

# Raspberry Pi Packet TNC, APRS Digipeater, IGate

Version 1.1 – December 2014

The Raspberry Pi (RPI) is a good platform for running a software TNC, APRS digipeater, and IGate.

This document is a Quick Start guide for running Dire Wolf on the Raspberry Pi and describes special considerations where it may differ from other Linux systems.

After completing the steps here, refer to the User Guide for more details on the Linux version.

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# 1 Install Appropriate Operating System

Select a version of Linux that has hardware floating point support. Dire Wolf makes extensive use of floating point calculations. Trying to use the slower software floating point will probably result in disappointment.

The Raspbian “wheezy” distribution from <http://www.raspberrypi.org/downloads> is known to work with the instructions here. I haven’t tried the others and don’t know how they might differ.

The Raspbian operating system distribution comes with the **gcc** compiler and most required libraries pre-installed. If you use a different operating system version, you might need to install a suitable compiler and/or additional libraries.

## 1.1 If operating system is already installed.

If you already have a different operating system version, verify that gcc is configured to generate hardware floating point code. Enter the “gcc -v” command and observe the result. Make sure that “--with-fpu=vfp --with-float=hard” appears in the configuration.

```
pi@raspberrypi:~$ gcc -v

Using built-in specs.
COLLECT_GCC=gcc
COLLECT_LTO_WRAPPER=/usr/lib/gcc/arm-linux-gnueabi/4.6/lto-wrapper
Target: arm-linux-gnueabi
Configured with: ../src/configure -v --with-pkgversion='Debian 4.6.3-12+rpi1' --with-bugurl=file:///usr/share/doc/gcc-4.6/README.Bugs --enable-languages=c,c++,fortran,objc,obj-c++ --prefix=/usr --program-suffix=-4.6 --enable-shared --enable-linker-build-id --with-system-zlib --libexecdir=/usr/lib --without-included-gettext --enable-threads=posix --with-gxx-includedir=/usr/include/c++/4.6 --libdir=/usr/lib --enable-nls --with-sysroot=/ --enable-clocale=gnu --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-gnu-unique-object --enable-plugin --enable-objc-gc --disable-sjlj-exceptions --with-arch=armv6 --with-fpu=vfp --with-float=hard --enable-checking=release --build=arm-linux-gnueabi --host=arm-linux-gnueabi --target=arm-linux-gnueabi
Thread model: posix
gcc version 4.6.3 (Debian 4.6.3-12+rpi1)
```

## 1.2 New System Setup & Configuration

If you are starting with a brand new RPi, the lessons here: <http://learn.adafruit.com/> are easy to follow and will get you running quickly.

- <https://learn.adafruit.com/adafruit-raspberry-pi-lesson-1-preparing-and-sd-card-for-your-raspberry-pi>
- <https://learn.adafruit.com/adafruit-raspberry-pi-lesson-2-first-time-configuration>
- <https://learn.adafruit.com/adafruit-raspberry-pi-lesson-3-network-setup>

- <https://learn.adafruit.com/adafruits-raspberry-pi-lesson-4-gpio-setup>
- <https://learn.adafruit.com/adafruits-raspberry-pi-lesson-6-using-ssh>
- <https://learn.adafruit.com/adafruit-raspberry-pi-lesson-7-remote-control-with-vnc>

The last two are optional, depending on your situation. In my case, I have a headless (no monitor, keyboard) Raspberry Pi in the radio “shack” which is accessed from other computers various places over the network. The VNC software allows me to have a virtual desktop displayed on other computers. If you are using a monitor / keyboard / mouse connected to the RPi, you won’t need to configure login by ssh and VNC.

The audio system on the Raspberry Pi has a history of many problems. Every time I did a software update, the behavior changed. Before October 13, 2013, the only way I could get it to work was with pulseaudio. After the most recent software update and firmware upgrade, pulseaudio stopped working ([http://elinux.org/R-Pi\\_Troubleshooting#Removal\\_of\\_installed\\_pulseaudio](http://elinux.org/R-Pi_Troubleshooting#Removal_of_installed_pulseaudio)) but the preferred method, which never worked properly before, is now fine.

You might be dooming your efforts to failure if you skip this software & firmware update step.

```
sudo apt-get update
sudo apt-get dist-upgrade
sudo rpi-update
sudo reboot
```

Check the firmware version with this command. I’m getting good results with the Oct 12 2013 version. **Earlier versions were not satisfactory.**

```
/opt/vc/bin/vcgencmd version
```

Pulseaudio was never right and it was even worse the last time I struggled with it. I believe it is no longer included in the current version of Raspbian. Remove it just to be safe.

```
sudo apt-get remove --purge pulseaudio
sudo apt-get autoremove
rm -rf /home/pi/.asoundrc /home/pi/.pulse
```

At this point reboot to make sure you are running the latest versions.

```
sudo reboot
```

### 1.3 Optionally enable IPv6.

You can enable IPv6 immediately by typing: `sudo modprobe ipv6`.

To start it up automatically after each reboot, edit `/etc/modules` and add a new line at the end containing `ipv6` (without the quotes).

## 2 Install Dire Wolf

### 2.1 Install sound library.

First, install the “libasound2-dev” package with the following command:

```
sudo apt-get install libasound2-dev
```

Failure to install libasound2-dev step will result in a compile error resembling “audio.c:....: fatal error: alsa/asoundlib.h: No such file or directory”

### 2.2 Download Dire Wolf source code

Download the source version from <http://home.comcast.net/~wb2osz/site/> and copy it to your Raspberry Pi. /home/pi is used as example here. If you put it somewhere else, you will need to make suitable adjustments to the commands shown.

The exact zip file name and unpacked path might vary if you are using a beta test or development version.

```
cd /home/pi
unzip direwolf-1.1-src.zip
cd direwolf-1.1
```

Optionally obtain the most recent updates for the APRS TO-CALL version numbers and the new symbol codes.

```
make -f Makefile.linux tocalls-symbols
```

### 2.3 Compile and Install

Compile and install the application.

```
make -f Makefile.linux
sudo make -f Makefile.linux install
make -f Makefile.linux install-rpi
```

You should now have files in these locations, under /usr/local, owned by root.

/usr/local/bin/direwolf	The application.
/usr/local/bin/decode_aprs	Utility to interpret “raw” data you might find on <a href="http://aprs.fi">http://aprs.fi</a> or <a href="http://findu.com">http://findu.com</a>
/usr/local/bin/tt2text /usr/local/bin/text2tt	Utilities related to APRStt gateway, UTM coordinates, and log file to GPX conversion.

/usr/local/bin/ll2utm /usr/local/bin/utm2ll /usr/local/bin/log2gpx	
/usr/share/applications/direwolf.desktop	Application definition with icon, command to execute, etc.
/usr/local/share/direwolf/tocalls.txt	Mapping from destination address to system type. Search order for tocalls.txt is first the current working directory and then /usr/share/direwolf.
/usr/local/share/direwolf/symbolsX.txt /usr/local/share/direwolf/symbols-new.txt	Descriptions and codes for APRS symbols.
/usr/share/direwolf/dw-icon.png	Icon for the desktop.
/usr/local/share/doc/direwolf/*	Various documentation.

You should also have these files, under /home/pi.

/home/pi/Desktop/direwolf.desktop	Symbolic link to /usr/share/applications/direwolf.desktop. This causes an icon to be displayed on the desktop.
/home/pi/dw-start.sh	Script to start Dire Wolf if it is not running already.

## 2.4 Get initial configuration file.

If this is the first time, you are installing Dire Wolf perform this step:

```
make -f Makefile.linux install-conf
```

When upgrading from an earlier version, you will probably want to skip this step because it will wipe out your earlier configuration file.

This step should have copied the initial configuration file to the home directory, /home/pi.

/home/pi/direwolf.conf	Configuration file. Search order is current working directory then the user's home directory.
------------------------	--

## 2.5 First Test

Go to your home directory and try to run "direwolf."

```
cd /home/pi
direwolf
```

You should see something like this, because we have not yet configured it for using an audio device.

```
Dire Wolf version ...  
Audio device for both receive and transmit: default  
Could not open audio device default for input  
No such file or directory  
Pointless to continue without audio device.
```

We will perform the necessary configuration in a later step.



## 3 Interface for radio

APRS, or other packet radio, operation requires connections between your transceiver and computer.

- (a) Received audio from receiver.

This can be very simple. All you need is a cable from the speaker of your radio to the computer's microphone or line in. Some people like to use audio isolation transformers but I never found this to be necessary.

- (b) Transmit audio to transmitter.

Audio output from the computer goes to the microphone input of your transceiver. A direct connection might be acceptable in some cases but typically you would want a trim pot to decrease the signal level and a capacitor (perhaps around 0.1  $\mu$ F) to block DC.

- (c) Push to Talk (PTT) signal to activate transmitter.

Traditionally, this has often been with one of the control lines of an RS-232 serial port. It would be possible to use a USB-to-serial adapter but there is a better way. The Raspberry Pi has a bunch of general purpose input output (GPIO) pins.

If you use a VOX circuit, to turn on transmitter automatically when audio is present, no PTT connection would be necessary. You can also ignore the warning message about PTT not being configured.

### 3.1 Audio input / output

The Raspberry Pi has built-in audio output but no audio input.

You can get a list of audio **output** devices with the “`aplay -l`” command.

```
pi@raspberrypi:~$ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: ALSA [bcm2835 ALSA], device 0: bcm2835 ALSA [bcm2835 ALSA]
  Subdevices: 8/8
    Subdevice #0: subdevice #0
    Subdevice #1: subdevice #1
    Subdevice #2: subdevice #2
    Subdevice #3: subdevice #3
    Subdevice #4: subdevice #4
    Subdevice #5: subdevice #5
    Subdevice #6: subdevice #6
    Subdevice #7: subdevice #7
card 0: ALSA [bcm2835 ALSA], device 1: bcm2835 ALSA [bcm2835 IEC958/HDMI]
  Subdevices: 1/1
    Subdevice #0: subdevice #0
```

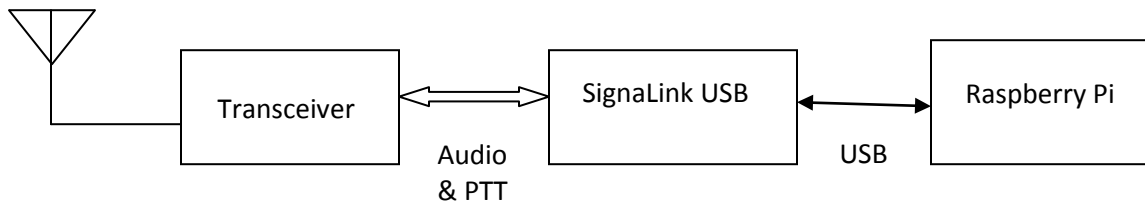
You can get a list of audio **input** devices with the “arecord -l” command:

```
pi@raspberrypi:~$ arecord -l
**** List of CAPTURE Hardware Devices ****
```

There aren't any! It will be necessary to add some sort of sound input device.

### 3.1.1 Signalink USB

An easy, but pricey, solution is the **Tigertronics Signalink USB** because it contains all of the interface circuitry.



### 3.1.2 Cheap USB audio adapters

A cheap USB audio adapter can also be used but the drivers and firmware tend to be little problematic.

I'm currently using this Syba adapter <http://www.amazon.com/gp/product/B001MSS6CS> successfully after upgrading to the Oct 12 2013 version firmware. The sticker on the package indicated it has a CMedia HS100 chip (see <http://www.cmedia.com.tw/ApplicationIndex/C1Serno-1/C2Serno-4.html>) but “lsusb” reports:

```
Bus 001 Device 004: ID 0d8c:0139 C-Media Electronics, Inc.
```

The C-Media product id 0139 indicates it's the CM108AH chip. The HS100 has a product id of 013C.

This one looks interesting because it has a short cable which provides more flexibility in the physical arrangement of the various components. <http://www.adafruit.com/product/1475>

“lsusb” reports this:

```
Bus 001 Device 005: ID 0d8c:000c C-Media Electronics, Inc. Audio Adapter
```

This appears to be the CM108 or CM109 chip. According to the CM108 datasheet, the product id can vary from 0008 to 000f and is programmable by the MSEL and MODE pins. The CM109 datasheet says the same thing so I don't know how you can tell them apart.

It works fine on Windows 7 but I have not yet been able to get audio input working properly on the RPi even with the latest (December 2014) firmware. I'd like to hear from anyone that is successful.

There is a report of this one spewing out a lot of RFI at 144 MHz so you might want to avoid it even after a properly working driver is available.

### 3.1.3 Avoid USB hub for audio adapter

Avoid putting a USB hub between the Raspberry Pi and the USB Audio adapter. I've received reports that exactly the same configuration works fine with the direct connection and a significant number of audio samples are lost when going through a hub.

## 3.2 Determine "card" number for audio device

After plugging in a suitable USB audio interface, you should see something like this, in response to the "aplay -l" and "arecord -l" commands:

```
pi@raspberrypi:~$ aplay -l

**** List of PLAYBACK Hardware Devices ****
card 0: ALSA [bcm2835 ALSA], device 0: bcm2835 ALSA [bcm2835 ALSA]
  Subdevices: 8/8
    Subdevice #0: subdevice #0
    Subdevice #1: subdevice #1
    Subdevice #2: subdevice #2
    Subdevice #3: subdevice #3
    Subdevice #4: subdevice #4
    Subdevice #5: subdevice #5
    Subdevice #6: subdevice #6
    Subdevice #7: subdevice #7
card 0: ALSA [bcm2835 ALSA], device 1: bcm2835 ALSA [bcm2835 IEC958/HDMI]
  Subdevices: 1/1
    Subdevice #0: subdevice #0
```



```
card 1: CODEC [USB Audio CODEC], device 0: USB Audio [USB Audio]
  Subdevices: 1/1
    Subdevice #0: subdevice #0
```

```
pi@raspberrypi:~$ arecord -l
```

```
**** List of CAPTURE Hardware Devices ****
```



```
card 1: CODEC [USB Audio CODEC], device 0: USB Audio [USB Audio]
  Subdevices: 1/1
    Subdevice #0: subdevice #0
```

The built-in (output only) interface will normally be card 0 unless you did something to change the order. The additional USB audio adapter will typically be card 1, as seen in the example above. If you

see a different number, you will have to modify a later step when we put the card number in the configuration file.

### 3.3 Transmitter PTT

If you want to transmit, some method is needed to activate the transmitter push-to-talk (PTT) function. Traditionally, this has been done with the RTS or DTR signal from a serial port.

Possible alternatives include:

- Reconfigure the built in serial port to have the RTS control.

The Raspberry Pi has a built in serial port which is normally configured as a console. It is possible to reconfigure this to be available for application use. In the default configuration, it does not have the usual RTS/CTS flow control signals. As described here, [http://elinux.org/RPi\\_Serial\\_Connection#Handshaking\\_lines](http://elinux.org/RPi_Serial_Connection#Handshaking_lines), it is possible to reconfigure some of the GPIO lines for the RTS/CTS signals. I haven't tried this.

- Use a USB to RS-232 converter cable to supply a full RS-232 port. You will need to put something like this in the configuration file.

```
PTT /dev/ttyUSB0 RTS
```

- VOX operation where transmitter is activated by transmit audio signal. The Signalink USB uses this technique. (Homebrew circuit example: <https://sites.google.com/site/kh6tyinterface/>)
- Use one of the General Purpose I/O (GPIO) pins. I'm currently using this along with the cheap USB audio adapter.

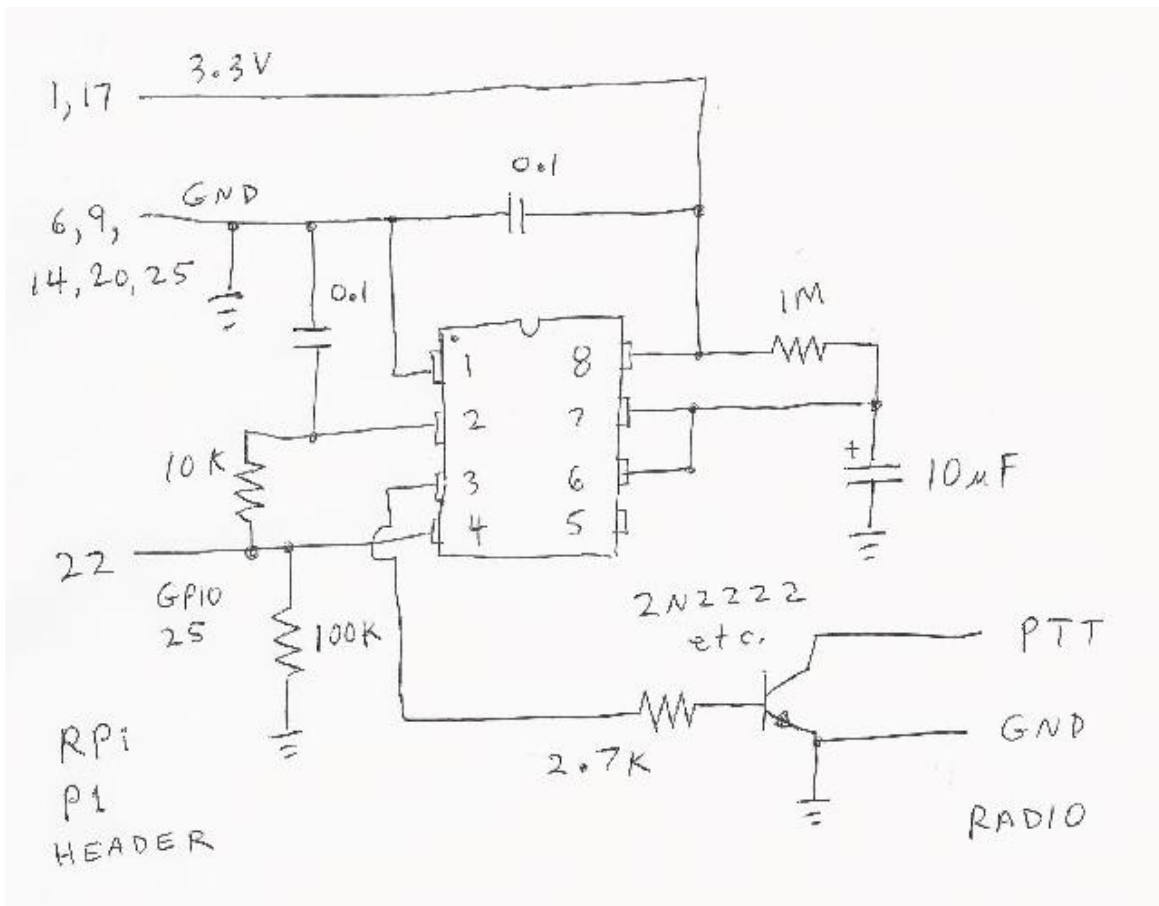
CAUTION! The general purpose input output (GPIO) pins are connected directly to the CPU chip. There is no buffering or other protection. The interface uses 3.3 volts and will not tolerate 5 volt signals. Static discharge, from careless handling, could destroy your Raspberry Pi.

There are many GPIO pins. How would you choose an appropriate one? These are my suggestions for the best choices. The others have special functions such as UART, SPI, PWM, or I<sup>2</sup>C. A few others changed positions between board revisions 1 & 2 which could cause confusion.

- P1-11 GPIO 17
- P1-15 GPIO 22
- P1-16 GPIO 23
- P1-18 GPIO 24
- P1-22 GPIO 25

Here is a recommended circuit using a CMOS 555 timer (LMC555, TLC555, ICM7555, etc.) to limit transmissions to about 10 seconds. Don't try using the original 555 because it needs a minimum of 4.5

volts and we have only 3.3 here. The time can be increased by making the 10  $\mu$ F capacitor larger. It's roughly 1 second for each  $\mu$ F.



You could get by with only a resistor and transistor but a software failure could cause the transmitter to be stuck on, jamming the radio channel, annoying other people, and possibly damaging the transmitter from overheating.

Finally, put a command like this in the configuration file with the actual I/O signal being used.

```
PTT GPIO 25
```

## 4 Configure for Radio Interface

We need to make a couple simple changes to the configuration file. Change to your home directory.

```
cd /home/pi
```

You should find a file called “direwolf.conf.” Modify it with your favorite text editor, as explained in the following steps.

### 4.1 Audio Interface Device

We previously determined the “card” number for the desired audio interface. Typically this will be 1.

Look in the “direwolf.conf” file for a line like this:

```
# ADEVICE plughw:1,0
```

Remove the “#” from the beginning of the line. If the card number, found in the earlier step, is not 1, use that number instead.

### 4.2 PTT Method

Look in “direwolf.conf” for a line like this:

```
# PTT GPIO 25
```

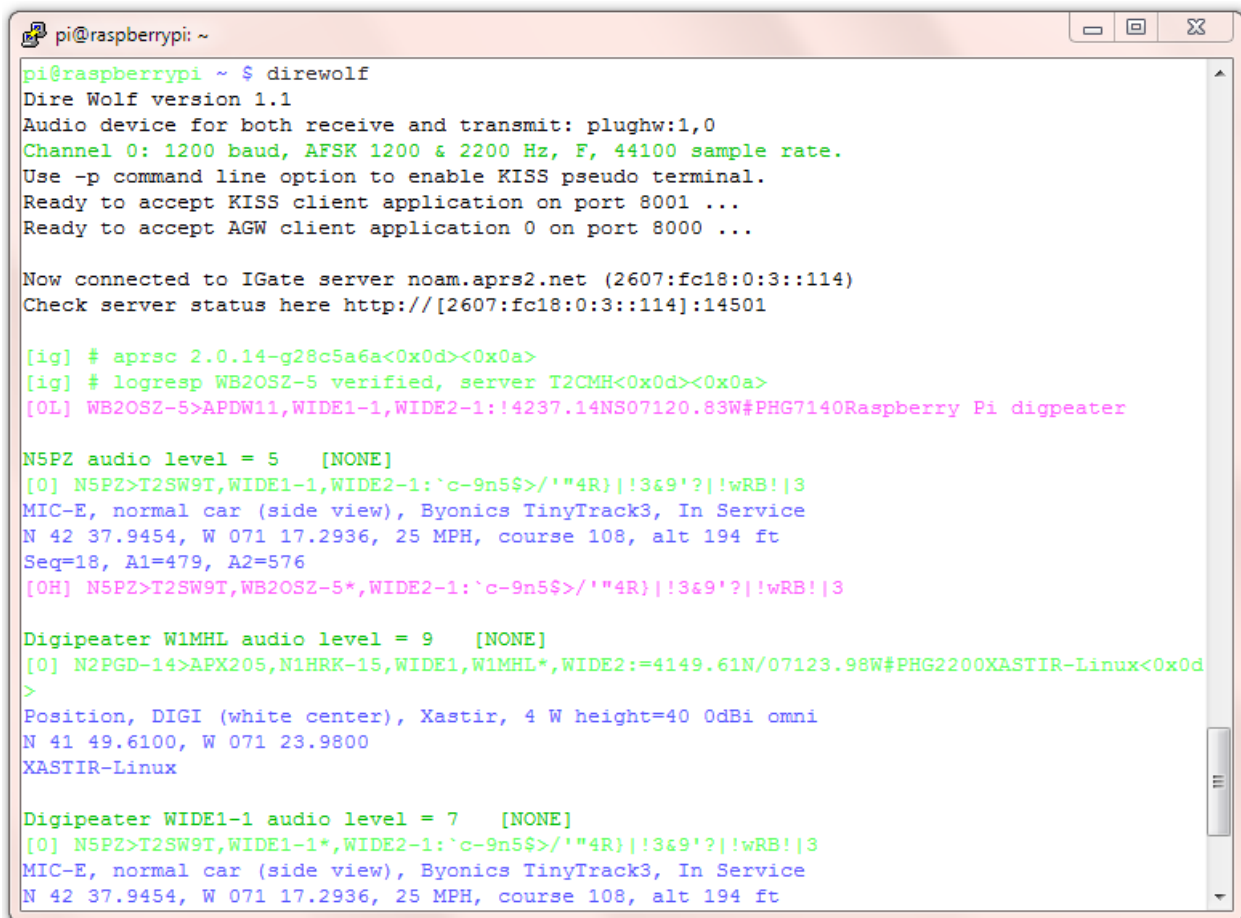
Assuming you are using GPIO 25 for the PTT control, simply remove the “#” from the beginning of the line. If using some other PTT method, refer to the User Guide for a discussion of other possibilities.

## 5 Run Dire Wolf application

Start up the application with the desktop icon or from the command line:

```
direwolf
```

Typical results will look something like this:



```
pi@raspberrypi: ~  
pi@raspberrypi ~ $ direwolf  
Dire Wolf version 1.1  
Audio device for both receive and transmit: plughw:1,0  
Channel 0: 1200 baud, AFSK 1200 & 2200 Hz, F, 44100 sample rate.  
Use -p command line option to enable KISS pseudo terminal.  
Ready to accept KISS client application on port 8001 ...  
Ready to accept AGW client application 0 on port 8000 ...  
  
Now connected to IGate server noam.aprs2.net (2607:fc18:0:3::114)  
Check server status here http://[2607:fc18:0:3::114]:14501  
  
[ig] # aprsc 2.0.14-g28c5a6a<0x0d><0x0a>  
[ig] # logresp WB2OSZ-5 verified, server T2CMH<0x0d><0x0a>  
[OL] WB2OSZ-5>APDW11,WIDE1-1,WIDE2-1:!4237.14NS07120.83W#PHG7140Raspberry Pi digpeater  
  
N5PZ audio level = 5 [NONE]  
[O] N5PZ>T2SW9T,WIDE1-1,WIDE2-1:`c-9n5$>/'"4R)||3&9'?|!wRB!|3  
MIC-E, normal car (side view), Byonics TinyTrack3, In Service  
N 42 37.9454, W 071 17.2936, 25 MPH, course 108, alt 194 ft  
Seq=18, A1=479, A2=576  
[OH] N5PZ>T2SW9T,WB2OSZ-5*,WIDE2-1:`c-9n5$>/'"4R)||3&9'?|!wRB!|3  
  
Digipeater W1MHL audio level = 9 [NONE]  
[O] N2PGD-14>APX205,N1HRK-15,WIDE1,W1MHL*,WIDE2:=4149.61N/07123.98W#PHG2200XASTIR-Linux<0x0d  
>  
Position, DIGI (white center), Xastir, 4 W height=40 OdBi omni  
N 41 49.6100, W 071 23.9800  
XASTIR-Linux  
  
Digipeater WIDE1-1 audio level = 7 [NONE]  
[O] N5PZ>T2SW9T,WIDE1-1*,WIDE2-1:`c-9n5$>/'"4R)||3&9'?|!wRB!|3  
MIC-E, normal car (side view), Byonics TinyTrack3, In Service  
N 42 37.9454, W 071 17.2936, 25 MPH, course 108, alt 194 ft
```

Let's examine each section.

*On the first line, we have the application version.*

*Next we have confirmation of the audio device being used.*

*The modem is configured for standard 1200 baud operation.*

```
Dire Wolf version 1.1  
Audio device for both receive and transmit: plughw:1,0  
Channel 0: 1200 baud, AFSK 1200 & 2200 Hz, F, 44100 sample rate.
```

*This is a summary of the interfaces available for client applications.*

```
Use -p command line option to enable KISS pseudo terminal.  
Ready to accept KISS client application on port 8001 ...  
Ready to accept AGW client application 0 on port 8000 ...
```

*This shows that the station is operating as an Internet Gateway and has successfully connected to a server. A URL is provided to check on the server status. “[ig]” at the beginning of the line indicates a response from the IGate server.*

```
Now connected to IGate server noam.aprs2.net (2607:fc18:0:3::114)  
Check server status here http://[2607:fc18:0:3::114]:14501  
  
[ig] # aprsc 2.0.14-g28c5a6a<0x0d><0x0a>  
[ig] # logresp WB2OSZ-5 verified, server T2CMH<0x0d><0x0a>
```

*This is a beacon, identifying the station. “[0L]” means it is transmitting on radio channel 0 at low priority. Notice that transmitted lines are displayed in magenta.*

```
[0L] WB2OSZ-5>APDW11,WIDE1-1,WIDE2-1:!4237.14NS07120.83W#  
PHG7140Raspberry Pi digpeater
```

*Here we are receiving a nearby station directly. “[0]” means it was heard on radio channel 0. Received signals are in green.*

```
N5PZ audio level = 5 [NONE]  
[0] N5PZ>T2SW9T,WIDE1-1,WIDE2-1:`c-9n5$>/'"4R}||!3&9'?|!wRB!|3
```

*What to all those strange characters mean? The next few lines contain the decoded information in human readable form. In this example, the last line is telemetry data.*

```
MIC-E, normal car (side view), Byonics TinyTrack3, In Service  
N 42 37.9454, W 071 17.2936, 25 MPH, course 108, alt 194 ft  
Seq=18, A1=479, A2=576
```

*This packet is a candidate for digipeating so we retransmit it. “[0H]” means it is being transmitted on channel 0. Digipeated packets go out at a higher priority. Notice how “WIDE1-1” was replaced by “WB2OSZ-5\*” so the actual path taken can be determined.*

```
[0H] N5PZ>T2SW9T,WB2OSZ-5*,WIDE2-1:`c-9n5$>/'"4R}||!3&9'?|!wRB!|3
```

*Now we hear another station. But this time it is not direct. We are actually hearing a digipeater. It is not a candidate for digipeating because the via path has been all used up. In this case, the last line is the comment.*

```
Digipeater W1MHL audio level = 9 [NONE]  
[0] N2PGD-14>APX205,N1HRK-15,WIDE1,W1MHL*,WIDE2:=4149.61N/07123.98W#  
PHG2200XASTIR-Linux<0x0d>  
Position, DIGI (white center), Xastir, 4 W height=40 0dBi omni  
N 41 49.6100, W 071 23.9800
```



XASTIR-Linux

Now we hear the first station again, but from a digipeater, not directly. The digipeater did not insert its own call so we don't know who retransmitted the packet.

```
Digipeater WIDE1-1 audio level = 7 [NONE]
[0] N5PZ>T2SW9T,WIDE1-1*,WIDE2-1:`c-9n5$>/'"4R}!!3&9'?|!wRB!|3
MIC-E, normal car (side view), Byonics TinyTrack3, In Service
N 42 37.9454, W 071 17.2936, 25 MPH, course 108, alt 194 ft
Seq=18, A1=479, A2=576
```

This is also a candidate for digipeating because "WIDE2-1" has not been used up yet. However, we transmitted this same packet within the past 30 seconds so the duplicate is dropped.

```
Digipeater: Drop redundant packet.
```

That's all you will see. No flashy graphics. No maps. No user interaction. But loads of valuable information for monitoring activity and debugging problems.

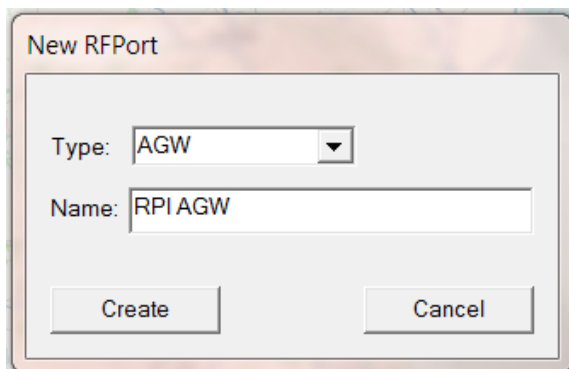
Dire Wolf is just a replacement for a TNC. To do more interesting things, you will need an application such as APRSISCE/32, UI-View32, Xastir, APRS-TW, YAAC, SARTrack, RMS Express, etc.

## 5.1 Use with client applications

Client applications can run on different computers and communicate with Dire Wolf over your local network. For example, you might have a Raspberry Pi in your "shack," in a cold damp basement, connected to your radio equipment. You might want to use a client application (such as APRSIS32, YAAC, or Xastir) on a laptop in a more comfortable location, perhaps next to the pool or fireplace. Here is an example of how you could configure APRSISCE/32 in this situation.

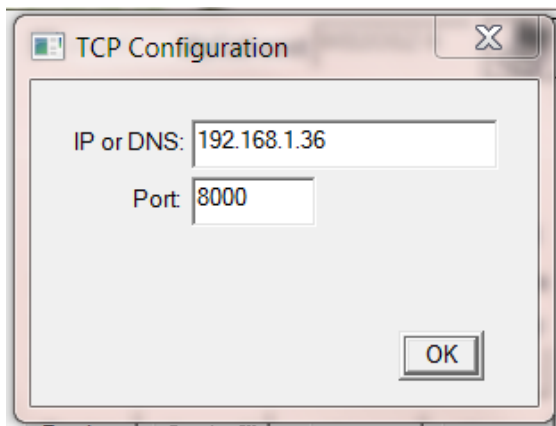
From the Configure menu, pick Ports → New Port...

Choose type of AGW and give it a meaningful name.



Click on Create and pick port type of TCP/IP.

Enter the IP address of the Raspberry Pi, and the default port of 8000.



## 6 Other Common Configuration Changes

### 6.1 Automatic Startup

You probably want your TNC / application server / digipeater to start up automatically after a power interruption.

If you followed the installation steps above, you should have a file named `dw-start.sh` in your home directory. Run the “`crontab -e`” command and add a line like this:

```
* * * * * /home/pi/dw-start.sh >/dev/null 2>&1
```

This script will run once per minute. Dire Wolf is started automatically if not running already. If it crashes, or is terminated for any other reason, it will be restarted. A log of restarts can be found in `/tmp/dw-start.log`.

### 6.2 Digipeater Operation

Edit the `/home/pi/direwolf.conf` file and look for a section like this:

```
# Station identifier for this channel.
# Multiple channels can have the same or different names.
#
# Naturally it must be up to letters and digits with an optional ssid.
# The APRS specification requires that it be upper case.
#
# Example (don't use this unless you are me): MYCALL WB2OSZ-5
#
MYCALL NOCALL
```

Change “`NOCALL`” to your ham radio call and optional SSID.

Next, look for a section like this:

```
#-----
# ----- Example 1: Typical digipeater -----
#-----
#
# For most common situations, use something like this by removing
# the "#" from the beginning of the line.
# To disable digipeating, put # at the beginning of the line.
#
#
#DIGIPEAT 0 0 ^WIDE[3-7]-[1-7]$ ^WIDE[12]-[12]$
```

Remove the “#” character from the beginning of the last line shown above. It is necessary to stop and restart the application to notice configuration file changes.

Here is an example of what you should see:

```
KB1UTS audio level = 5 [NONE]
[0] KB1UTS>APWW10,WIDE1-1:@021038h4235.16N/07121.53W-
Position with time, House QTH (VHF), APRSISCE win32 version
N 42 35.1600, W 071 21.5300
[0H] KB1UTS>APWW10,WB2OSZ-5*:@021038h4235.16N/07121.53W-
```

Dark green: Information about the station we heard. Either the originating station or a digipeater.

Green: Raw received data. Notice that the digipeater field contains “WIDE1-1.”

Blue: An explanation for troubleshooting. The destination (APWW10) is used to determine the type of system generating the signal.

Magenta: This is the re-transmitted packet. Notice that the digipeater field now contains “WB2OSZ-5\*.” The “\*” indicates that it has been used up and won’t be digipeated again.

### 6.3 Enable Beacons

Be sure that MYCALL has been set as in previous step.

Look for a section like this in `direwolf.conf` file.

```
# PBEACON delay=0:15 every=30 overlay=S symbol="digi" lat=42^37.14N lon=071^20.83W
power=50 height=20 gain=3 comment="Chelmsford MA" via=WIDE1-1,WIDE2-1
# PBEACON delay=10:15 every=30 overlay=S symbol="digi" lat=42^37.14N lon=071^20.83W
power=50 height=20 gain=3 comment="Chelmsford MA"
# PBEACON delay=20:15 every=30 overlay=S symbol="digi" lat=42^37.14N lon=071^20.83W
power=50 height=20 gain=3 comment="Chelmsford MA"

#
# Modify this for your particular situation before removing
# the # comment character from the beginning of the lines above.
#
```

Remove the “#” comment character from the beginning of the “PBEACON” lines. Make necessary adjustments to latitude, longitude, comment, etc. These options, and more, are described in the User Guide.

Note that each position beacon command must be on a single line. Multiple lines are shown above due to page width limitations.

### 6.4 Internet Gateway (IGate)

Dire Wolf can serve as a gateway between the radio network and servers on the Internet. This allows information to be retrieved from locations such as <http://aprs.fi> or <http://findu.com>. Information can optionally be relayed from the servers, through your station, and on to the radio.

First you need to specify the name of a Tier 2 server. The current preferred way is to use one of these regional rotate addresses:

- noam.aprs2.net - for North America
- soam.aprs2.net - for South America
- euro.aprs2.net - for Europe and Africa
- asia.aprs2.net - for Asia
- aunz.aprs2.net - for Oceania

Each name has multiple addresses to achieve load balancing and resiliency. Visit <http://aprs2.net/> for the most recent information. You also need to specify your login name and passcode. For example:

```
IGSERVER noam.aprs2.net
IGLOGIN WB2OSZ-5 123456
```

Contact the author if you can't figure out how to generate a passcode for your ham radio call.

If you want to transmit information from the servers, you need to specify the radio channel and the via path for the packet header. Example:

```
IGTXVIA 0 WIDE1-1,WIDE2-1
```

You might want to apply a filter for what packets will be obtained from the server. Read about filters here: <http://www.aprs2.net/wiki/pmwiki.php/Main/FilterGuide> Example:

```
IGFILTER m/50
```

Finally, we don't want to flood the radio channel. The IGate function will limit the number of packets transmitted during 1 minute and 5 minute intervals. If a limit would be exceeded, the packet is dropped and warning is displayed in red.

```
IGTXLIMIT 6 10
```

## 7 Receive Decoding Performance and CPU Requirements

As explained in the User Guide, multiple decoders are available and it is possible to run them at the same time. They were tuned in different ways and differ by effectiveness and CPU power used.

Decoder	Packets decoded from WA8LMF test CD	Percent of CPU time required on Raspberry Pi.	Comment
A	965	23 - 30	
B	968	34 - 39	
C	971	45 - 50	
A & B & C	976	87 - 92	Not a good idea because there is no idle time left over. Data will be lost.
F	965	17 - 25	Only for 1200 baud, 1200/2200 Hz, 44100 sample rate.  Default for Raspberry Pi.

You can pick one depending on the requirements of your particular situation with configuration options like this:

```
MODEM 1200 1200 2200 C
MODEM 1200 1200 2200 F
```

When building for the ARM processor (Raspberry Pi, Beaglebone, etc.), **decoder F is the default to minimize CPU load**. It uses considerably less CPU power with very little difference in decoding performance.



## 8 Troubleshooting

First check the audio gain on your input device. I've always found it necessary set it at the maximum or fairly high. In one case, with a new USB audio adapter, the initial microphone input gain was set to zero.

Different systems may have different applications for configuring the sound system. If using "alsamixer" follow this procedure:

- Press F6 to select the "sound card." Use up and down arrows and press Enter.
- Press F4 to set the Capture level. Use up arrow to set level to the max or fairly high.

Did you run apt-get and rpi-update to get the latest software and firmware? After many months of aggravation, it finally worked right after an update mid October 2013.

### 8.1 Before that time...

The Signalink USB worked OK but I couldn't get a cheap USB audio adapter to operate properly.

The same USB audio adapter worked fine on Microsoft Windows. It worked fine with Ubuntu Linux on a regular PC. It was a miserable failure on the Raspberry Pi.

Every 100 seconds, there was a debugging message similar to these in green:

```
Past 100 seconds, 3924900 audio samples, 0 errors.  
Past 100 seconds, 3977820 audio samples, 0 errors.  
Past 100 seconds, 3949155 audio samples, 0 errors.
```

It reveals that the audio input system was providing less than 4000000 samples during a period of 100 seconds. We expect this to be close to 4410000 for the 44.1 kHz sample rate. Instead we find it is about 10% lower than expected. With the sample rate that far off, or 10% of the audio samples getting lost somewhere, nothing gets decoded. If no signals are decoded, look for these messages for a clue.

The USB audio device was fine on Windows and Ubuntu Linux on a regular PC, so it was probably a software driver issue. After the most recent software/firmware update, it's now fine. The messages every 100 seconds show the expected number of audio samples for that time period.

If you can't copy any signals, make sure you have software/firmware no earlier than mid October 2013, crank up the audio input level, and then look for the debug messages every 100 seconds.

### 8.2 USB Hubs

Avoid putting a USB hub between the Raspberry Pi and the USB Audio adapter. I've received reports that exactly the same configuration works fine with the direct connection and a significant number of audio samples are lost when going through a hub. With direct connection this was observed:



Past 100 seconds, 4410000 audio samples, 0 errors.

With the hub in the middle, numbers like this were seen:

Past 100 seconds, 4275495 audio samples, 0 errors.

Past 100 seconds, 4279905 audio samples, 0 errors.

Some complain about these annoying messages but they provide valuable debugging information.

### 8.3 Use with AX25 kissattach

Sometimes kissattach has an issue with the Dire Wolf pseudo terminal. This shows up most often on Raspbian but sometimes occurs with other versions of Linux.

```
kissattach: Error setting line discipline: TIOCSETD: Device or resource busy
Are you sure you have enabled MKISS support in the kernel
or, if you made it a module, that the module is loaded?
```

Consult the **Linux AX25** section of the **User Guide** for more details and work-arounds.