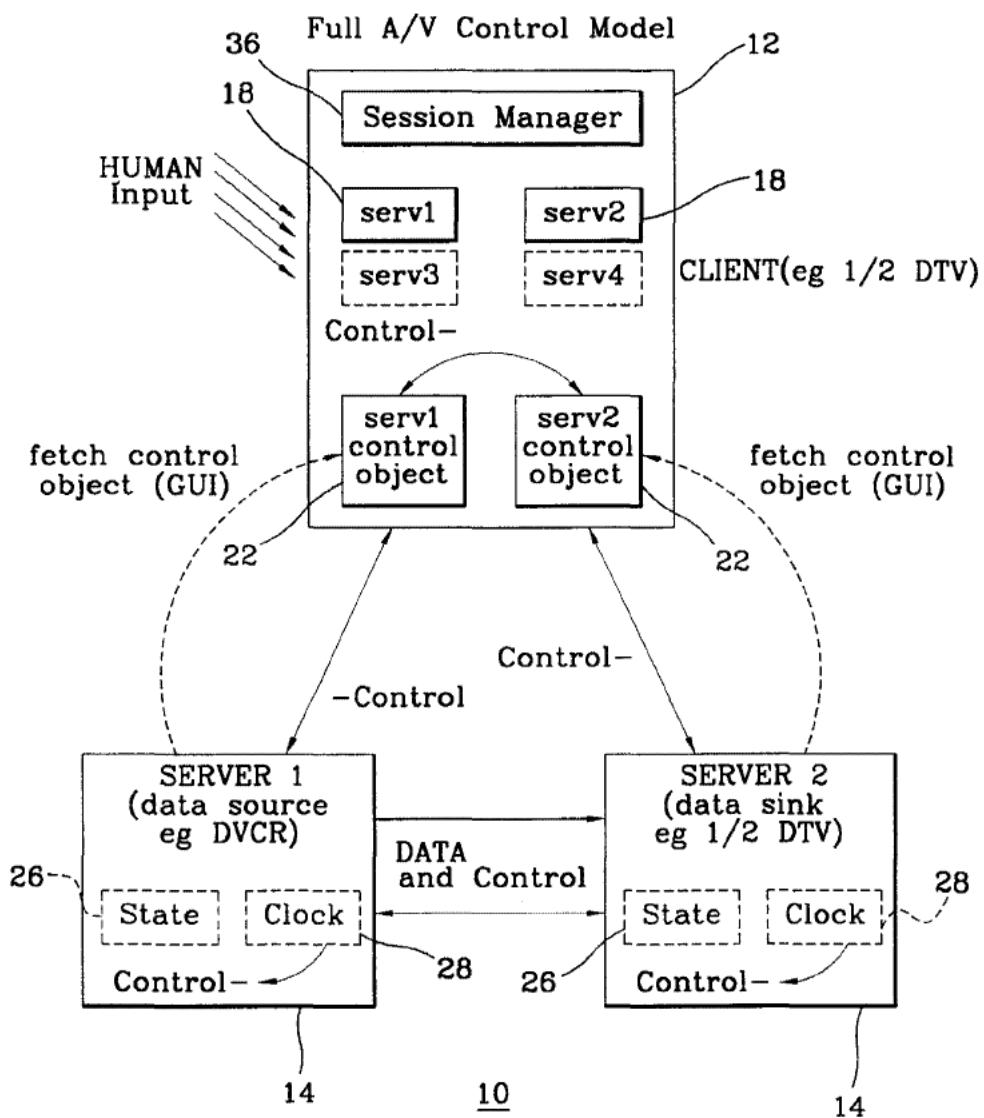
FIG. 10

Table 1: Capabilities Tavble

Service	Sink/Source
Service A	Sink
Service B	Source
Service C	Source
Service D	Sink

FIG. 11

Tavle 2: Attributes Table

NAME	LENGTH	VALUE
DeviceManufacturer	20 chars	Device manufacturer's name
ManufacturerURL	60 chars	Device manufacturer's home page URL
ManufacturerIcon	20 chars	Name of Device manufacturer's Icon
DeviceName	30 chars	Device name
DeviceModel	20 chars	Device model number
DeviceType	20 chars	Device category
DeviceLocation	30 chars	Device group or location
DefaultSource	15 chars	Data type, Default source device (IP address)
DefaultSink	15 chars	Data type, Default sink device (IP address)
DeviceIcon	20 chars	Name of device icon

FIG. 12

Message construction used by CAL and AV/C

FIG. 13

Message construction of new XCE/XML

App layer< >HTTP 1.1 layer

```
40 ──┐                    44 ──┐              42 ──┐              48 ──┐        46 ──┐
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ Functional   │   │ Industry     │   │              │   │ Message      │   │              │  I/F
│ Specification│──▶│ Standard     │──▶│ Message      │──▶│ String       │──▶│ Message      │──▶
│ of Service   │   │ Format       │   │ Composition  │   │ Construction │   │ Compression  │
│              │   │ (vocabulary) │   │              │   │              │   │              │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
```

FIG. 14

Client Server Models Using Web and XML
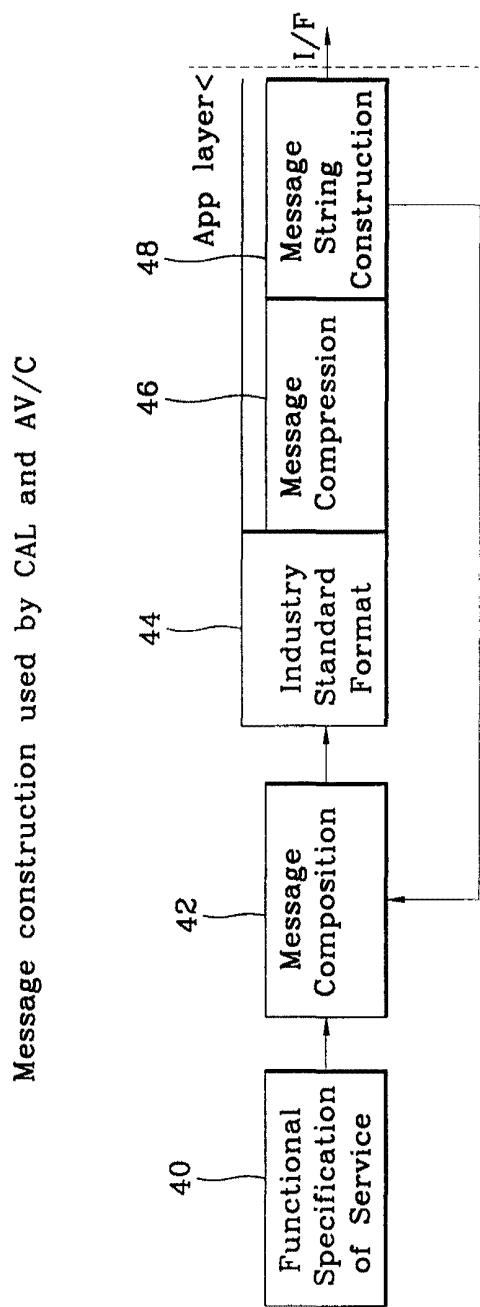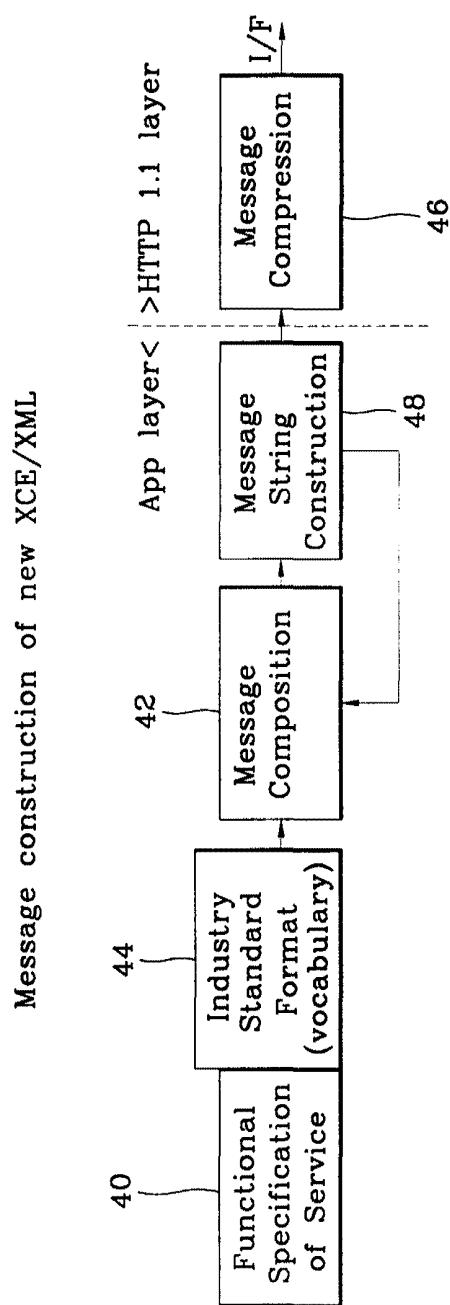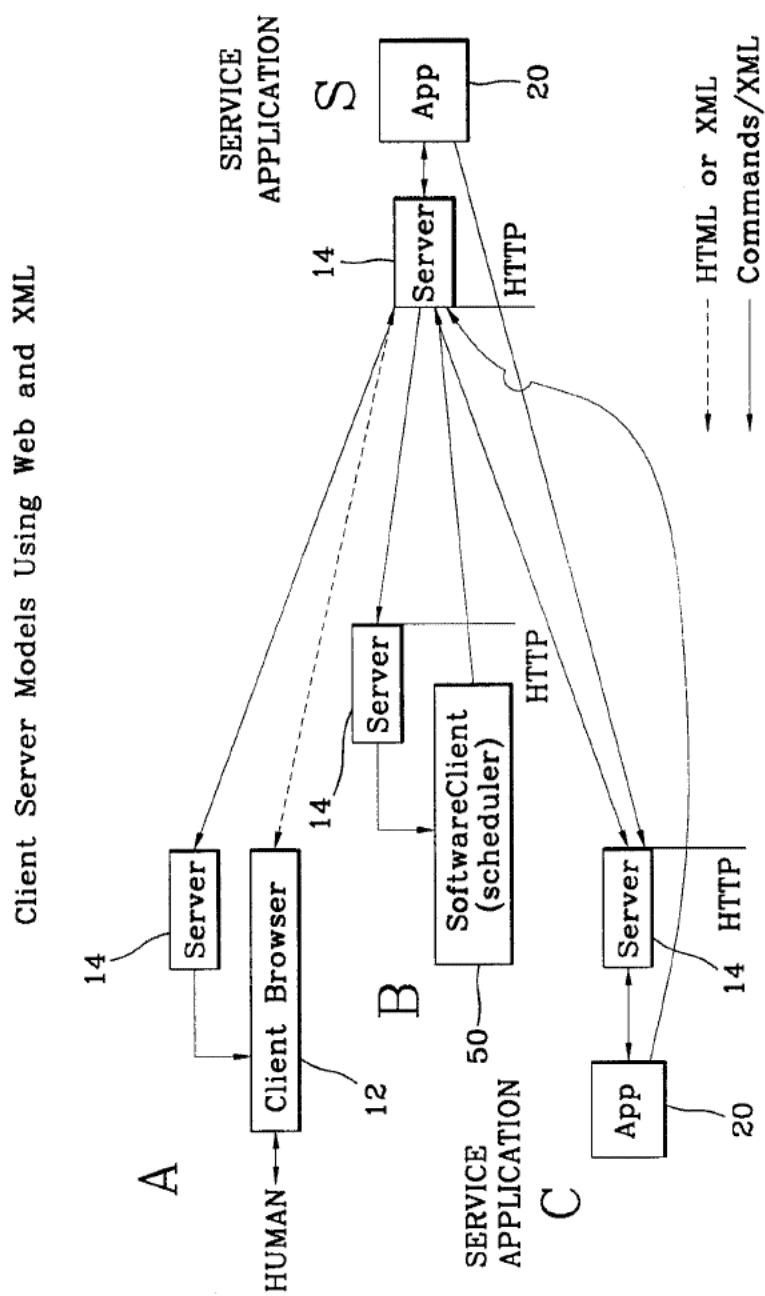
FIG. 15
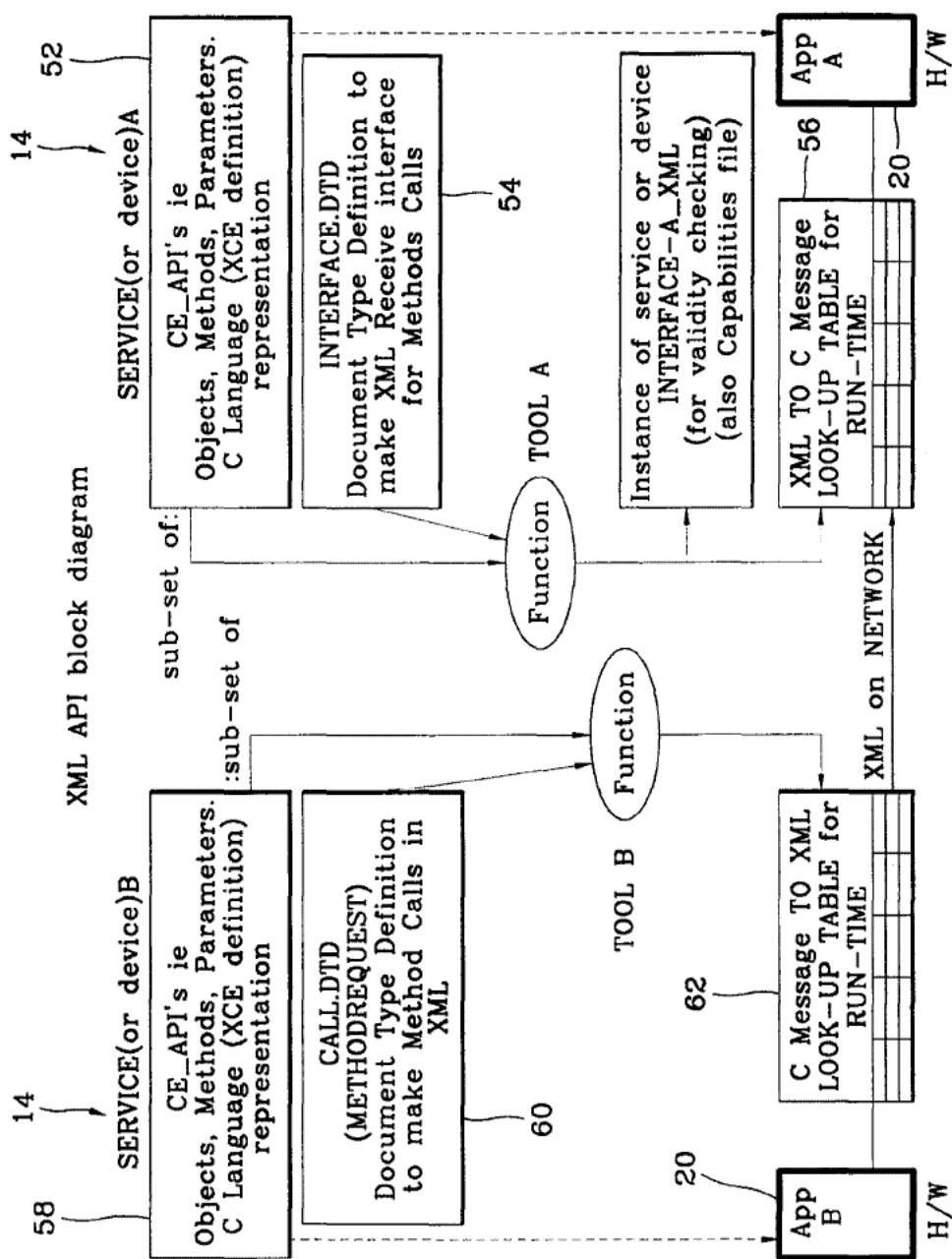
FIG. 16

Transfer and Learn foreign INTERFACE–INSTANCE.XML

Device A

Device B

INTERFACE–A.XML

INTERFACE–A.XML

INTERFACE–B.XML

TRANSFER XML OBJECT

Queries of foreign
App A Interface by App B

XML QUERY

Application A

Application B

To Drivers and h/w

To Drivers and h/w

10

20

14

20

14

FIG. 17

64

Library (cases3,4)

| (A1-moved) APP.INTERFACE Description(s) of Application(C1) | (A-moved) APP.INTERFACE Description(s) of Application(C) | (A2-moved) APP.INTERFACE Description(s) of Application(C2) |

Query Interface Case-3

API Transfer Case-3

CONTROLLER   **NETWORK**   **CONTROLLED**

Query Interface Case-2

(A-moved) APP.INTERFACE Description(s) of Application(C)

API Transfer Case-2

(A1-moved) APP.INTERFACE Description(s) of Application(C)

(E) Controller Application

XML RPC Enc/Dec

Action

XML RPC Enc/Dec

(C) APPLICATION Executable

Response Acknowledgment

20

20

(D) HARDWARE OR SERVICE

14   14

Case 1. XML Application-C INTERFACE(A) for remote query by (E)
Case 2. Move XML Application-C INTERFACE(A) to controller for local query by (E)
Case 3. Move XML Application-C INTERFACE(A) to 3rd party device-a collecting place (library) for allinterface for remote query by (E). The library would have to have the address (URL) of the associated application available for direct control action and responses.
Case 4. Is case 3 but the 'indirect' control action (and response) is also directed at the library device. In this case the library is built with a 'forwarder'

FIG. 18

XCE/XML Protocol Stack

App. originally in AV/C

App. originally in CAL   Convert I/F to XCE/XML

Application in XCE for XML interface		XCE definition
		CALL.DTD

Service Software   XML Layer IN   XML Layer OUT   68

70

Drivers   HTTPD L1 Web server Layer   XCE definition

                                                          INTERFACE.DTD

Device Hardware   IP Network Layer

                        Physical Layer

Servisce or Device S/W, H/W Stack

66   Communication Stack

FIG. 19

FIG. 20

Relation between Interface Library & XCE Database

Relation between Interface Library & XCE Database

FIG. 21

Example of Hierarchical IL & Device Interface

FIG. 22

Hierarchical Interface Structure. Four layers.

Layer	Interface Layer	Interface Example
1	XML interface for each HN, listing current available devices.	MyHN(VCRs.TVs...)
2	General XML interface for each dvice, listing function categories.	General VCR Interface. (Record, play...)
3	Specific XML interface for each function category for a device.	VCR.record category
4	Specific XML interface for each function in function category.	VCR.record.tdr function

112 — 114 — 116 — 118 —

FIG. 23
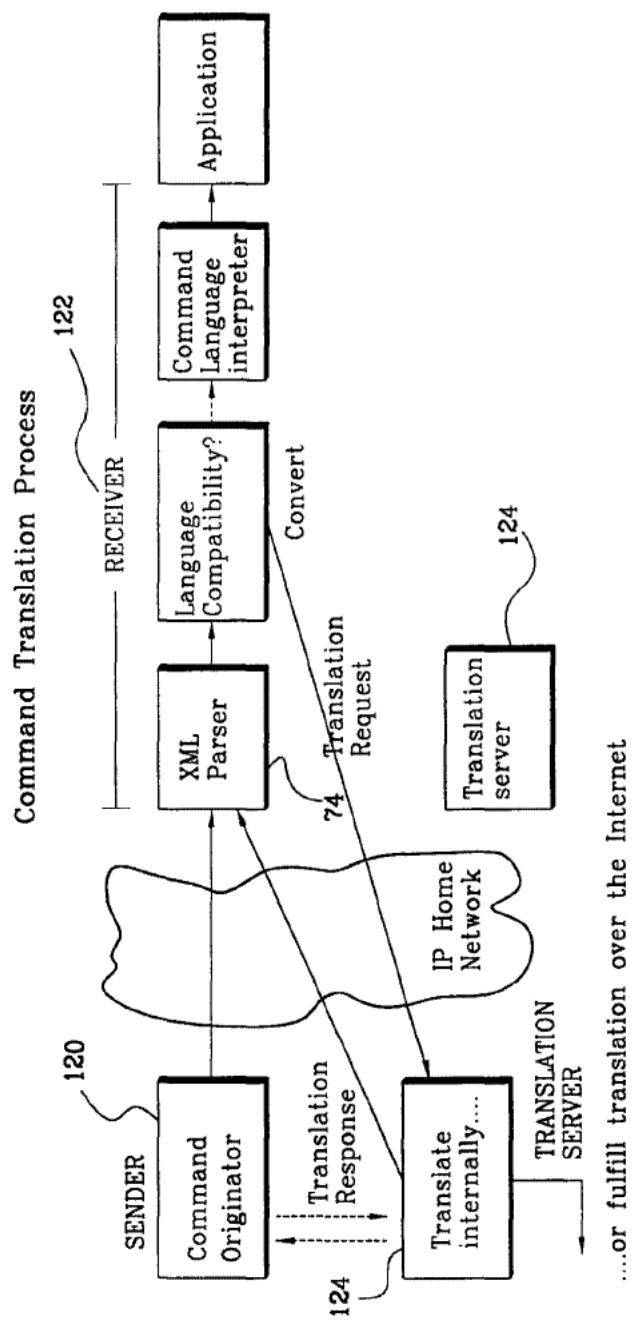
FIG. 24

Table 3: Example Formats and Types

Type	Format
command	CAL, AV/C, X-10
image	jpeg, gif, bitmap, tiff
language	English, French, etc
video_stream	mpeg2
video_clib	avi, quickime, mpeg
text	html, plain
audio	wav, aiff
application	msword, pdf, postscript, gzip

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A Digital Video Library for Classroom Use

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Abstract

Moving images, stored in the form of digital video, present a great many challenges to the designers of digital libraries since the source material is not stored in word form. In present-day analog film and video libraries, librarians and patrons must resort to very primitive tools to find information of interest. Digital video provides the opportunity to greatly improve access to moving image material, but new techniques are required for searching video collections, presenting the information contained in large collections in useful summaries, and in databases for annotating the material found in the library. This paper summarizes the new techniques being developed for digital video libraries by the Princeton Deployable Video Library (PDVL) project, a video library we are building to support education and research.

keywords: video library, video browsing, video annotation, scene transition graph

1 Introduction

The moving image is an important source of information for scholars and students. Moving images record historical events, comprise a literature of feature films, record scientific experiments, and perform many other functions. Film and analog video are much harder to manipulate than books. As a result, film libraries often have fewer accessions, are less fully used, and provide less circulation of materials than the book collections of libraries. Digital video promises to radically transform the cataloging, retrieval, and search of moving image records. However, making moving images truly easy to handle requires a new class of video understanding and manipulation tools which are much more powerful than the VCR controls provided by today's digital video interfaces. The goal of the Princeton Deployable Video Library (PDVL) project is to develop the next generation of digital library tools which provide powerful video understanding mechanisms at cost that allows such systems to be deployed in education and related disciplines.

The next section describes the requirements of educational users on digital video libraries. Section 2 surveys the architecture of the system we are constructing. Section 3 surveys the techniques we are developing for navigation, browsing, referencing, and annotation.

2 Educational uses of video libraries

In a digital library, the user has direct access to the full collection, not just cataloging information. Books which have been electronically captured provide characters and words as powerful abstractions to which text search algorithms can be applied. Image recognition provides some powerful tools which are of use in extracting information from video programs. Moving images add the dimension of time to images—not only must we consider a sequence of images in a single shot, but we must consider the construction of the video program as a collection of discrete shots. In order to solve the needs of library patrons, a digital video library must be able to take advantage of all the media which contain relevant information: the moving images, the audio track, bibliographic information, notes, and the knowledge of the librarians and patrons. The search for relevant video information can be divided into two phases: users **navigate** through a large collection of video programs to identify the few which may contain material of interest; they then **browse** through individual programs to determine their contents and identify relevant sections. Patrons also need to **refer** to the sections of video programs they identify as relevant and to **annotate** their selections. The goal of our digital video library project is to make moving image material a first-class element in critical thinking—the equal of text, which can be perused, analyzed, and quoted as well as written.

The PDVL project's aim is to create a testbed system which demonstrates new tools which make advances in navigation, browsing, reference, and annotation. Our first tests of PDVL will be on academic users. Moving images are primary source material for disciplines ranging from political science to literature:

- news coverage of political events and politicians is one of the most important sources of information on politics;
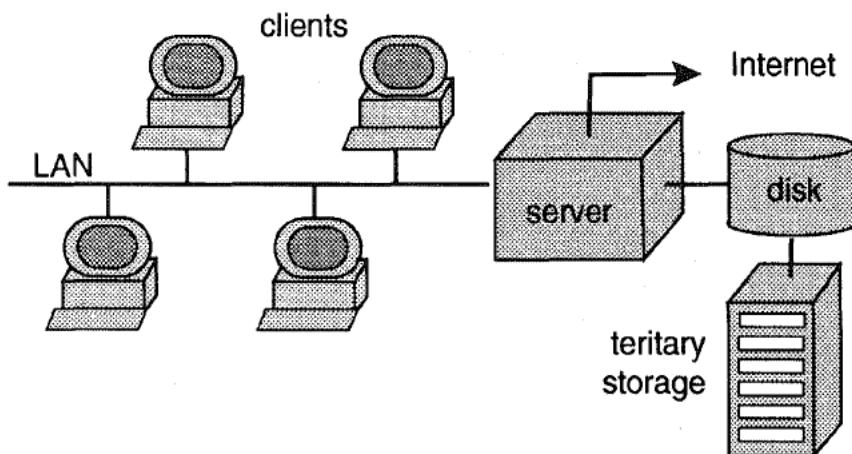
FIGURE 1. Hardware architecture of PDVL.

- psychology courses use video to record experiments and study subjects;

- literature courses study films both for their own content and as how they relate to the books from which they were adapted;

- historians use movies ranging from newsreels to popular entertainment as recordings of the time and culture which made them.

We are starting with users interested in political science and news as a sample domain[1]. Video is a very important source of material for political science because many appearances of politicians, both public and private, are recorded on film and videotape. In an era when so much political discourse takes place over television, politics cannot be fully understood without the examination of video source material. Some of the most important historical documents o f this century, such as the Kennedy-Nixon debates and the Zapruder film of the Kennedy assassination, are

moving image documents. Political science and news have several advantages as a test domain for our library: we have access to both historical and current material; the domain is of interest to scholars at Princeton and to potential test audiences at high schools; and since U. S. copyright law places appearances of the President of the United States in the public domain, Presidential libraries provide a valuable source of available material.

Our research effort is still in its early phases and we do not yet have all the answers to these problems. However, we have identified some key problems: how to help patrons find what they want, how to refer to pieces of a video, how to do all this cheaply enough that we can afford to deploy the system. We have also developed some techniques which point the way to the answers to these questions. Section 4 describes an algorithm we have developed which can automatically extract a summary from a complex video program. The summary is sufficiently compact
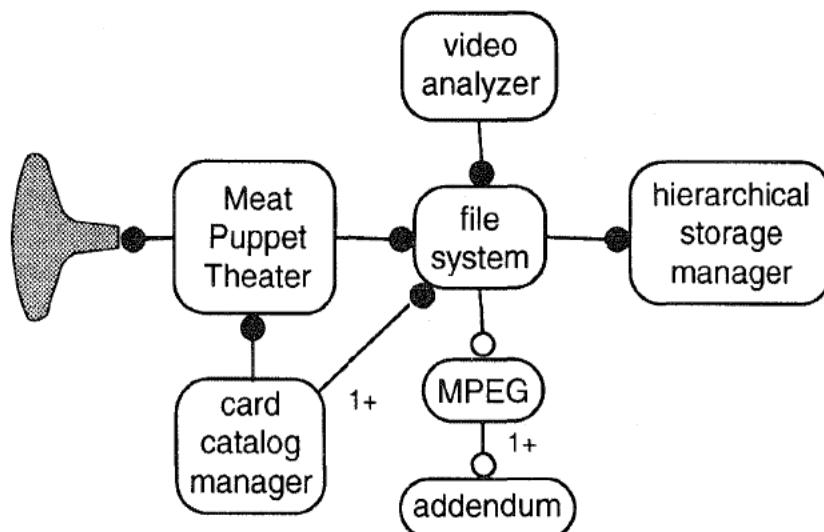
FIGURE 2. Software architecture of PDVL.

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to fit a half-hour program on a single computer screen. We believe that such summaries are critical in allowing users to quickly scan a long video program and understand its overall content. We also believe that summaries are critical for content-based searches of large video collections, since eliminating redundant or unnecessary video material greatly increases the efficiency of the complex algorithms required for visual search. The search requirements for a digital video library for educational use are complex—patrons will want and need to use many different types of information, including traditional cataloging information, sound track and closed-captioning information, and visual information, to find the material of interest to them. The architecture of the video library must accommodate cataloging information of many forms. It must also provide searching facilities for all the different components of the video programming. Since we are unlikely to have perfect feature-extraction algorithms for either audio or video track information in the near future, the library mechanisms must make it easy for the human patron to make the final selection of material, based on an initial search conducted by the available algorithms.

While traditional libraries do not have to provide annotation facilities to patrons, digital libraries must provide annotation mechanisms compatible with their content access mechanisms. While well-understood standards like SGML exist for text annotation, we have no such notation schemes available for digital video, so the creation of library-compatible annotation schemes is a key problem in the development of video library systems.

Since we are interested in educational uses of video programs, we are particularly interested in facilities which allow both teachers and students to select and annotate video material and incorporate that material into comprehensive lessons. The ability to refer into and out of a clip is important to courseware development. A reference into a video clip may serve as a table of contents into the clip. References into a clip are also useful when a text accompanying the video makes reference to the video: a political science report may refer to different parts of a political speech video at different parts of the report; an on-line manual may refer to successive steps in a video of a mechanical operation. References out of a clip are equally important: one clip may refer to a similar action in another clip; a sequence in a clip may refer to an auxiliary text, such as a set of specifications for a part used in an operation.

A digital video library system which provides annotation facilities allows a community of users—both teachers and students—to create a pentimento of notes and links to material. The curriculum developer creates the initial set of links between video,

sound, and textual material. The teacher may enrich that material by adding a new set of annotations and links. The student may make one set of annotations which represent personal notes, and another set of links and notes when writing a report on the curriculum material. The teacher may then comment on the student's report with another set of links, which may refer to both the student's notes and the original material.

We believe that many of the mechanisms we propose are useful in business and entertainment as well. For example, many businesses want to make and use video transcripts of both public and private meetings. In order to make those transcripts useful, they want to search, browse, annotate them, and include important segments in reports passed onto others. The ability to refer to a video library, find, and annotate interesting material would be useful to financial analysts who study stockholders' meetings, managers who want to record internal meetings, etc. Consumers also want to be able to navigate through a large collection of programming to find material of interest, cut and paste multimedia material into personal collages, and in general interact with the material rather than be passive viewers. However, we believe that our educational testbed is a particularly appropriate and useful domain in which to develop digital video library techniques. Political scientists have very aggressive requirements for video libraries—they require large collections, they want powerful search techniques, and they need to perform detailed analysis of certain works. Furthermore, the tools developed for digital video libraries will allow us to teach students how to critically interpret news coverage on television, transforming them from passive viewers of news to active, critical students of the media.

3 PDVL architecture

PDVL is designed to be a classroom- or campus-size system. We believe that the most important problems in digital video libraries can be addressed using local user populations; in fact, given the computational requirements of digital video, using a small user population may be the only way to acquire workload statistics from actual use. Since local networks have higher throughputs and lower latencies than wide area networks, testing our system on a local user population lets us focus on the core problems of summarizing and manipulating moving images.

As shown in Figure 1, PDVL is a client-server system. Video storage is distributed across the network: some videos and annotations may be stored on local machines (either on magnetic disk or CD-ROM), videos in current general use will be stored on a file server's magnetic disks, and lower-cost storage will provide backup of other material. We are using per-
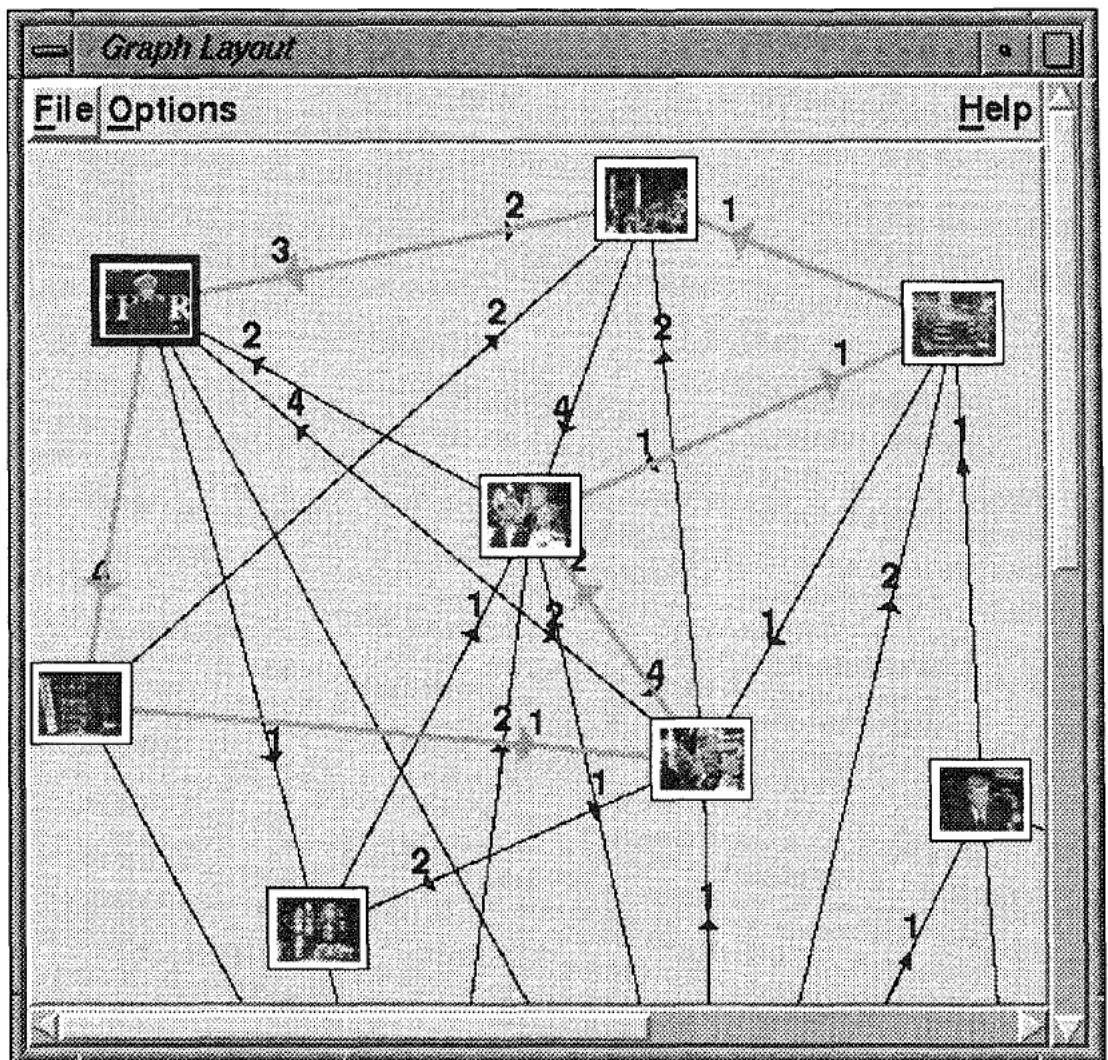
FIGURE 3. A scene transition graph extracted from a network news program.

sonal computers as the clients to reduce system deployment cost.

Figure 2 shows the software architecture of PDVL. We are relying on standards and existing software tools to the extent possible to make deployment easier and allow us to concentrate on problems unique to video libraries. The file system and hierarchical storage are fairly standard. We store videos in MPEG format; each film may have one more addendum files which keep indexing and annotation information. We are designing the card catalog manager to provide cataloging information based on annotation files of the same format used by patrons to annotate videos, giving us a seamless system for describing personal and library-wide descriptions of videos. Our video analyzer extracts information from videos: some of this information may be stored in the file system to provide general-purpose summaries of video programs, while other information may be extracted on the fly for a particular query. Our navigation and browsing tool, Meat Puppet Theater[1], presents summaries and the results of queries prepared by the

video analyzer, providing a non-linear video interface to the programs in the collection.

4 Video library tools

Given the wide range of possible queries of interest to library patrons, we believe that semi-automated methods of search are most likely to provide useful information to patrons in the next generation of video library systems. Our goal is to develop video understanding algorithms which can extract useful indexing information from videos; patrons will then be presented with a ranked list of programs and can select the material they want based on the presentation of visual, audio, and textual summaries of the programs.

---

1. "Meat puppet" is television industry term for news anchors who read the news but are not skilled reporters.

Many of our techniques for browsing and navigation rely on **key-frame summaries**. Key frames are representative of the action in longer shots. The story board is a traditional, direct representation of key frames in linear order. However, by applying a combination of image and temporal analysis, we can summarize the program by identifying story structure. Figure 3 shows a **scene transition graph**[2] automatically extracted from network coverage of the 1992 Democratic National Convention. The scene transition graph is extracted in several steps summarized in Figure 4: the video analyzer first segments the video into shots and selects one key frame per shot; the key frames are then clustered according to visual similarity (we currently use a combination of color histogramming and first-moment of luminance as the clustering metric); we then build a graph in which clusters are nodes and a directed edge connects two clusters which include temporally contiguous shots; we then analyze the graph to identify story structure. The result of analysis is a hierarchy of scene transition graphs, with smaller graphs providing more abstract views of the overall program and larger graphs providing more detailed information.

Graph structure as well as visual content are important in summarizing the content of video programs, since many programs use the juxtaposition of images to deliver information. For examples, cycles of all sizes are important structures in scene transition graphs: an interview consisting of two talking heads will appear as a pair of nodes connected in a cycle; a longer story segment will often appear as a large cycle, as an establishing shot is used to introduce the subject (such as the shot of the podium and audience in the Democratic National Convention) as well as to denote the transition to another subject at the end of that segment.

Our analysis of scene transition graphs provides very concise summaries of video programs. A summary of a program can often be viewed on a single screen so that the patron can browse and select the part of the program of direct interest. We also use summaries in navigation, since analysis reduces the representation of the program to a handful of key frames. Rather than search for visual information on the complete content of a large set of video programs, we first search over scene transition graph summaries, saving substantial amounts of computation time. For example, by reducing a long interview to a pair of heads, we can quickly search over a large collection of interviews to find the interview with the person being sought; we can also exclude from the search scene transition graph structures which don't have the structure of an interview, interviews which do not fall within a certain length, and other criteria. We also plan to explore how to take advantage of sound in identifying useful sections of video pro-

grams. We are investigating the effectiveness of commercial, speaker-independent speech recognitions systems for keyword spotting. We are also analyzing how more general properties of the sound track, such as the absence of sound, the presence of background music, and changes in speaker help patrons identify clips of interest in length video programs.
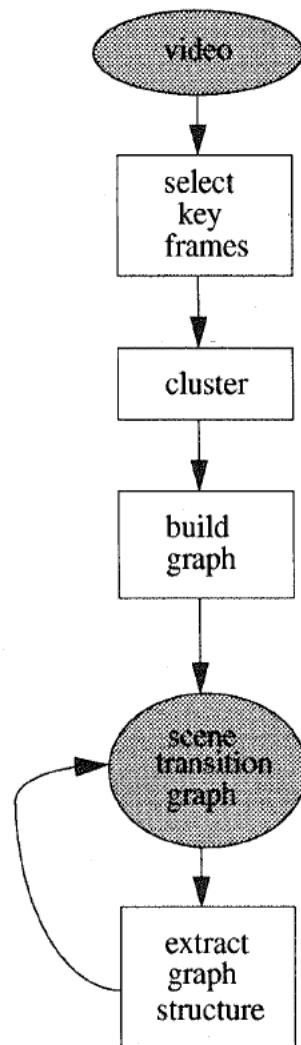

FIGURE 4. The scene transition graph extraction process.

The scene transition graph is a powerful tool for summarizing a long, complex video program—the algorithm has reduced 30 minutes of convention coverage to a graph which can fit on a single SVGA computer screen, while retaining a clear view of the content and structure of the program. The scene transition graph is a much more concise representation of a program than the storyboards used in film production. A storyboard, which is a succession of key frames which make up a scene, is linear. In contrast, the scene transition graph construction algorithm first eliminates visual redundancy by folding key frames with similar visual content into a single node; the graph edges describe complex story structure in a

small amount of space and in an easy-to-follow form.

Scholars and students need annotation for both private and public use. Annotations must be able to refer to particular points within videos, to cross-link videos, and to refer to external textual and audio documents. Patrons want to be able to point to items in single frames or sequences of frames, add textual or audio notes, relate one frame or clip to another clip, and to embed videos in documents. Useful types of annotation and hyperlinks include:

- links from a separate text document into a given point into the video;

- links from a given point in the video to a point in a separate text document;

- annotations which are not part of a separate document;

- drawings on the video, which may be used to point to or highlight certain features;

- additional sound tracks which provide narration or other commentary.

All these types of annotations refer to specific parts of the video, not merely the video as a whole. The annotation system must provide access control—some notes are personal which the patron does not want released until publication, while other annotations are meant to be shared with others. Annotations must also be layerable—consider, for example, a teacher using annotations to correct the annotations made by a student about the contents of a news program. We also plan a seamless system in which cataloging information is a form of publicly-available annotation.

5 Conclusions

Moving image source material presents many challenges for digital libraries since the content is kept in multiple media. We are building the Princeton Deployable Video Library as a test-bed to demonstrate the utility of next-generation digital video library tools—we believe that video library tools cannot be evaluated without testing on significant user populations. We are developing interactive methods to allow patrons to navigate through large video collections and find the material of interest to them—our tools extract summaries of programs which can be scanned by patrons much more quickly than they could view the complete programs. We are also developing annotation tools to make moving images first-class elements in digital libraries. Our overall goal is to transform scholars and students from passive viewers of film and television into active users who manipulate and analyze moving images, just as they manipulate and analyze texts today. We believe that the next generation of video library systems will provide powerful tools for library patrons and librarians.

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[2] Minerva Yeung, Boon-Lock Yeo, Wayne Wolf, and Bede Liu, "Video browsing using clustering and scene transitions on compressed sequences," in 1995 *SPIE Conference on Multimedia Computing and Networking*, SPIE, 1995.

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Cut in Fiber Cable Disrupts Internet Traffic Nationwide

By SARA ROBINSON
Published: September 30, 1999

Internet traffic across the United States was severely disrupted yesterday when a gas company in Ohio accidentally sliced through a fiber cable with a backhoe.

The cut, which occurred around noon Eastern Time about 30 miles east of Cleveland, slowed traffic to the point that data transmissions were taking 20 to 50 times longer between the East and West Coasts than they do on a normal business day. Some companies experienced more severe disruptions and were forced to shut down.

While fiber cuts are not uncommon, the size of the cable that was cut yesterday -- a bundle of fibers carrying 40 gigabits, or 40 billion bits, of data a second -- is extremely rare, said Bill Woodcock, network architect for Zocalo, a regional Internet service provider in Northern California.

"We've seen plenty a quarter this size, but my impression is that if this is not the largest to date it's very near," he said.

The traffic most affected was data that would normally travel through the fibers that were cut. This traffic was rerouted to other parts of the global network, but the net effect was congestion that slowed all data moving through large stretches of the nation's Internet arteries.

Corporate customers whose internal networks used the severed cable, Mr. Woodcock said, "might not be able to access their corporate data base or retrieve mail from their mail server."

The GTE Corporation, which owned portions of the cable that was cut, estimated last night that the cable would be repaired by 9 P.M. Eastern time. When that deadline passed, though, officials at some affected companies said they were being told that thunderstorms in Ohio were making it difficult to offer accurate estimates concerning when the repairs would be completed.

It was not clear which Internet service providers, or I.S.P.'s, own or lease the fiber that was cut. Several service providers can own strands of fiber that run through the same cable, or one company can own it and lease portions of it to other I.S.P.'s.

Some of the fiber belonged to GTE, which purchased it two years ago from Qwest. "The majority of our Internet customers are still up -- they are seeing degraded performance, but they are still up," said Vaughn Harring, a spokesman for GTE Internetworking, the Internet division of GTE.

He added, though, that some customers' service had degraded so far that they were effectively off line.

Many reports issued by Internet service providers said that some of the fiber was owned by a division of MCI Worldcom, but the company would not confirm that.

"It is not impacting MCI Worldcom," a spokesman for that company said, adding that the cut was not affecting customers of MCI Worldcom's Uunet subsidiary either.

Dave Rand, senior vice president and chief technical officer for the Internet service provider Abovenet said that his company's traffic was down about 20 percent, mostly because of problems with other I.S.P.'s. Abovenet's traffic from San Jose, Calif., to Chicago, he said, was down to 25 percent of its normal capacity.

"It's not as bad as it could be," Mr. Rand said.

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