COMREX

SWITCHBOARD

TRAVERSAL SERVER

Account Manual

for use with

Audio Codecs

SWITCHBOARD FOR AUDIO CODECS

ABOUT COMREX

Comrex has been building reliable, high-quality broadcast equipment since 1961. Our products are used daily in every part of the world by networks, stations and program producers.

Every product we manufacture has been carefully designed to function flawlessly, under the harshest conditions, over many years of use. Each unit we ship has been individually and thoroughly tested.

Comrex stands behind its products. We promise that if you call us for technical assistance, you will talk directly with someone who knows about the equipment and will do everything possible to help you.

You can contact Comrex by phone at 978-784-1776. Our toll-free number in North America is 1-800-237-1776. Product information along with engineering notes and user reports are available on our website www.comrex.com. Our email address is info@comrex.com.

TRAVERSAL SERVER TERMS OF USE

You have purchased a product from Comrex that uses the Switchboard TS (Traversal Server) to provide the ability to locate Comrex hardware via the Internet and to aid in the making of connections when certain types of NAT routers are involved in the link. Switchboard TS consists of two distinct elements: the firmware that functions within the codec hardware to enable use of the function; and a server deployed on the Internet which provides the services to the codec hardware.

The purchase you have made entitles you only to the firmware elements within your codec that utilize these functions. The functions of Switchboard TS, as implemented in your codec, are warranted to work as described (according to standard Comrex warranty terms found in your User Manual) when used with a properly functioning Traversal Server deployed on the Internet.

Comrex has deployed and provided you account details for a Switchboard TS account on our server, located at **http://switchboard.comrex.com**.

Comrex provides this service, free of charge and at will. As such, Comrex offers no warranty as to availability of this server or of its function. Comrex reserves the right to discontinue availability of this service at any time. Comrex also reserves the right to remove any account from the server at **http://switchboard.comrex.com** at any time for any reason. In no way shall Comrex be liable for this server's malfunction, lack of availability or any resultant loss therein.

The software that runs the Comrex Traversal Server on the Internet is available from Comrex in an executable format, free of charge, with basic instructions on how to set it up. The address of the server used for these functions is configurable in the codec firmware. If you wish to deploy your own Traversal Server, contact Comrex for details on obtaining this software.

Comrex is not liable for training or support in setting up a TS server, and the software is available without warranty or guarantee of suitability of any kind.

With the exception of the warranties set forth above, Comrex Corporation makes no other warranties, expressed or implied or statutory, including but not limited to warranties of merchantability and fitness for a particular purpose, which are hereby expressly disclaimed. In no event shall Comrex Corporation have any liability for indirect, consequential or punitive damages resulting from the use of this product.

I. INTRODUCTION

WHAT IS SWITCHBOARD?

Switchboard is a feature that allows a Comrex codec to “sync” with a cloud-based server maintained by Comrex. The **Switchboard Traversal Server** is a service built and maintained by Comrex on the public Internet that facilitates connections between audio codecs by allowing them to share network and status information across a fleet of other codecs. Devices added to a **Switchboard Account** can share connectivity parameters with any other units on that account, and the Switchboard server will keep these units up to date on how best to connect across various network types.

This allows for easy connections to be made between codecs without any knowledge of IP addresses on either end of the link. It also provides presence and status information about all the Comrex codecs in your fleet, and can help make some connections through routers and firewalls that might be difficult otherwise.

Switchboard is enabled by default on all **ACCESS** audio codecs, which often travel and connect in various locations. **BRIC-Link**, **BRIC-Link II** and **BRIC-Link III** codecs, which are particularly suited for point-to-point “nailed up” audio links, can be activated for use on Switchboard through the purchase of a **Switchboard Traversal Server License**. Contact an authorized Comrex dealer for more information.

This manual describes how to set up and configure a **Switchboard Account** for use with Comrex audio codecs. Also included is a brief description of how to make connections between audio codecs using Switchboard. Once a codec is added to a **Switchboard Account**, connections can be made with as little as one step.

II. THE SWITCHBOARD ACCOUNT INTERFACE

LOGGING IN TO SWITCHBOARD

In order to use Switchboard, users must first have an account with the server. This account can be obtained by contacting Comrex at 978-784-1776 / 800-237-1776, or by emailing techies@comrex.com / info@comrex.com. Only one account is required for each group of codecs. Once a user name and password are provided, navigate to **Switchboard.comrex.com** in a web browser and log in to access the account page (as shown in **Figure 1**).

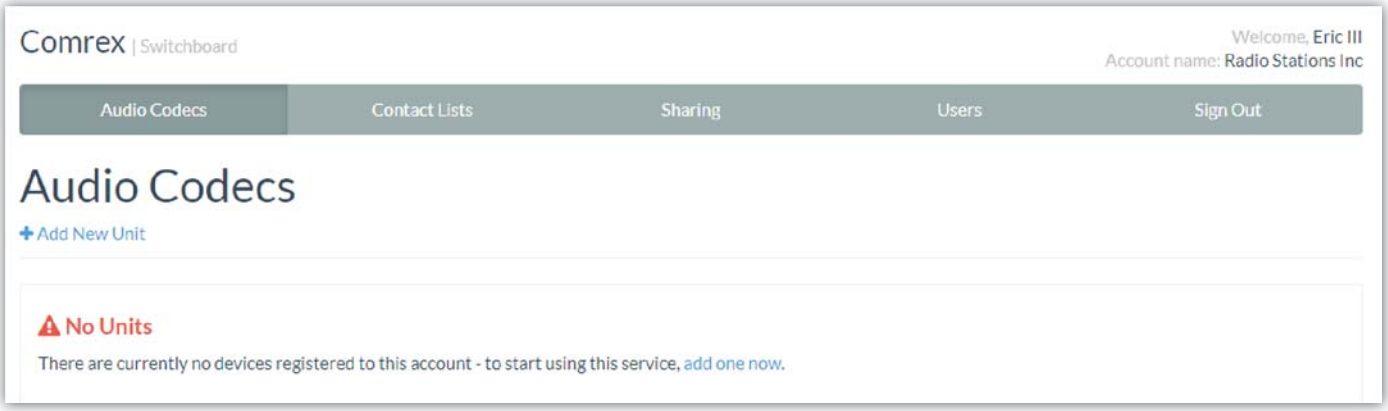

FIGURE 1 **SWITCHBOARD ACCOUNT PAGE**

ACCOUNT PAGE LAYOUT

The Switchboard Account interface offers several ways to control a fleet of codecs, and is organized by the **Tabs** shown across the top of the screen. Before getting started, it is helpful to understand what Switchboard can do and how each of these Tabs is used. The functions of each Tab will be explained in more detail in the next few sections.

THE AUDIO CODECS TAB

Displays a list of all codecs on the account, and allows new codecs to be added (for new accounts, there will be a notice stating that no units have been added to the account). Units added to an account are listed on this page with helpful information such as *connection status* and *IP address*, and more detailed information for each unit can be viewed by clicking the “Details” button.

THE CONTACT LISTS TAB

Displays the “Contact Lists” available on the account, and allows new Contact Lists to be added (a new account will show one standard List here, called “Auto Default List”). Contact Lists are like phonebooks; each codec can be added to a List (or several Lists), and each codec can choose which List (or Lists) to use when “calling” other units. Users can manage which units appear on each Contact List using this Tab.

THE SHARING TAB

Displays a list of “Shares” that have been set up for the account, and allows new Shares to be created (a new account will have no Shares listed yet). Shares are very similar to Contact Lists; however, Shares allow units on a different Switchboard account to see and connect to certain units in this fleet. On this Tab, users can view and edit Shares created on this account, as well as Shares sent from other accounts.

THE USERS TAB

Displays a list of users who can log in and manage the account, and allows more users to be added (a new account will show only the current user). Switchboard allows multiple users to be added by entering a unique *username*, a secure *password*, and a valid *email address*. User entries added here can also be removed from the account anytime if they are no longer needed.

THE SIGN OUT TAB

Simply logs a user out of the account.

III. ADDING AND MANAGING CODECS

ADDING UNITS

The **Audio Codecs Tab** is the first page loaded when logging in to a Switchboard account. This Tab displays a list of all codecs on the account, and allows new codecs to be added. Click "Add New Unit" to open a dialogue box that will ask for the Switchboard ID (Ethernet MAC address) of the Comrex codec you wish to add (shown in **Figure 2**). A codec's Switchboard ID can be obtained from that unit's **Web User Interface**, the built-in **Portable User Interface** or by utilizing Comrex's **Device Manager** program running on a computer in the same *Local Area Subnet* as the codec.

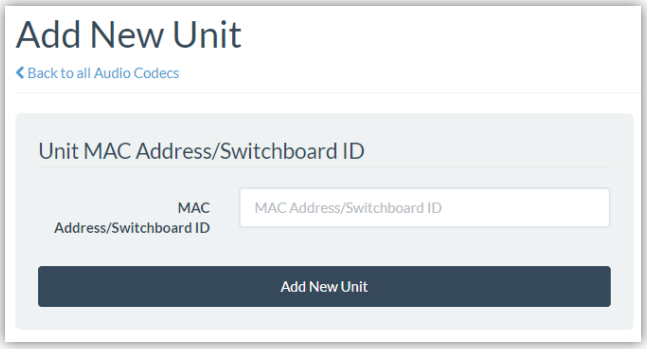

FIGURE 2 **ADD NEW UNIT**

After entering the Switchboard ID and clicking "Add New Unit", the next dialogue box will ask which **Contact List** the unit should use—and which **Contact List** it should be added to (**Figure 3**). Contact Lists are a method for Switchboard to determine which units can "see" which other units within an account. A brief description is included below, but for a basic setup these options can be left at their default values (use the "Auto Default List").

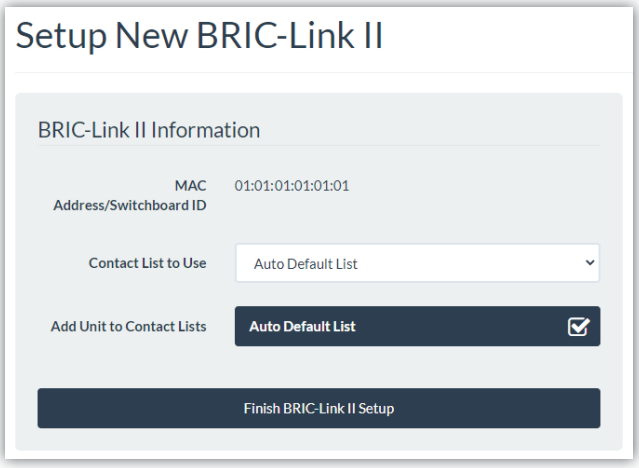

FIGURE 3 **DEFAULT CONTACT LIST**

When adding a new unit to a Switchboard account, there are 2 main options that should be decided:

1. **"Contact List to Use"** (i.e., Which other units should this codec be able to see?)
   Use the drop down menu to select which Contact List this codec will see.
2. **"Add Unit to Contact Lists"** (i.e., Which other units should be able to see this codec?)
   Check the box on any number of Contact Lists, and units on those lists will see this codec.

The default selection for both options is called “Auto Default List”, and if any other Contact Lists have been created, they will also be listed here to choose from. Any one Contact List can be selected from the drop down menu for this codec to see units on that list (more Lists can be selected later); however, this codec can be added to any combination of Contact Lists by “checking” the name of the Contact List shown on this page. The “Auto Default List” can work well as a *Master List*, allowing all units on an account to see—and be seen by—each other. After choosing Contact Lists, click “Finish [*codec*] Setup”, and the unit will be added to the list on the **Audio Codecs Tab**, among other units on the account, if any.

MANAGING UNITS

As shown in **Figure 4**, codecs added to the account are listed with helpful information about each unit. The information is organized by several columns, and users can click the title of each column to arrange the list of codecs by that criterion (e.g., alphabetically by *Unit Name*).

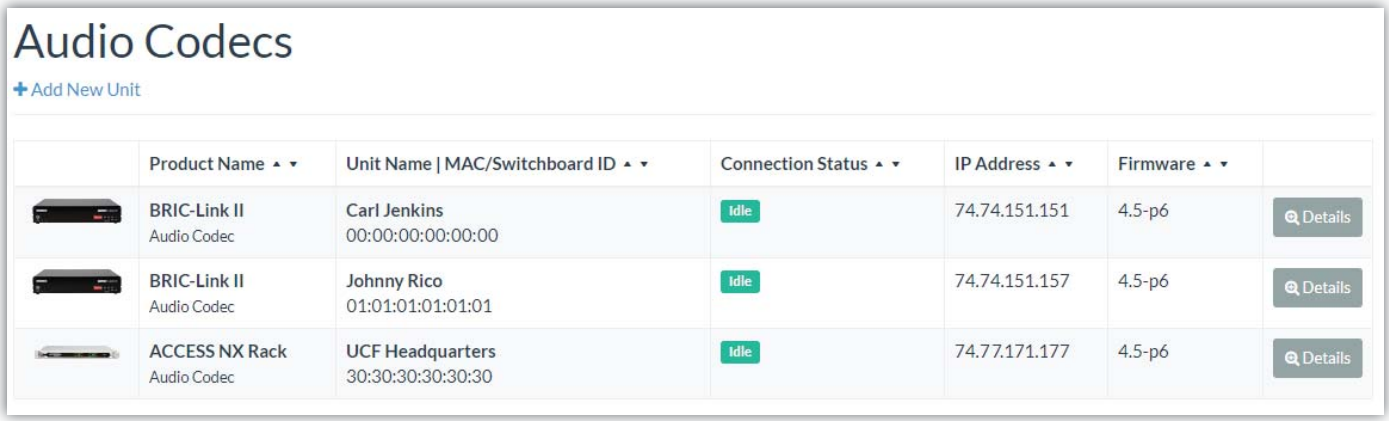

FIGURE 4 **AUDIO CODECS ADDED**

The columns offer the following information for quick reference:

- A small picture of each unit helps indicate the type of product, and the **Product Name** column can confirm this;
- the **Unit Name** column displays each codec’s current “unit name”, as well as its *Switchboard ID (MAC address)*;
- the **Connection Status** column shows if each unit is “Idle”, “Connected” or “Offline”;
- the **IP Address** column lists the current public IP address for each unit;
- and the **Firmware** column shows the current firmware version installed on each unit.

Click the “Details” button to show more information about any unit. A full page opens with data specific to that unit (as shown in **Figure 5**), and even offers the date and time that the unit last connected to the Switchboard server. A unit can be removed from the Switchboard account by clicking the link on the lower right side of this page.

This **Unit Information Page** also allows users to define a very important parameter called **“Followed Contact Lists”**.

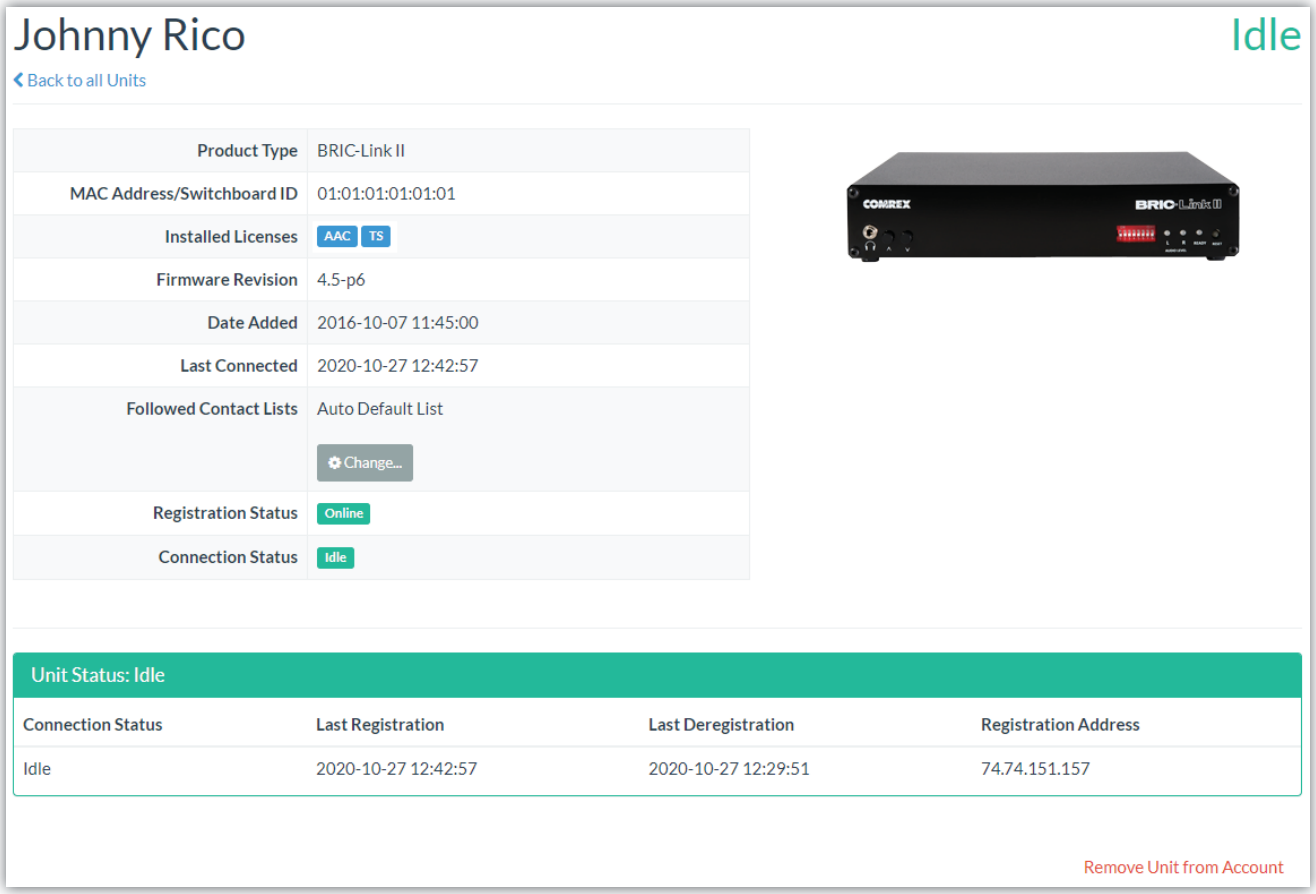

FIGURE 5 **UNIT INFORMATION PAGE**

FOLLOWING CONTACT LISTS

As mentioned previously, Contact Lists are like phonebooks that codecs use to "call" each other. As such, there are two important aspects to consider: First, a Contact List needs to have units added to it for the List to be of any use (this process will be covered in the next section); and second, a unit needs to know which Contact List to use when looking for other units. The process for choosing a Contact List to use is called "**Following**".

A unit should always be following at least one Contact List, and the first Followed List is chosen when a unit is added to a Switchboard Account. Any Contact Lists followed by a unit are shown in the **Unit Information Page** (**Figure 5**). Click the "Change" button to open a dialogue box where more Contact Lists can be followed or "unfollowed" (as shown in **Figure 6**). Clicking any of these Contact Lists will add a "check mark" and the unit will follow that List.

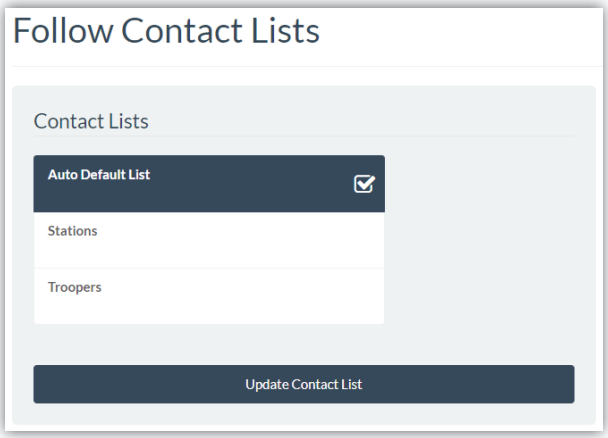

FIGURE 6 **FOLLOWED CONTACT LISTS**

With proper management of **Followed Lists**, a Switchboard account can allow limited access to any unit in its fleet while maintaining full fleet access for other units. For example, a common application of Switchboard involves leaving all units added to the "Auto Default List" and creating a series of smaller Contact Lists containing only certain units (e.g., *East Coast Units* and *West Coast Units*). A codec can then "unfollow" the Auto Default List and follow one of these smaller Contact Lists, allowing it to see only units on that smaller List (e.g., only East Coast Units). Since "unfollowing" a List does not remove the unit from that List, any other units that still follow the Auto Default List can still see and initiate connections to this codec, even though this codec can now only see units on the smaller list.

The next section will cover how to created new Contact Lists, and how to manage which units show up on each list. Note: Once new Contact Lists are created, return to the *Unit Information Page* on the **Audio Codecs Tab** to manage which units are following those Lists.

IV. CONTACT LISTS

On the Switchboard account page, the **Contact Lists Tab** shows all of the Contact Lists that have been created for an account (as shown in **Figure 7**). List names are displayed in the left column, and the units within each List are shown in the center column. The right-most column allows each List to be viewed in more detail, or edited.

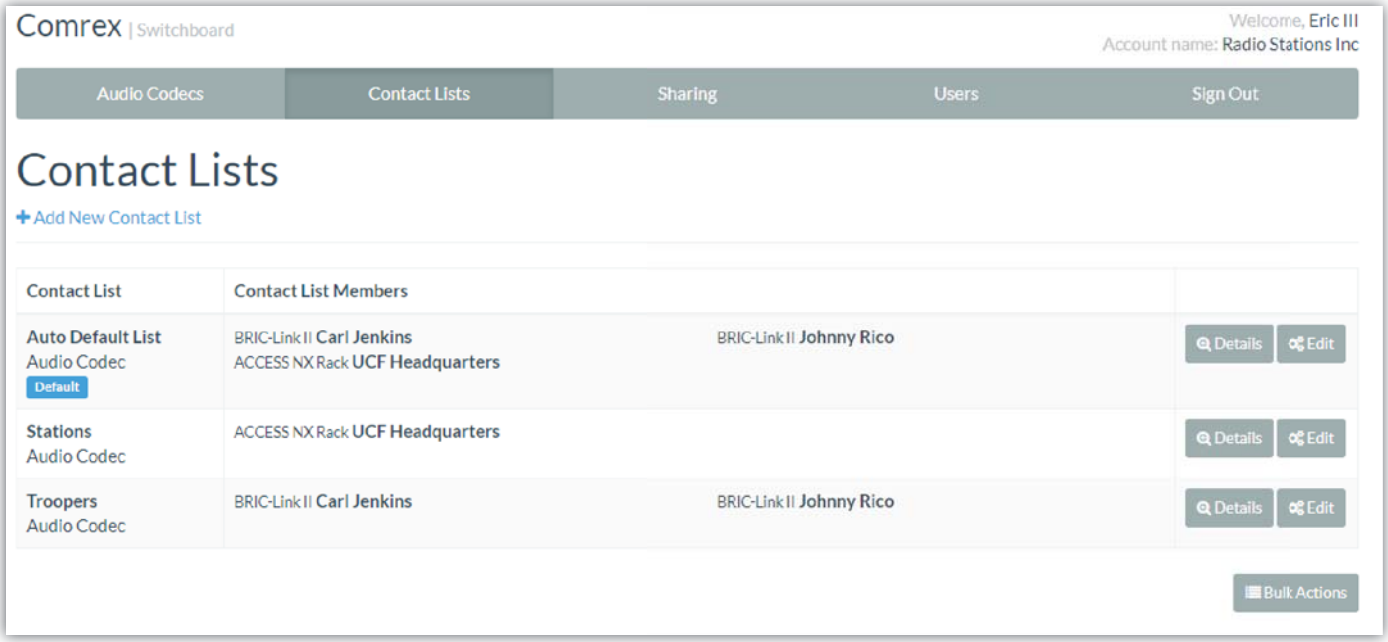

FIGURE 7 **CONTACT LISTS TAB**

New Switchboard accounts will have one built-in Contact List, called “Auto Default List”. For a basic setup, this list works well as a “Master List”, and should include all units on an account. In some situations, it might not be desirable for every codec to be able to see and connect to every other codec in a fleet. To help filter what’s displayed on a codec’s interface, new Contact Lists can be created by clicking “Add New Contact List” on this page.

ADDING CONTACT LISTS

Clicking “Add New Contact List” brings up a dialogue box that will ask for a *List Name* and a selection of codecs to be included in the List (as seen in **Figure 8**).

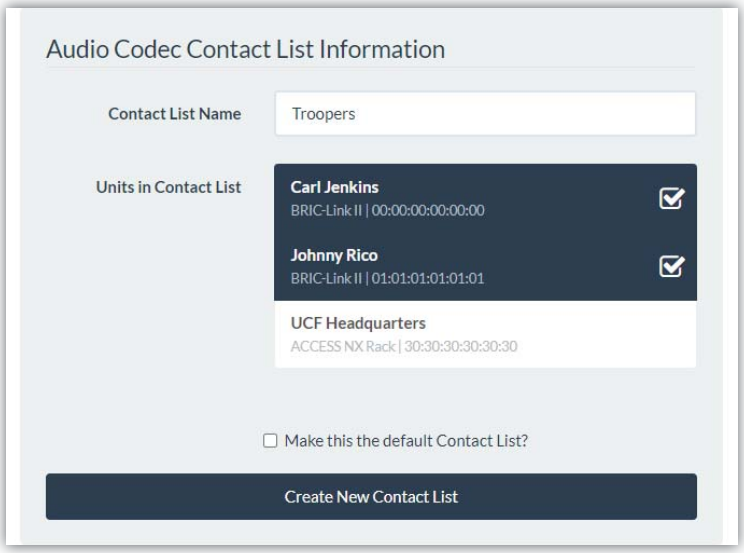

FIGURE 8 **CREATING CONTACT LISTS**

All of the available codecs on an account are listed to choose from. Clicking any of the codecs adds a "check" mark and includes that codec in the new List. Click a "checked" unit to remove the check mark and that unit will no longer be included in the new List. Once the desired units are selected, and a *List Name* is entered, click the "Create new Contact List" button to save the new List. This Contact List will now appear on the **Contact Lists Tab** and units on the account will now be able to **Follow** this List from their *Unit Information Page* on the **Audio Codecs Tab**.

Note: Any new Contact List can also be selected as the new Default List by choosing the "Make this the default Contact List" option. The chosen Default List will be the first option available to new units as they are added to an account. Alternately, it is often easier just to edit the existing Default List through the process mentioned below.

MANAGING CONTACT LISTS

From the **Contact Lists Tab**, any available Contact List can be viewed or edited using the buttons in the right-most column. Clicking "Details" displays an overview of the units on that List, including the *status* and *IP address* for each unit (as shown in **Figure 9**).

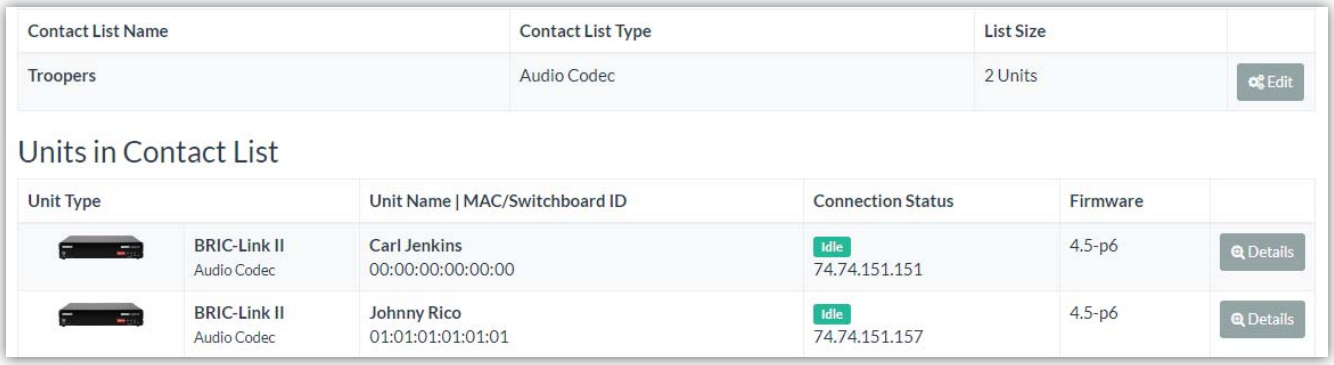

FIGURE 9 **CONTACT LIST DETAILS**

Clicking the "Edit" button (available before–or after–opening "Details") opens a dialogue box used for changing the *List Name* and the selection of units on the List. This dialogue box functions exactly as the "Create New Contact

List" option mentioned above, and can be used to change List parameters at any time. While editing any Contact List, a link on the lower right of the screen allows the List to be removed from the account, if it is no longer needed.

BULK ACTIONS

In larger Switchboard accounts, managing multiple Contact Lists can take time. This task becomes much easier when utilizing the "**Bulk Actions**" feature. Rather than selecting individual codecs and assigning them Contact Lists to follow, a single Bulk Action can tell an entire group of codecs what to do. Bulk Actions are available on the lower right side of the **Contact Lists Tab**, underneath the displayed Contact Lists. Clicking the "Bulk Actions" button opens a dialogue box with a series of logic-based options (as shown in **Figure 10**).

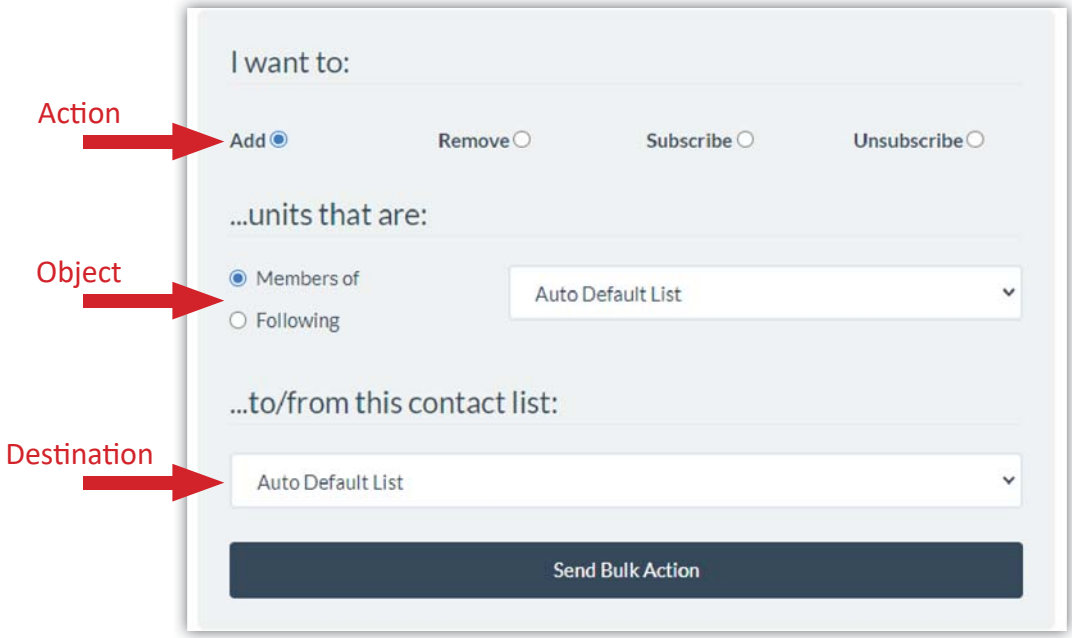

FIGURE 10 **BULK ACTIONS**

Bulk Actions use a logic statement that can be simplified as: "I want to [move] [these units] [there]."
In this statement, users must define an **Action** ("move"), an **Object** ("these units") and a **Destination** ("there").

- There are four **Actions** to choose from:
  - Add - Used to include units in a Contact List.
  - Remove - Used to exclude units from a Contact List.
  - Subscribe - Tells units to follow a Contact List.
  - Unsubscribe - Tells units to stop following a Contact List.

- The **Object** can include *Members of* any existing Contact List, or units that are currently *Following* any Contact List.

- And the **Destination** can be any existing Contact List.

As an example, a Fleet Manager can create a Bulk Action to Unsubscribe units that are Members of the "West Coast Units" Contact List from the "Auto Default List". Another Bulk Action can then be used to Subscribe the units that are Members of the "West Coast Units" Contact List to the "West Coast Units" Contact List. Now, codec users on the West Coast will be able to see and connect to other units on the West Coast, without seeing the entire fleet of units on their codec's interface. This will be easier for West Coast codec users to find the units they want, and allows the Fleet Manager to know that each region is staying in its lane.

Note: Bulk Actions rely on Contact Lists that have already been created in the Switchboard account.

FOLLOWING MULTIPLE CONTACT LISTS

Adding units to a Contact List allows codec users to find and connect to any unit on that list, as long as that codec is set to **follow** that Contact List. When a codec is set to follow more than one Contact List, the codec user will be able to find and connect to units on all the followed Contact Lists. However, this changes the way codec users will interact with Switchbaord. To understand the difference, first see the codec's **Web User Interface** as it appears when only one Contact List is followed (**Figure 11**).

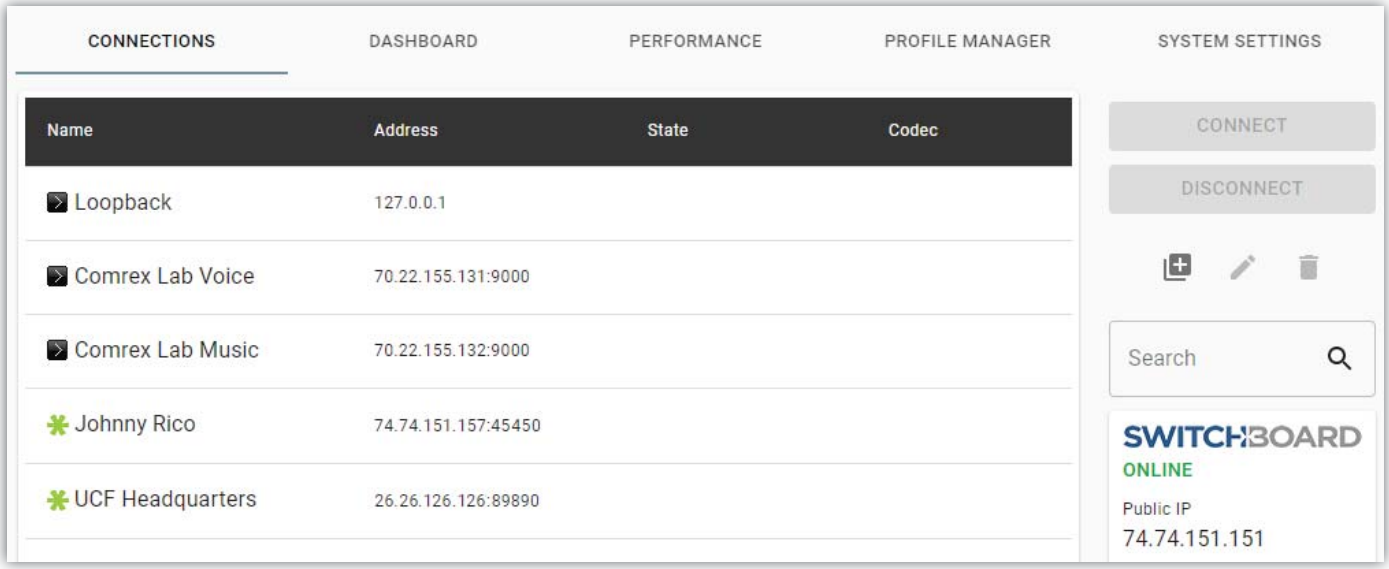

FIGURE 11 **FOLLOWING ONE CONTACT LIST**

The **Connections Tab** will usually show any units that are on a followed Contact List, with a color-coded "Gear" icon indicating the unit's connectivity status. When multiple Contact Lists are followed, the **Connections Tab** will instead show each Contact List, with a "Folder" icon (as seen in **Figure 12**).

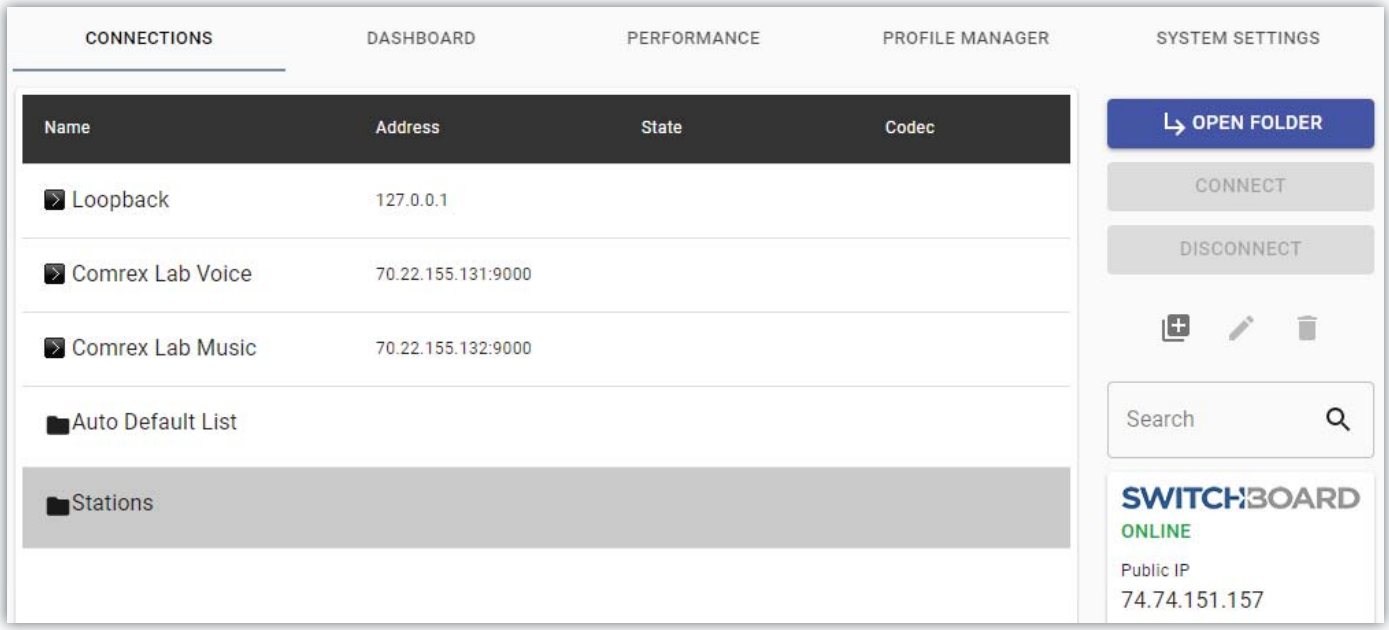

FIGURE 12 **FOLLOWING MULTIPLE CONTACT LISTS**

Select any Contact List and click the “Open Folder” button on the right side of the screen (or double-click the Contact List) to open that List. Units on that List will now be displayed with their familiar “Gear” icon (**Figure 13**).

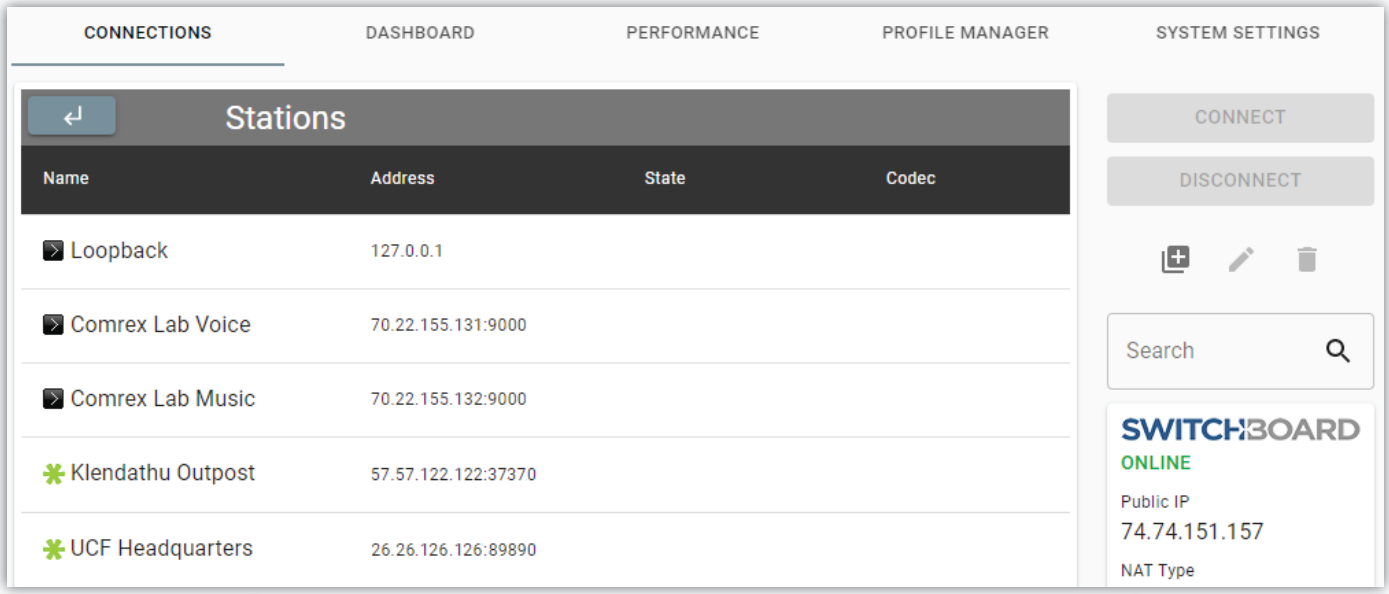

FIGURE 13 **FOLLOWING MULTIPLE CONTACT LISTS**

A new header also appears above the Connections list, displaying the name of the opened Contact List, and a “Back” button ( ), used to close the current Contact List and display all available Lists again. Connections to units on the opened Contact List can be made as usual, and active connections will remain connected even if the Contact List folder is closed on this screen (i.e., an active connection may be **hidden from view** when this happens).

Note: While units can follow multiple Contact Lists that contain the same unit, a unit will only appear in one Contact List, to prevent “duplicate entries”. If the “Auto Default List” is used as *Master List* containing all units on an account, that List will now only show units not already available in another Contact List. If the same unit is in several followed Contact Lists, it will typically only show up in the alphabetically-first List.

Following multiple Contact Lists is especially useful when receiving **Shared** Lists from other accounts, as described in the next section.

v. SHARES

While Contact Lists allow codecs to easily connect to other units in their own Switchboard account, Switchboard also allows users to grant connectivity access to users on a different Switchboard account through the "**Shares**" feature. Like Contact Lists, Shares can be made to include any number of units on an account; however, Shares are then activated to allow another account to see and connect to any of the selected units as if they were on the same account.

On the Switchboard account page, the **Sharing Tab** displays a list of Shares that can be managed, and allows new Shares to be created. As seen in **Figure 14**, the Shares are organized into two sections:

1. Shares owned by this account,
2. Shares given to this account from other Switchboard accounts.

Note: A new account will not have any Shares listed here yet.

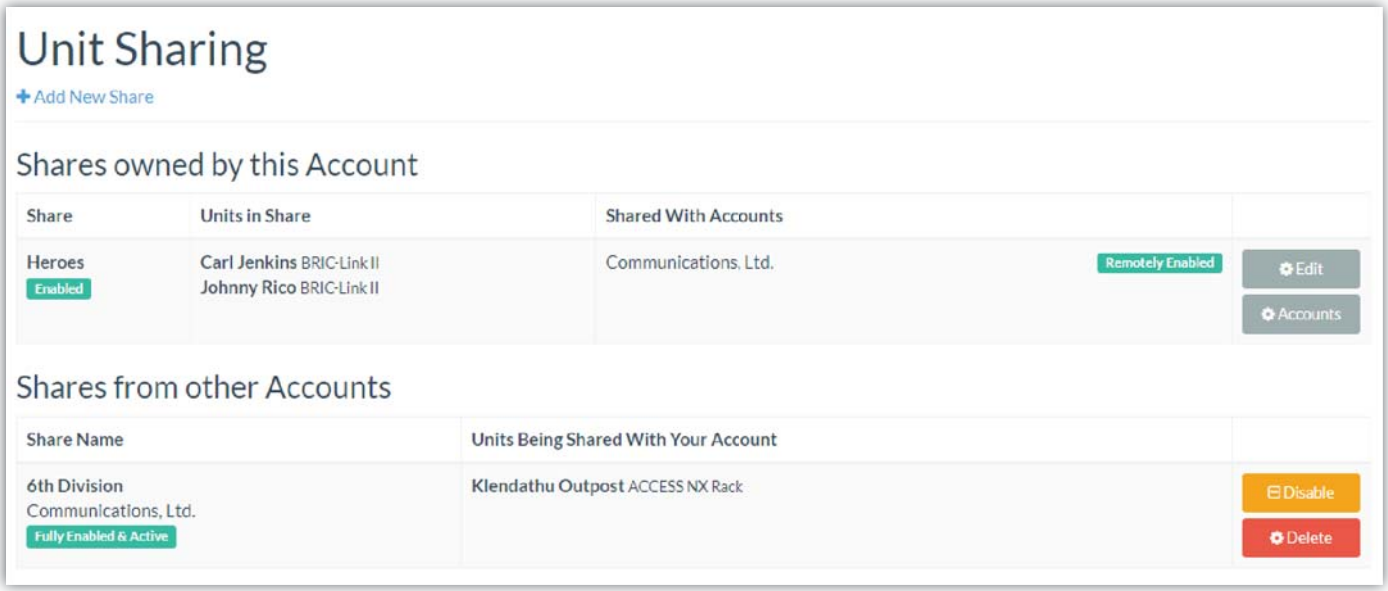

FIGURE 14 **SHARING TAB**

Shares created locally are shown in the "Shares owned by this Account" section, and display a list of *Units in the Share* along with the name of *the account that is being given access to these units*. Users can modify the Share using the buttons on the right side of the screen.

Shares created by other accounts are shown in the "Shares from other Accounts" section and display the *Name of the Share*, the *Account* they are from, as well as a list of *Units being shared to this account*. Local users cannot modify incoming Shares, but the buttons on the right side of the screen allow for *Disabling* or *Deleting* the Share.

CREATING SHARES

Click “Add New Share” to open a dialogue box as shown in **Figure 15**.

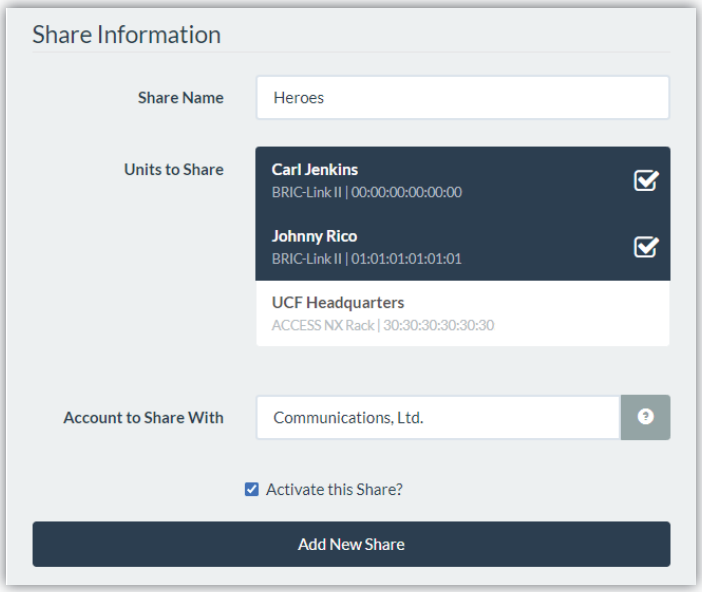

FIGURE 15 **ADD NEW SHARE**

Any units on the account can be selected by clicking the *Unit Name* in the list to add a “check” mark. The name of the account that will receive this Share must be spelled exactly as it appears in that account’s Switchboard page. After naming the Share, selecting units to share, and designating a “destination account” to Share to, click the “Add New Share” button to save this Share locally. The option to “Activate this Share?” is selected by default, and enables the new Share to show up on the **Sharing Tab** of the destination account. This option can be “unchecked” if a Share is being created ahead of time, and units are not yet ready to be shared. Any inactive Shares can be activated later by editing the Share (as described below).

MANAGING SHARES

Added Shares will appear in the “Shares owned by this Account” list on the **Sharing Tab** (shown in **Figure 16**), and can be managed using the buttons on the right side of the screen. Click the “Edit” button to change the Share’s name, change the units selected to be shared, or change the “activated” status of the Share. This process functions the same as when creating a Share, as described above.

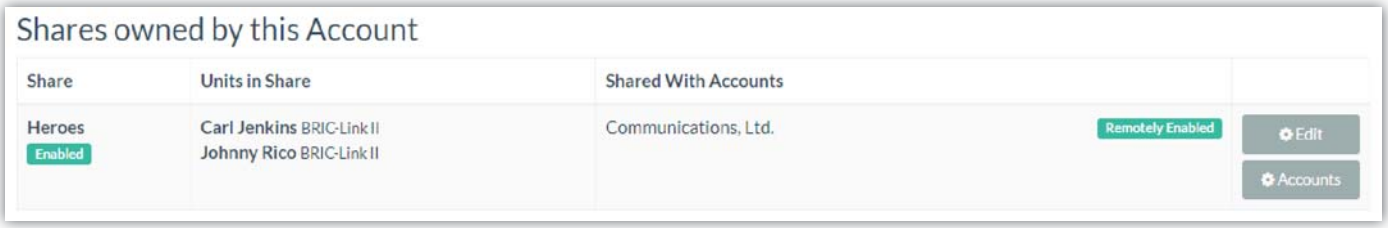

FIGURE 16 **CREATED SHARES**

The “Accounts” button is used to change which account is being given access to the shared units (as seen in **Figure 17**). When creating a Share, only one account can be chosen to share to; however, the chosen account can be changed and more accounts can be added at any time. Ensure the correct spelling is used when adding any new accounts. When multiple accounts have been added to a Share, they can be removed by clicking the account name to remove the “check” mark. When the desired accounts are “checked”, click the “Update Accounts in Share” button to save the new settings.

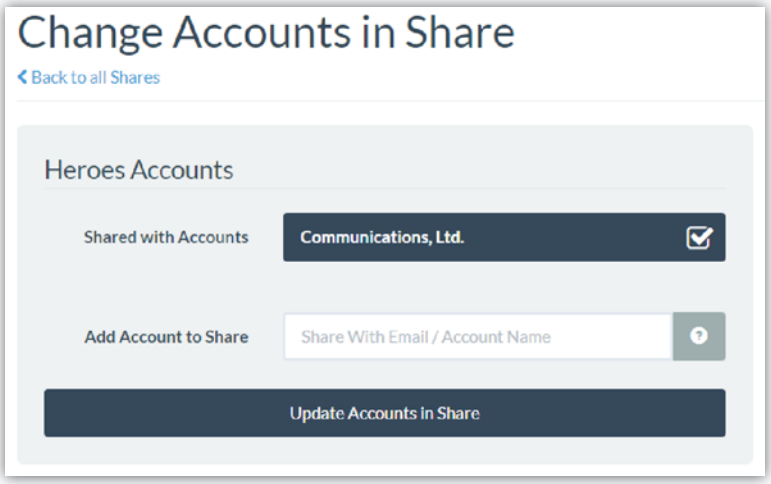

FIGURE 17 **CHANGING ACCOUNTS IN SHARE**

Once a Share is added and activated, it will be available on the **Sharing Tab** of the other Switchboard account, but codec users will not see any of the units being shared to them until the “received Share” is added to a Contact List. The next section will discuss how to receive a Share and enable it for codec users to see.

RECEIVING SHARES

On the **Sharing Tab**, Shares that have been granted from a different Switchboard account will be listed in the “Shares from other Accounts” section (as shown in **Figure 18**). These Shares must be added to a Contact List before codecs on this account can see the units that have been shared.

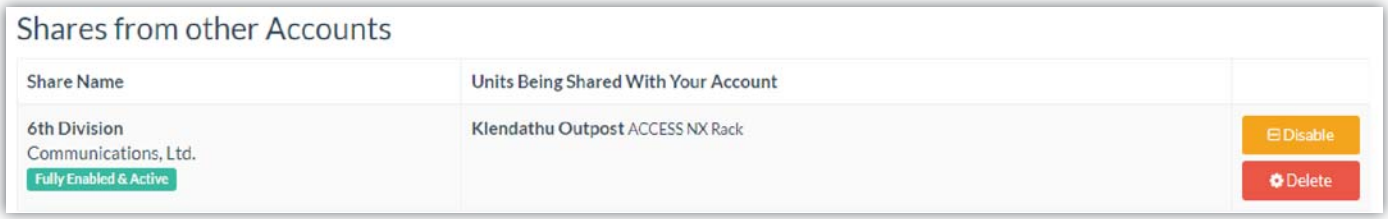

FIGURE 18 **SHARES FROM OTHER ACCOUNTS**

Local users have limited control over a “received Share”, since the sharing options are determined by the account that created the Share. Received shares can, however, be locally disabled or deleted. Clicking the “Disable” button will easily remove the shared units from any Contact List that is currently using the Share. The Share can be re-enabled here as well by clicking the “Enable” button that appears.

If a Share is no longer needed, click the “Delete” button to remove it from the account locally. The deleted Share will remain on the account that created it, but it will no longer show that it is sharing to the account that deleted it. If the Share was granted to multiple Switchboard accounts, units will continue to be shared to accounts that have not deleted the Share.

To enable the received Share for codecs on this account, the Share must be added to a Contact List. For a basic setup, Shares can be added to the “Auto Default List” so that they show up with the full list of units on the account. From the **Contact Lists Tab**, click the “Edit” button for the “Auto Default List” to open the dialogue box shown in **Figure 19**. Any Shares that have been granted to this account will be shown underneath the list of *Units*.

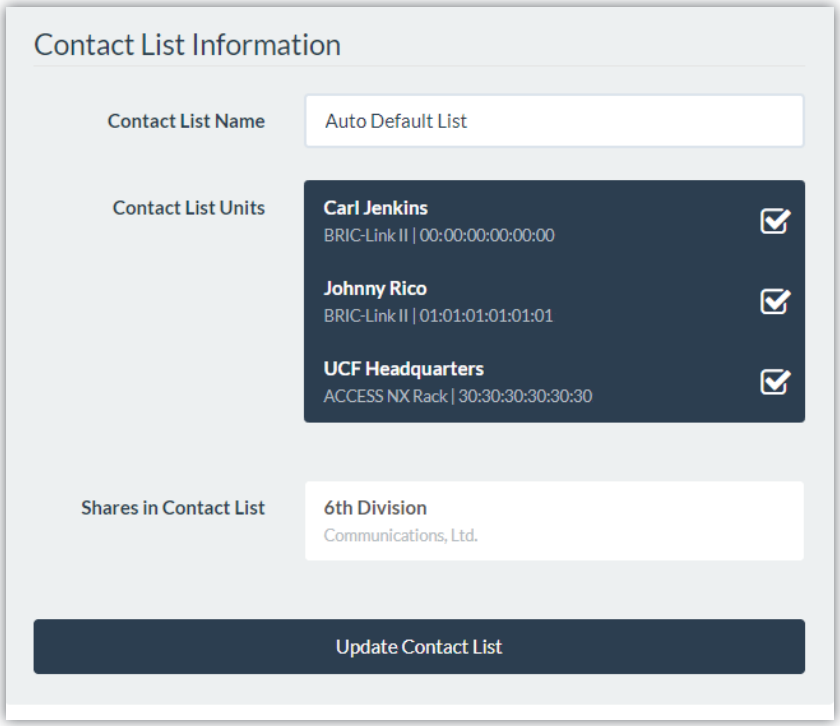

FIGURE 19 **ADDING SHARES TO A CONTACT LIST**

Click the name of the Share on the list to add a “check” mark, similar to selecting units. Once the Share is “checked” all units within that Share will be visible to any codecs that are following the “Auto Default List”. They can now be connected as if they were on the same account. Using more advanced Contact List distributions, Shares can be limited to only certain codecs in a fleet, or arranged in other ways. See the previous section for details on managing Contact Lists, and consider adding Shares to any List as needed.

Note: Shares are a **one-way transaction**. Codecs that are shared to an account cannot necessarily see the units that will connect to them until a connection is established. For codecs to be shared *both ways*, a Share must be created in each account, granting access to the other account; these Shares must also be included in a Contact List on the receiving account.

VI. USERS

It is possible to add additional Switchboard users who can access the Switchboard interface. This is done via the **Users Tab** (shown in **Figure 20**). Users are listed by *Name* and display a *Username*, *Email address*, and *Phone number*, if available.

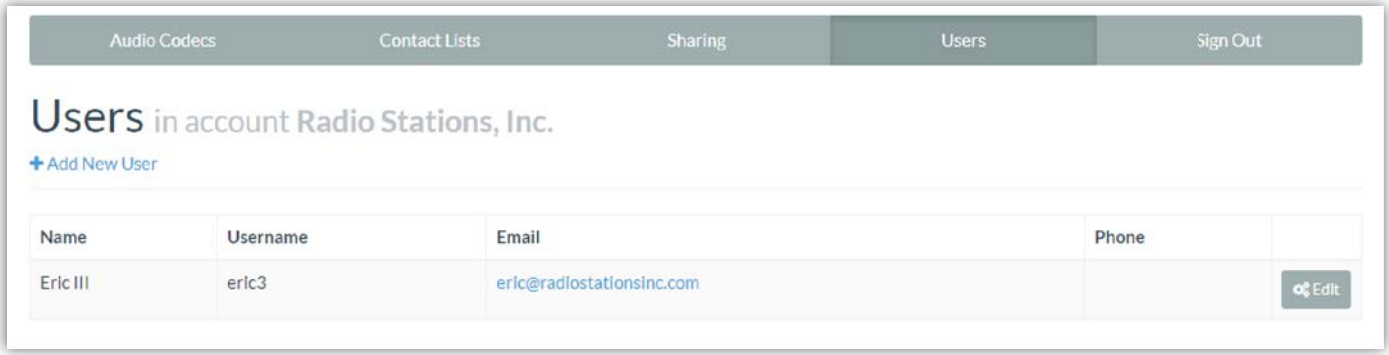

FIGURE 20 **USERS TAB**

ADDING USERS

To add a User, click “Add New User”, and a dialogue box will appear (as shown in **Figure 21**).

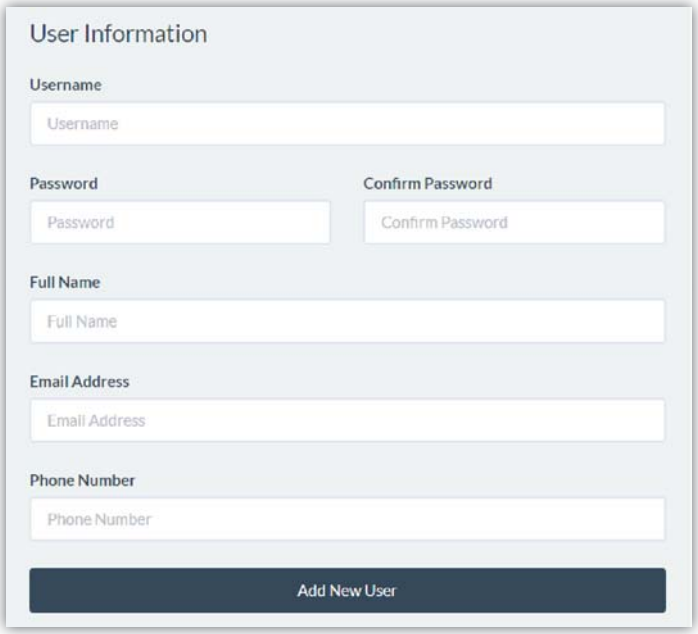

FIGURE 21 **ADD NEW USER**

Enter a unique *Username* and a secure *Password* for the new User (this will be the user’s login credentials). Then enter the User’s *Full Name* and a contact *Email address*. A *Phone number* is optional, but can assist in communication among Switchboard users. Click “Add New User” when finished and the User will be displayed on the **Users Tab** (**Figure 22**). Click “Edit” on any user to change entries or remove Users at any time. Any User given login credentials can access the Switchboard account and perform any the actions described previously.

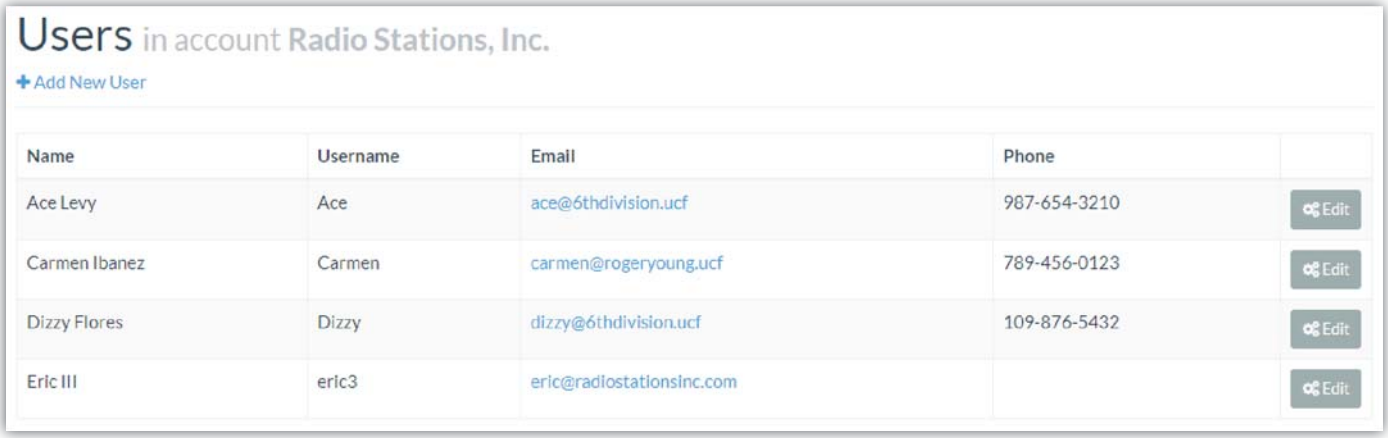

FIGURE 22 **USERS ADDED**

The next section of this manual offers more detailed information about how Switchboard is utilized from the perspective of the codec user. Once the Switchboard account is set up properly, codecs in the field will be able to establish audio connections quickly and easily from a wide variety of locations.

VII. MAKING CONNECTIONS WITH SWITCHBOARD

This section of the manual describes the procedure for making and receiving connections using the *ACCESS* and *BRIC-Link* audio codecs via the Comrex *Switchboard* server. This is the easiest, but not the only way to make audio connections on a Comrex codec. As described in the product manual and quickstart guide, manual connections can be made but require additional configuration for each remote, which is not necessary when using Switchboard. Once a codec is added to a **Switchboard Account**, connections can be made with as little as one step.

This section assumes that the local codec has already been added to an existing **Switchboard Account**, and that the account has other remote codecs available for a connection. Please refer to the individual product manual for more detailed instructions on setting up and using each kind of Comrex codec.

FROM THE WEB USER INTERFACE

Once a Comrex audio codec is added to a **Switchboard Account**, connections to any other codec in that account can be made by logging into the **Web User Interface** of the local unit. The **Connections Tab** will appear different for units that use Switchboard (as shown in **Figure 23**).

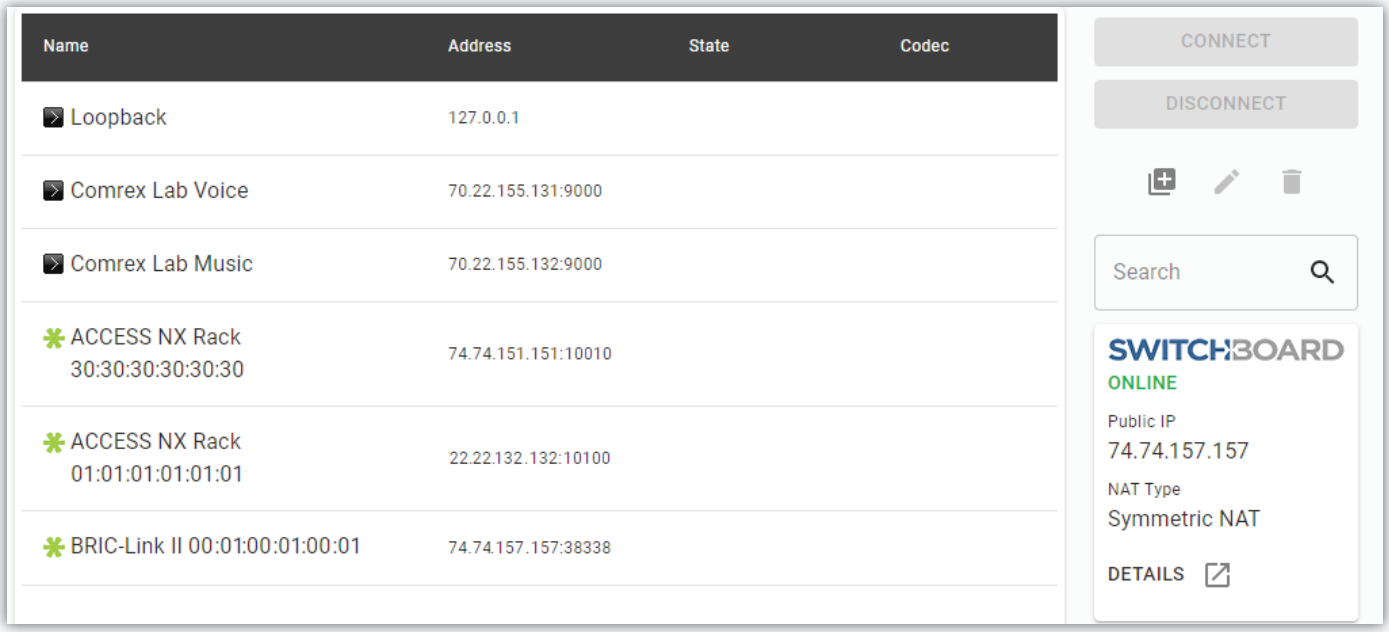

FIGURE 23 **SWITCHBOARD PEERS**

PEERS

The *Remotes* list will show special entries for any units (or "**peers**") that can be connected to via Switchboard. The *"gear"* icon (✱) next to each Switchboard peer indicates the availability of connection to that unit. The local codec can connect to any **peer** with a *green gear* next to its name. A *yellow gear* signifies that the peer is currently busy with another connection, whereas a *red gear* signifies that it is inaccessible (usually due to network incompatibility). Any Switchboard peer that is currently offline or has lost communication with the TS server will be hidden from this list by default; however, the local codec can be configured to "Show Offline Switchboard Units" via the *Connections* section of the **System Settings Tab**. Offline peers are displayed with a *gray gear* icon when shown.

By selecting a Switchboard peer and clicking the edit "*pencil*" icon ( )on the right side, you can change several important aspects of the Switchboard connection:

Use CrossLock - Determine whether the connection will be made over the CrossLock Layer and port arrangement, or over the legacy BRIC Normal protocol and port arrangement. Note: this choice affects which IP ports are used for connections, so there are implications concerning firewalls and routers (refer to the **product manual** for more details).

Connection Password - This adds an extra layer of security to the connection. This is a password that has been programmed into the receiving codec, and will be required on the outbound side for proper connection. Since Switchboard provides its own connection filtering, passwords are not normally used in this mode.

Profile - Choose one of the factory supplied or custom built audio profiles for this connection. This defines encoders used in both directions, along with a long list of other parameters. If none is specified, the profile designated as default will be used.

Backup/Fall Forward settings - Allows a backup peer to be chosen.

CONNECTIONS

Once your Switchboard peers are configured, connecting to one is simple. (You can also easily connect to any existing peer using the default configuration.)

1. Select the desired Switchboard peer.
2. Make sure the "gear" icon is green.
3. Click the "Connect" button on the right side of the screen.

Switchboard connections can be ended from either end of the link, by choosing the active connection in the list and clicking "Disconnect". Active connections will display additional information such as the *connection state* and the *encode/decode algorithms* (as seen in **Figure 24**).

FIGURE 24 **CONNECTED SWITCHBOARD PEER**

Incoming connections will appear as new entries in the Switchboard peer list while they are active. They can be disconnected the same way.

SWITCHBOARD STATUS

When Switchboard is enabled on a Comrex audio codec, additional status information appears on the right side of the **Connections Tab**, including “Public IP” and “NAT Type” (as shown in **Figure 25**). The IP ports currently used by the unit can also be shown by clicking the “Details” button. This information is often useful for IT managers to open or forward network ports. Note: A codec’s unique **Switchboard ID/ MAC address** can be found here in the “Details” pop-up window. This ID is required to add units to a Switchboard account, as described in the previous sections of this manual.

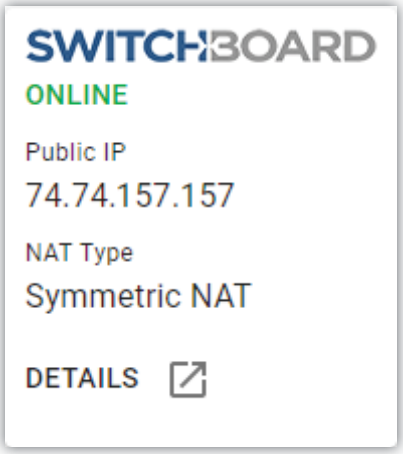

FIGURE 25 **SWITCHBOARD STATUS**

FOLLOWING MULTIPLE CONTACT LISTS

Part of setting up a **Switchboard Account** involves managing a feature called “Contact Lists” (see **page 12**). Adding units to a Contact List allows codec users to find and connect to any unit on that list, as long as that codec is set to **follow** that Contact List. When a codec is set to follow more than one Contact List, the codec user will be able to find and connect to units on all the followed Contact Lists. However, this changes the way codec users will interact with Switchboard. To understand the difference, first see the codec’s **Web User Interface** as it appears when only one Contact List is followed (**Figure 26**).

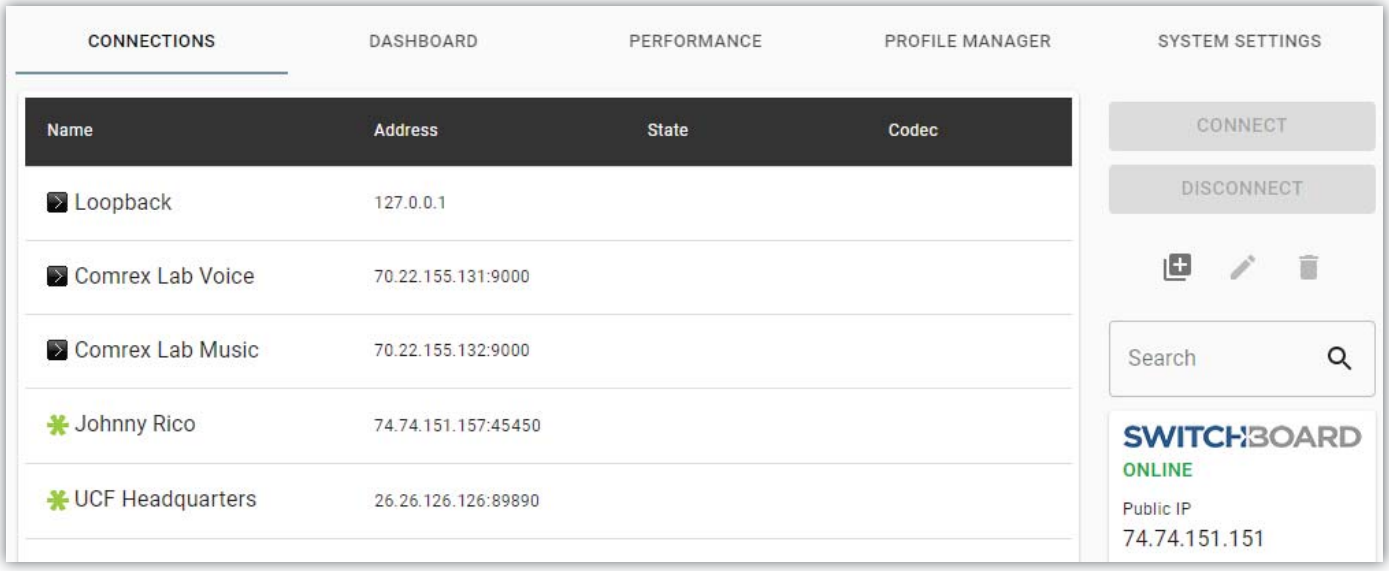

FIGURE 26 **FOLLOWING ONE CONTACT LIST**

The **Connections Tab** will usually show any units that are on a followed Contact List, with a color-coded "*gear*" icon indicating the unit's connectivity status. When multiple Contact Lists are followed, the **Connections Tab** will instead show each Contact List, with a "Folder" icon (as seen in **Figure 27**).

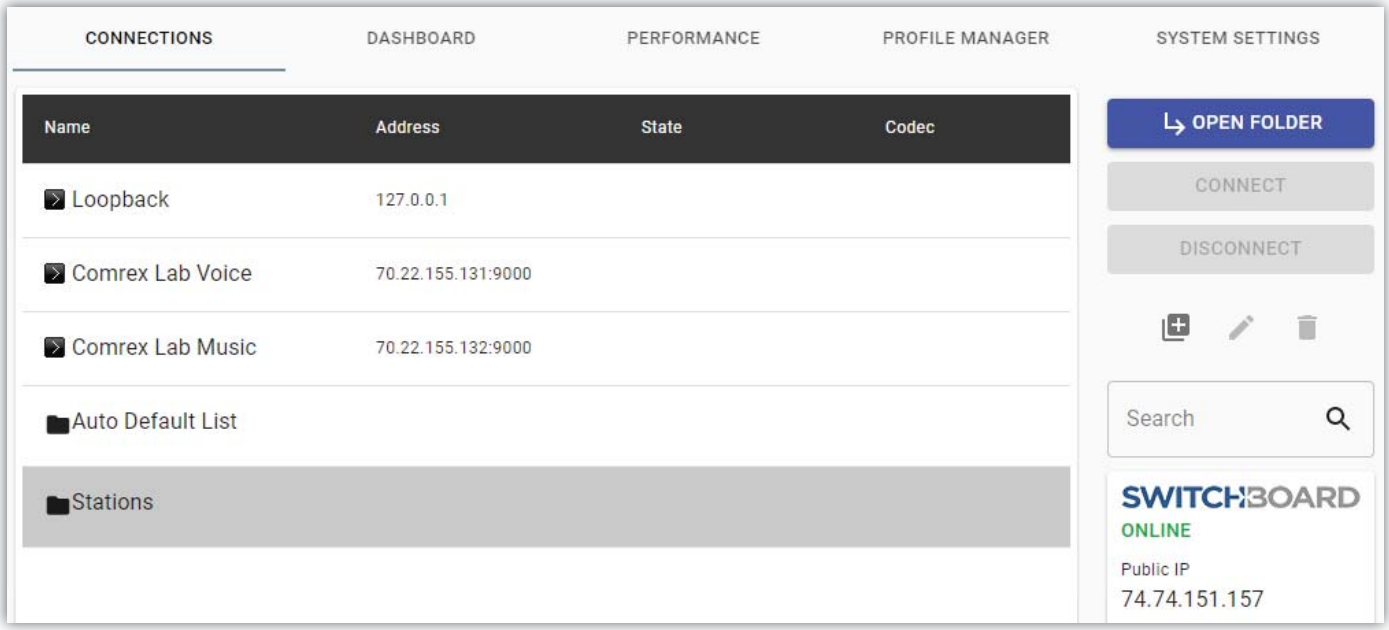

FIGURE 27 **FOLLOWING MULTIPLE CONTACT LISTS**

Select any Contact List and click the "Open Folder" button on the right side of the screen (or double-click the Contact List) to open that List. Units on that List will now be displayed with their familiar "*gear*" icon (**Figure 28**).

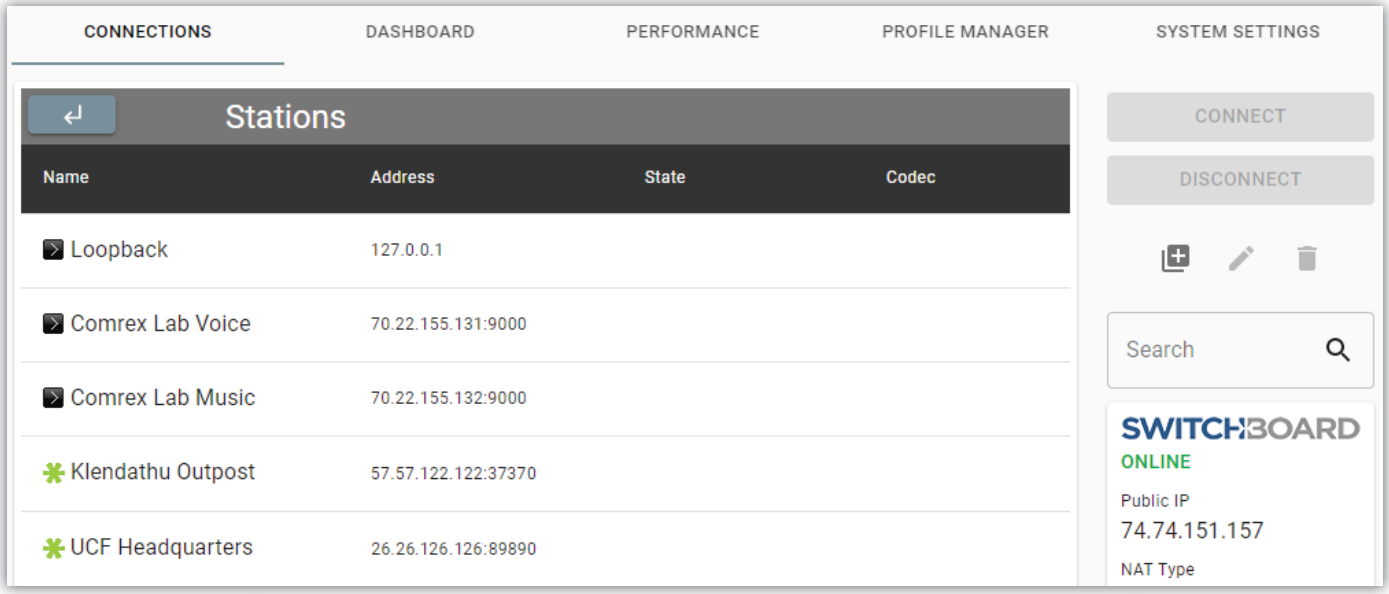

FIGURE 28 **OPENED CONTACT LIST**

A new header also appears above the Connections list, displaying the name of the opened Contact List, and a "Back" button ( ), used to close the current Contact List and display all available Lists again. Connections to units on the opened Contact List can be made as usual, and active connections will remain connected even if the Contact List folder is closed on this screen (i.e., an active connection may be **hidden from view** when this happens).

Note: While units can follow multiple Contact Lists that contain the same peer, a peer will only appear in one Contact List, to prevent "duplicate entries". If the "Auto Default List" is used as *Master List* containing all units on an account, that List will now only show peers not already available in another Contact List. If the same peer is in several followed Contact Lists, it will typically only show up in the alphabetically-first List.

Following multiple Contact Lists is especially useful when receiving **Shared** Lists from other accounts.

FROM THE PORTABLE USER INTERFACE

Portable Comrex codecs with LCD displays, such as the *ACCESS NX Portable* and the *ACCESS 2USB*, can also establish connections via Switchboard using the built-in **Portable User Interface**. Similar to the *Web User Interface*, Switchboard peers are displayed on the **Remote Connections** screen with a *"gear"* icon ( ) indicating the availability status to that unit (as shown in **Figure 29**).

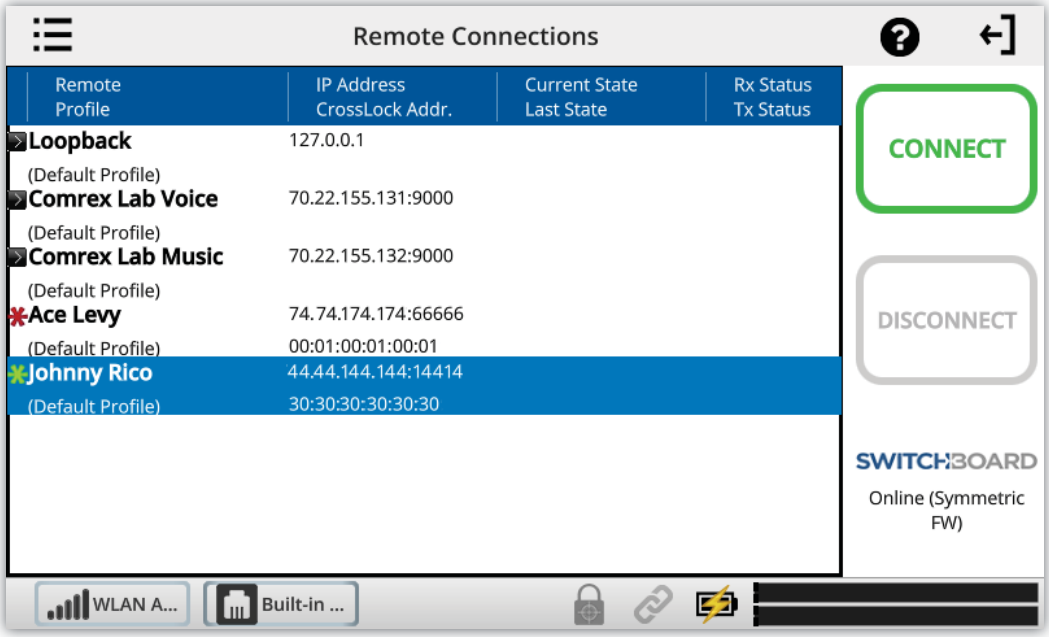

FIGURE 29 **PORTABLE USER INTERFACE**

The local codec can connect to any **peer** with a *green gear* next to its name. A *yellow gear* signifies that the peer is currently busy with another connection, whereas a *red gear* signifies that it is inaccessible (usually due to network incompatibility). Any Switchboard peer that is currently offline or has lost communication with the TS server will be hidden from this list by default; however, the local codec can be configured to "Show Offline Switchboard Units" via the *Connections* section of the **System Settings Menu**. Offline peers are displayed with a *gray gear* icon when shown.

To establish a connection:

1. Select the desired Switchboard peer.
2. Make sure the “gear” icon is green.
3. Click the “Connect” button on the right side of the screen.

Additional options available on the **Portable User Interface** are generally consistent with those available through the **Web User Interface**. Refer to the previous section for more details if needed.

APPLYING A SWITCHBOARD TS LICENSE

Switchboard is enabled by default on all **ACCESS** audio codecs, which often travel and connect in various locations. **BRIC-Link**, **BRIC-Link II** and **BRIC-Link III** codecs, which are particularly suited for point-to-point “nailed up” audio links, can be activated for use on Switchboard through the purchase of a **Switchboard Traversal Server License**. Contact an authorized Comrex dealer for more information.

Comrex Tech Support will supply the activation key for a purchased license. Use the **Device Manager** program available on www.comrex.com to apply a Switchboard TS License to a BRIC-Link codec (as shown in **Figure 30**).

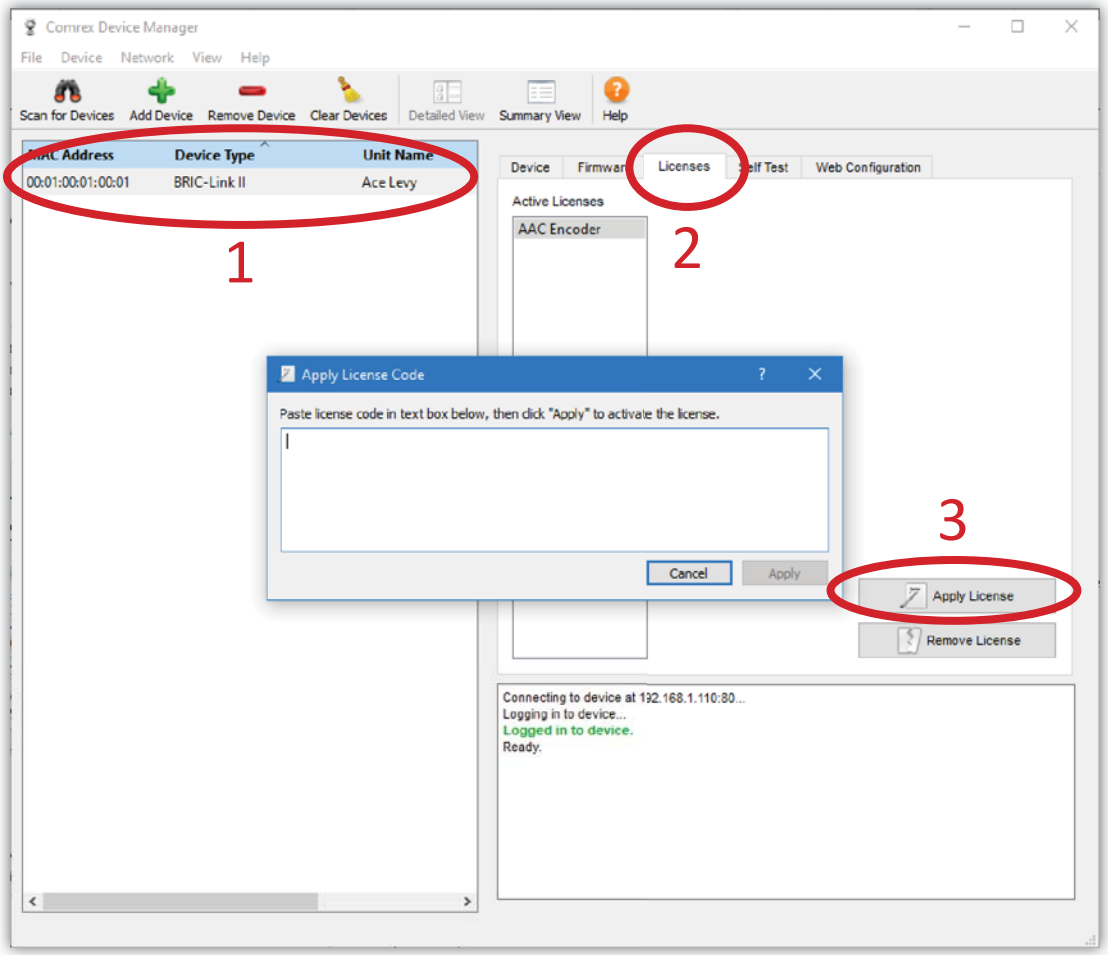

FIGURE 30 **APPLY A LICENSE**

The next section of this manual offers more detailed technical and conceptual information about how Switchboard works, rather than how it is used. This can be helpful to understand what goes on behind the scenes each time a codec connects via Switchboard.

VIII. SWITCHBOARD THEORY AND CONCEPTS

WHY SWITCHBOARD?

Switchboard offers a distinct advantage facilitating connections because it's not always simple to connect two devices, which are essentially "peers", over the Internet. There are two major reasons for this. First, initiating communication to a device over the Internet requires knowing its IP address. This is the number that gets applied to the destination field of an IP packet, so internet routers can determine how best to send it along its way. Second, traffic can often be blocked or lost along the way even if the IP address is known.

IP ADDRESSES

Every device that connects directly to the public Internet must have an IP address. However, when web browsing or sending email, this information is usually hidden from the user. In the traditional client/server scenario, such as web browsing, a Uniform Resource Locator (URL) is used to represent the IP address of the web page, which is decoded by a Domain Name System (DNS) server. Once a computer requests a web page by URL from a web server, the web server can automatically derive the reply address from the request and respond to it. So the traditional four segment decimal address (e.g., 70.22.155.130) is completely obscured to the user.

Even if you know your IP address, it's quite possible that address will change over time. This is because the vast majority of internet users establish their addresses via the Dynamic Host Configuration Protocol (DHCP), whereby a server maintained by the Internet Service Provider (ISP) will deliver one of their available addresses to the client on initial connection. That address is "leased" from the server for a particular time period, and after the "lease" expires, the server is free to change it.

The commonly used Network Address Translation (NAT) router adds to the confusion, making codecs even harder to find. Most Local Area Network (LAN)-based Internet connections (as opposed to computers connected directly to ISPs) actually negotiate with a local router containing its own DHCP server. This router assigns the LAN computer or device a "private" IP address for identification within the local network.

The challenges of connecting codecs behind NAT routers will be addressed in more detail shortly. For now, remember that one of the problems NAT servers add is that private IP addresses delivered to codecs (and the only addresses of which the codecs are aware) have no bearing on the public addresses seen from the Internet. In extreme scenarios, several layers of address locality can be stacked, assuring that the IP address assigned to a device is several degrees removed from the public IP address used for connections (as illustrated in **Figure 31**). Additionally, each address in the stack is often temporary and able to change at any time.

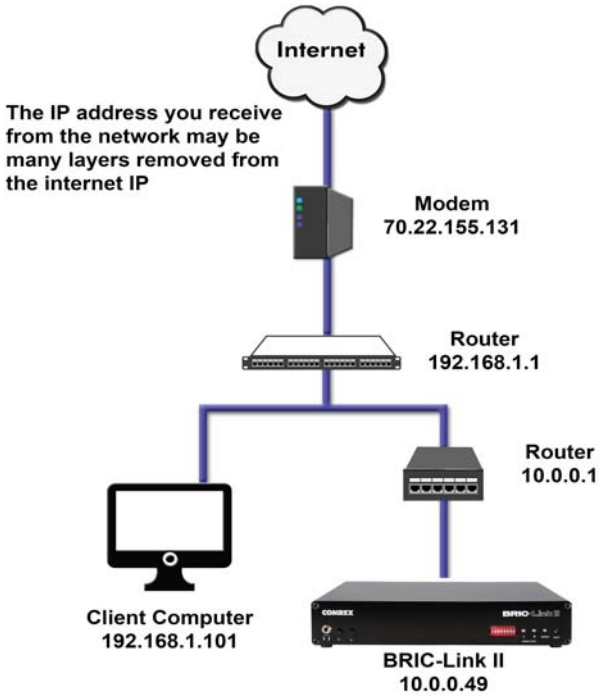

FIGURE 31 **LOCAL AREA NETWORK**

Before deployment of Switchboard, the answer to this dilemma was to assure that the codec located in the studio had a fixed, public IP address. This meant that the address was allocated exclusively by the ISP, and that address was entered manually into the configuration of the codec and not subject to change. This scenario worked because IP “calls” are usually initiated from the field. As long as the field unit can find the fixed address of the studio unit and send a stream to it, a reverse channel can be created easily and automatically by the studio unit, using the source information contained in the incoming packets. In this scenario, the studio IP address must be memorized or input into each codec individually.

The first function Switchboard works around is the dynamic IP address problem by acting as a Directory Server. Similar to a DNS, this Directory Server function stores real IP addresses and translates them into user-friendly names, but on a much smaller scale that is only relevant to Comrex codecs. Codec users can name their codecs and use those names to establish connections, rather than using IP addresses. The codecs themselves need only know the public IP address of the Switchboard server, and that server provides them with the more elusive IP addresses of other codecs in their group. Because Switchboard stays on a fixed IP address which is programmed into all Comrex codecs, this works naturally and easily.

Once enabled, a codec in a group that is physically connected to the Internet will sync with the server. The server recognizes the sync attempt by the unique Media Access Control (MAC) address of the device reaching out to it (which the server knows from an internal database). The current public IP address of the codec will be obtained by the server and a user directory will be updated with the new IP address. In addition, the availability status of the codec is also updated. The codec will then “ping” the server if anything changes (address, status, etc.). As we’ll see, this “ping” function will prove useful in other ways as well.

Once the codec has updated its status with the server, it instantly downloads the directory of IP addresses and statuses of other codecs within the group. This information forms a “Buddy List” of sorts that gets integrated into the codec’s connection address book. Codec users see the whole address book as it is updated in the background, and are given easy-to-understand icons depicting the presence and connection status of the remote units made available to them by Switchboard. The address book may still contain entries made manually by entering IP addresses into the codec, but those are signified by different icons in the user interface.

If IP addresses should change, the codec will re-sync with the server from the new address, and all will be updated automatically. Connections can be made by simply clicking on the correct name, without any updating on the part of the user.

NAT TRAVERSAL

The other roadblock to connecting devices over the internet, which stems from the use of NAT routers, is the inability to accept unsolicited incoming connections from the Internet. Generally, this function acts as a rudimentary firewall and is a net positive for security, but it does cause headaches for codec users. A router that receives a connection request doesn’t have a clue where to forward that stream unless it has specific instructions programmed into it (as illustrated in **Figure 32**). These instructions are known as “port forwarding”.

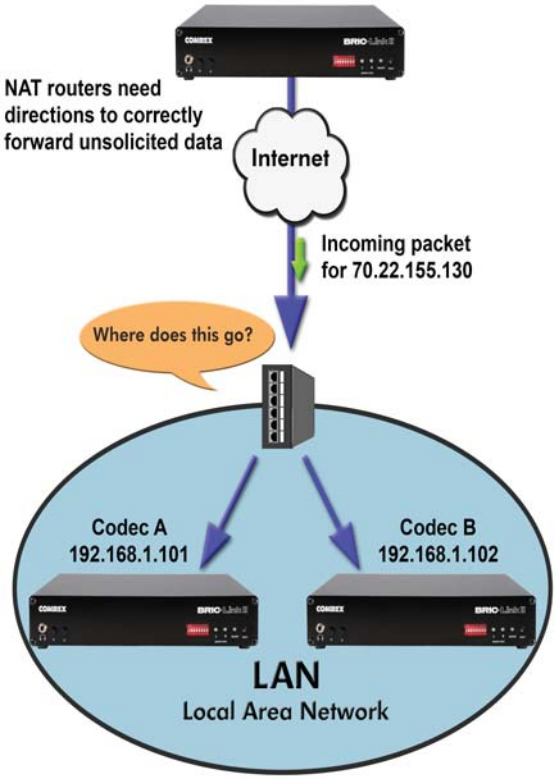

FIGURE 32 **NAT TRAVERSAL**

This can work well for fixed installations, but it’s not always an easy task to obtain that kind of security access on corporate routers. Additionally, forwarding functions are implemented differently depending on the hardware. One can easily imagine the complications of obtaining or managing port forwarding on the LAN when arriving at a new remote venue. This would likely encounter a large amount of resistance or confusion on the part of local IT staff.

In describing NAT routing, it's important to understand the concept of ports. These are numbers, like the source and destination IP addresses, that are attached to each packet. They further qualify which application on a computer (or codec) is meant to send or receive a packet. In a typical codec application, Codec X will send a packet from Address A/Port B, to Address C/Port D on the Destination Codec Y. A codec that has multiple applications running (like streaming audio while simultaneously serving a configuration web page) would deliver these applications from, and to, different port numbers, but perhaps to the same IP address. Port numbers are also used by NAT routers in segmenting applications flowing through them, and they may change source port numbers at will.

The term "Network Address Translation" (**NAT**) refers to the ability of a router to translate requests from computers (or codecs) within its LAN into formats usable on the public internet. On its most basic level, this involves replacing the private "source" or return IP address in each packet with the true public IP and remembering where that packet was sent. This insures that any response can be forwarded back to the proper device.

A good way to think of this is that an outgoing packet "punches a hole" in the router, through which authorized reply packets may be returned to the codec for a limited time (as shown in **Figure 33**).

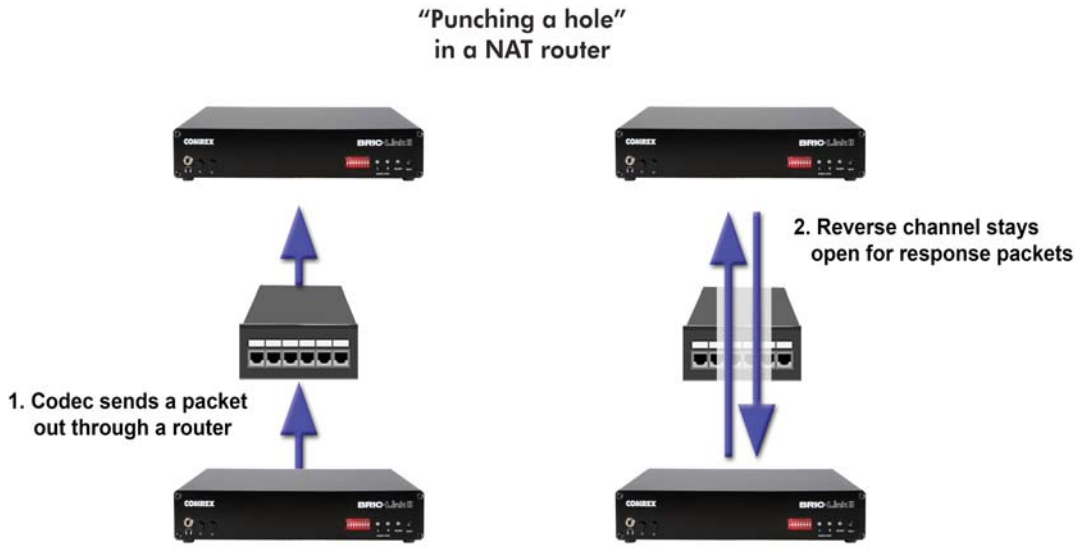

FIGURE 33 **BIDIRECTIONAL COMMUNICATION**

Switchboard aids in breaking through these different types of routers for incoming calls. Because it is in constant contact with all subscribed codecs, it can send and receive test patterns to determine whether one or more NAT routers exist on a link and what type they are. It can then choose a connection method to be used to circumvent any issues.

Depending on the what network restrictions it detects, Switchboard can:

- Instruct the calling codec to make a normal connection (no NAT detected).
- Use the hole punched by connection to the Directory Server for incoming connections from other codecs.

-or-

- Instruct the called codec to make the connection in the reverse direction.

The second option, which utilizes the outgoing Directory Server “ping” described earlier, is very useful. The interval of this ping is adjustable, but defaults to about one minute, which is short enough to keep a hole punched through the majority of NAT routers.

These techniques are based loosely, with enhancements, on a generic internet protocol called STUN (Simple Traversal of UDP through NAT). The system works well in all environments except one: when both users are sitting behind a symmetric NAT. In this situation, calls will fail even with Switchboard. The only option in that environment is to resort to port forwarding on one side of the link.

Overall, Switchboard takes the complexity of interactions between public and private internet and translates the user experience into a simple point-and-click methodology, giving Comrex codec users more freedom with less effort.