DVSwitch Installation and User Guide
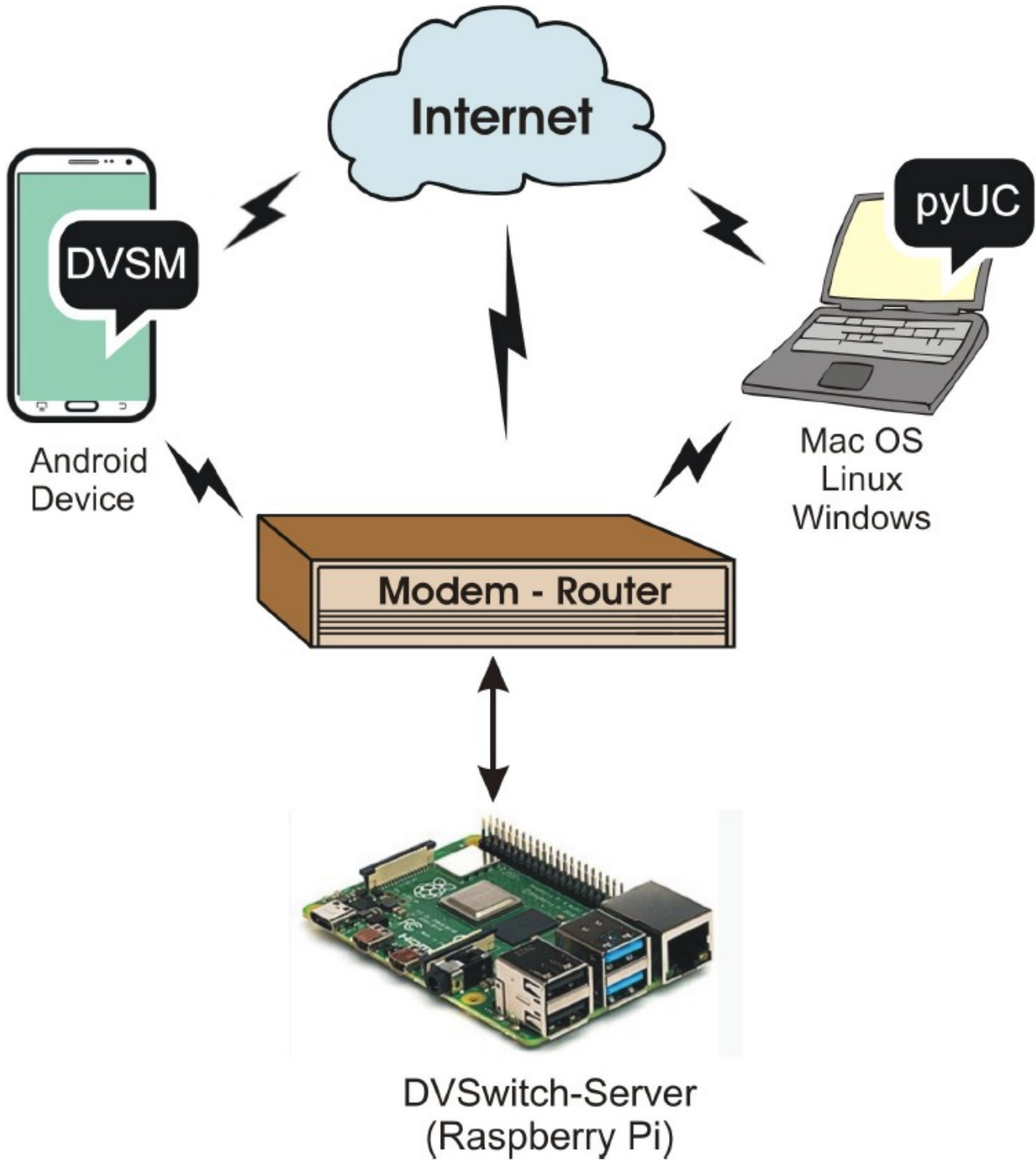
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Introduction

DVSwitch is a Client-Server application for Amateur Radio Digital Voice. The application provides a "Server" component which runs on a Raspberry Pi (RPi) or other Linux platform. It can also be installed on a cloud server running Linux. The server component is distributed as an RPi image with all features and functions installed. Therefore, no additional modules or programs need to be downloaded or installed for a Raspberry Pi. There are two clients available for DVSwitch. An Android client is available on the Google App store for virtually any type of Android device. In addition, the python USRP Client (pyUC) is available to use on Windows, Linux or Mac. Installation instructions for the Server and all Clients are provided in this document.

DVSwitch supports all current Digital Voice modes with no additional hardware with the exception of D-Star. For D-Star, an external hardware Vocoder such as the Northwest Digital ThumbDV dongle. For other modes, the software Vocoder included in DVSwitch provides high quality audio

While DVSwitch has been in use for sometime but the installation was somewhat complex and was mostly used by computer "geeks". With this release, an average ham can be up and running in less than 10 minutes. This release provides many new features including the ability to switch modes dynamically, customize Talk Group, Room, and Reflector lists from either the server or client and dynamically switch among DMR networks such as Brandmeister, TGIF, QRM, etc.

The basic components of the system are shown in the following diagram:
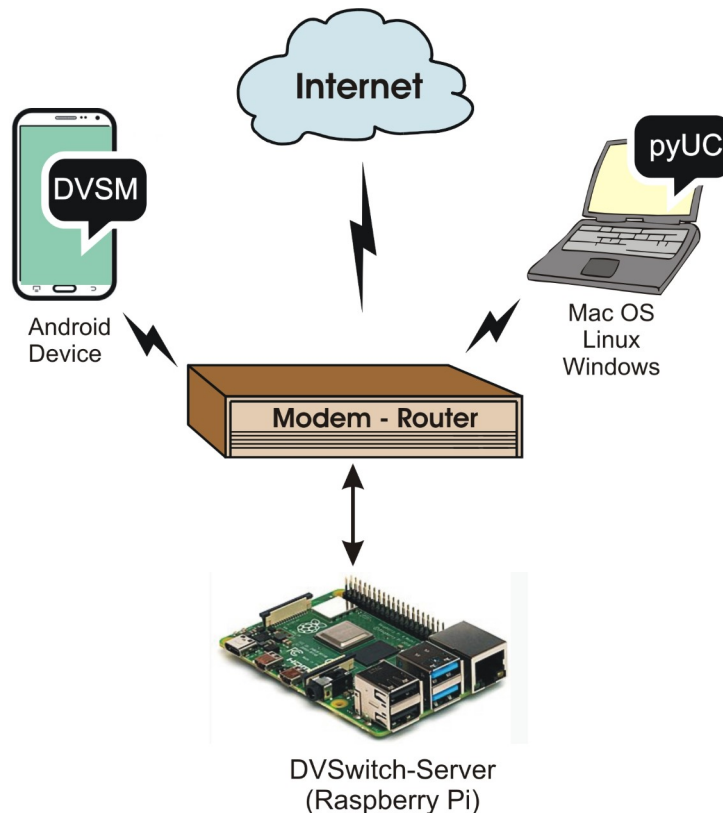
Getting Started

When installing for the first time, it is recommended that the user first print the following table and gather all the equipment and information needed to get the server up and running.

CCS7/DMR ID NXDN ID	To operate on the DMR system, you need to register with an authentication and routing system called CCS7 (Callsign Communication System, 7-digit). • For website DMR and NXID registration for North America, South America, Asia and Oceania go to: https://www.radioid.net/register#! • All Europe and Africa DMR Registrations must use the https://register.ham-digital.org/ website registration.
D-Star Registration	To register your Callsign with the D-Star network go to: https://www.D-Stargateway.org/D-Star_Registration.html .
Hardware Vocoder	An external hardware Vocoder is not required. The software Vocoder used in the DVSwitch-Server (i.e., MD-380-emulator) does a good job but does not support D-Star. The software Vocoder can be used for testing D-Star however it will not produce communications quality audio in that format. The DV3000/ThumbDV is one of the best Vocoder available (http://nwdigitalradio.com/). If you have one available use it. It is one of the best Vocoder to use for D-Star, DMR, YSF and NXDN.
Raspberry Pi	The DVSwitch-Server has been tested with the Raspberry Pi Model B Rev. 2, RPi3 Model B+ and RPi 4, • RPi's, particularly the RPi 4, run relatively hot. Consequently, we advise a clear plastic vented case with a built-in fan. These cases are inexpensive and many are even supplied with heat sinks. • Since the RPi does not have a power switch, we also recommend a power cable with an On/Off switch.
MicroSD Card	We recommend using a 16 GB or 32 GB class 10 MicroSD card. Format the MicroSD card using any software available, such as .SD Memory card Formatter The actual DVSwitch image is less than 3 GB so unless you are planning to install a lot of other software, the smaller card is adequate.
DVSwitch-Server Image	Download the DVSwitch-Server software. It will be a zip file. Download the official image from http://dvswitch.org/DVSwitch-Server-RPi.zip Flash (write) the image onto the MicroSD. There are many good SD card imaging tools. The option we recommend is **balenaEtcher**. Etcher is cross-platform, open source, and easy to use. Etcher will also flash the DVSwitch-Server image directly from the zip file.

How to install DVSwitch-Server on a Raspberry Pi

Insert the MicroSD card flashed with the DVSwitch server image created above into the Raspberry Pi, connect it to you home network, power it up and go through the configuration process. You must have a network connection (either Ethernet or WiFi) in order to use DVS. You can connect either via method 1 below or methods 2 and 3.

1. The easiest way to get the server connected is to use an Ethernet patch cable, plug it into your home router or switch and connect from another computer using SSH.

2. PuTTY is a highly recommended free open source SSH client.

   To connect using PuTTY you will need to find the DVSwitch-Server IP address.

   In a web browser navigate to your routers IP address (e.g. 192.168.1.1) and browse to the list of connected devices. Look for the IP of the Raspberry Pi running dvswitch=server.

   Another way to find the IP address of the Pi is to use an IP scanner such as advanced ip scanner

   The standard port for SSH is 22,

   When using an SSH Telnet client, make sure the remote character translation is set to "UTF-8", If using the Windows PuTTY SSH client this setting can be accessed via the "Category" window (i.e., Window > Translation > Remote character set - drop down list).

3. If you don't want go the SSH route, simply connect a monitor and keyboard.

4. If your RPi server does not have an Ethernet connection to your home network (i.e., hardwired), to enable wireless networking use the raspi-config tool.

   From the command line, enter "**sudo raspi-config**" and select "**Network Options**".

   Select "**Wireless LAN**", enter your country, network "**SSID**" identifier and "**passphrase**".

   Select "**Finish**" and after a few seconds the RPi will be connected to your wireless home network.

5. Once you are connected to the Raspberry Pi either via ssh or a monitor and keyboard, you will see a command prompt. Enter "**dvswitch**" as your login(no quotes). The initial password is also "**dvswitch**" (no quotes). You will then be required to change your password. After the password is changed and you log back in, you will see another command prompt.

6. At the command prompt enter "**dvs**" to begin the configuration process.

   You will see the DVS Main Menu

DVSwitch Server Configuration

```
┤ MAIN MENU ├
Menu Script v.1.0

01 Initial Configuration    Enter Callsign, DMR ID, BM Server and AMBE
02 Advanced Configuration   TG/Ref Management and Adhoc Macro
03 Tools                    SD Card Clone, Upgrade, Language, Reboot/Shutdown
04 Credits                  Credits of DVSwitch and Menu Scripts
05 Exit                     Exit DVSwitch Menu


            <Ok>                            <Cancel>
```
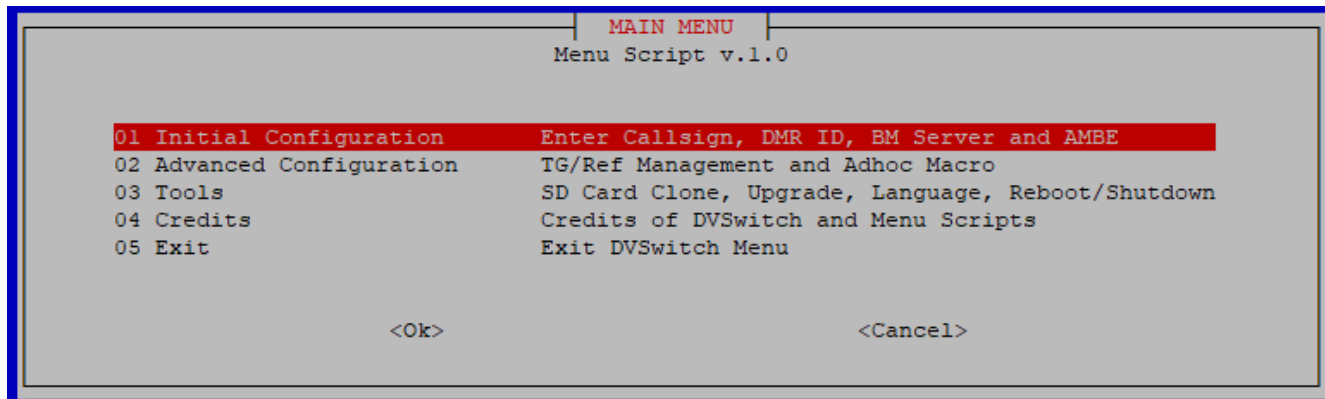
Main Menu

Menu Option	Description
Initial Configuration	The brief initial configuration dialog is used to collect specific information required to get the server up and running in its basic configuration.
Advanced Configuration	After completing the initial configuration most users will want to enable the additional features made available via the Advanced Configuration Menu. The server can always be returned to the basic configuration.
Tools	A variety of tools that will let you clone the running RPi SD card, manually edit configuration files, update and upgrade the server software, change the menu language, restart dvswitch services and reboot or shutdown the RPi server.
Credits	The main characters.
Exit	Exit dvswitch menus and return to the command prompt.

Each of the entries is explained below.
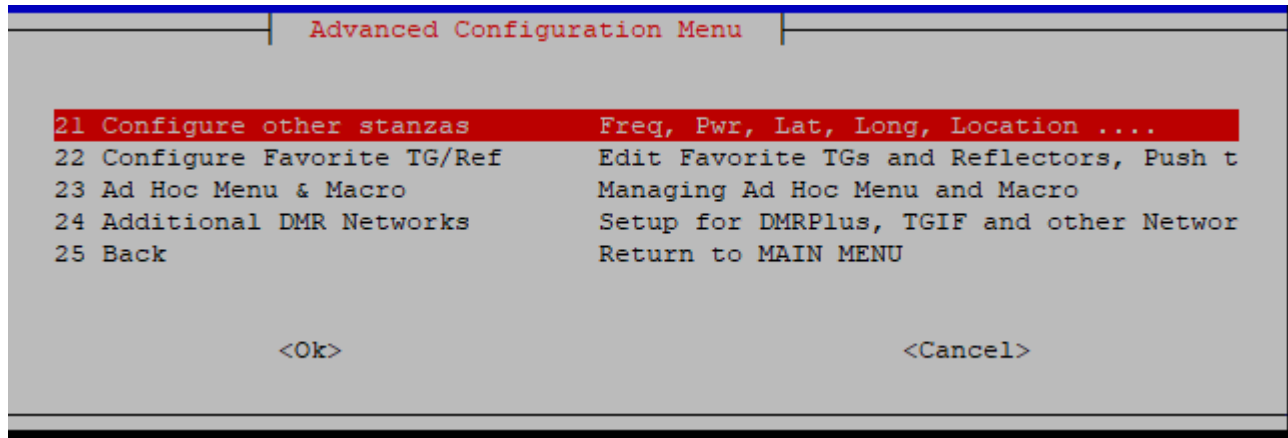
Initial Configuration

In response to prompts, the user enters information contained in the following table. This data is then written to the appropriate configuration (*.ini) file. When installing for the first time, it is recommended that the user first print the table and gather all of the needed information.

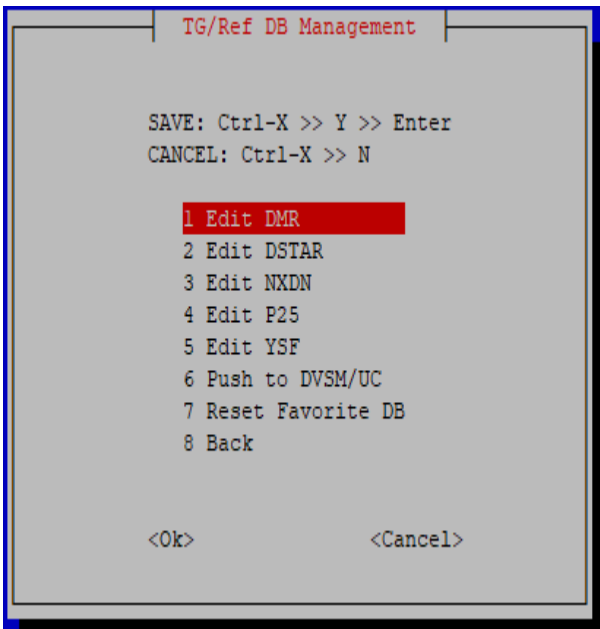| Data to Input	Description
Callsign (Required)	Enter your Callsign (not case sensitive).
CCS7/DMR ID (Required)	Enter your 7-digit CCS7/DMR ID.
Repeater ID (Required)	In order for the Brandmeister network to distinguish your DVSwitch server from other devices (e.g., pi-star hotspots) on your network, you must add a unique 2-digit suffix, (referred to as a Brandmeister Extended ID (ESSID), to your 7-digit CCS7/DMR ID. Note, the system will automatically append 2 digits to your DMR ID so just accept the default value.
D-Star Module (Required)	Enter the D-Star reflector module. The DVSwitch Mobile user should accept the default "B" module.
NXDN ID (Optional)	Enter your NXDN ID.
USRP Port	To avoid conflicts with other applications, it's best to choose a port between 50000 and 55000 (e.g., 50111). In the analog bridge configuration this same port number will be entered for both txPort and rxPort.
BM Server (Required)	From the scroll-down list, select your preferred DMR master server.
BM Password (Required)	If you enabled a hotspot security password in Brandmeister SelfCare, enter it here in order to access the Brandmeister network, otherwise accept the default (i.e., passw0rd). For more information, see: http://wiki.pistar.uk/Pi-Star_Brandmeister_Hotspot_Security.
Hardware Vocoder (Required)	If you do not have an external AMBE Vocoder, select "4 NONE (No Hardware Vocoder)". 1. If you are using an external standalone Vocoder (e.g., ZUM radio AMBE Server board. http://ambeboard.zumradio.com/), select "1 AMBE Server". You will then be required to enter the IP address and UDP port of the device. 2. If you are using the Northwest Digital USB DV3000u/ThumbDV dongle, select item "2 ThumbDV, Dvstick to USB". You will then be required to enter the baud rate (230400 or 460800) of the dongle. Note that starting 13 July 2015 ThumbDV™ devices were set to a baud rate of 460800.

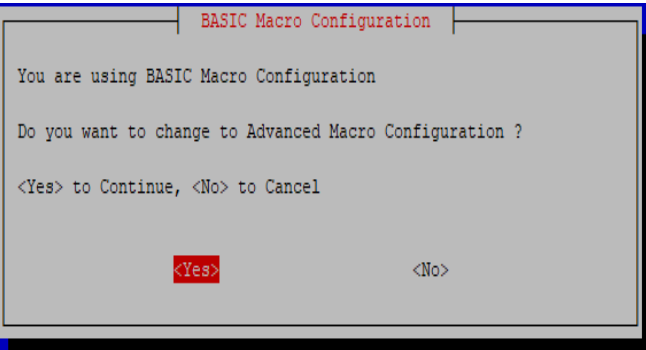| Data to Input	Description
Hardware Vocoder (Required) (Continued)	3. If you are using a Vocoder that connects to the RPi GPIO (e.g., Northwest Digital PiDV™), select "3 AMBE Board to GPIO". You will then be required to enter the baud rate (230400 or 460800) of the device.

After the initial configuration is finished the DVSwitch server will be up and running in its basic configuration and the user will be returned to the DVS Main Menu. When installing the server for the first time, it is recommended that you test the server in its basic configuration prior to activating the advanced macro configuration (see **Appendix A, DVSwitch Mobile – Android Application, Basic Configuration or Appendix B to use the pyUC client**).
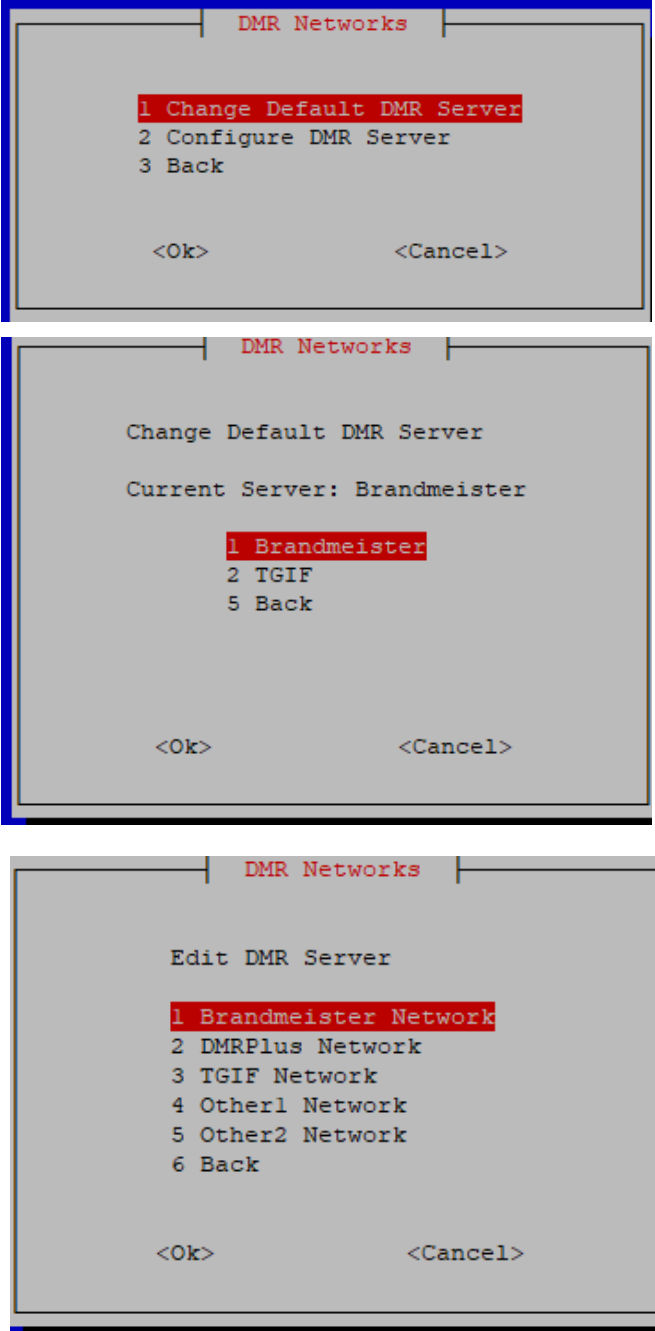
Advanced Configuration

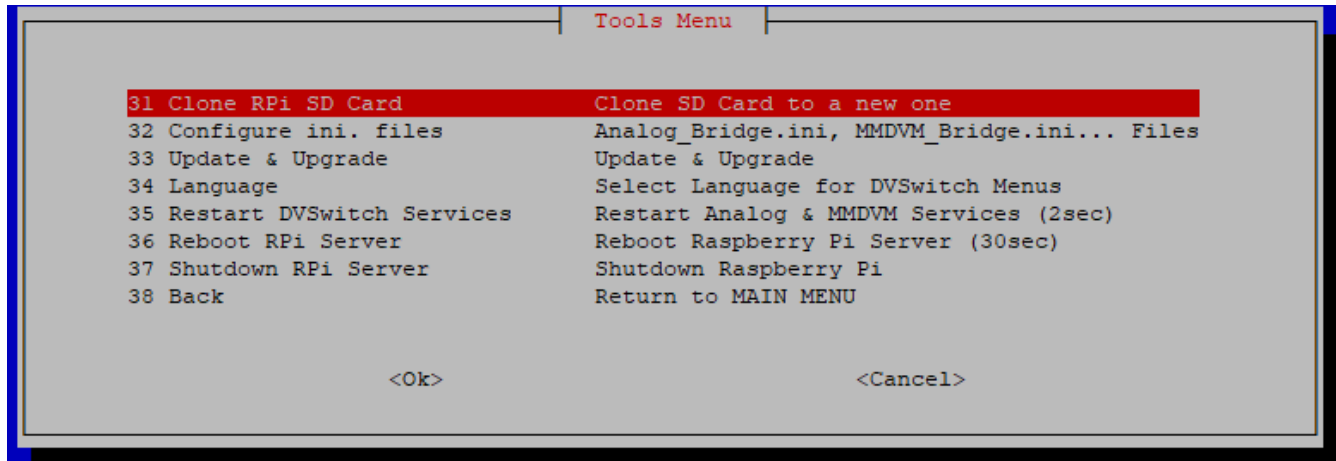| Advanced Configuration Menu Option	Description
Configure Other Stanzas 	The Configure Other Stanzas option allows the user to specify certain optional parameters. It is not necessary to configure these in order to use DVSwitch. However, some of these fields may appear on certain dashboards and so the user may want to configure these. The fields include TX and RX frequencies (these are not used and are for reference only), latitude and longitude, location (city, state), and the name and URL of the groups.io support group.

Advanced Configuration Menu Option	Description

TG/Ref DB Management
 	
``
        TG/Ref DB Management
 	
   SAVE: Ctrl-X >> Y >> Enter
   CANCEL: Ctrl-X >> N
 	
      1 Edit DMR
      2 Edit DSTAR
      3 Edit NXDN
      4 Edit P25
      5 Edit YSF
      6 Push to DVSM/UC
      7 Reset Favorite DB
      8 Back
 	
   <Ok>   <Cancel>
``
	On digital voice networks there are thousands of talkgroups (and reflectors). The user, from the client side, connects to a talkgroup by selecting it from a, sometimes very long, mode specific talkgroup list.
	
	The user can create and edit "favorite" talk groups, rooms, reflectors etc. separately for each digital voice mode. Each mode has it's own format and there is at least one default entry in each file to demonstrate this format.
	
	When editing a file, be sure to keep the same format. For example (**1 Edit DMR**):
	
	    4000|||Unlink
	    313966|||Marysville
	    31665|||TGIF 31665
	
	Note that each file (mode) uses 3 vertical bars (|||) to delineate the data from the description.
	
	DVSwitch supports both the standard YSF network and the FCS network. Favorites for both of these networks are configured by editing the YSF file. YSF entries can be made using either the "room number" or the ip/port of the reflector. For example, America Link can be entered as:
	
	209.126.110.236:42000|||America Link (using ip/port)
	
	or
	
	02108|||America Link (using room number)
	
	Further, the room number can be pre-pended with an "8" for YSF or a "9" for FCS. Thus
	
	802108 will connect you to AmericaLink YSF reflector.
	
	900335 will connect you to Ohio-Net FCS
	
	After editing any of the Favorites files, the user will want to upload the updated favorite talkgroup lists to the client (**6 Push to DVSM/UC**).
	
	   Note: Before uploading files to the DVSwitch-Server, make sure the client is on and connected to the server.
	
	From this menu, the user can also reset the favorite DB (**7 Reset Favorite DB**).

Advanced Configuration Menu Option	Description
Ad Hoc Menu & Macro ![BASIC Macro Configuration dialog box] BASIC Macro Configuration You are using BASIC Macro Configuration Do you want to change to Advanced Macro Configuration ? \<Yes\> to Continue, \<No\> to Cancel \<Yes\> \<No\>	**Important:** The system is distributed with the Macros in "Basic" mode. This is essentially intended as a troubleshooting mode. Most users will want to switch the system to the "Advanced Macro" mode. The following explains how to do this. From the select "Ad Hoc Menu and Macro". If the system is in Basic mode, it will display the screen on the left Select "Yes" and the system will change to Advanced Mode and restart the services. You will be returned to the "Advanced Configuration Menu". Note: Additional information on Ad Hoc Menu and Macro use will be forthcoming at a later date.

Advanced Configuration Menu Option	Description
Additional DMR Networks	
	Change Default DMR Server.
	This menu option allows you to change the default DMR server that will be used when the system restarts. You can only change the default to a server that has been configured using the next menu option.
	Configure DMR Server.
	This feature allows the user to configure the DVSwitch server to connect to the following additional networks (other networks may be added in the future).
	• **Brandmeister Network.** This option lets you edit details about the Brandmeister network.
	• The **DMRPlus Network** is another DMR network that is starting to gain popularity in North America (see https://dmr-marc.net/FAQ/dmrplus-america.html) and the Pacific (it has been used in Europe for a long time). To configure the DMRPlus network, from the drop down list, simply select one of the IPSC2 servers.
	Note: While you can use any IPSC2 server you like, IPSC2-Quadnet is recommended. It is very well maintained and extremely stable (see https://www.openquad.net/) also https://dmr.openquad.net/).
	• The **TGIF Network** is a popular DMR network with 381 talkgroups (see http://tgif.network/index.html). To configure the tgif network, in response to prompts, enter the following (accept the defaults).

	IP or DNS of Server: tgif.network
	    Password of TGIFServer: passw0rd
	    Port: 62031

	• **Other Networks** include the QRM Network and DVSwitch network. The DVSwitch network is simply a test server available for future use. The QRM Network, with 33 DMR talkgroups is gaining popularity.
	To configure the **QRM Network**, in response to prompts, enter the following: Name: QRM

Advanced Configuration Menu Option	Description
	IP or DNS of the Network Server: qrm.kc3ol.net Password: passw0rd Port: 62031 ○ To configure the DVSwitch Network, in response to prompts, enter the following: Name: DVSwitch IP or DNS of the Network Server: dvswitch.org Password: passw0rd Port: 62031

DVS Tools Menu

```
                              ┤ Tools Menu ├
┌──────────────────────────────────────────────────────────────────────┐
│                                                                        │
│                                                                        │
│  31 Clone RPi SD Card         Clone SD Card to a new one               │
│  32 Configure ini. files      Analog_Bridge.ini, MMDVM_Bridge.ini... Files │
│  33 Update & Upgrade          Update & Upgrade                         │
│  34 Language                  Select Language for DVSwitch Menus       │
│  35 Restart DVSwitch Services Restart Analog & MMDVM Services (2sec)   │
│  36 Reboot RPi Server         Reboot Raspberry Pi Server (30sec)       │
│  37 Shutdown RPi Server       Shutdown Raspberry Pi                    │
│  38 Back                      Return to MAIN MENU                      │
│                                                                        │
│                                                                        │
│              <Ok>                          <Cancel>                    │
│                                                                        │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
```

DVS Tools Menu Option	Description
Clone RPi SD Card	Users are advised to clone the DVSwitch Server SD card for backup. To clone the current running installation: • Insert a new SD card into a USB card reader. Use a clean formatted SD card, The new card can be same, larger or smaller size card as long as it is large enough to accommodate the image. • Plug it into the RPi, • Select this menu option. • Follow the prompts. Cloning takes about one minute. (May take longer the first time you clone to a new card)
Configure ini. files	By selecting this menu option, the user can view/edit the DVSwitch configuration files (i.e., Analog_Bridge.ini, MMDVM_Bridge.ini NXDNGateway.ini P25Gateway.ini YSFGateway.ini ircddbgateway and DVSwitch.ini). Only edit these files if you know what you are doing!
Update & Upgrade	This menu option will check for available package upgrades and automatically upgrade (i.e., update and upgrade) the server as needed. If there are no packages to upgrade, the system will respond with the message "There are no new packages to upgrade."

DVS Tools Menu Option	Description
Language	DVSwitch supports changing the default menu language. The following languages are available: • English (Default) • Korean • Japanese • French • Greek • Polish • Spanish More languages will be added as soon as the translations are available. Some of the above languages are based on machine translation
Restart DVSwitch Services	Restarts Analog Bridge and MMDVM Bridge services. Some server issues can be resolved by simply restarting services rather than doing a system reboot.
Reboot RPi Server	Causes the server to reboot.
Shutdown RPi Server	Causes the server to safely shutdown (halt). To restart the server you must power cycle it.
Back	Returns to the Main Menu.

Appendix A: DVSwitch Mobile Android Client

You can install DVSwitch Mobile on as many Android devices as you like (e.g., cell phones, tablets, Internet radios, etc.). This appendix shows how to download, install and use the DVSwitch Mobile application on a Samsung Galaxy S9. DVSwitch mobile has been successfully run on the ANYSECU W2 and W5. Inrico T320, Internet radios,

Basic Configuration

1. Download and install the DVSwitch Mobile application from the Google Play Store.

Dialer Screen

Notes: This is the main window for the Android app. Across the top of the screen find the tab menu (Dialer, Status, Accounts and Config).

- To connect to a host, check it on the Accounts tab.

- After you have selected an account, the selected mode for that account (e.g., *DMR) will be displayed in the dial string window above the **Send** button.

- **Hangup** will toggle (disconnect/reconnect) connection with the host server.

- Long press **A**-key to bring up **Mode Select** menu.

- Long press **B**-key to bring up mode specific **Talkgroups** selection menu.

- Long press star (*****) key will display the standard macro menu. If uploaded, a mode specific ad hoc menu will be displayed (see **Ad hoc Menu and Macro,** page 9).

To talk, when connected to a talkgroup select and release PTT (the button will go red), speak through the Android microphone, and then select and release (the button will return to white). Other PTT options (e.g., Headset PTT, Volume PTT) can be selected from the Config tab.

2. From the main menu, select **Accounts** and then select the first profile and configure the account.

Notes

- Select **Protocol USRP.**

- For **Hostname** enter the LAN **IP address** of the Raspberry Pi DVSwitch-Server.

- For **Port** and **TX Por**t, enter **USRP Port** number. These values should be identical.

    Note
    To access your DVSwitch-Server from the outside world. configure your router to forward this port (UDP protocol) to the LAN IP address assigned to the DVSwitch-Server (i.e., **Hostname** – see a) above). Then create a separate account using your public (ISP assigned) IP address as the **Hostname**. DO NOT add the port number to the Hostname.

- Finally, enter your **Callsign** and 7-digit **DMR ID** registration number (i.e., **CCS7/DMR ID**).

- Initially set **Transmit Level** to about 20 percent and the **Receive Level** at 100 percent. Later audio levels can be adjusted, as needed.

- Scroll up to view **Codec Types** and verify that it is set to **Server Selected** (default).

- **Save** and return to the **Dialer** screen by pressing the back arrow (**<**) button.

    Note: All pages except the "Accounts" page allow you to navigate between screen pages via the tab menu.

Accounts Tab

3. **To select/change modes**, from the **Dialer** screen long press the **A** key. The Mode Select screen displays a list of digital voice modes DVSM supports.
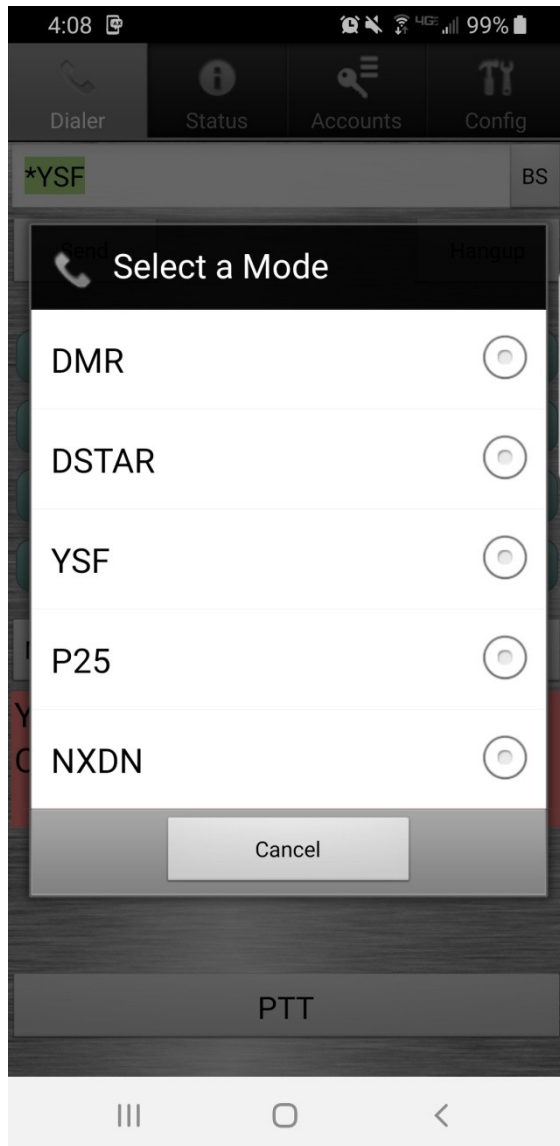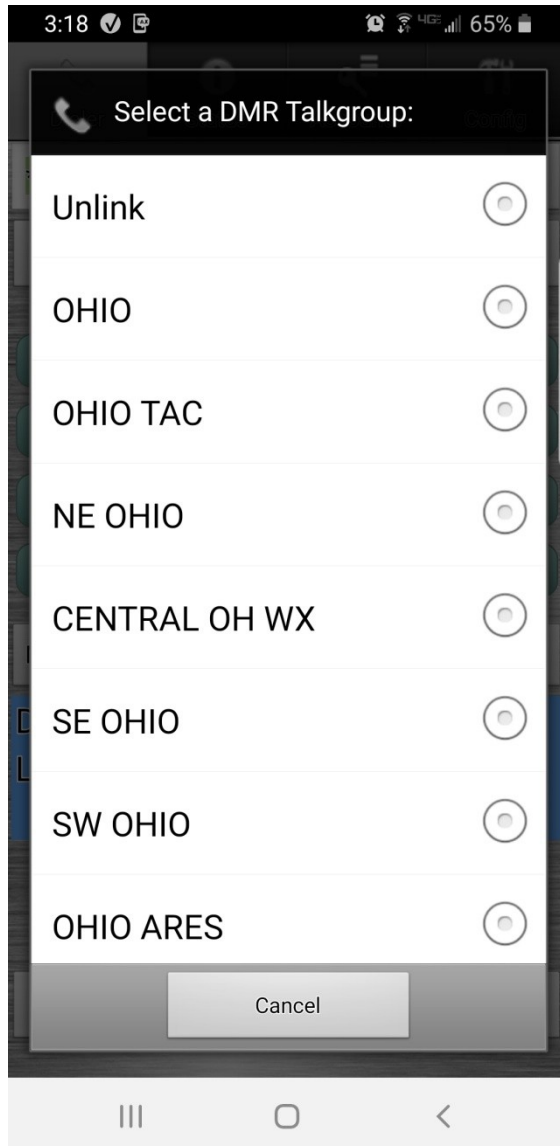
Mode Select Screen	**Notes**
	• Simply tap the desired mode. The message "Setting mode to...") will be displayed. • When mode selection is accomplished the display returns to the Dialer screen. • The selected mode (e.g., *DMR) will be displayed on the Dialer screen.

4. **To select/change a talkgroup**, from the **Dialer** screen long press the **B** key. The display will show a list of mode specific talkgroups (reflectors).

> **Note:** In DMR, P25 and NXDN mode, you can change talkgroups by entering the talkgroup number (e.g., 3139, 31399, 313966, etc.) and pressing the **Send** button.

Talkgroup Listing

Notes

- The first 10 entries in each database are tied to the long press function of the dial pad buttons 0-

- Simply scroll through the list and select.

- When mode selection is accomplished the display returns to the Dialer screen, the node name will appear in the window below the PTT button (e.g., DMR TG 3190 OHIO TAC) and the connection dial string will appear in the window above the **Send** button (e.g., 31390).

The **Status** Display:
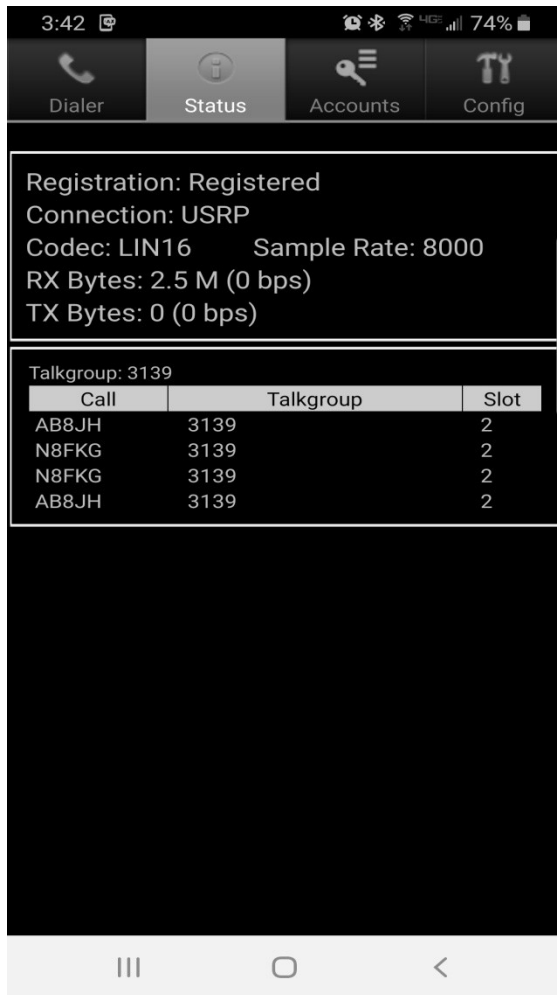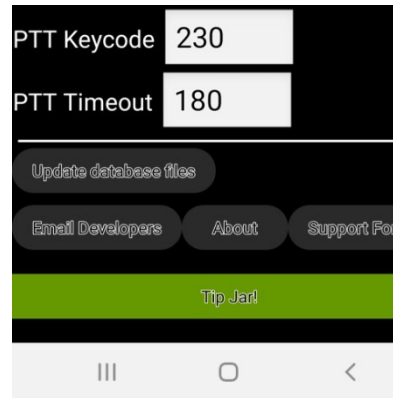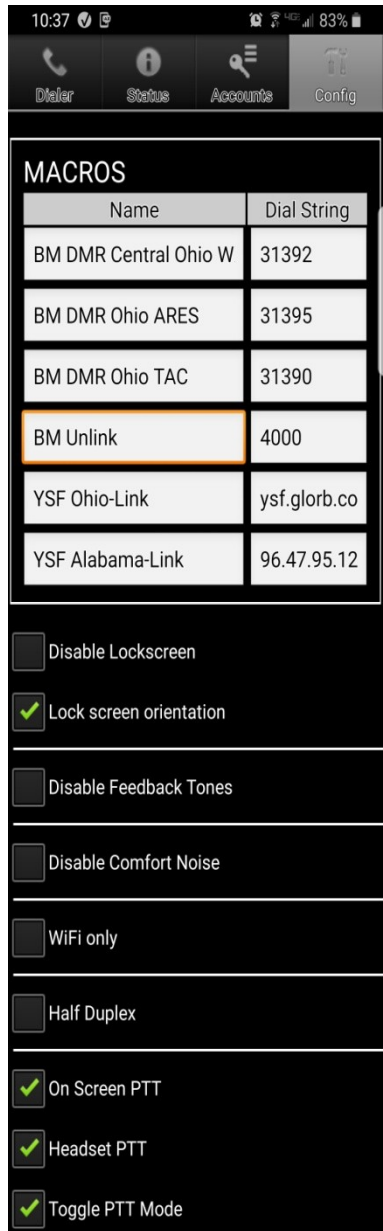
Status Display	**Notes**

The status display tab shows the following:

- Registration Status
- Connection State
- Codec
- Sample Rate
- Amount of Data Transferred
- Talkgroup Activity

To return to the main screen, tap the Dialer tab.

Config Screen

• MACROS are accessible by selecting the MACROS drop-down window (see next page). Both the Macro Name and Dial String are editable.

> For example:
> > Name = YSF Ohio-Link
> >
> > Dial String = ♦

- Enter dvsm.macro command (e.g., *22).
- For D-Star enter reflector type, number, module, L (e.g., REF030CL).
- For DMR, P25 & NXDN enter just the tg number (e.g., 3139).
- For YSF enter IP:port (e.g., 94.47.95.121:42000) .or reflector/room number

- Audio Source selections are Auto, Audio, Bluetooth and Speaker.
- **Lock screen orientation** is **checked** to prevent losing connection when orientation of the screen is changed.

- At the bottom is a button to **Update data files**, (i.e. Database Files) and links to **Email the developers** (tell them what you think), view version info (**About**) and to join the **Support Forum: https://dvswitch.groups.io/g/Mobile**
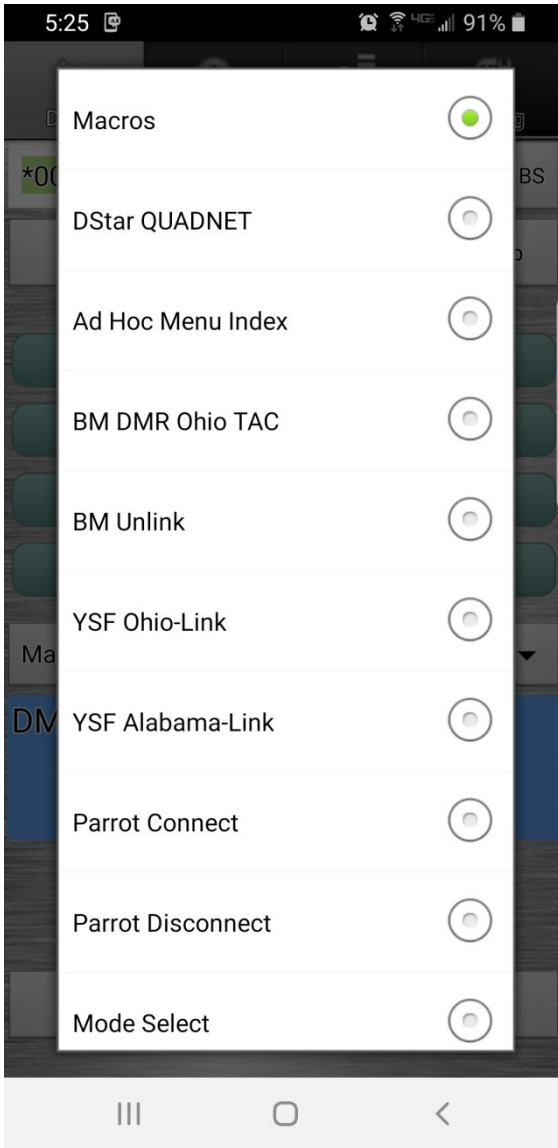
Macros Window

Notes
- To access the Macros Window, from the Dialer screen **tap** the **Macros** button located below the keypad.
- To execute, simply tap the selection.
- Six of the selections (after Macros and before Parrot Connect) can be edited via the Config tab.

Advanced Configuration

When Advanced Configuration has been enabled on the server, additional scripts and menus are activated. These scripts and menus make it possible for the user to adjust the transmit and receive audio gain, switch between different networks (i.e., TGIF, DMRPlus, Brandmeister and other networks), manage talkgroups, unlink from an active talkgroup/reflector, restart service and reboot or shutdown the server. All of this can be done from the client device with just a few button presses.

To activate the Main Menu, on the keypad the user presses *0 (i.e., star+zero).and then taps the **Send** button. The Main Menu will be displayed. To access a sub-menu, simply tap the selection.

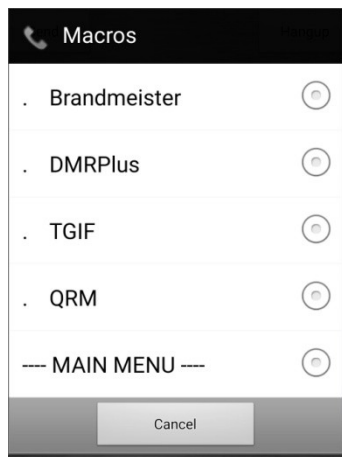A long press on the star (*) key bring up the active menu/submenu.

Main Menu
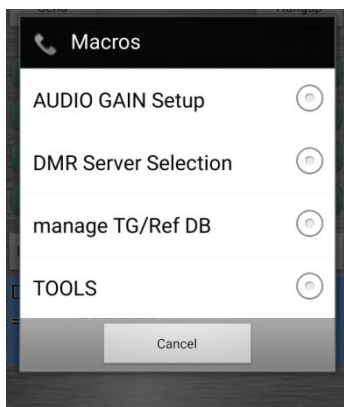
The main menu provides access to the following sub-menus:

- Audio Gain Setup
- DMR Server Selection
- Manage TG/Ref DB
- Tools

Each sub-menu has the option of returning to the Main Menu.
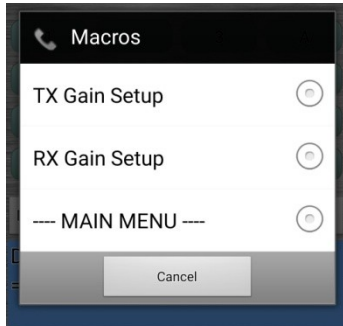
DMR Server Selection

DMRPlus, TGIF and another network are configured as part of the server Advanced Configuration dialog. In this example, the "Other Network" was configured to access the QRM Network.

- To make your selection tap on the desired network.
- To connect to a talkgroup, from the dialer screen key in the talk group number and then tap the **Send** button.
- For example, to connect to TGIF talkgroup 31665, select TGIF and then when connected key 31665 and then tap **Send**.
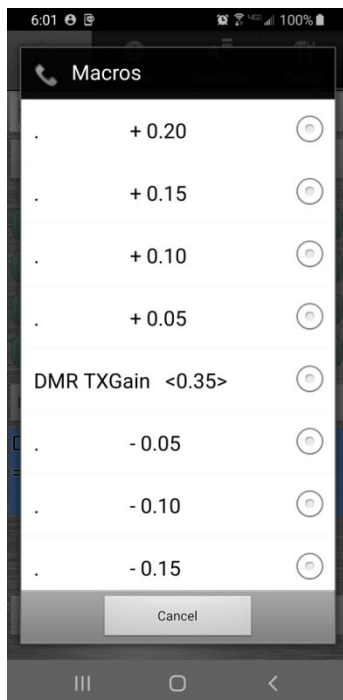
Setting Audio Levels

AUDIO GAIN Setup

Digital voice repeaters often bridge different modes with various equipment. This complicates the audio path. Consequently, digital voice repeaters can be finicky when it comes to audio levels.
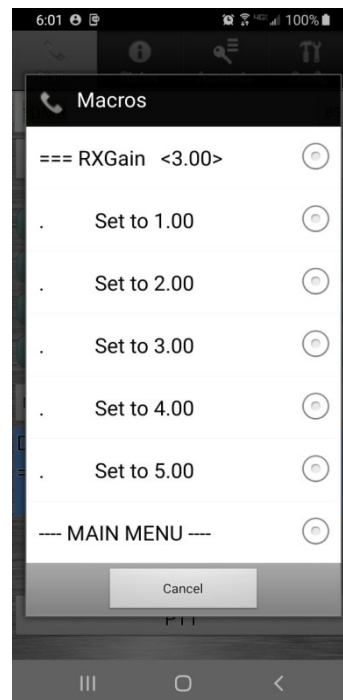
With the AUDIO GAIN Setup, it is possible to adjust audio levels from a menu displayed on the clients main screen and, if necessary, make further adjustments with the client volume control (receive audio) or via sliders (Transmit Level and Receive Level) on the client Accounts tab.

TX Gain Setup
(Your transmit audio.)

RX Gain Setup
(Your receive audio.)

- The current value (DMR TXGain, YSF TXGain, etc.) is displayed.
- Select the Plus or Minus button to add (+) or subtract (-) the TXGain level by the amount shown.
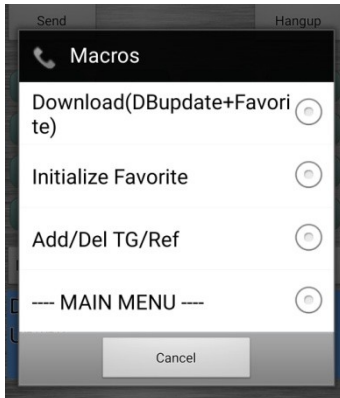- After selection, the screen will refresh and display the new value.

- The current value (RXGain) is displayed.
- To adjust the RXGain, select the button for the value you want.
- After selection, the screen will refresh and display the new value.

Manage TG/Ref DB

From the client, the user can now, with the touch of a few buttons, identify favorite talkgroups and have them placed at the top of a mode specific list

Download (DBupdate+Favorite)
- Download your favorites from the server.

Initialize Favorite

>**ARE you sure?**
>**YES**
>**NO**

- Select <YES> to delete all of your talkgroup favorites.
- Select <NO> to return to the Main Menu.

Add/Del TG/Ref – Additions and deletions are applied to the active mode favorites list.

>**AA Add bottom line**

- Adds the connected TG to the bottom of your favorites list.

>**A1 Add below line 1**

- Adds the connected TG to line 2 of your favorites list.
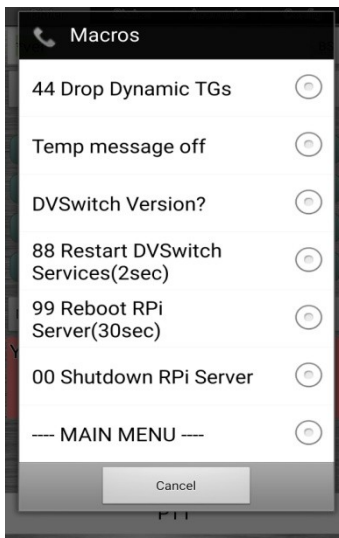
>**A2 Add below line 2**

- Adds connected TG to line 3 of your favorites. Other entries will be sequence down one line.

>**DD Delete line**

- Removes the current talkgroup from your favorites list.

Tools Menu

+44 Drop Dynamic TGs
- Disconnects the DVSwitch server from the active talkgroup/reflector.

Temp message off
- If activated, turns off CPU temperature display.

DVSwitch Version
- Displays the DVSwitch version.

88 Restart DVSwitch
- Restarts dvswitch analog bridge and mmdvm bridge services. Frequently server issues can be resolved by simply restarting services rather than doing a system reboot.

99 Reboot RPi
- Causes the server to reboot.

00 Shutdown RPi Server
- Causes the server to safely shutdown (halt).

Appendix B: pyUC (python USRP Client)

Introduction

pyUC supports all features of the DVSwitch-Server. pyUC can be installed on virtually and platform that supports the Python programming language. This section provides detailed instructions for installing and configuring pyUC on Windows, Linux and Macintosh operation environments.

Features

The user can:

- Select digital network
- Select "talk group" or reflector from a list
- Transmit and receive to the network using the PC speakers and mic
- Record a list of stations received in the session
- See pictures of the hams from QRZ.com

Install Instructions by Platform
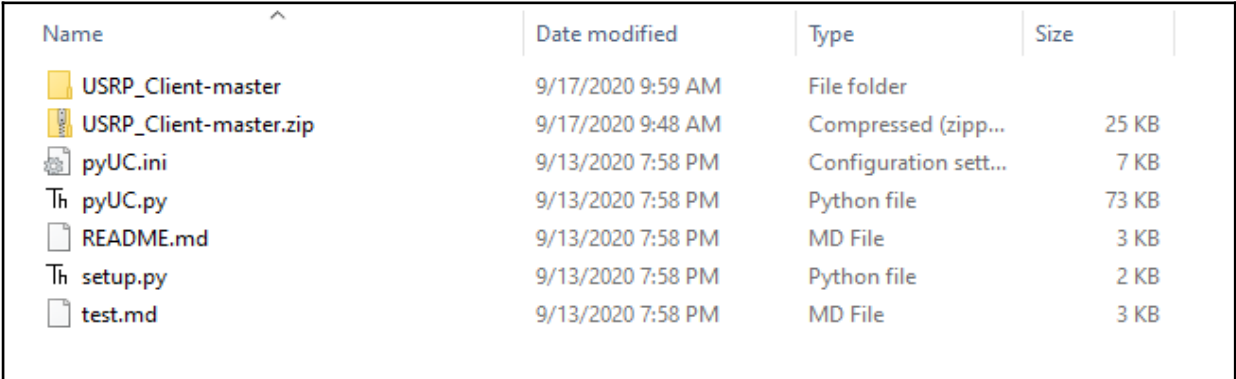
Windows 10

1 Download and unzip the pyUC client from:
   https://github.com/DVSwitch/USRP_Client/archive/master.zip

   The location of the installation files is not critical. You should create a directory in a convenient location. We recommend the following:

   Windows: c:\pyUC

   When you unzip the downloaded file, it will unzip to a sub directory called **USRP_Client-master**. We want the individual files in this sub directory to be in c:\pyUC so move them there. Your directory should look like this:

Name	Date modified	Type	Size
USRP_Client-master	9/17/2020 9:59 AM	File folder	
USRP_Client-master.zip	9/17/2020 9:48 AM	Compressed (zipp...	25 KB
pyUC.ini	9/13/2020 7:58 PM	Configuration sett...	7 KB
pyUC.py	9/13/2020 7:58 PM	Python file	73 KB
README.md	9/13/2020 7:58 PM	MD File	3 KB
setup.py	9/13/2020 7:58 PM	Python file	2 KB
test.md	9/13/2020 7:58 PM	MD File	3 KB

   You can then delete USRP_Client-master and USRP_Client-master.zip if you choose.

2 **Install Python 3.8 from the Microsoft Store (Note, the system has not been tested on Python 3.9 so that version may not work).**

(If you already have Python 3.4 or later, you can use it instead of installing a new version.)

3   **pip** is the Python Install Program. It is used at the command line (dos prompt) to install Python programs from various Windows repositories or a local file. If the above install of Python didn't include the latest version of pip which is sometimes the case, you will get a warning each time you use it. To prevent this, upgrade to the latest pip by entering the following command at a command prompt:

python -m pip install --upgrade pip (note the double dash before "upgrade")

4   Change Directory (cd) to the directory where you unzipped the installation files (c:\pyUC)

5   **PyAudio** is a key component needed for pyUC. You must install the correct version which matches both your version of Python and your version of Windows. If you don't know the version of Python you have installed, you can enter the following command at any commend prompt:

Python –V

If you don't know the type of Windows you are running, you can find it in settings -> system ->about.

You must download and then install (with pip) the version of **pyaudio** for your version of Python and Windows.

These files can be downloaded from

https://www.lfd.uci.edu/~gohlke/pythonlibs/#pyaudio

The general form of the file to download is: PyAudio-0.2.11-cpYY-cpYY-win_XXX.whl
You match the "cpYY" to the version of Python you have (i.e. Python 3.8 would use the cp38 version) and "win_XXX" to the version of Windows you have (i.e. on a 64bit version of Windows, you would replace XXX with "amd64").
So for the above example of Python 3.8 on Windows 64 you would download the following file
         PyAudio-0.2.11-cp38-cp38m**-win_amd64.whl**
Note that the cpYY appears twice in the file name. In addition, release prior to cp38 have a letter "m" before the "-win".

Once you have downloaded the correct version of pyaudio, you install it using:
pip install PyAudio-0.2.11-cp38-cp38-win_amd64.whl (use the name of the file you downloaded)

6   Once you have installed the correct PyAudio version, just enter the following commands one at a time:

pip install bs4
pip install Pillow
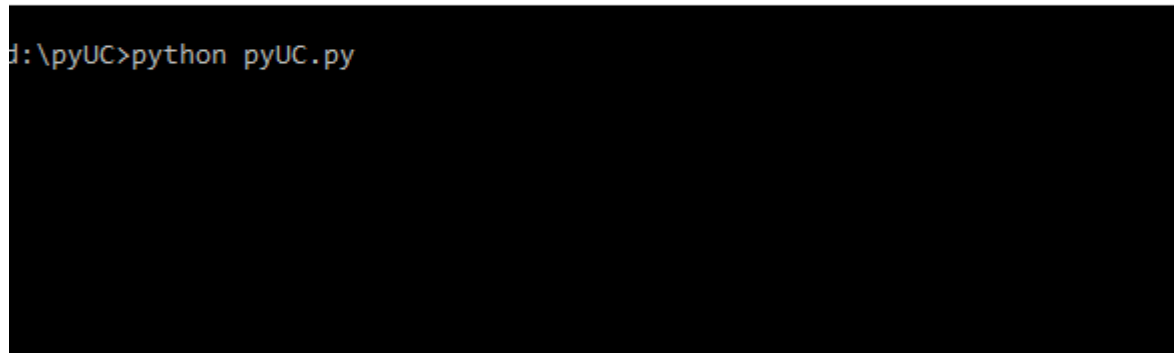**pip install requests**

7   Now you must edit the **pyUC.i**ni. You can use Notepad or any other text editor you choose. See the section below entitled "**Configuration**" to configure the system. The minimum configuration you must do is:

```
myCall = W8RIK                 ; You callsign
subscriberID = 3160129      ; Your DMR/CCS7 ID
repeaterID = 316012904        ; Your repeater ID
ipAddress = 192.168.1.110       ; IP address or hostname of DVSwitch Server
(AB)
usrpTxPort = 50415          ; Port on which AB is listening
usrpRxPort = 50415          ; Local port to listen for packets from AB
```

8   To execute pyUC make sure you are at a command prompt in the installation directory (c:\ pyUC) and enter:

python pyUC.py

9   You may wish to create a Shortcut to execute this commend. The following assumes you have installed pyUC into c:\pyUC. Change the directory below if you have installed it to a different location. On the desktop, right-click and select new→shortcut. When prompted for the location of the item, enter "python c:\pyUC\pyUC.py" (no quotes). Click Next. Give the shortcut a name and click Finish. Double-click the shortcut to test. Note, this will bring up a "dos" window in the background which will echo all activities of the client. If you would like to eliminate this window, enter "pythonw" instead of "python" in the shortcut.   See below (note Windows command lines are not case–sensitive)
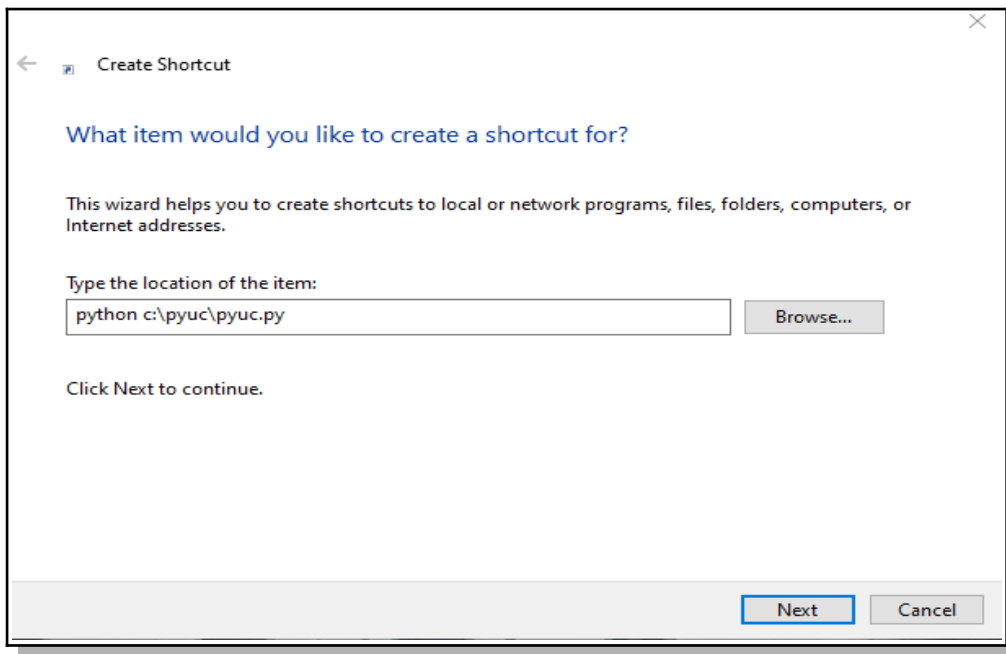
If you get an error about MSVCP140.DLL, then you will need to install the MSVC C++ runtime library.

Get it from: https://support.microsoft.com/en-us/help/2977003/the-latest-supported-visual-c-downloads

Linux (Tested on a Raspberry Pi running Buster and Linux Mint 19)

Since the pyUC is a Desktop type application, it makes sense to install it on a version of Linux that supports desktop apps as opposed to a "lite" installation. You can either connect mouse, keyboard and monitor to the Linux machine or use VNC or SSH to access it. Note however you will not be able to run the application using SSH.

Important: The Raspberry Pi does not support using the audio jack for microphone input. You must connect a microphone via a USB port. If you want to test without a microphone, set **in_index = -1** in the pyUC.ini file. This will not allow you to transmit but you can connect to the server and talk groups.

1   Download and unzip the pyUC client from
    https://github.com/DVSwitch/USRP_Client/archive/master.zip

    The location of the installation is not critical. You should create a directory in a convenient location. We recommend the following:

    /home/<user name>/pyUC   (i.e. /home/pi/pyUC)

    When you unzip the downloaded file, it will unzip to a sub directory called USRP_Client-master. We want the individual files in this sub directory to be in the \pyUC\ so move them there. Your directory should look like this:
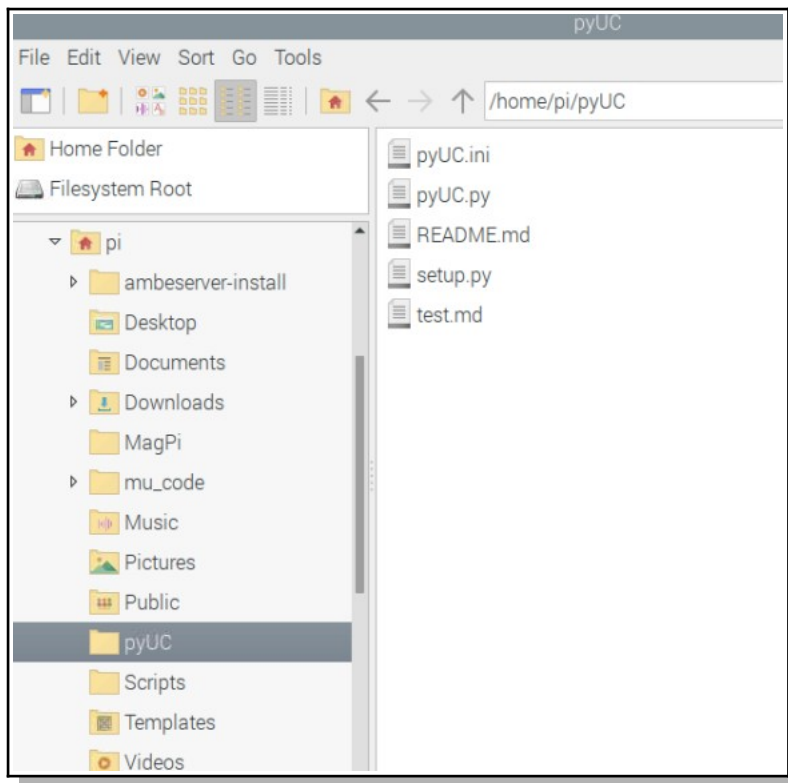
1   Open a Terminal window and change to the directory which contains the extracted files from master.zip.

2   Run the following commands in sequence:

sudo apt-get install python3-pyaudio
sudo apt-get install portaudio19-dev
sudo apt-get install python3-pil.imagetk

3   Now you must edit the **pyUC.i**ni. You can use **nano** any other text editor you choose. See the section below entitled "**Configuration**" to configure the system. The minimum configuration you must do is:

```
myCall = W8RIK               ; You callsign
subscriberID = 3160129       ; Your DMR/CCS7 ID
repeaterID = 316012904       ; Your repeater ID
ipAddress = 192.168.1.110    ; IP address or hostname of DVSwitch Server (AB)
usrpTxPort = 50415           ; Port on which AB is listening
usrpRxPort = 50415           ; Local port to listen for packets from AB
```

4   Change permissions of pyUC.py to allow anyone to execute it by entering:

4.1   sudo chmod 775 pyUC.py

5   To execute pyUC make sure you are at a command prompt in the installation directory and enter:
pyUC.py

Mac (Tested on Macbook Pro running Catalina.)

1 Download and unzip the pyUC client from:
   https://github.com/DVSwitch/USRP_Client/archive/master.zip

   The location of the installation is not critical. You should create a directory in a convenient location. We recommend the following:

   pyUC

   When you unzip the downloaded file, it will unzip to a sub directory called USRP_Client-master. We want the individual files in this sub directory to be in the pyUC so move them there. Your directory should look like this:
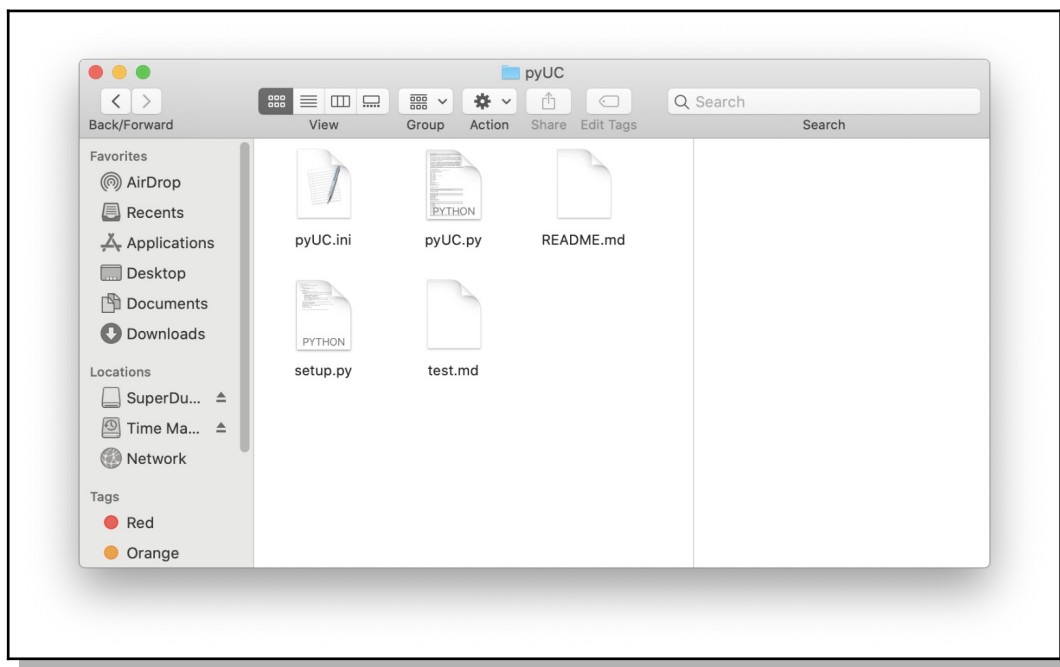
2 Open the Terminal application. It's located in the Utilities folder within the Applications folder on your hard drive — choose Applications→Utilities.

3 In the command line, enter the following commands:
   /bin/bash -c "$(curl -fsSL
   https://raw.githubusercontent.com/Homebrew/install/master/install.sh)"
   brew install python
   brew install portaudio
   pip3 install pyaudio
   pip3 install bs4 Pillow requests

4   Now you must edit the pyUC.ini file. Double click on the pyUC.ini file and use TextEdit. See the section below entitled "Configuration" to configure the pyUC client. The minimum configuration you must do is:

```
myCall = W8RIK                ; You callsign
subscriberID = 3160129        ; Your DMR/CCS7 ID
repeaterID = 316012904           ; Your repeater ID
ipAddress = 192.168.1.110           ; IP address or hostname of DVSwitch Server
(AB)
usrpTxPort = 50415            ; Port on which AB is listening
usrpRxPort = 50415            ; Local port to listen for packets from AB
```

5   To execute pyUC, in the Terminal application command line make sure you are in the pyUC installation directory and then enter:

python3 pyUC.py

Configuration

To configure the pyUC client, open the pyUC.ini file. At a minimum, you must set your call (myCall), 7-digit Subscriber ID (DMR/CCS7), 9-digit Repeater ID ip address of the server and usrp ports (i.e., usrpTxPort and usrpRxPort).

```
[DEFAULTS]
myCall = W8RIK                ; You callsign
subscriberID = 3160129        ; Your DMR/CCS7 ID
repeaterID = 316012904           ; Your repeater ID
ipAddress = 192.168.1.110           ; IP address or hostname of DVSwitch Server (AB)
usrpTxPort = 50415            ; Port on which AB is listening
usrpRxPort = 50415            ; Local port to listen for packets from AB
defaultServer = DMR           ; Start up UI on this mode (AB will override)
slot = 2                      ; Slot to transmit on for DMR
in_index = Default            ; pyaudio  index for input device (0-N or -1 to
disable)
out_index = Default           ; pyaudio  index for output device (0-N or Default)
loopback = 1                  ; NOT USED
dongleMode = 1                ; NOT USED
micVol = 50                   ; NOT USED
spVol = 50                    ; NOT USED
voxEnable = 0                 ; Enable = 1, disable = 0
voxThreshold = 200            ; This seems to be a good value for me
voxDelay = 50                 ; 50 samples (which is 1 second)
aslMode = 0                   ; For VERY limited use with chan_usrp (ASL
experimental).
backgroundColor = Default     ; Use the color names (white, red, blue, etc.)
textColor = Default           ; Use the color names (white, red, blue, etc.)
```
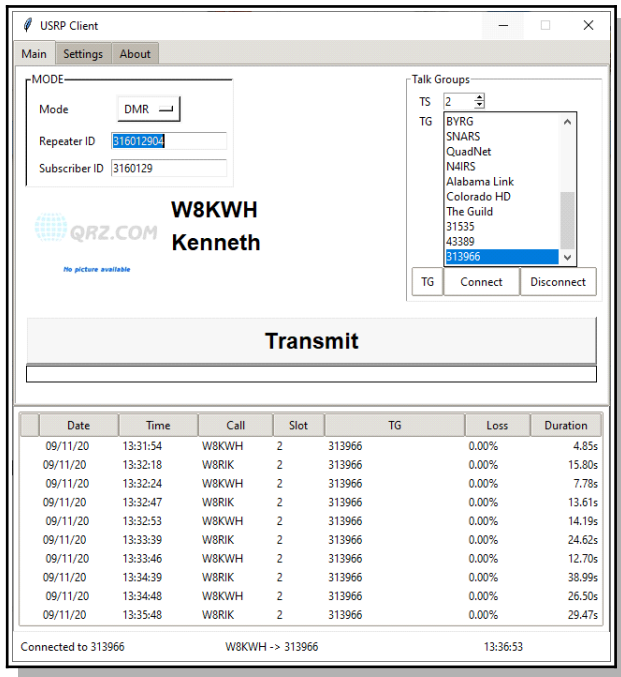
Favorite talkgroups and reflectors
The pyUC.ini file contains lists of talk groups, reflectors, etc. for each mode. You can add and/or modify this list to contain the entries you would like to appear in the Talk Group window on the client.
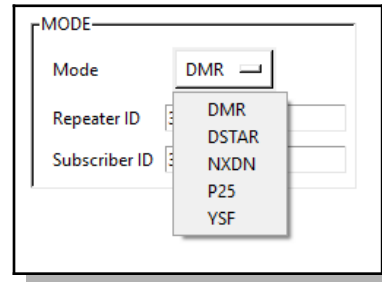
Using pyUC to Access DVSwitch

The Main Screen

The main screen is divided into three sections; **Mode, Talk Groups** and **Activity**

- In the **MODE** section find the active **Mode**, your 9-digit **Repeater ID** and 7-digit **Subscriber ID** (i.e., CCS7/DMR ID.
- To change modes, click the active **Mode** button and, from the dropdown list, select the desired mode (**DMR, D-Star, NXDN, P25** or **YSF**).

- In the **Talk Groups** section find the DMR time slot (**TS 1** or **2**), a scroll down list of talk groups for each mode and **TG** (talk group), **Connect** and **Disconnect** buttons. There are two ways to connect to a talk group.
- Select from the scroll down list and then tap the Connect button.
- **Note** The scroll down lists can be customized to reflect the user's favorite talkgroups. See Favorite talkgroups and reflectors page B7.
- Click the TG button, and a pop up window will be display. Enter the talk group number in that window and select OK.
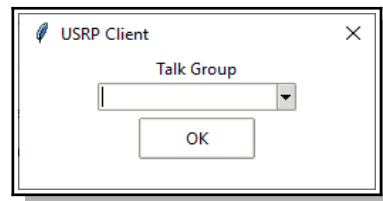
-
- The **Activity** area shows the network activity and is displayed on all three tabs.

Settings Tab   **About Tab**

The USRP pyUC client Version number can be found on the About screen.

- The **Server** section ……..

- The **Network** section shows

- With **Vox Enabled** (i.e., voice operation switch) the user can adjust the sound level (i.e., **Threshold**) below which the transmission stops and the **Delay** that prevents the circuit turning off during short pauses in speech.

- The **Audio** section allows you to adjust the microphone (**Mic**) and **Speaker** levels and, using a dropdown list, select your desired audio **Input** and **Output** device.

Advanced Configuration

When Advanced Configuration has been enabled on the server, additional scripts and menus are activated. These scripts and menus make it possible for the user to adjust the transmit and receive audio gain, switch between different networks (i.e., TGIF, DMRPlus, Brandmeister and other networks), manage talkgroups, unlink from an active talkgroup/reflector, restart services on the server and reboot or shutdown the server. All of this can be done from the client device with just a few clicks .
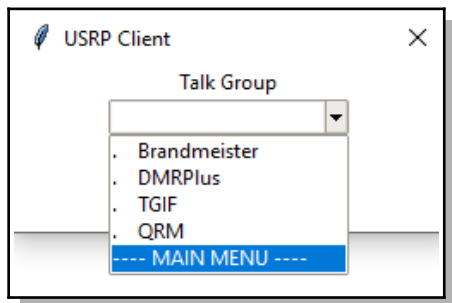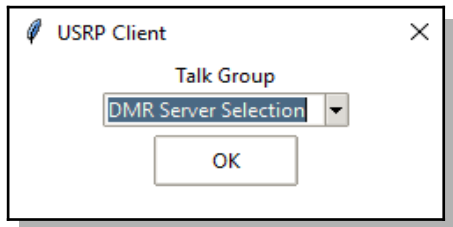
Main Menu
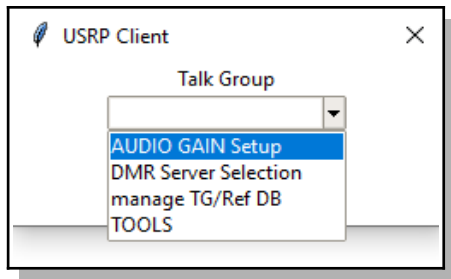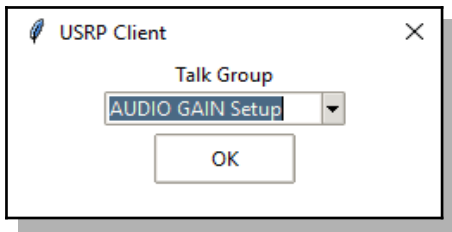
The main menu provides access to the following sub-menus:

- Audio Gain Setup

- DMR Server Selection

- Manage TG/Ref DB

- Tools

Each sub-menu has the option of returning to the Main Menu.

- To activate the Main Menu, from the main screen, click the TG button.

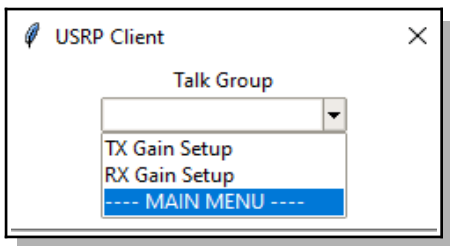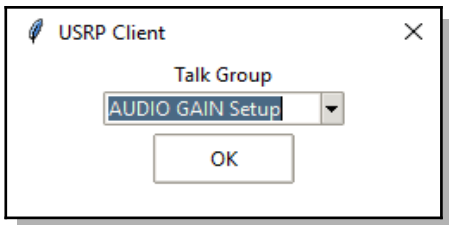- To navigate through the menus, click on the desired selection and then click OK..
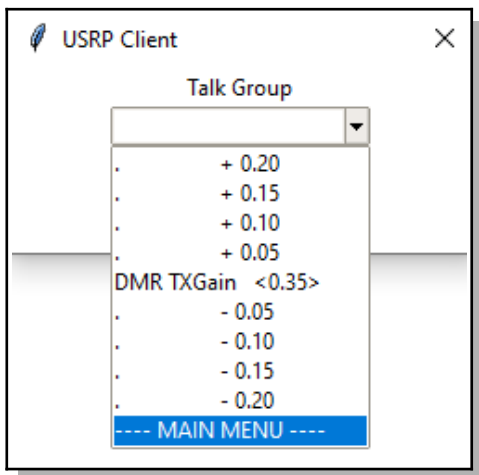
DMR Server Selection

DMRPlus, TGIF and another network are configured as part of the DVSwitch-server Advanced Configuration dialog. In this example, the "Other Network" was configured to access the QRM Network.

- To make your selection click on the desired network and then click OK.

AUDIO GAIN Setup

Digital voice repeaters often bridge different modes with various equipment. This complicates the audio path. Consequently, digital voice repeaters can be finicky when it comes to audio levels.

With the AUDIO GAIN Setup, it is possible to adjust audio levels from a menu displayed on the clients main screen and, if necessary, make further adjustments with the client volume control (receive audio) or via sliders (Transmit Level and Receive Level) on the client Accounts tab.
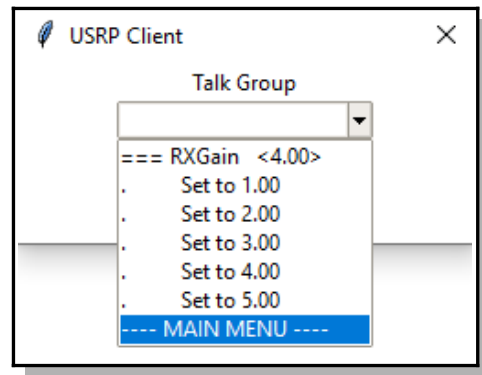
TX Gain Setup
(Your transmit audio.)

- The current value (DMR TXGain, YSF TXGain, etc.) is displayed.
- Select the Plus or Minus button to add (+) or subtract (-) the TXGain level by the amount shown.
- After selection, the screen will refresh and display the new value.

RX Gain Setup
(Your receive audio.)

- The current value (RXGain) is displayed.
- To adjust the RXGain, select the button for the value you want.
- After selection, the screen will refresh and display the new value.

Manage TG/Ref DB

From the client, the user can now, with the touch of a few buttons, identify favorite talkgroups and have them placed at the top of a mode specific list.

Download (DBupdate+Favorite)
• Download your favorites from the server.
Initialize Favorite
 ARE you sure?
 YES
 NO
• Select <YES>to delete all of your talkgroup favorites.
• Select <NO>to return to the Main Menu.
Add/Del TG/Ref - Additions and deletions are applied to the active mode favorites list.
 AA Add bottom line
• Adds the connected TG to the bottom of your favorites list.
 A1 Add below line 1
• Adds the connected TG to line 2 of your favorites list.
 A2 Add below line 2
• Adds connected TG to line 3 of your favorites. Other entries will be sequence down one line.
 DD Delete line
• Removes the current talkgroup from your favorites list.

Tools

+44 Drop Dynamic TGs
- Disconnects the DVSwitch server from the active talkgroup/reflector.

Temp message off
- If activated, turns off CPU temperature display.

DVSwitch Version
- Displays the DVSwitch version.

88 Restart DVSwitch
- Restarts dvswitch analog bridge and mmdvm bridge services. Frequently server issues can be resolved by simply restarting services rather than doing a system reboot.

99 Reboot RPi
- Causes the server to reboot.

00 Shutdown RPi Server
- Causes the server to safely shutdown (halt).

Appendix C: System Monitor

For those interested, a system monitor dashboard is available. You can access the dashboard web page at <http://ip_address_raspberry_pi:2812> (e.g., 192.168.0.201:2812).

> **Note:** The web server is only available to non-routeable addresses.

The dashboard displays statistics like CPU load, time and temperature. Information pertaining to a service can be displayed by clicking on the service in the Process column. It also allows users to start and stop services from the web page. Host files are also tracked.

Actually, the dashboard was made available, just for fun, to pique your interest and curiosity. It does have some useful features.

Monit Service Manager

Monit is running on dvswitch-server and monitoring:

System	Status	Load	CPU	Memory	Swap
dvswitch-server	OK	[0.04] [0.05] [0.07]	0.8%us, 1.3%sy, 0.0%wa	12.0% [110.9 MB]	0.0% [0 B]

Process	Status	Uptime	CPU Total	Memory Total	Read	Write
YSFGateway	OK	11h 30m	1.1%	0.3% [3.2 MB]	0 B/s	0 B/s
Quantar_Bridge	OK	11h 30m	0.0%	0.0% [376 kB]	0 B/s	0 B/s
P25Gateway	OK	11h 30m	0.5%	1.1% [9.9 MB]	0 B/s	0 B/s
NXDNParrot	OK	11h 30m	0.7%	0.1% [984 kB]	0 B/s	-
NXDNGateway	OK	11h 30m	0.5%	0.3% [2.5 MB]	0 B/s	0 B/s
MMDVM_Bridge	OK	3h 19m	0.7%	2.0% [18.5 MB]	0 B/s	0 B/s
md380-emu	OK	11h 30m	0.0%	0.0% [4 kB]	0 B/s	-
ircddbgatewayd	OK	11h 30m	0.3%	2.1% [19.9 MB]	0 B/s	0 B/s
Analog_Bridge	OK	3h 18m	0.0%	2.5% [22.9 MB]	0 B/s	0 B/s

Program	Status	Output	Last started	Exit value
CPU_temperature	OK	CPU temperature: 37.5 C (99.5 F)	24 Aug 2020 03:03:32	0
Lookup_ID	OK	3112138 N4IRS Steven S	24 Aug 2020 03:03:32	0
Modes	OK	Enabled Modes: DMR System Fusion P25 D-Star NXDN	24 Aug 2020 03:03:32	0

File	Status	Size	Permission	UID	GID
YSF_Host_file	OK	69.6 kB	0644	0	0
P25Host_file	OK	6.0 kB	0644	0	0
NXDN_Host_file	OK	4.5 kB	0644	0	0
DMR_ID_file	OK	3.6 MB	0644	0	0
Subscriber_ID_file	OK	3.6 MB	0644	0	0

Appendix D: Dashboard

The DVSwitch Dashboard is based on Pi-Star Dashboard, © Andy Taylor (MW0MWZ) and adapted to DVSwitch by SP2ONG. The Dashboard is accessible via a web page at the IP address of the DVSwitch server. Foe example: http://192.168.1.25/. As can be readily observed, it is based on the very popular Pi_Star dashboard and provides similar information. In general, the Dashboard is for display of the activity of the current gateway as well as showing many of the parameters of the DVSwitch configuration and hardware environment. Most of the items are self explanatory. If you hover your mouse over the "Analog Bridge Info" header, the system will display more details of the AB configuration. Another interesting feature is that for YSF stations with APRS, the system shows a clickable GPS link in the Duration column. Clicking on this link opens a detailed map of the location of the station. Here is an example of the Dashboard:

DVSwitch Dashboard

Status

Analog Bridge Info

Callsign	K2KXK
GW ID	3123681
RPT ID	312368112
Mode	YSFN
Tx TG	0
AB ver	1.5.9

TRX Info
Listening

DMR Master
BM United States ..

YSF Net
Not Linked

P25 Net
Not Linked

NXDN Net
Not Linked

DStar Net
IRC rr.openquad.net
Not Linked

Gateway Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)	Loss	BER
14:57:18 Oct 08	YSF	K2KXK	ALL at K2KXK	Net	GPS		
14:57:08 Oct 08	YSF	K2KXK	TG 0	DVSM/UC	---	---	---
14:55:19 Oct 08	YSF	KC3KJF	*****HFG0D at N5YX	Net	4.9	0%	0.0%
14:36:19 Oct 08	DMR	K2KXK	TG 313966	DVSM/UC	3.2	---	---
14:35:35 Oct 08	DMR Slot 2	W8KWH	TG 313966	Net	43.7	0%	0.0%
13:25:13 Oct 08	DMR Slot 2	N4ASA	TG 31535	Net	3.0	0%	0.0%
13:19:45 Oct 08	DMR Slot 2	K2KXK	TG 31535	Net	0.9	0%	0.0%
13:14:47 Oct 08	D-Star	K2KXK/INFO	CQCQCQ	Net	2.5	0%	0.0%

DVS Mobile/pyUC Activity

Time (EDT)	Mode	Callsign	Target	Src	Dur(s)
14:57:08 Oct 08	YSF	K2KXK	TG 0	DVSM/UC	---
14:36:19 Oct 08	DMR	K2KXK	TG 313966	DVSM/UC	3.2

Modes	DMR	YSF	NXDN	P25	D-Star	Networks	DMR Net	YSF Net	NXDN Net	P25 Net	D-Star Net

Hardware Info

Hostname IP: 192.168.1.25	Kernel release	Platform Uptime: up 22 hours, 49 minutes	Disk used	Memory used	CPU Load	CPU Temp
dvswitch-server2	5.4.51-v71+	Pi 4 Model B (2GB) - Sony, UK	6%	7%	0.3 / 0.3 / 0.4	41°C / 105.8°F

DVSwitch Dashboard 2020