Packet Radio

A blathering by Mark Phillips, G7LTT

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Who am I?

Mark Phillips, G7LTT/NI2O

Radio Ham licence since February 1992

IT Engineer since 1988 (HM Royal Signals, Cray, DEC, BT, JPMC)

IT Director since 2002

Operator of GB7TVG - UK's first Internet connected Packet BBS

"Mr KM4WSK"

What we'll cover

What is “Packet”?

What is AX.25?

Why Packet?

Why not other modes?

“But, the Internet ….”

How do I “do” Packet?

Speed. More speed and applications

Packet near me / Shameless plug for 44Net

Live Demo

What is “Packet”

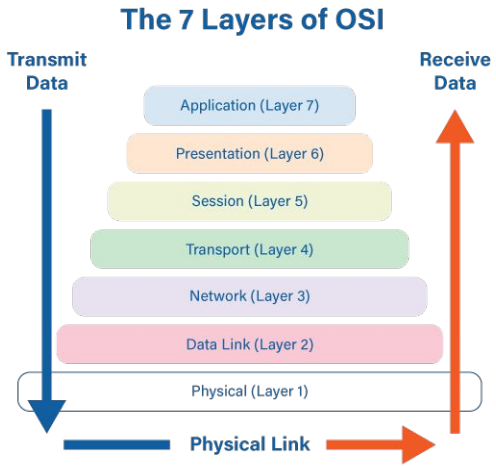
Generic term for packetized data delivery. A method of exchanging data. Commonly used for email and small file transfer.

Data broken down into “packets” or frames of information.

Most common transport method is AX.25 (a variant of X.25).

Typical data rate 1200bd or about 768bps *.

Sits at layer 2 in the OSI model.



What is Packet #2

Functions similar to Ethernet raw MAC transport.

Requires a modem to generate tones using the (A)FSK Bell 202 Standard *.

Bell 202 uses a tone of 1200 hz for mark or “0” and 2200 hz for space or “1”.

A frame is sent to the radio as a train of tones representing binary 1’s and 0’s.

Most commonly used today for APRS (a Layer 7 “application”).

What is AX.25?

1980’s modification of 1970’s ITU Standard X.25 packet switching data exchange protocol used in wireline applications . Used by ATM’s, Compuserv, Mainframes, etc. I built the first X.25 over ISDN ‘D’ channel network back in the late ‘80’s for credit card clearing.

Small 256 byte payload (Ethernet has 1500 bytes).

Concurrent connection abilities. Unencrypted.

Functions similar to raw ethernet. Substitutes callsigns for MAC addresses:

G7LTT = 47:37:4C:54:54 NI20 = 4E:49:32:4F KM4WSK = 4B:4D:34:57:53:4B

My laptop = 70:CD:0D:94:22:CC Your laptop = 48:41:43:4B:4D:45

What is AX.25? #2

Flag 01111110	Destination Address	Source Address	Optional Digipeaters	Control & Protocol	Information	Frame Check (CRC)	Flag 01111110
1 byte	7 bytes	7 bytes	0 – 56 bytes	1 – 3 bytes	0 – 256 (or more) bytes	2 bytes	1 byte

Ethernet (802.3) Frame Format

7 bytes	1 byte	6 bytes	6 bytes	2 bytes	42 to 1500 bytes	4 bytes	12 bytes
Preamble	Start of Frame Delimiter	**Destination MAC Address**	**Source MAC Address**	Type	Data (payload)	CRC	Inter-frame gap

For TCP/IP communications, the payload for a frame is a packet

Why Packet?

Common, established, understood method of data transfer.

Very low entry costs.

Modest HF/V/UHF hardware requirements.

Published ITU standard. No licensing issues (but not “open”).

Transparency, Error Correction and Automatic Control.

Easy to do in a shelter situation. Makes passing that list of clients faster/secure.

“Set-n-forget”.

Why not other modes?

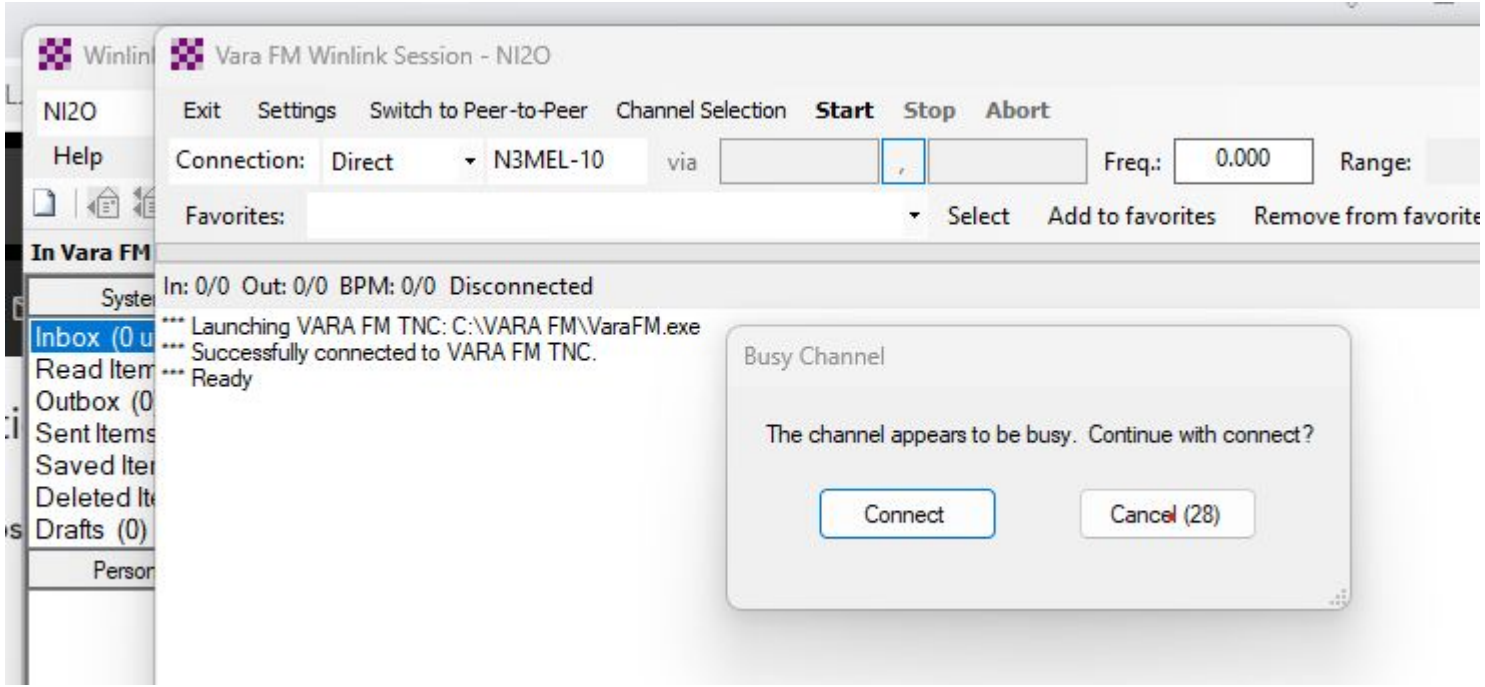
Much confusion about “modes”. EG WinLink is not a “mode” but an application.

Most “digital modes” are simply an exchange of QSO details.

Other modes have little to no handshaking. They rely on a simple one-to-one transfer of (error ladden?) information.

Concurrent usage and error correction are a must. No other operating mode allows this.

AX.25 is not the only protocol that can support packetized data. Others include FX.25, IL2P, PacTOR and even raw Ethernet. AX.25 is the most common as that’s what was easiest at the time.


Vara FM Winlink Session - NI2O
NI2O
Help
Exit
Settings
Switch to Peer-to-Peer
Channel Selection
Start
Stop
Abort
Connection:
Direct
N3MEL-10
via
Freq.:
0.000
Range:
Favorites:
Select
Add to favorites
In Vara FM
In: 0/0 Out: 0/0 BPM: 0/0 Disconnected
*** Launching VARA FM TNC: C:\VARA FM\VaraFM.exe
*** Successfully connected to VARA FM TNC.
*** Ready
Inbox (0
Read Item
Outbox (0
Sent Items
Saved Iter
Deleted It
Drafts (0)
Busy Channel
The channel appears to be busy. Continue with connect?
Connect
Cancel (28)

'Nuff said!!

“But, the Internet …..”

Requires access fees.

Relies on wired infrastructure.

Is “local” in its presentation. No power, no Internet.

Struggles with low speed data links.

Is full of SPAM/UCE/Junk/porn that may be contrary to your license conditions.

May not be allowed in your jurisdiction.

How do I “do” Packet?

User access requires a computer (PC/Mac/RPi/whatever), Modem or Terminal Node Controller (TNC), software, usual radio hardware. Stay away from APRS “TNC” modems.

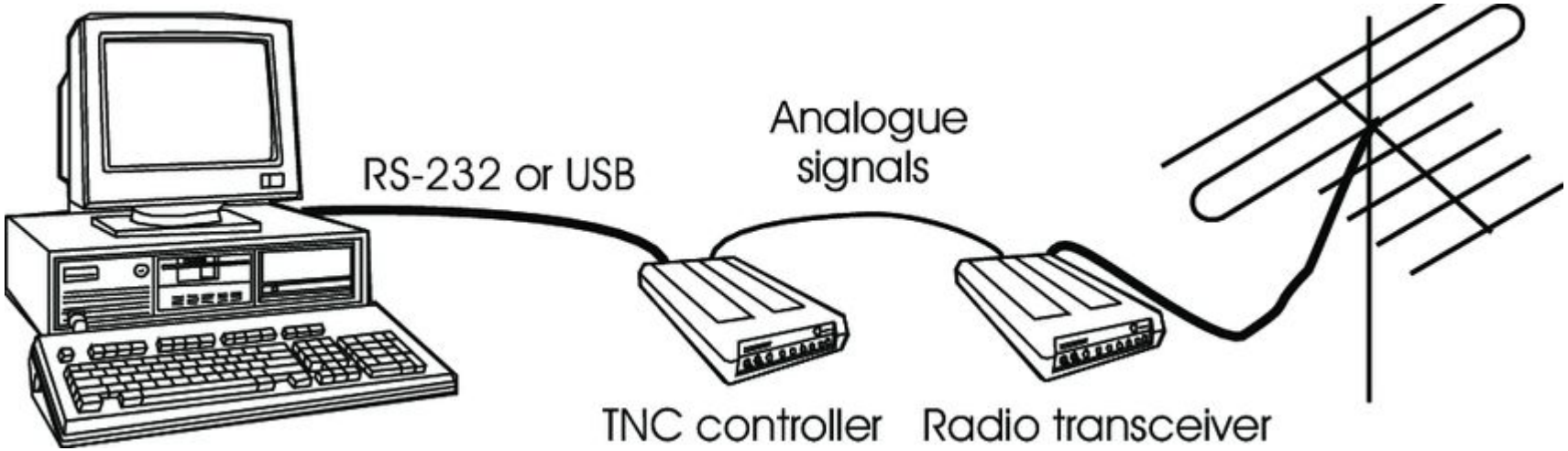
Find you local packet frequency.

Connect!

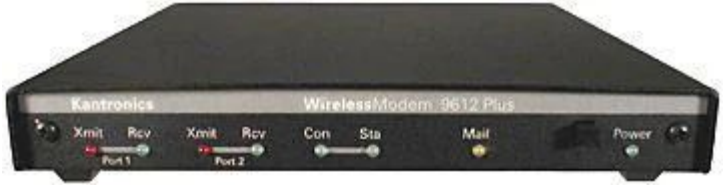
Play a game of chess, send an email, get the latest weather report, kill a few Kobolds, locate the hot DX, know where your towel is.

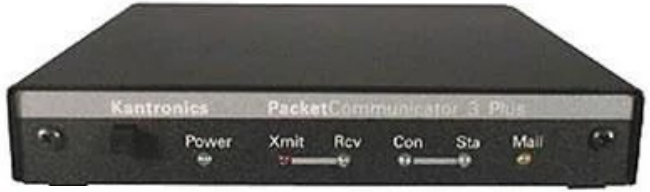
1993 is calling. They want their TNC back

A “vintage” packet setup




PicoPacket
RS-232-1
RADIO


Kantronics
WirelessModem 9612 Plus
Xmit
Rcv
Xmit
Rcv
Con
Sta
Mail
Power
Port 1
Port 2


Kantronics
PacketCommunicator 3 Plus
Power
Xmit
Rcv
Con
Sta
Mail


Timewave
PK-12
XMT
DCD
CON
STA
MAIL
POWER


PK-96
XMT
DCD
CON
STA
MAIL
POWER

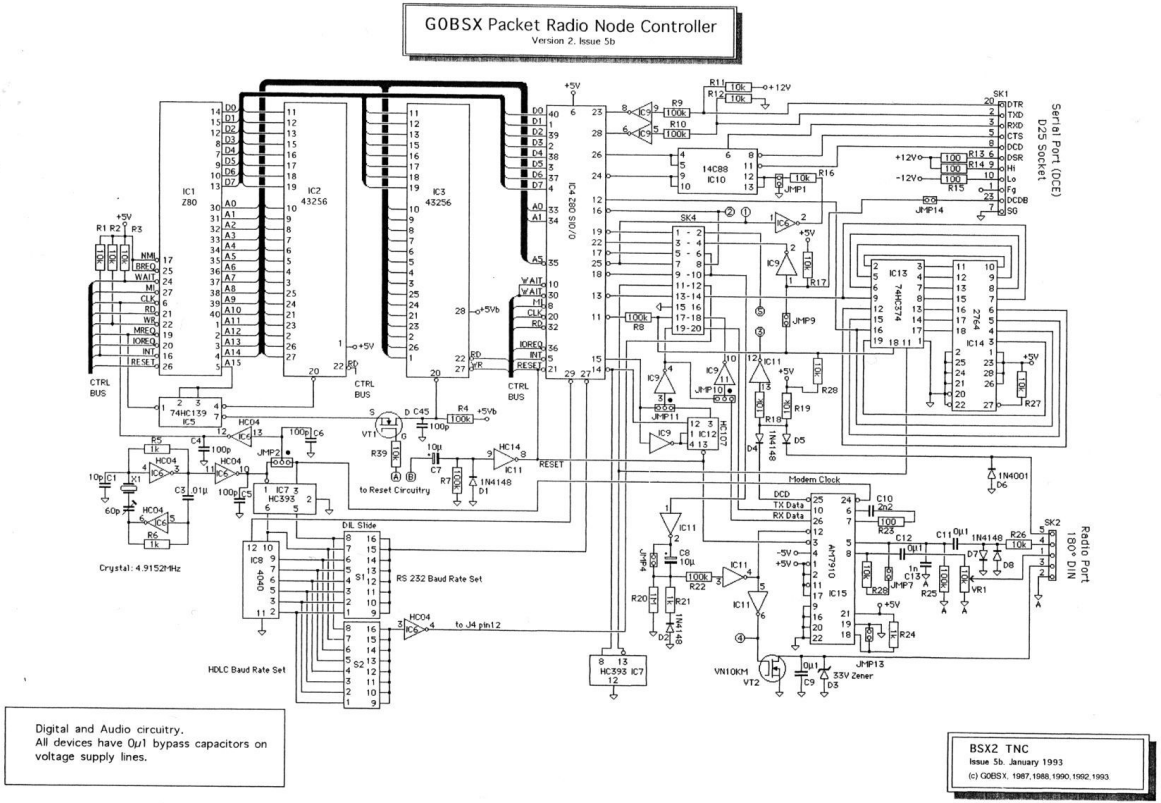

PacComm
TINY-2
DCD
PTT
STA
CON
PWR
ON/OFF


MFJ TNC 2 PACKET RADIO
MODEL MFJ-1274
TUNE
INDICATOR
DCD
PTT
STA
CON
PWR

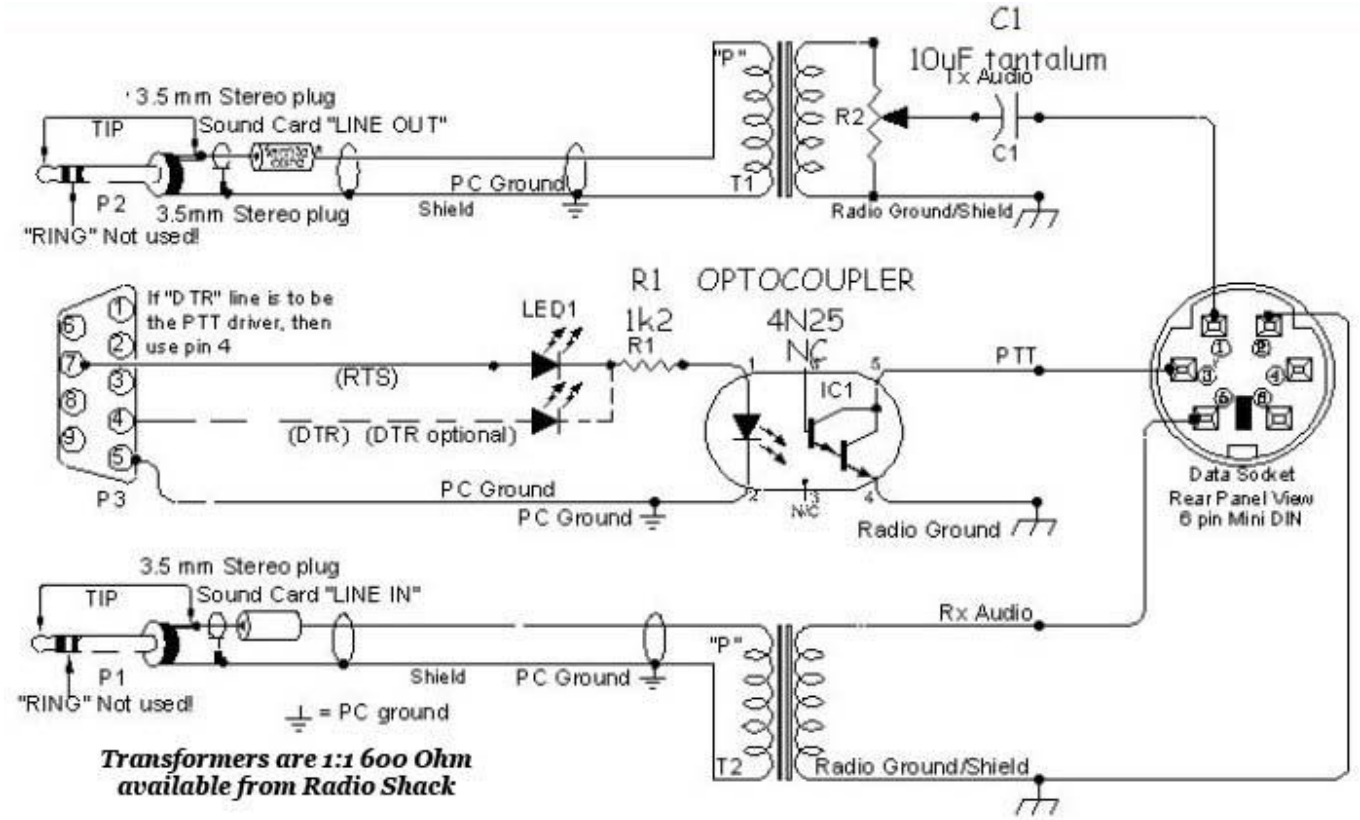

Advanced Electronic Applications, Inc.
Model PK-232MBX
THRESHOLD
M
S
DCD
TUNE
PAKRATT 232
STATUS
MODE
RADIO 1
RADIO 2
OFF
ON


Model PK-88
CONV
TRANS
CMD
SEND
DCD
STA
CON
MULT
PWR
Advanced Electronic Applications, Inc.
Packet Controller

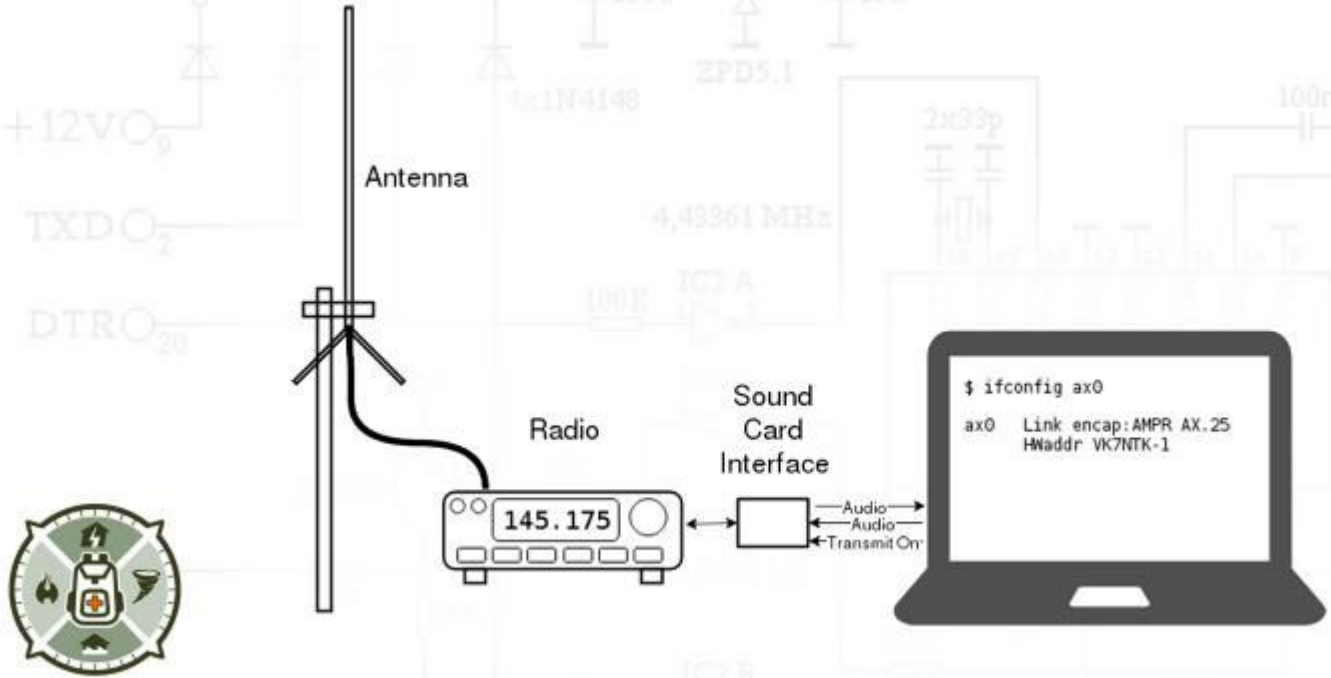
Common BBS setup



They used to be very complicated

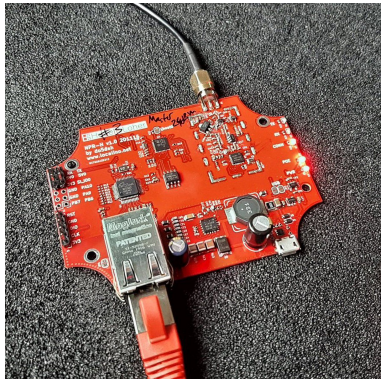


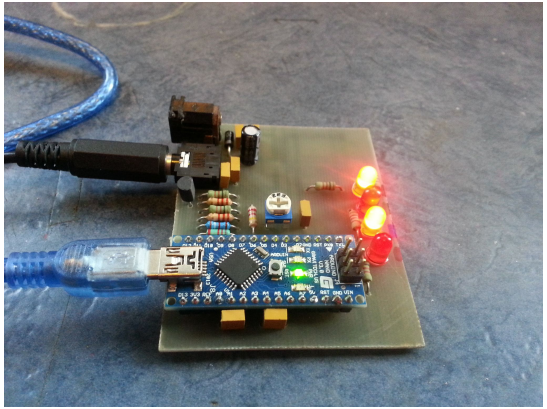
Today, not so much

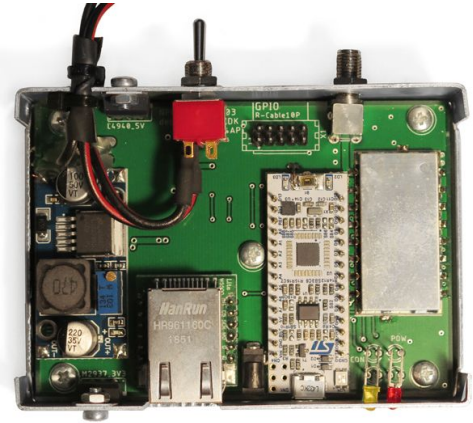


Modern packet setup

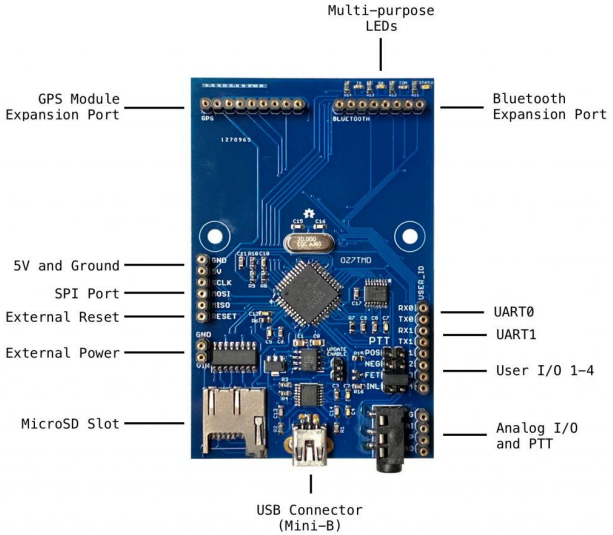

XILINX
XC5202-TM
PC84AK39729
A2004931A






GPIO
HanRun


PTT OUT
TinyTrak
MSBG


Multi-purpose LEDs
GPS Module Expansion Port
Bluetooth Expansion Port
5V and Ground
SPI Port
External Reset
External Power
MicroSD Slot
UART0
UART1
User I/O 1-4
Analog I/O and PTT
USB Connector (Mini-B)

Look what I built

Speed, more speed and applications

HF still at 300bd due to (A)FSK bandwidth constraints.

Common V/UHF data rate is 1200bd (1K2bd) AFSK but no need to be this slow.

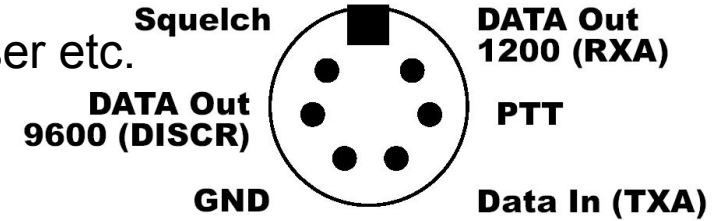
9600bd (9K6bd) is very easy with modern rigs.

56Kbd* also very cheap and fastest we can go under current FCC regulations.

Treat your setup like a network connection. Create IP layer.

Use common IP based tools such as email, browser etc.

Connect to the 44Net!



Packet near me

Delaware Packet Network (DEPN) http://www.depn.net/delaware-packet-stations/

EastNet http://www.ww2bsa.org/eastnetpackethome.htm

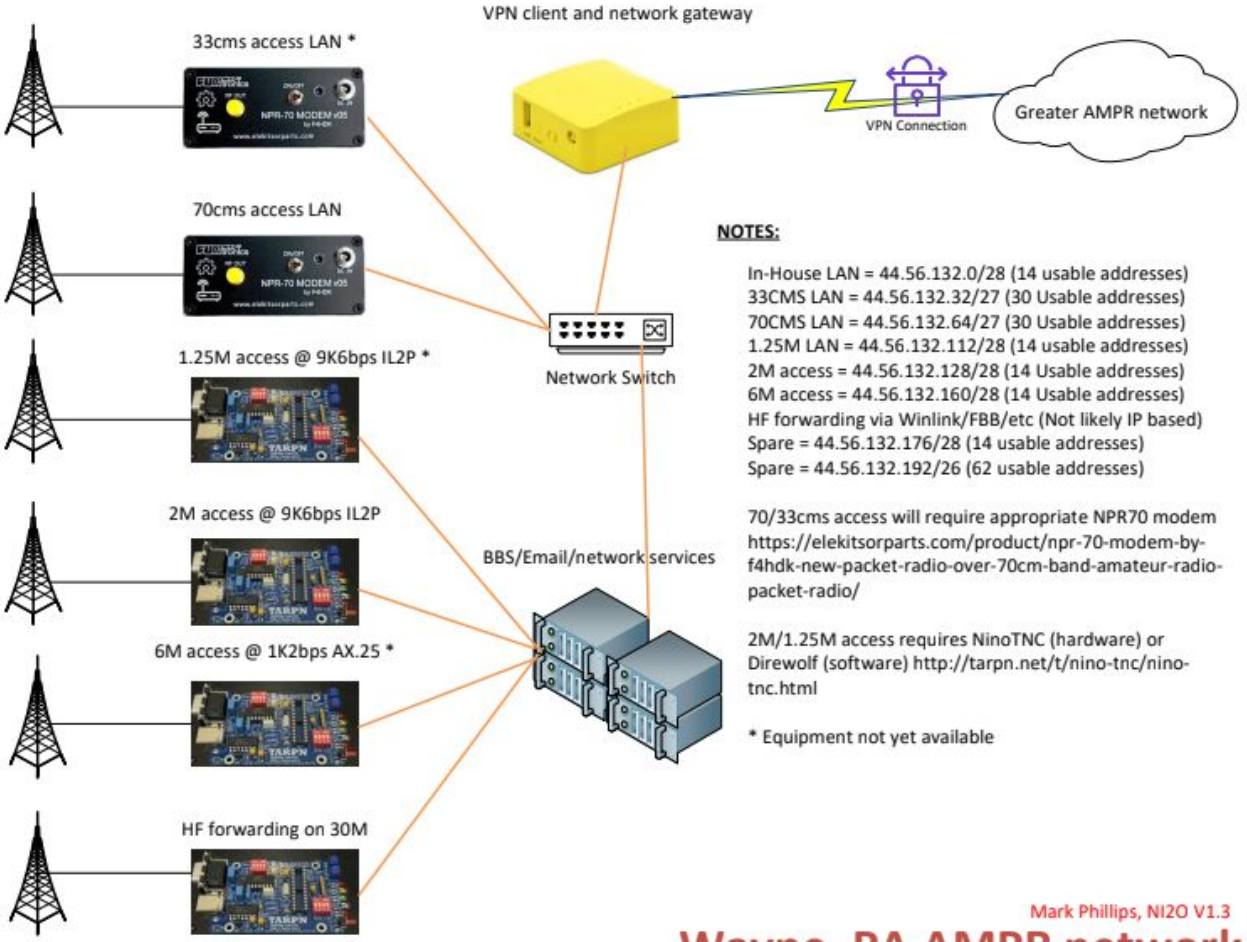
HamGate Project http://hamgatepa.ampr.org

ARDC (was AMPR) https://www.ardc.net/

Join the 44Net!! Join the 44Net!! Join the 44Net!! Join the 44Net!!

Request AMPR IP allocation https://portal.ampr.org/

Tune your radio to 144.990, 145.010, 145.030, 145.050, 145.070, 145.090



NOTES:

In-House LAN = 44.56.132.0/28 (14 usable addresses)
33CMS LAN = 44.56.132.32/27 (30 Usable addresses)
70CMS LAN = 44.56.132.64/27 (30 Usable addresses)
1.25M LAN = 44.56.132.112/28 (14 usable addresses)
2M access = 44.56.132.128/28 (14 Usable addresses)
6M access = 44.56.132.160/28 (14 Usable addresses)
HF forwarding via Winlink/FBB/etc (Not likely IP based)
Spare = 44.56.132.176/28 (14 usable addresses)
Spare = 44.56.132.192/26 (62 usable addresses)

70/33cms access will require appropriate NPR70 modem https://elekitsorparts.com/product/npr-70-modem-by-f4hdk-new-packet-radio-over-70cm-band-amateur-radio-packet-radio/

2M/1.25M access requires NinoTNC (hardware) or Direwolf (software) http://tarpn.net/t/nino-tnc/nino-tnc.html

* Equipment not yet available

Mark Phillips, NI2O V1.3

Wayne, PA AMPR network

Live demonstration