Appalachian Trail Golden Packet APRS "Appliance"

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Introduction:

As an alternative to the Kenwood D7XX series, the Appalachian Trail Golden Packet team is exploring options as an alternative to the Kenwood Systems for supporting the AT Golden Packet event.

The intent is to allow others to construct working prototypes and confirm functionality, help measure actual performance, and provide operational feedback on the basic design.

We are assuming that the potential builder/user is:

- comfortable with the raspberry Pi
- knowledgeable in APRS
- Has a working knowledge of Raspian LINUX

I am confident that there are errors in this document. Please review and provide feedback so we can improve the document.

Functional Needs:

1. Beaconing
2. Digipeating using modern (WIDE1-1, WIDE2-X) routing
3. Tracking is desired
4. Support for messaging

There is concern about the quality of the packets produced and the complexity of establishing appropriate levels for the audio/rf train, and so initial efforts will be focused on interfacing through the 6 pin mini-din connector which is an EU standard and provides moderately stable sound levels between systems.

Initial meta-design:
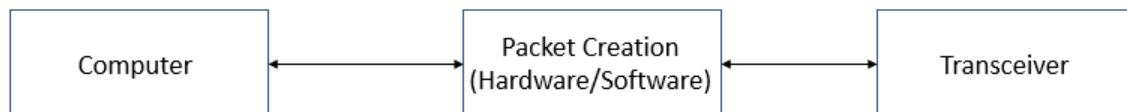
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For the Mark 1 prototype we will use:

- Raspberry Pi 3B+
- Direwolf software TNC: tested version 1.6
- KitsForHams DINAH USB sound card
- Transceiver: FT817ND used for initial testing by Don Rolph/AB1PH

We also include a gps puck to provide GPS inputs for tracking purposes.

Initial configuration/connectivity:

The Raspian OS image is designed to run on a Raspberry PI 3B+ although the software has been demonstrated to work on a Pi ZeroW, albeit with a recompile of Direwolf. Pi ZeroW has demonstrated sensitivity to RFI and limited USB services, so the initial approach will be to establish the environment on a Raspberry Pi 3B+, and then migrate to PI ZeroW.

For initial configuration the PI is configured as a hotspot. The WIFI hotspot connectivity is:

- SSID: ATGP
- Password: ChangeOnInstall

The initial login to the system is:

User: pi
Password: ChangeOnInstall

One can:

- connect to the graphical user interface with an HDMI monitor/cable and USB keyboard/mouse

- connect over SSH to tcp/ip address: 10.0.0.5

For simplicity during the development process, a second WIFI USB dongle may be added which can be configured to connect to the local area network.

Parts list:

- Raspberry Pi 3B+ with case and power supply:
- https://www.amazon.com/Vilros-Raspberry-Clear-Power-Supply/dp/B01D92SSX6/
- KitsForHams DINAH sound card: https://kits4hams.com/dinah
- GPS puck: https://www.amazon.com/gp/product/B073P3Y48Q/
- WIFI USB fob: you need a fob which is plug and play with Raspberry PI such as: https://www.amazon.com/dp/B06Y2HKT75
- Ferrite beads for all connecting wires: https://www.amazon.com/gp/product/B07SKK9PGD/

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- 16 GB SSD card: https://www.amazon.com/gp/product/B089DPCJS1/

You will also need:

- a transceiver supporting the 6 pin mini-din data connection
- PC running Windows with APRSIS32 installed or an iPhone running aprs.fi for client connections

There is a preliminary Raspbian OS image available which has all required software installed and mostly configured or you can build your own image using the instructions for the OS image build.

Construction notes:

- *you will need to cut JP3 to disable the COS (carrier on sense) line in DINAH*

Use perhaps the Raspberry Pi imager to write the image to the SSD card:

- https://www.raspberrypi.com/software/

Software configuration:

On first login to the ATGP APRS Appliance (and before plugging the transceiver into the DINAH sound card):

1. Change the password on the pi account from ChangeOnInstall
2. As root in /root change MYCALL (presently NOCALL-XXX) to your call sign with SSID in the direwolf.conf file
3. Modify /etc/wpa_supplicant/wpa_supplicant.conf to connect to the local WIFI

This should be the total amount of configuration if you are using a GPS puck. If you are using a static position, then look into the Direwolf documentation for the configuration approach: example lines are commented out in the direwolf.conf file. You will also need to comment out the GPSD statements.

Cabling:

- Plug the DINAH card into the Raspberry Pi 3B+ in the bottom outside USB port
- Plug the 6 pin mini-din cable into the mini-din jack on the transceiver and the 6 pin mini-din on the DINAH
- Plug the GPS puck into the bottom center USB port
- Plug the USB wifi fob into the top center USB port
- DO NOT plug in the transceiver until MYCALL NOCALL-XXX in direwolf.conf is changed to your call sign and SSID

First loging:

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- After boot-up, connect to Raspberry Pi
  - To 10.0.0.5
  - User id: pi
  - Initial password: ChangeOnInstall
- sudo su -
- in direwolf.conf change MYCALL NOCALL-XX to MYCALL <callsing-SSID>
- in /etc/wpa_supplicant directory edit wpa_supplicant.conf to provide the WIFI-SSID of the established WIFI network and the password for the network
- reboot
- connect to Raspberry PI at 10.0.0.5
- sudo su –
- now enter hostname -I and see what the established network ip address is for the Raspberry PI
  -    example output: Example output: 10.0.0.5 192.168.6.53 where 10.0.0.5 is the hotspot and in this case 192.168.6.53 is the established network address of the system

Using the System:

- After boot-up, connect to Raspberry Pi
  - Say to 10.0.0.5 or the established network ip address
  - User id: pi
  - Initial password: ChangeOnInstall
- sudo su -
- screen -D -r direwolf (Dire Wolf is autostarted in crotab at boot time)

To connect Windows APRSIS32 to the System:

- assume connection to hotspot (local WIFI network)
- -Open APRSIS32
- Configure a new port:
  - SimplyKiss
  - tcp/ip
  - Ip address: 10.0.0.5 or established network ip address
  - Port 8001
  - Do not enable beaconing
  - Enable messaging
    Picture of Raspberry PI 3B+ based system

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Next Steps Mark 2 prototype:

One can reproduce the basic system using:

-        Raspberry PI Zero W or Pi Zero 2 W (either work and for this project are plug interchangeable. The PI Zero 2 W can be used at 9600 baud
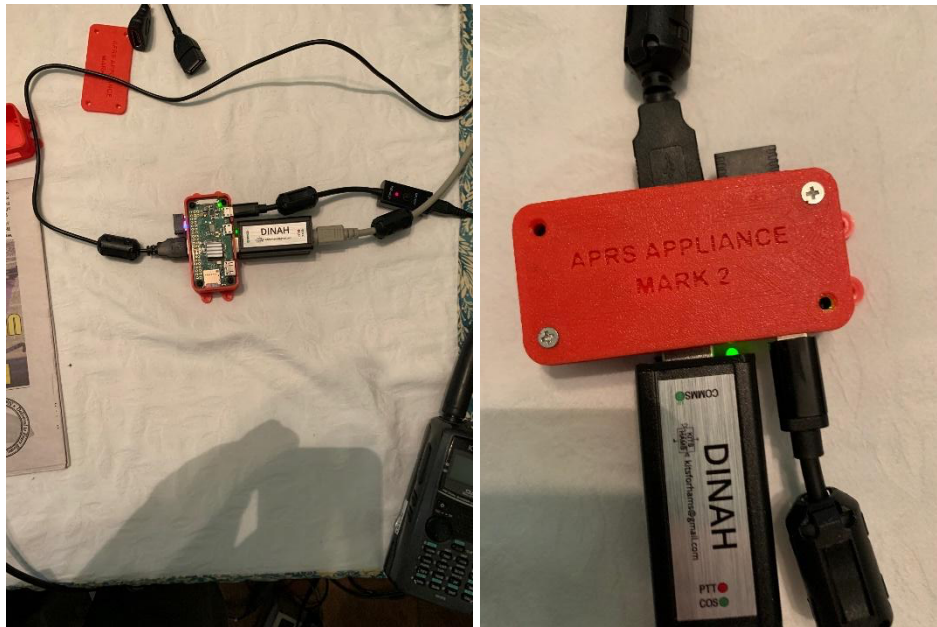
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-      USB hub perhaps:
-      https://www.amazon.com/gp/product/B01IT1TLFQ/

The resulting system looks like:

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And performs comparably to the Raspberry PI 3B+ based systems. One can 3D print a specific case for this design and the system looks like:

This has proved stable in testing but requires more effort on the builder than a Raspberry PI 3B+ system. The two systems behave essentially identically.