TNC-Pi

A TNC for the Raspberry Pi

What is TNC-Pi

- The TNC-Pi is a Terminal Node Controller for the Raspberry Pi, based on the KISS protocol.
  - We'll dive into this definition shortly.
  - The TNC-Pi is available at tnc-x.com.
    - The TNC-X and TNC-Black are also available.
  - $40.00 for the kit, $65.00 assembled and tested.
  - Developed by John Hansen, W2FS
  - Introduced at the 2003 ARRL/TAPR Digital Communications Conference

Terminal Node Controller

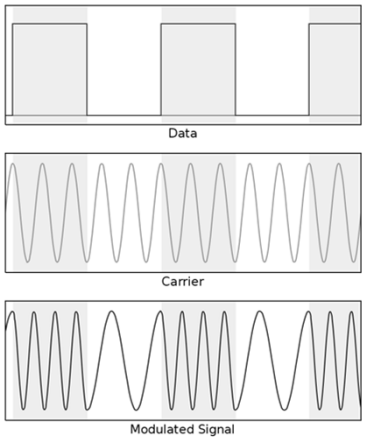
- Often abbreviated TNC.
- A terminal node controller consists of:
  - Modem – Converts a packet of data to audio frequencies and back again.
  - Processor – Accepts commands and data from the attached terminal, computer or Raspberry PI and controls the radio.
- The connection from the terminal, computer, or Raspberry Pi is usually RS-232. The TNC-Pi can communicate using I2C.
- The audio modulation is “always” AFSK.
- The packet protocol is “always” AX.25.

Audio Frequency-Shift Keying

- Abbreviated to AFSK.
- Binary data is represented with two frequencies.
- Seemingly by convention, the Bell 202 standard defines those frequencies:
  - 1200 Hz and 2200 Hz to represent bits.
- These frequencies are transmitted over an AM or FM frequency.
  - For example, FM at 144.390 MHz is usually used by Automatic Packet Reporting System

Audio Frequency-Shift Keying

- Sample
  - http://commons.wikimedia.org/w/index.php?title=File%3AAFSK_1200_baud.ogg
- Visual
  - http://en.wikipedia.org/wiki/Frequency-shift_keying#mediaviewer/File:Fsk.svg



AX.25

- Designed for amateur radio.
- Based on the X.25 ITU-T standard, used for packet switched wide area networks.
- Along with control information and data, a packet contains the source address and destination address, call signs.
  - E.g., KF5IDY-1 is encoded as KF5IDY1.

KISS protocol

- Designed by Mike Chepponis (K3MC) and Phil Karn (KA9Q).
- Provides a simple protocol to control a TNC.
- Assumes a host device (computer) powerful enough to build the AX.25 frames.
- KISS has become the standard protocol for computer control of a TNC.

TNC-Pi Assembly

- Easy to assemble.
- Only a couple tricky steps.
  - Differentiating the transistor and regulator.
  - Differentiating the crystals.
- Requires a cable.
  - DB-9 to the TNC-Pi, optionally solder directly to the TNC-Pi.
  - Audio and push-to-talk to the radio.
    - Can be to the data port, such as on the Yaesu FT-817ND.
    - Can be to the audio jack, such as on the Yaesu VX-7R

TNC-Pi Software Installation

- “sudo apt-get update”
- “sudo apt-get upgrade”
- Disable the console on the serial port by removing references to /dev/ttyAMA0.
  - /boot/cmdline.txt
  - /etc/inittab
- “sudo apt-get install ax25-tools”
- “sudo apt-get install ax25-apps”

TNC-Pi Software Installation

- Edit /etc/ax25/axports
  - “1 KF5IDY-1 19200 236 2 TNC-Pi 1”
  - Remove blank lines

TNC-Pi Demonstration

- "sudo kissattach /dev/ttyAMA0 1 10.1.1.1"
  - Should replace 10.1.1.1 with your assigned packet radio IP address, if you have one.
- "sudo axlisten -a"

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- "axcall 1 KF5IDY-2"

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- "sudo apt-get install xastir"
- Run Xastir from the GUI.

TNC-Pi Lab

- Using "TNC-Pi Assembly Instructions & Operating Tips" from http://www.tnc-x.com/TNCPi.pdf (start on page 12)
- Update the Raspberry Pi software
- Disable the console on /dev/ttyAMA0
- Install and use the AX.25 software
- Install and use Xastir

Resources

- http://tnc-x.com/ - The web site for the TNC-X and related products, including the TNC-Pi.
- https://www.tapr.org/pr_intro.html - An early description of packet radio, including the role of the terminal node controller.
- http://www.symek.com/g/pacmod.html - A nice summary of AFSK modulation.
- http://commons.wikimedia.org/w/index.php?title=File%3AAFSK_1200_baud.ogg – A very short recording of 1200 baud AFSK.
- https://www.tapr.org/pub_ax25.html - The TAPR page describing the AX.25 protocol.

Resources

- http://www.ax25.net/kiss.aspx - A description of the KISS protocol.
- http://www.tnc-x.com/TNCPi.pdf - TNC-Pi assembly guide and manual.