



Raspberry Pi D-Star Hotspot Step-by-Step



The intent of this document is to simplify the setup of a hotspot using the Raspberry Pi. The step-by-step procedure includes links to the hardware and image our members have successfully used to build their hotspots. We have attempted to bring together, in one location, the rudimentary material the Linux novice would require to be up and running, in 20 to 30 minutes, following assembly of the hardware, download of the setup utilities and creation of the SD card image.

Maryland D-Star

<http://maryland-dstar.org>

- G4KLX's latest dstarrepeater release includes support for multiple modem platforms including:
 - ✓ DVAP
 - ✓ DVMEGA
 - ✓ DV-RPTR V1
 - ✓ DV-RPYR V2
 - ✓ DV-RPTR V3
 - ✓ GMSK Modem
 - ✓ Sound Card
 - ✓ Split

3 / 11 / 2014

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Acknowledgments

Johnathan Naylor, G4KLX, for all his efforts in producing feature-rich reliable software and placing it in the public domain. We agree with hundreds of users and developers of supporting software that without Jonathan's efforts the world of amateur radio and in particular D-Star would be more difficult to navigate.

[westernstar](#) for the image and KLXupdate script to simplify installation of updates to G4KLX's repeater and gateway software.

[Raspberry Pi Foundation](#), designers and developers of the Raspberry Pi hardware.

[Gordon Henderson](#), for producing the 'WiringPi' libraries used to control the Raspberry Pi GPIO pins.

[PCrepeatercontroller](#) Yahoo group, the place to find out anything and everything about running D-Star hotspots.

[ircDDBGateway](#) Yahoo group, the place to find out anything and everything about running ircDDBGateways.

[RaspberryPi-DVAP](#) Yahoo group, the place to find out anything and everything about running a Pi and DVAP.

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The image you will download is comprised of Linux version for the Raspberry Pi, Raspbian Wheezy Kernel 3.10.25+, G4KLX's dstarrepeater v20140217 and ircDDB gateway v20140101. It also includes a program to send the Pi's acquired IP address via text message to your phone or to an e-mail address following a successful boot or reboot of the Pi.

The dstarrepeater will also provide limited control of the Raspberry Pi over RF via a REBOOT and HALT command transmitted from the D-Star transceiver to the control board or DVAP. The purpose of HALT is to orderly shutdown the OS to reduce the chance of SD card corruption. The purpose of the REBOOT command is to restart the OS so that the Network Manager can reset the IP address of the Wi-Fi adapter or to allow the OS to clear the memory swap and temporary files.

List of Hardware used to assemble the Raspberry Pi for use with dstarrepeater and ircddb gateway and test the setup procedures in this document:

1. [Microcenter SKU 601278 Raspberry Pi Model B 512MB](#)
2. [Microcenter SKU 707471 Heat Sink Kit](#)
3. [Microcenter SKU 525857 Class 10 16GB Micro SD card](#)
4. [Microcenter SKU 707273 SD to Micro SD Adapter](#)
5. [Microcenter SKU 874834 P-Link Nano USB Adapter](#)
6. [Microcenter SKU 706481 Case to Protect Pi](#)
7. [amazon.com ASIN B00EHEEFWY RavPower 14000mAh Battery Pack for Remote Operation](#)
8. Micro USB cable and USB PSU
9. [DVAP, DVRPTR V1 or other GMSK boards](#)

Step I.

- Download and **save the setup preparation file to your PC's desktop** by clicking on the following link: (download can take up to 10 minutes depending on the throughput of your internet link)

<http://maryland-dstar.org/downloads/raspi/Setup-DStar.exe>

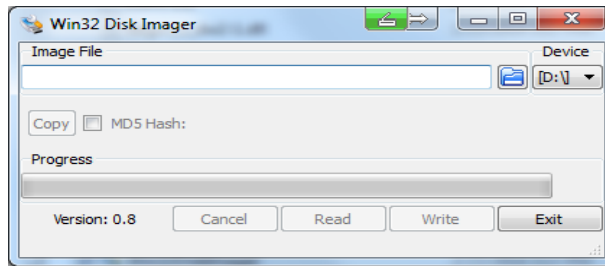
- Click on Setup-DStar. The program will start and create the maryland-dstar.pi folder on your desktop. This folder contains everything you need to prepare a SD or Micro SD card to install the OS, dstarrepeater, the ircddb gateway and utilities to connect your PC to the Raspberry PI Model B.
- Download the maryland-dstar.zip file containing the SD image **saving it in the maryland-dstar.pi folder created on your desktop by Setup-DStar.exe.** (This can take up to 20 minutes depending on the speed of your PC, internet connection and hard drive.)

<http://maryland-dstar.org/downloads/raspi/maryland-dstar.zip>

After the file is downloaded and saved **extract the maryland-dstar.pi.img file to the maryland-dstar.pi folder on your desktop created by Setup-DStar.** WinZip can be downloaded from the web. You may also use 7-Zip or Windows built in archive support by dragging/dropping the image file into the maryland-dstar.pi folder. The extract can take upwards of 10 minutes.

Step II.

- Open the maryland-dstar.pi folder.
- Place a class 10 16GB Micro or SD card in a SD reader/writer on your PC
- Double Click on Win32Disk Imager and the following will display on your screen.



Step II. (continued)

- Click on the file folder icon on the right side of the Win32 Disk Imager screen and navigate to the maryland-dstar.pi folder installed on the PC desktop by the Setup-Pi install program. When the folder opens select the on the maryland-dstar-pi.img file.
- Click on the Device Drop down and select the Sd Reader/Writer that contains the SD card.
- Click on the Write button to start the transfer of the image to the SD card. (This can take up to 20 minutes)
- When the card is imaged, click on OK, exit WIN32Diskimager and safely remove the SD card from the PC and place it in the Pi.

Step III.

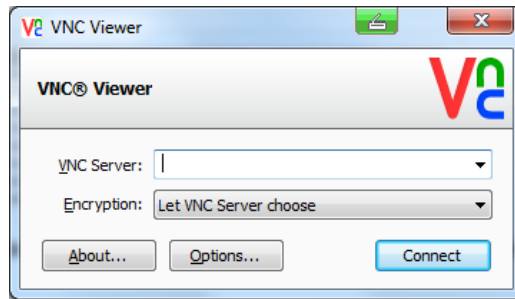
- Place the Nano WiFi adapter in the top USB port on the Pi.
- Connect the [DVAP](#) or [DVRPTR V1 GMSK board](#) to the lower USB port on the Pi.
- Connect the Pi Ethernet port to a Ethernet switch on your network or an open port on your router. The remainder of this setup procedure assumes your router will assign an IP address to the Pi in the 192.168.1.x – 192.168.1.255 range.
- Connect the micro USB cable from the USB charger/wall adapter to the micro USB power port on the PI than plug the adapter into an AC outlet. The power light will come on, the ACT and Link lights will flash and the Pi will initialize.

Step IV.

- Open a browser and log into your router by entering its ip address in the address bar. In our example the ip address of our router is 192.168.1.1, yours may be different. You may have to enter the router's administrator user id and password. Navigate to the router page listing ip addresses (may be listed under LAN status) assigned to DHCP clients. You may have to enter the routers administrator user id and password. The screen from our router appears below, yours may look similar or completely different.

Hostname	IP Address	MAC Address	Expires	Delete
pdsnet-b	192.168.1.1	64:70:02:AA:AC:B5	never	
android_be0fbc2c	192.168.1.130	58:67:1A:48:2E:12	2 days 20:01:56	
wnce2001	192.168.1.132	84:1B:5E:98:B8:40	2 days 22:31:56	
HAL-2001	192.168.1.134	64:70:02:8D:A7:2B	2 days 15:27:59	
UpperLevel-PC	192.168.1.150	00:26:82:6D:78:B1	2 days 19:48:08	
android-55632ac1088cc69a	192.168.1.141	5C:F8:A1:2E:CD:DE	2 days 15:27:59	
DIRECTV-HR24-783933A0	192.168.1.142	00:03:78:39:33:A0	2 days 16:32:42	
maryland-dstar.org	192.168.1.139	C0:4A:00:19:F1:A7	2 days 23:50:57	

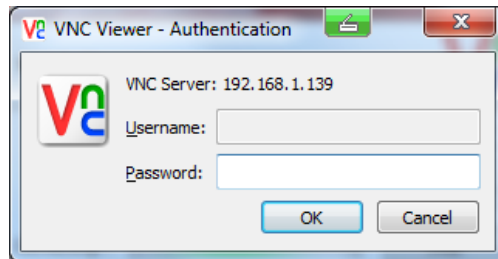
- Find the line with the host name maryland-dstar.org. In our example the first address assigned to the Raspberry Pi is 192.168.1.139.
- Open the maryland-dstar.pi folder and click on VNC64 if you're running the 64bit version of Windows and VNC32 if you are running the 32bit version of Windows. The following window will appear.



3. Enter the IP address from the DHCP list earlier in this step and click on the Connect button. The following window will appear.



- Click on the Continue button and the password screen will be displayed.



5. Enter the default password “maryland-dstar” and click the OK button. A few seconds after clicking OK the Pi desktop will appear on your PC screen.



6. Close down the `ircddb` gateway and `dstarrepeater` windows. The only items on your desktop will be the icons on the left side of the screen.

Step V.

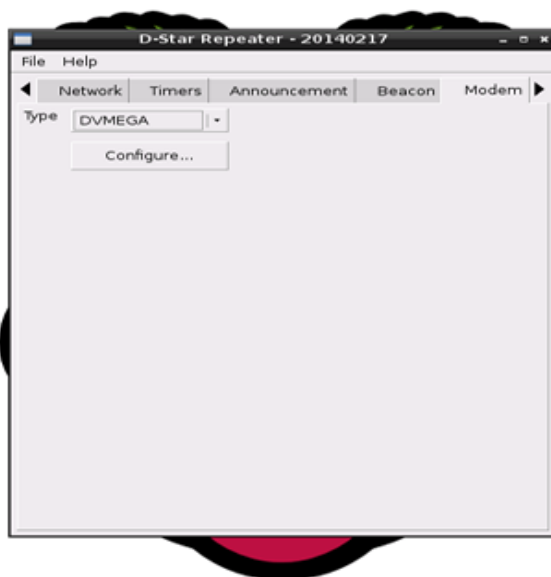
- Double click on “Config Repeater” icon to begin the configuration process. The following screen will display.



1. Place your call sign in the “CallSign” box and click in the dropdown. Set it to “B” for 70CM or “C” for 2M. Next place your call sign in the “Gateway” box and set the following:
 2. “Mode” to Simplex
 3. “Ack” is set to Status
 4. “Restrict” to Off to allow others to connect to your hotspot or On to restrict it to your call sign.
 5. “RPT1 Validation” to Off
 6. “DTMF Blanking” to On
 7. “Error Reply” to On
- Click on the Beacon tab.



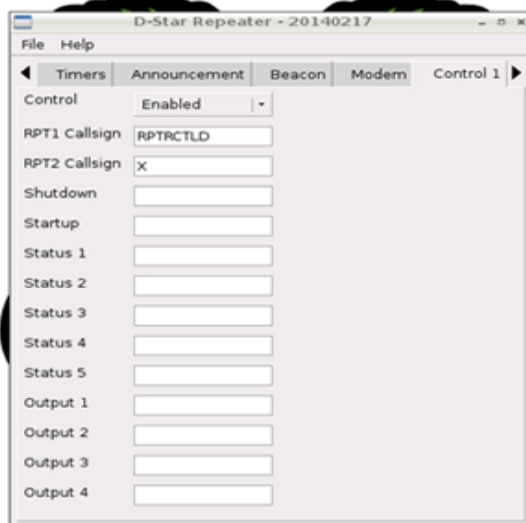
1. Use the slider to set the time period between transmissions of a beacon from dstarrepeater.
 2. Place your FCC issued call sign in the Message box identify the dstarrepeater setup, set "Voice" to Enabled..
- Click on the right arrow to advance to the "Modem" tab.



1. Click on the drop down and select the "Type" of modem you are using. In our example we will select DVAP. After selecting the modem "Type" click on the "Configure.." button.



- a. Do not change the "Port" setting.
 - b. Go the drop down and select the "Band" for the DVAP.
 - c. Enter the simplex "Frequency" you selected for use with the DVAP. Example only **do not use** this frequency, 145.145 is entered as 145145000, 434.1125 as 434112500. Do not enter the decimal point.
 - d. Set the "Power" level from 1 to 10. 10 is full power, approximately 10MW and 1 is extremely low, approximately 1MW. We have found that 5 to 7 is reasonable for use in and around a medium size two story home with up to ½ acre of property. Set this to the lowest workable power level.
 - e. Set "Squelch" to -100.
 - f. Click on "OK" to save the configuration.
- Click on the right arrow to advance to the "Control 1" tab.



1. Click the "Control" drop down and set it to Enabled
 2. Verify the "RPT1 Callsign" is set to RPTRCTLD
 3. Place your FCC issued call sign in the "RPT2 Callsign" box with a G in position 8.
- Click on the right arrow to advance to the "Control 2" tab.



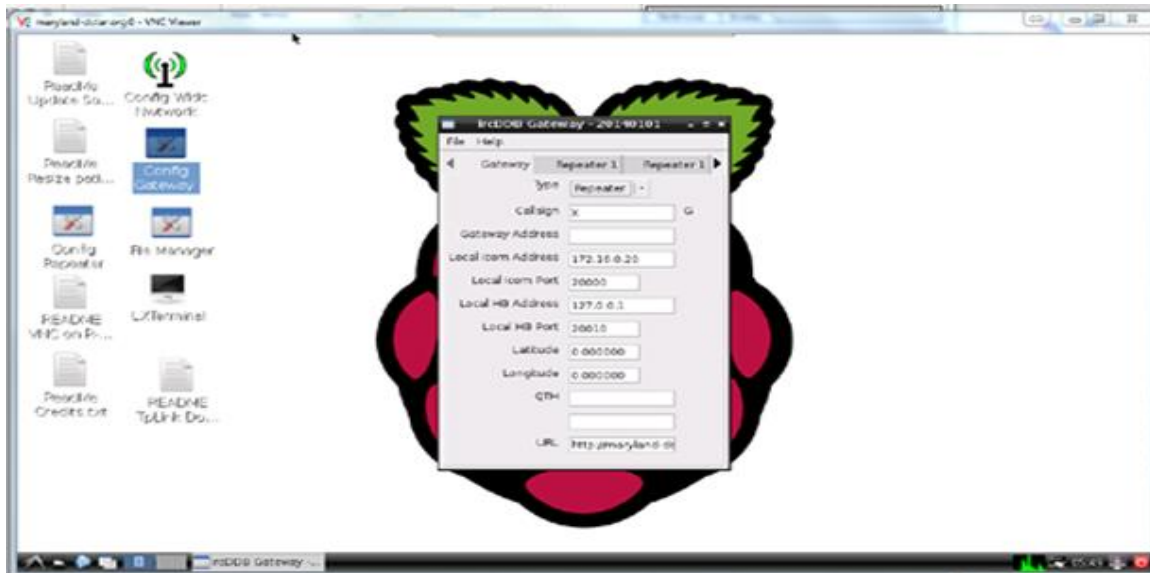
1. Verify Command 1 is set to "REBOOT" and verify "sudo shutdown -r now" is in the second text box.
2. Verify Command 2 is set to "HALT" and "sudo shutdown -h now" in the second text box.
3. Click on File than Save and the below dialog will appear and the below dialog will be displayed.



4. Click on "OK" to save the configuration than click on "File", followed by "Exit" to shutdown the repeater configuration program.

Step VI.

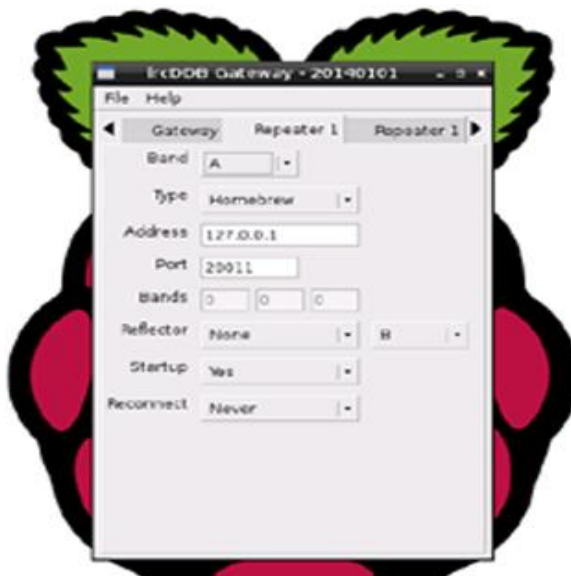
- Double click on the “Config Gateway” icon and the below screen will appear after a few seconds.



1. Verify that the “Type” is set to “Hotspot”
2. Enter your call sign in the “Call sign” text box
3. Enter your location’s latitude in the “Latitude” text box
4. Enter your location’s longitude in the “Longitude” text box
5. Enter your City and State in the first “QTH” text box and your Country in the second “QTH” text box.

The following website can be used to locate your latitude and longitude:
<http://itouchmap.com/latlong.html>

Click on the first “Repeater 1” tab.

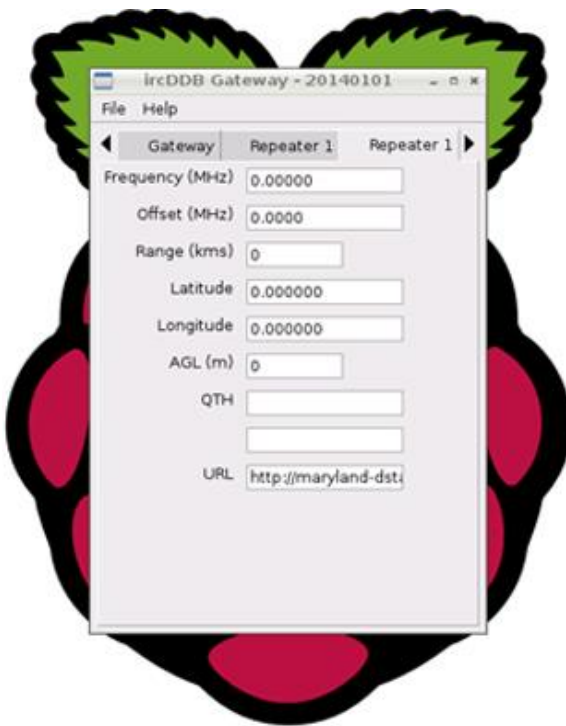


1. Set the “Band” to B for 70CM and C for 2M and set “Type” to Homebrew..
2. If you want to automatically link to a reflector when the gateway initializes click on the “Reflector” drop down and select a reflector from the list than select the reflector module you want to link to A, B, C or D. You may not be

able to set this until you enable DExtra and D-Plus. If this occurs return to the Repeater 1 Tab after enabling DExtra and D-Plus to select your auto startup reflector.

3. Set "Startup" to Yes to automatically link to the previously selected default reflector when the ircddb gateway is initialized. Set "Startup" to no to bypass the automatic statusup reflector link,
4. Using the "Reconnect" drop down you can select the time in minutes that the gateway will automatically reconnect to the default reflector when it is temporarily link to another reflector. Leaving set to Never is the accepted practice and you will have to manually relink to your default reflector.

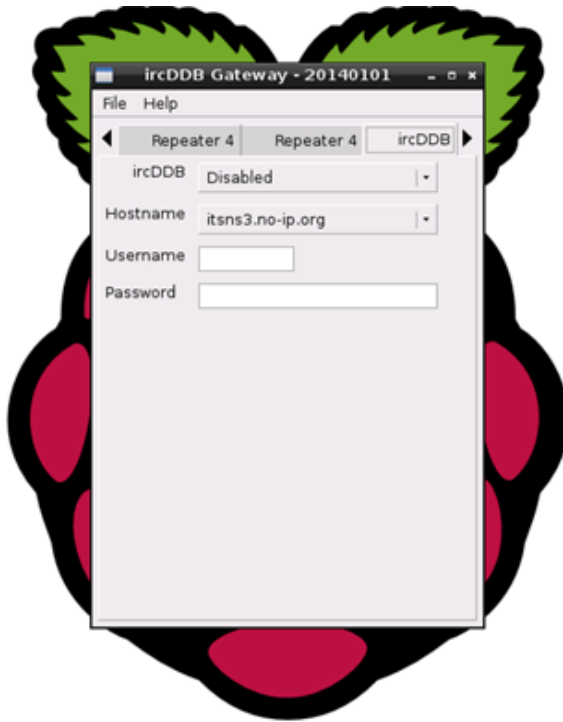
- Click on the second "Repeater 1" Tab.



1. Enter the repeater frequency in the "Frequency" text box. This must be the same frequency entered when you configured the dstarrepeater. However here you enter the decimal point.
2. If using a DVAP the "Offset" must be set to 0.0000.
3. Enter the estimated range of your repeater in kilometers.
4. Enter the "Latitude" – should be the same as entered when configuring setting up dstarrepeater.
5. Enter the "longitude" – should be the same as entered when configuring the dstarrepeater.
6. Skip the "AGL" field.
7. Enter the "QTH" – should be the same as entered when configuring the dstarrepeater.

The following website can be used to locate your latitude and longitude:
<http://itouchmap.com/latlong.html>

- Click on the right arrow until the "ircddb" tab is displayed.



1. Click on the “ircddb” drop down and set it to Enabled.
2. Click in the “Hostname” drop down to select the ircddb host nearest your primary operating location.
3. Enter your call sign in the “Username” text box.
4. No “Password” is needed when using the QUADNET ircddb host system for routing.

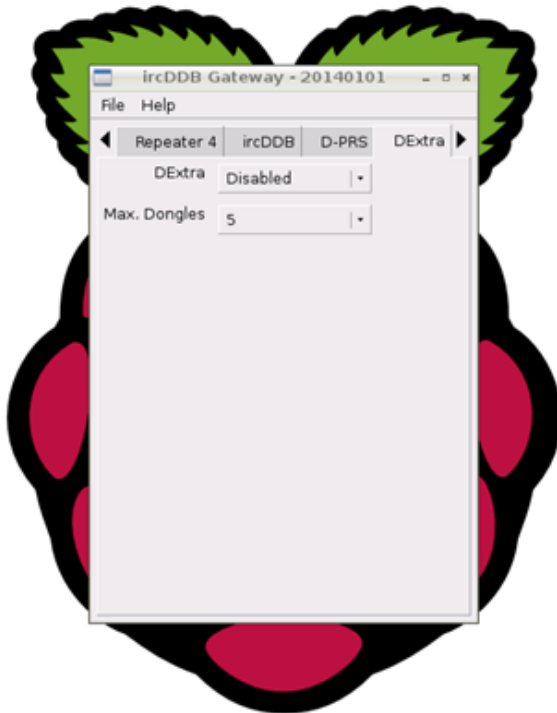
- Huntsville, irc1.openquad.net
- Jackson, MS. irc2.openquad.net
- Spanaway, WA, irc3.openquad.net
- Pilot Knob, MO, irc4.openquad.net
- Redirected. irc5.openquad.net
- Chicago, IL. rc6.openquad.net

You will find a PDF in the maryland-dstar.pi folder that provides a brief overview of the QUADNET ircddb system. It is common practice to select the host nearest your primary opening location.

Sidebar Commentary

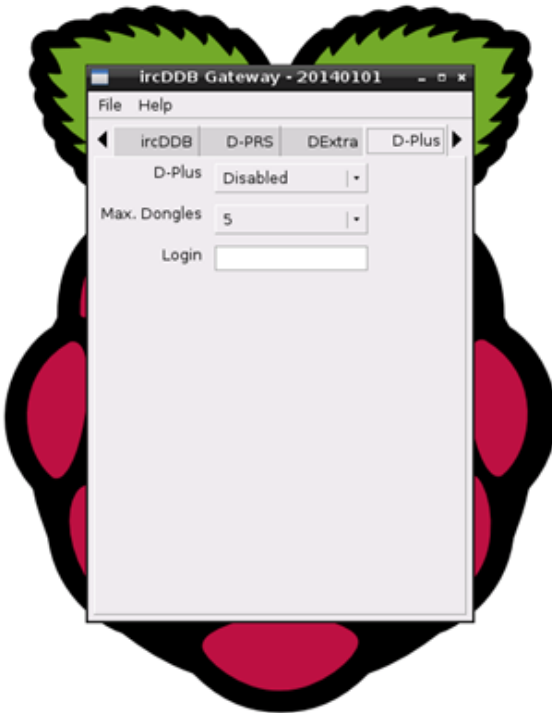
... the ircDDB network is larger in terms of gateways than the USROOT network. In most countries the number of gateways on the ircDDB network is greater, sometimes significantly so. With the rapid increase in users on the ircDDB network these numbers will increase further. The ircDDB network is open, and encourages experimentation and open source. “
Jonathan G4KLX.

- Click on the right arrow to advance to the DExtra tab



- To link to DExtra Reflectors set "DExtra" to Enabled.
- Verify "Max Dongles" is set to 5.

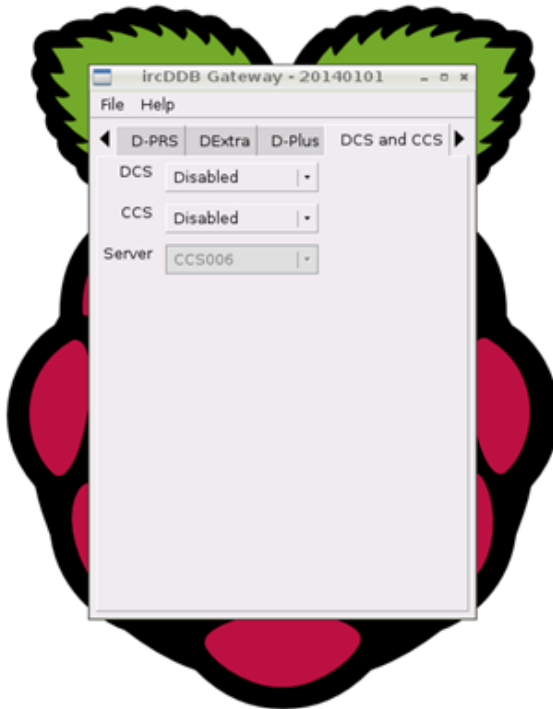
- Click on the right arrow to advance to the "D-Plus" tab



Some users set this to one of their terminal entries on the US Trust Server. This is an acceptable practice. However, it must match the terminal entry exactly. Any deviation will prevent linking to the D-Plus reflector system. To ensure that you are able to link to D-Plus reflectors we recommend that this field is initially set this to you call sign.

1. To link to D-Plus reflectors REF001 through REF062 select the “D-Plus” drop down and set it to “Enabled”.
2. Verify “Max Dongles” is set to 5.
3. Set “Login” to your US Trust Server registered Call Sign.

- Click on the right arrow to navigate to the DCS and CCS tab.



1. To enable linking to “DCS” reflectors select the drop down and set it to Enabled.
2. To enable CCS call sign routing select the drop down and set it to Enabled
3. Verify that “Server”: is set to CCS006 for USA.
4. Save the ircddb gateway configuration, click on File than Save.



1. Click on the “OK” button to save the configuration.

With the dawn of the CCS Reflectors you can use DTMF numbers to call another amateur without locking up multiple repeaters. The first thing you need to do before you can use the CCS call routing is go to xReflector.net find the CCS link on the left-hand side of the screen, and select "User Register". This is a really quick process, the only personal information you need give is your callsign, and a valid email address, and of course selectt a password. Once you have done this you will be issued a DTMF number, usually 4 digits, however as the system expands the number of digits will expand. Now anyone working through a Repeater or node that is CCS enabled can call you using that DTMF number. It is not always necessary to disconnect from a Reflector before using CCS Callsign Routing, however it is good practice.

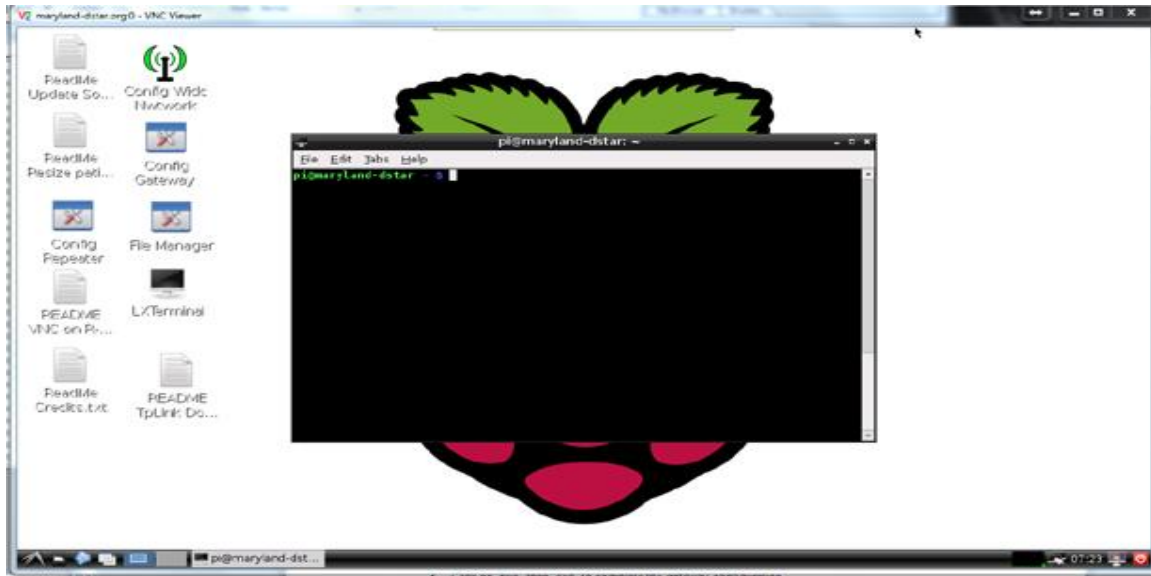
To advise other users of what your DTMF number is, it's good practice to either put the number in the "Suffix" field of your callsign entry on the transceiver, or in your outgoing text message.

2. Click on “File” than “exit” to complete the gateway configuration

Step VII.

- **Double click on the LXTerminal icon**

Configure the system to send the Pi's DHCP assigned ip address to a cell phone via text message or to an e-mail; address. This feature has only been verified to work when setup with google e-mail account as the sender of the message. The IP address can be sent to any e-mail address or US based cell phone.

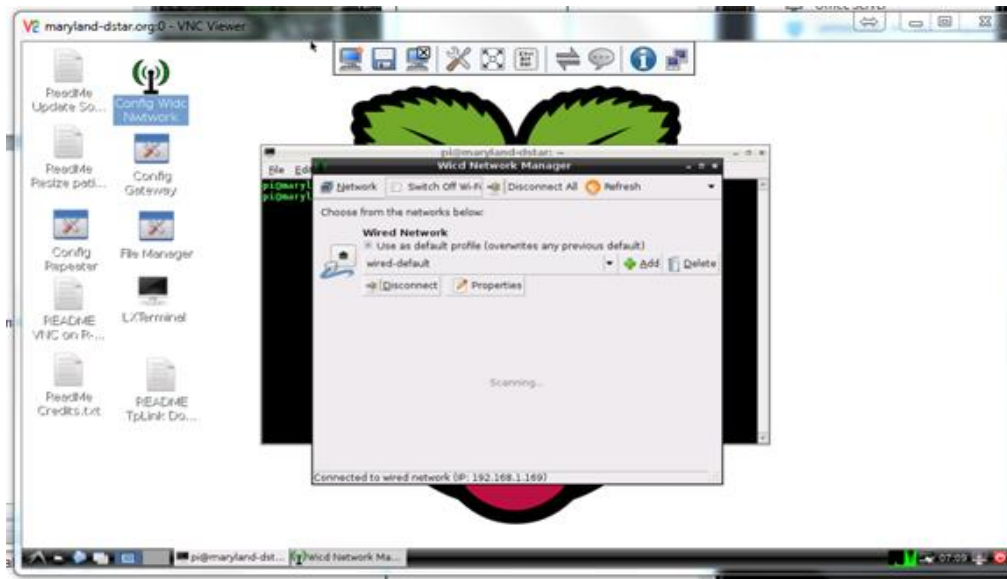


1. At the prompt type leafpad sendipaddress.py then press enter to start the editor.
2. The code you have to modify appears between the [Start of Custom Items] and [End of Custom Items] comment lines. Only replace the items within single quotes to the right of the equal sign. Do not delete the single quotes.
3. Replace 'xxxxxxx@gmail.com' with your gmail login.
4. Replace 'password' with your gmail password.
5. Replace '10digitphonenumber' with your phone number and replace @carrier.net with your Carrier's text message domain. The domains for the four top US carriers are;
 - a. ATT: 10digitphonenumber@text.att.com
 - b. Verizon: 10digitphonenumber@vtext.com
 - c. T-Mobile: 10digitphonenumber@txt.tmobile.net
 - d. Sprint: 10digitphonenumber@messaging.sprintpcs.com
6. Save the updates to sendipaddress.py – click on “File” than “save”
7. Exit LeafPad – click on “File” than “Quit”

Step IX.

- **Configure the Wi-Fi adapter**

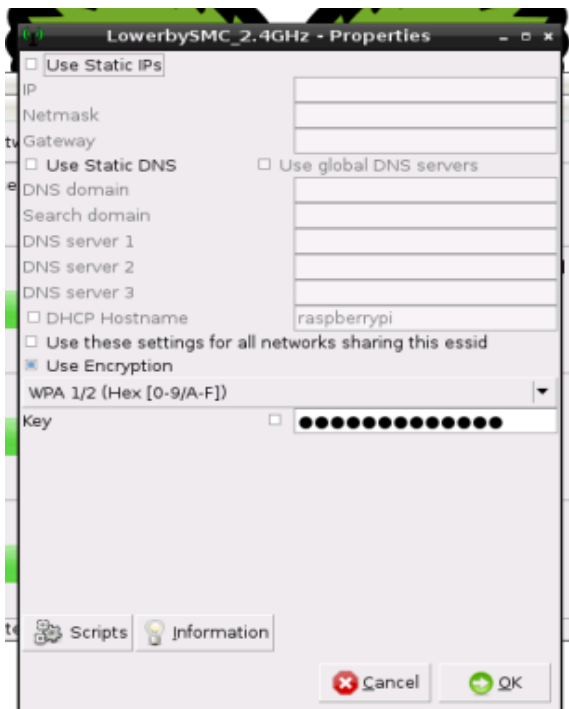
The next step is to configure the Pi to use the nano wireless adapter. Double click on the “Config Widc” icon on the Pi desktop and the following screen will display.



The system will scan for available Wi-Fi access points than display the following screen listing all access points within range of the Pi. Click on refresh to update the list if your access point does not appear in the list on the screen.



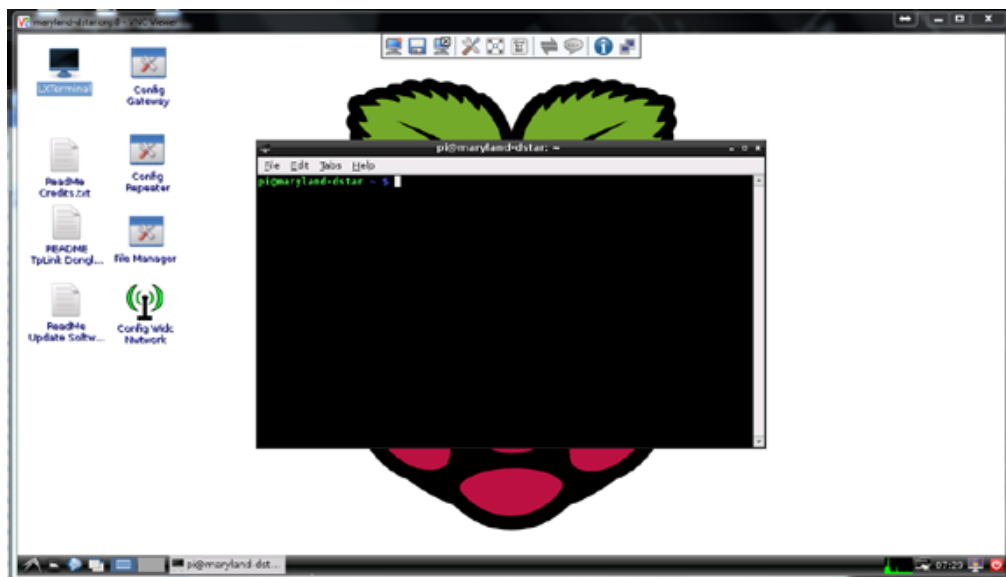
1. Verify that the "Used as default profile (overwrites any previous default) box under "Wired Network" is checked"
2. Find your router in the list and check the box next to "Automatically connect to the network".
3. Click on the "Properties" button for the selected router and the following screen will display.



1. If your wireless router uses encryption check the “Use Encryption” box.
2. Click on the down arrow and select the encryption method used to secure the router.
3. Enter the encryption key in the “Key” text box.
4. Click the “OK” button to save the configuration and return to the previous screen.
5. Click on the “X” in the upper right to close down the Widc configuration screen.

Step X.

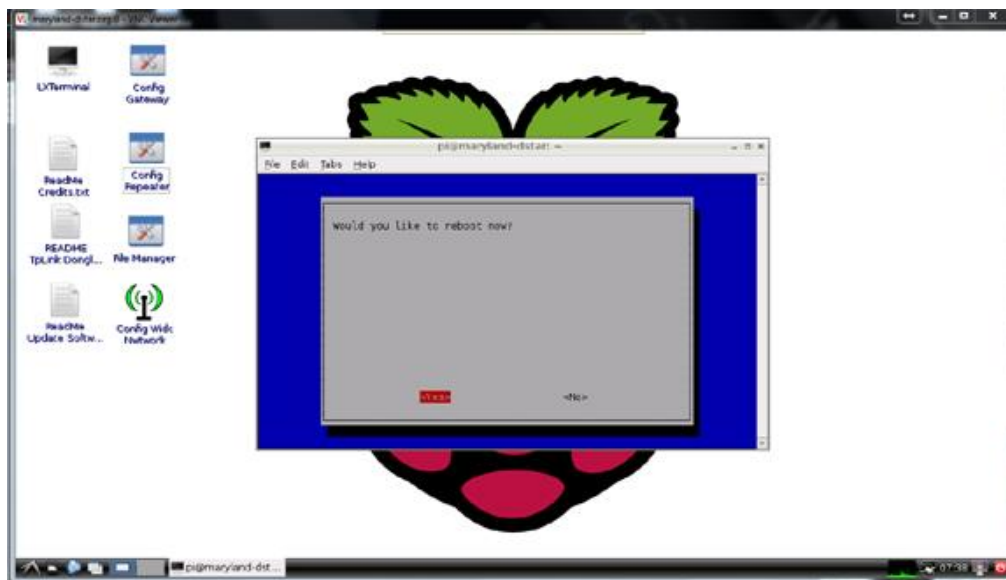
- Expand the partition to use the full capacity of the 16GB SD card.
 1. If the LXTerminal window is closed reopen it by double clicking on LXTerminal icon on the desktop



2. Type “sudo raspi-config” than press enter. The following screen will display.



3. When the menu is displayed press enter to "Expand Filesystem".
4. Using the TAB Key navigate to <Finish> than press enter.



5. Highlight <No> than press enter. The next time the Pi is started the full 16GB will be available to the Operating System, dstarpeater and irrcdbgateway software..
6. When raspi-config shuts down and the LXterminal windows is displayed type "sudo shutdown -h now".
7. When the power light is the only status light active on the Pi remove power.
8. Disconnect the Ethernet cable if you plan to connect the Pi to your access point/router via Wi-fi.

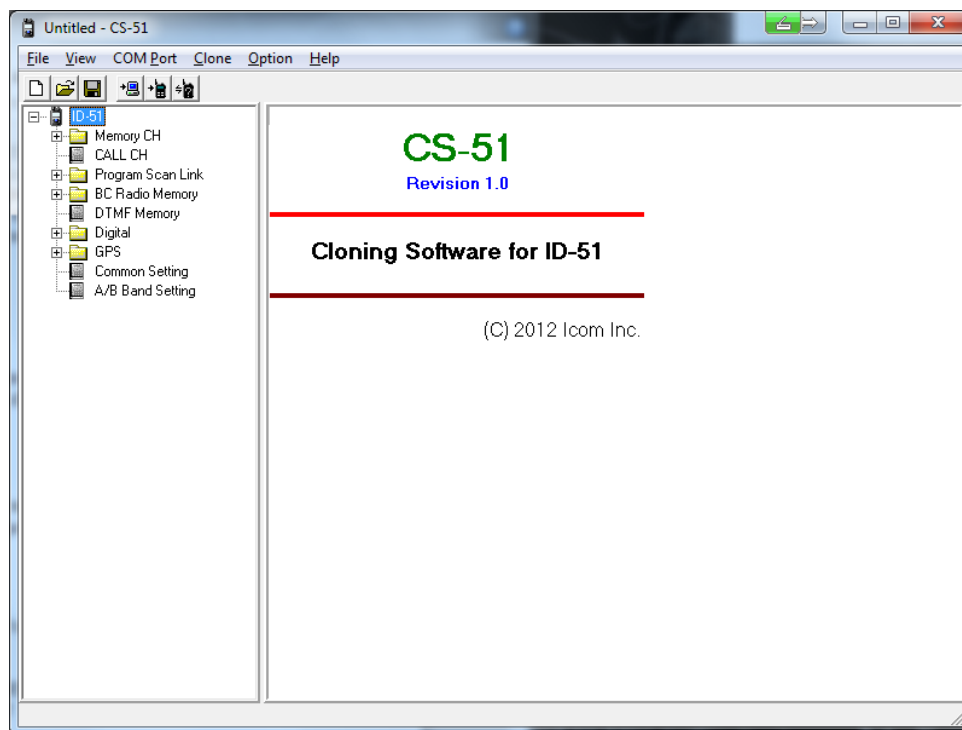
Step XI.

- **Setting up an ID-51 to Transmit and Control the Pi.**

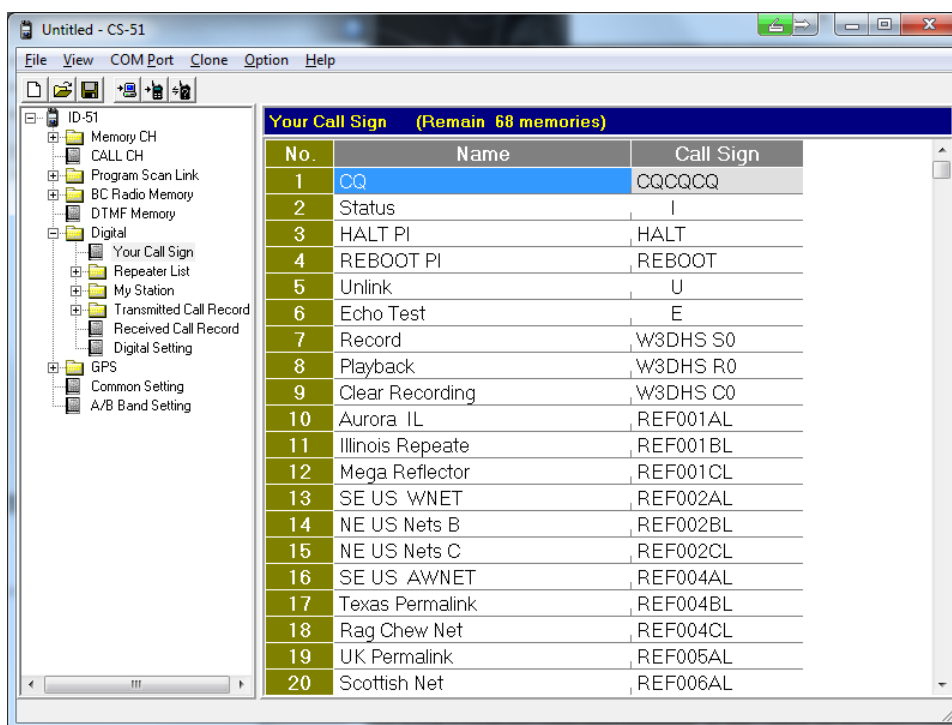
To shut down and reboot the Pi over the air you will have to add a few entries to the transceiver's programming file. You may add them to the standard memory locations or in the case of an ID-31, ID-51 or newer radios you can add the entries to the Digital Repeater memory locations.

Example with ID-51.

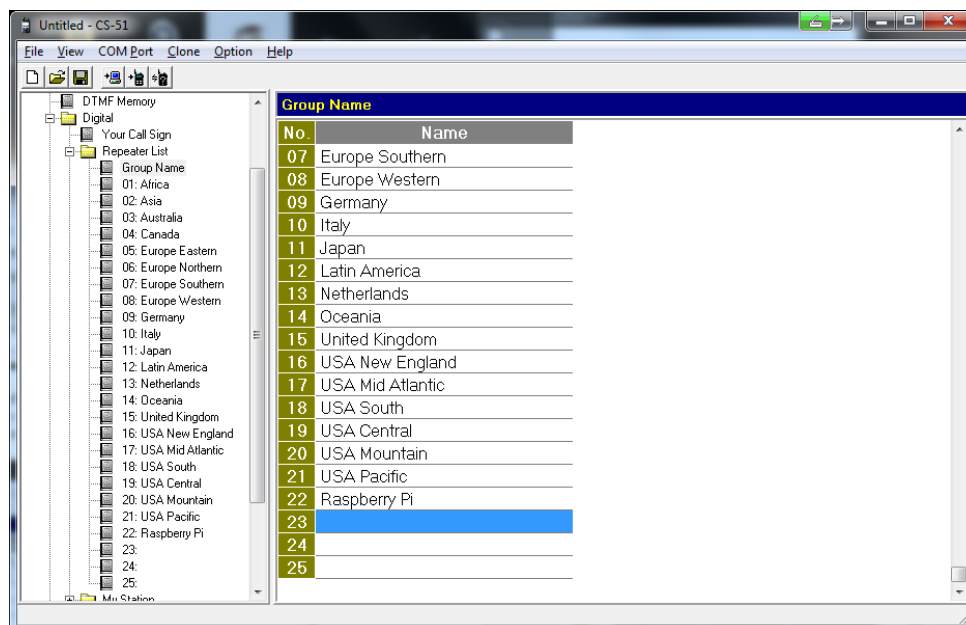
1. Connect the programming cable to your PC's USB port and the radio.
2. Start the CS-51 program and open the file containing the configuration for your radio or read the current configuration from your radio.



- Expand the Digital Folder on the left of the screen and click on Your Call.



- Add two new lines so that it they appear exactly like line No. 3 and line No 4 in the above example.
- Click on and expand the "Repeater List" then click on "Group Name". Scroll to the bottom of the list and add and entry similar to line No. 22 in the below example.



6. Scroll down to the bottom of the repeater list and click on the Raspberry Pi entry on the left side of the screen. Add a new line with the following settings to send the "REBOOT" and "HALT" commands to the Pi via R:

Name.....Pi Control
 Sub Name..... ircddb
 Repeater Call Sign..... RPTRCTLD
 Gateway Call Sign..... The gateway call sign entered Step V followed by a G in position 8
 Operating Frequency.....The DVAP frequency entered in Step V
 DUP.....-DUP
 Offset Frequency..... 0.000000
 Use From..... Yes
 Position.....None
 UTC Offset..... -5:00

7. Add an entry to link the Pi and DVAP to a repeater or reflector.

Name.....Pi Repeater
 Sub Name..... ircddb
 Repeater Call Sign..... The repeater call sign entered in Step V
 Gateway Call Sign..... The gateway call sign entered in Step V followed by a G in position 8
 Operating Frequency.....The DVAP frequency entered in Step V
 DUP.....-DUP
 Offset Frequency..... 0.000000
 Use From..... Yes
 Position.....None
 UTC Offset..... -5:00

8. Save the file and upload configuration to the Radio. After a successful upload turn the Radio off than on.

STEP XII.

- **Test the Configuration and prepare for your first contact.**

1. Press and hold DR on the ID-51 until the screen changes over from VFO to the DR screen.
2. Highlite the To field, press the Blue Button, scroll to "Your Call" and press the Blue Button.
3. Scroll to "CQ" and press the Blue Button .
4. Scroll to the From field, press the Blue Button, scroll to "Repeater List" and press the Blue Button.
5. Scroll to "Raspberry Pi" and press the Blue Button.
6. Scroll to "Pi Repeater" and press the Blue Button.
7. The To field on the screen should be set to "CQ" and From field should be set to "Pi Repeater".
8. Apply power to the Raspberry Pi. The POWER light will glow red and the ACT light will flash while the operating system boots and the hardware is initialized. No other status lights will glow or flash unless the Pi remains connected to a router or network switch via the Ethernet port. The status light on the Wi-Fi dongle will flash and the status light on the DVAP will flash than go off and switch to a flashing Blue light. This indicates that the Pi is communicating with the DVAP.

If the radio is set correctly you should see the message "Not Linked" or "Linked to" scroll across the display. If all is good continue on to 9. If it fails than you will have to go back and review the configuration of the Pi and the setup of the radio.

9. Next we will link to one of the many reflectors.
 - a. Scroll to the "To" field and press the Blue Button.
 - b. Select "Your Call" and press the Blue Button.
 - c. Scroll down to "Mega Reflector" and press the Blue Button.
 - d. The To field should be set to "Mega Reflector",
 - e. The From field should be set to ".Pi Repeater"
 - f. Key the radio to link to the Reflector. If all is working properly the Radio will respond with "Linked to REF001" when the PTT is released.

Let's try rebooting the Pi using the Radio.

- g. Scroll to the "To" field on the radio and press the Blue Button.
 - h. Scroll to "Your Call" and press the Blue Button.
 - i. Scroll to "Reboot Pi" and press the Blue Button.
 - j. Scroll to the "From" field on the radio and press the Blue Button.
 - k. Scroll to "Pi Control" and press the Blue Button
 - l. Key the radio to reboot the Pi.

To shut down the Pi, select "Halt Pi" from the "Your Call" list and key the radio. On release of the PTT the Pi will stop, all status lights will go out, the status lights on the DVAP will glow green.

Congratulations!

Welcome to the wide world of D-Star.

A few last comments:

- When switching between reflectors there is no need to issue an unlink command. The ircddb gateway software will unlink the current reflector or repeater before linking to a new one.
- If the radio responds with "Linking To" when you attempt a link it can indicate that the internet connection was dropped or the repeater / reflector has maxed out its bandwidth. Try another repeater / reflector, check your internet link and/or reboot the Pi.
- To link to DCS or other international reflectors you will have to add entries for the reflector to your programming file "Your Call" list or "Direct Input" the reflector information on the radio.
- Now testing running a 70CM and 2M DVAP together using one Pi Model B. Send an e-mail to pi@maryland-dstar.org and add your e-mail to the notification list.

End of Document