Digital Voice Strategies

Have Fun With Digital Voice on VHF/UHF

Why Digital?

- Emerging Technology (in Ham Radio)
- Hams Building on the New Technologies
  - New VOIP Networks
- Combining RF and Networking
- Easily Converse with Hams Around the World
- Lots of Activity
- It can be interesting and fun to fiddle with hardware and software
  -

Terminology

- Room (Wires-X), Reflector (D-Star), Talk Group (DMR)
  - These are essentially the same thing. Similar to a repeater, but done on network equipment.
  - A gathering point where “one to many” communication can take place over large distances.
  - Repeaters are often linked to these entities
- Hotspot
  - A small device that includes a radio, digital voice modem, and a microcomputer to transfer voice signals from a ham radio to the internet and back.
- Pi-Star
  - Open source Software designed by Andy Taylor (MW0MWZ) to run on hotspots
  - WPSD is another version that was forked from Pi-Star (by W0CHP)
  - Openspot is another hotspot designed by HG1MA and HA2NON
- DMR - Digital Mobile Radio
  - Developed for commercial use by Motorola
  - Hams have adapted it for ham use
  - Lots of infrastructure worldwide. Repeaters, networks, Talk Groups

Terminology (con’t)

- Wires-X - Yaesu’s proprietary network for System Fusion. It is very capable and well designed, fairly easy to use.
- Cross Mode - Two different protocols communicating
- Transcode - the hardware or software that enables cross mode to work
- Brandmeister - the most popular DMR network out there. There are quite a few others, System X, TGIF, DMR+, AMCOMM.
- YSF Reflectors - A decentralized network for System Fusion radios. Not Yaesu controlled, and open source
- M17 - A new protocol designed by hams. Open Source

RF Only

- An RF only strategy is like traditional FM. Need to be in range of other simplex station or repeater.
- Need repeater that operates same digital protocol (DStar, Fusion C4FM, DMR, P25 etc.)
- Not a lot of digital repeaters in our area. There are a few of each. Repeaters may or may not have connections to digital networks.
- Other areas of the country and world have substantial digital presence
- System Fusion makes most sense IMHO for this strategy in our area

Why Fusion?

XARC has a Fusion capable repeater with Wires-X enabled (its connected to a network) via node running at K2AS QTH

Easiest to learn and use

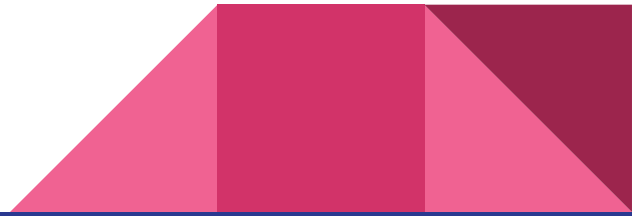
Fusion radio can be used as a PDN (Personal Digital Node) which would give direct access to Wires-X network (and our repeater) via your home internet and a PC (Windows only)

The bad news, options for radios are limited to Yaesu, and they have had parts availability issues. Several models discontinued, but I expect new ones coming soon.

Hotspots

More versatile than just RF

- Connect to multiple networks
- Cross mode - converse with other digital modes
- A bit more cost



What is Required?

- Home Wi-Fi and Internet Connectivity
- Digital Transceiver - DMR (Cheapest), Fusion (easiest)
- Hotspot
- Device with WWW Browser on Home Network
- MicroSD Card and Reader to Load SW on to
  - Some limited Linux Knowledge is helpful
  - Usually not necessary if you can follow instructions
  - Not needed with OpenSpot

Cheapest Route

- Chinese DMR HT w/ 440 MHz Band
  - Baofeng DM-1701 $72 - $90
  - TYT MD-380 $100
  - Radioddity GD-73A $75
- Build a Digital Hotspot
  - Raspberry Pi Zero 2W - $21
  - MMDVM (Multi Mode Digital Voice Modem) - $42
  - WPSD Hotspot Software or Pi-Star Software - $0.00 - Free
  - A little bit of time and effort getting all together
- Approx. Cost - $153.00 - if all new

(NOTE: This is Cheapest Route - the most popular DMR HT the Anytone UV878II Plus is about $320)

How Does it Work?

- Get a digital ID at radioid.net
- Set HT Up to Operate DMR on a Choosen Simplex Frequency
- MMDVM Board Mounts on Raspberry Pi Zero 2W
- MMDVM Receives and Transmits on 440 MHz at Very Low Power
- WPSD Software is Loaded on to Raspberry Pi Zero 2W (or iV, V)
- SW and Raspberry Pi handles Wi-Fi network connection
- SW and Radio Determine What Modes, Rooms, Reflectors, Talk Groups, Repeaters You Can Connect To
- Connect to One of the Above, and listen and Talk Away

Bumps in the Road

- Doesn’t come with instructions, but many online resources available including videos
- DMR has some of the Most Inexpensive HTs, but is probably a bit more difficult to learn the ins and outs
- Code Plug - Essentially Radio Programing Software for DMR.
  - I have used some. Really not that bad.
- Terminology - DMR, Fusion, D-Star have different terminology. Can be confusing.
- Cross Mode-ing - DMR to Fusion, or Fusion to DMR. Easily done with Pi-Star and WPSD Software. Some rooms, reflectors, etc also automatically cross mode.
- Becoming more and more prevalent

Fusion with a Hotspot

- Yes, It Can Be Done
- YSF Network for Fusion radios
- Or cross mode to any DMR network
- Wires-X can’t be accessed directly
  - But often YSF is bridged to Wires-X
  - Most popular USA Wires-X room are
  - W2XRX repeater is bridged to YSF
- But Wires-X can be accessed with a Fusion radio as a PDN node.

Could I Talk on Our Repeater?

- With RF, only with Fusion
- With DMR , yes in Digital Mode using a hotspot. Digital Mode is now used more than FM on our machine.
- K2AS has our Repeater Bridged to our Wires-X Room, Which can be Accessed via a Hotspot
- K2AS has a XLX Reflector running in the cloud, which will transcode DMR to Fusion and vice versa.

Could I Use FM and Hotspot and Connect to Our Repeater?

- Short answer, no. Most Hotspots are for Digital Voice.
- Dozens of repeaters in the area are already capable of various analog linking schemes.
- Clearnode makes a hotspot that goes from FM to digital, but costs $355 and I’m not sure how well it works.

What About Mobile?

- It can be done
- OpenSpot 4 is battery powered with Wi-Fi
- MMDVM can be built to run on batteries
- A bit of a project with either, OpenSpot easier.
  - Both would need phone used as cellular hotspot
  - W2NED has done this I believe

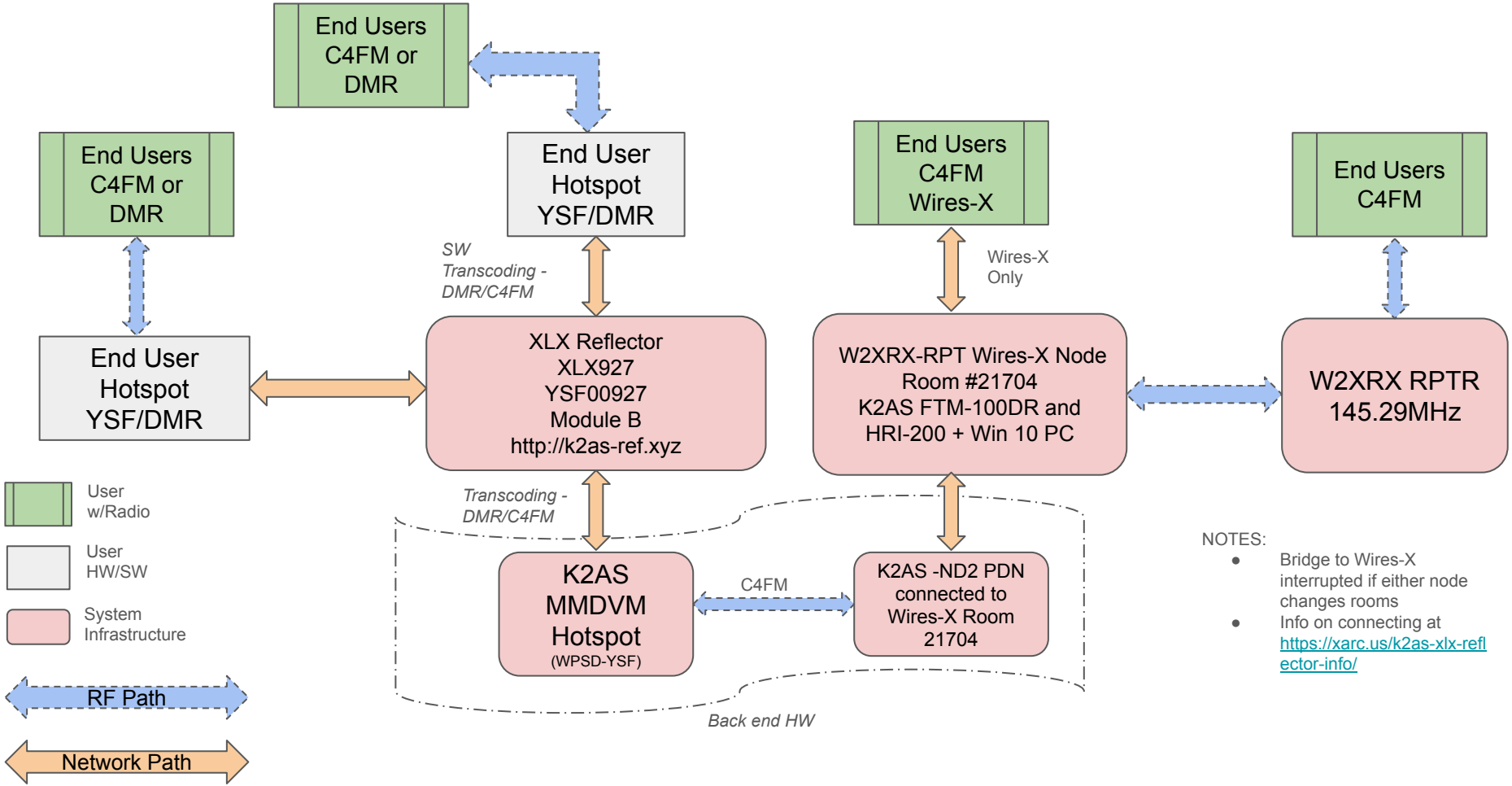
DStar

- Oldest protocol
- Designed by hams for hams
- Not quite as good audio quality, but totally usable
- Icom and Kenwood make equipment
- Usually not that cheap
- Cross Mode hurdles, usually requires special hardware
- Unless you have friends using it, have a specific repeater to use with it, or some DStar reflectors you want to access, just prefer Icom or Kenwood, I would not advise as first choice.

Pricier Digital Voice Hardware

Hotspots

- OpenSpot 4 Pro
  - A hardware and software solution, not open source
  - Around $250-$280
  - Transcodes D-Star and all other digital protocols using Hardware
  - Easiest to get going and use
- OpenSpot 4
  - Around $190-$230
  - Transcodes using SW, but not D-Star
- Bridgecom Skybridge
  - $425 for Hotspot Only
  - Customer service, resources
- ZumSpot
  - $175 - $250


End Users C4FM or DMR
End Users C4FM or DMR
End User Hotspot YSF/DMR
End Users C4FM Wires-X
End Users C4FM
SW Transcoding - DMR/C4FM
Wires-X Only
End User Hotspot YSF/DMR
XLX Reflector XLX927 YSF00927 Module B http://k2as-ref.xyz
W2XRX-RPT Wires-X Node Room #21704 K2AS FTM-100DR and HRI-200 + Win 10 PC
W2XRX RPTR 145.29MHz
Transcoding - DMR/C4FM
K2AS MMDVM Hotspot (WPSD-YSF)
C4FM
K2AS -ND2 PDN connected to Wires-X Room 21704
Back end HW
User w/Radio
User HW/SW
System Infrastructure
RF Path
Network Path
NOTES:
Bridge to Wires-X interrupted if either node changes rooms
Info on connecting at https://xarc.us/k2as-xlx-reflector-info/

Final Thoughts

- Digital Voice continues to emerge
- Hams have figured out how to bridge the protocol divide
- Less important what digital mode to use
- Challenging, but can be another fun way to experience ham radio
- Try something new
- Just pick one and get started
- Club Elmers - KA1CNF Steve, Ned W2NED, Brian K2AS