

Digital Voice & D-STAR



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Topics



- Why Digital Voice? Why D-STAR?
- My Favorite D-STAR Extensions
- What your W6CX D-STAR Repeater Can Do

Why Digital Voice



- Bandwidth
 - FCC is moving other services to narrow band
 - Most DV modes use no more than 12.5 KHz
 - D-STAR uses 6.25 KHz
- Clear, quiet Audio
 - Digital audio does not include hiss or noise, even as signals weaken (though it can suffer multipath)
 - Digital just drops out entirely when signal too weak

Why Digital Voice?



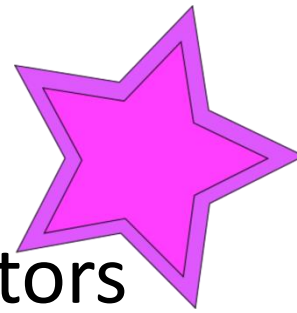
- Robust Networking
 - Ability to link repeaters together using Conference Bridges (Talkgroups, Reflectors)
 - Ability to link bridges to bridges
- Active 3rd Party Development
- Examples of good DV modes:
 - D-STAR, DMR, C4FM/Fusion, P25

What is D-STAR?



- **Digital Smart Technologies for Amateur Radio**
- A digital voice and data protocol standard
 - JARL facilitated multiple radio companies to develop an open DV/DD standard for Amateur Radio
 - ICOM built D-Star radios based on the standard
 - Kenwood announced a D-Star radio at Dayton
 - Others are under development
 - ICOM 9100 and 7100 support D-Star on HF bands
- Basically, D-STAR uses FM technology, but instead of analog voice, it converts that to a digital voice stream and uses GMSK modulation. Still, it's really just FM with very fast tones that sound like a rushing noise

Why D-STAR?



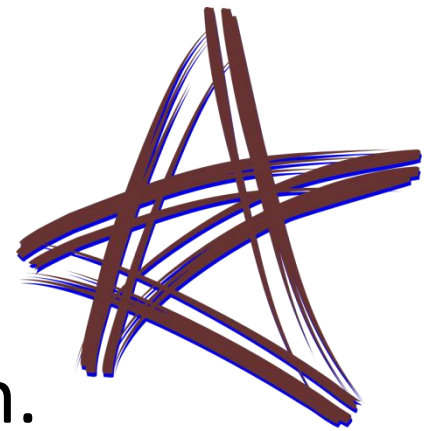
- D-STAR network links repeaters and reflectors around the world
- You can fully control where you link
- Callsigns & messages on radio screen
- Let the system find another ham (callsign)
- Homebrew Repeaters & Hotspots
- Can send small data files (spreadsheets, “emails” & forms for EmComm, etc.)

Why D-STAR?



- Mature but Very Active Development
- Robust Infrastructure
 - DPlus Linking to REF Reflectors (V2 released 2008)
 - DExtra Linking added some improvements
 - DCS Linking added more
 - DExtra now allows linking reflectors to reflectors
- Example:
 - D-STAR Round Table net Thursday Nights 8pm
 - On XRF002A, linked to XRF310A and XRF55A

My Own Experiences With D-STAR Add-ons



- Some may think it's a closed system.
- It's not. (REF linking, DVAPs, Dongles...)
- I got my 1st D-STAR radio in 2007.
- In 2010 I built a D-STAR Hotspot and things have never been the same.
- Here are some of my favorite devices and projects.

My Favorite D-STAR Extensions

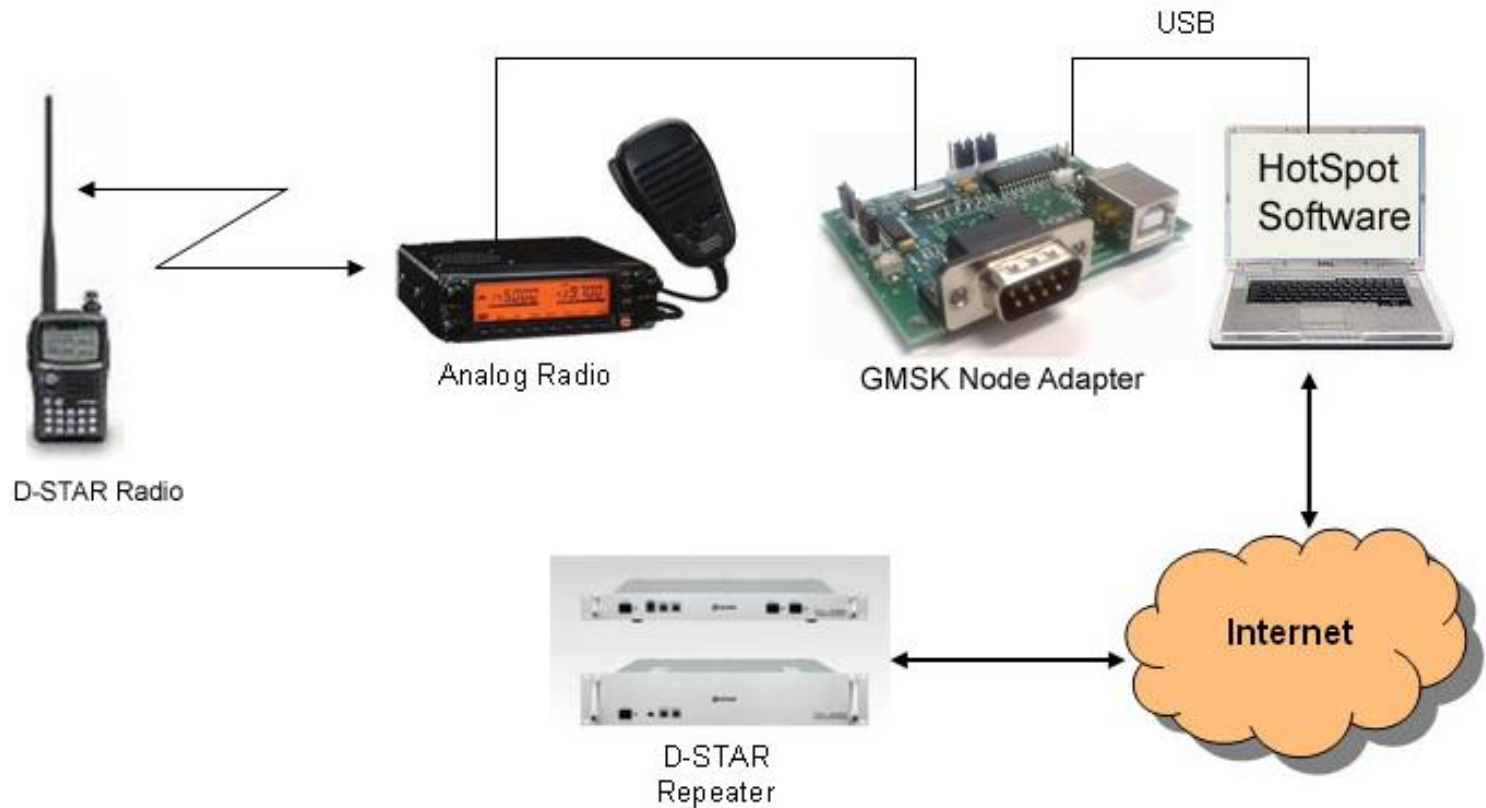


D-STAR QSOs with an AMBE “Dongle”

Software links to Reflectors over Internet,
talk using computer’s Speaker & Mike

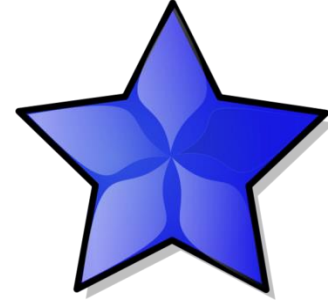
- **DV Dongle** and **DV3K** – Internet Labs created this category. I’ve had lots of fun w/DV Dongle
- **ThumbDV** from NW Digital Radio – works great & excellent support.
- **Star*DV** – includes onboard codec, just plug in Speaker/Mike. Soundcard on pc not needed.
- With the right software, some people adapt analog HF radios for D-STAR QSOs.

My Favorite D-STAR Extensions Hotspots



My Favorite D-STAR Extensions

Medium/Hi Power Hotspots



“Extends D-STAR Network to Your Neighborhood”
Needs D-STAR radio. Can build simplex Hotspot or full duplex repeater (including 220MHz)

GMSK Modems

Satoshi Yasuda invented them

Uses CMX589 IC for modem functions

- I have used modems from Satoshi, Mark Phillips and Fred Van Kempen. Favorite was Fred’s **HSA modem**.
- **Star*Board** (which my company sells; uses DUTCH*Star firmware)
- **DVMEGA GMSK Modem Shield** – fits on Arduino, which runs firmware written by Guus Van Dooren

My Favorite D-STAR Extensions

Medium/Hi Power Hotspots



“Extends D-STAR Network to Your Neighborhood”
Uses D-STAR radio to talk through analog radio to
D-STAR network of reflectors and repeaters

DSP Modems

Firmware and CPU handle modem functions

- **DVRPTR_V1** is my absolute favorite – firmware by Jan Alte, co-designer of this DSP Modem

Note: There are several other DSP Modems, including the DVRPTR_V2 and V3, but I have not had the time yet to try them.

My Favorite D-STAR Extensions

Low Power Hotspots

Nearby Coverage, Simpler & Easier



- **DVAP** by Internet Labs – again, Robin & Moe invented the category. Great hardware, software and support
- **DVMEGA** by Guus Van Dooren, is available in 2 forms:
 - DVMEGA RF Board Shield – this is what I have and I love it. Mine fits onto an Arduino Uno (tiny) and works flawlessly, either with Win PC or Linux (Pi)
 - DVMEGA RPI Radio has equivalent of Arduino processor on the board and fits on the Pi. Simple

My Favorite D-STAR Extensions



Multi-Mode

D-STAR and More

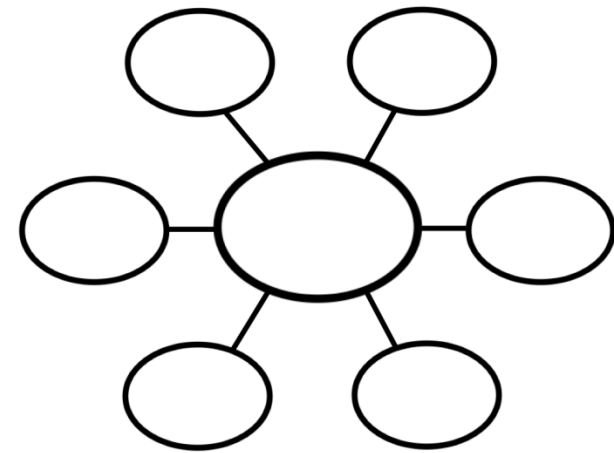
- **DV4mini**
 - From German team who created DVRPTR_V2 & V3. Low Power Hotspot that supports D-STAR, DMR, Fusio, P25
 - Mode is set during configuration. Software links to new DMR “reflectors” and Fusion “rooms”.
- **DVMEGA** RF Boards support multi-mode firmware supported by G4KLX software. Easy!
- **MMDVM** – Modem proposed by G4KLX. Designed by Jim KI6ZUM. Prototypes available from Bruce Given: dvrptr.net. Evolving but very promising.



Enhancing ICOM Repeaters

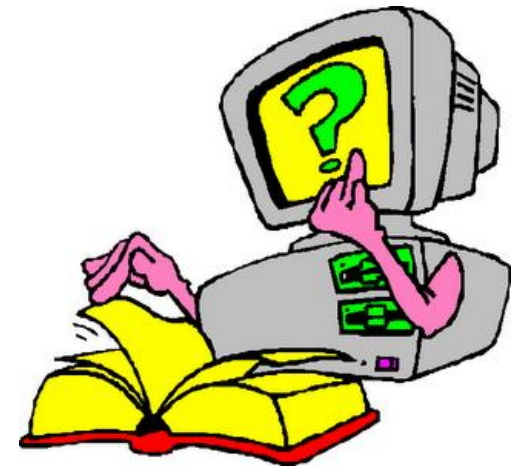
- D-Star lets users decide who they want to link to
- Most ICOM repeaters allow users to link and unlink DPlus REF reflectors
- Users who buy DV Dongles, DVAPs or build Hotspots can link nearly anywhere, anytime
- This is the real fun of the new digital modes

What's New



- Optional software allows linking not only to REF (DPlus) reflectors, but XRF (DExtra) & DCS
- This software also supports a new kind of Callsign Routing called CCS7
- This allows you to connect to a given ham if their callsign is set up with a CCS7 id
- The system finds them anywhere in the world and connects you to where they were last heard

Is that good?



- DCS is very popular in Europe and growing in the US
- XRF has some very interesting reflectors too, including experimental servers that bridge with other systems
- CCS7 is fun because it doesn't require hitting special buttons (e.g. callsign capture)

W6CX D-STAR



- The new linking is no longer just for DVAPs etc.
- W6CX D-Star repeater and gateway now support DCS & XRF linking and CCS7 routing
- D-Star users in the area are free to use these features
- Just program your radio like you do for REF linking, but use DCS or XRF instead

How We Did This



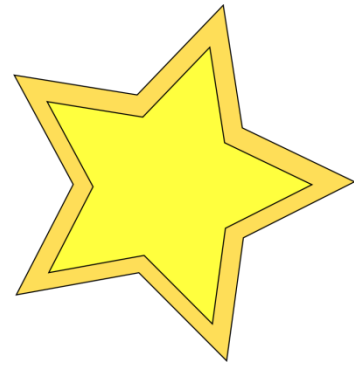
- **We Run both ICOM G2 and G4KLX Gateways**
 - G2 handles all normal D-STAR activity
 - Genuine DPlus handles links to REF reflectors
 - ircDDBGateway is enabled for DCS, XRF and CCS7
 - At W6CX, we also run Monlink to maintain a default REF reflector
 - How did we do this? We are grateful to Adrian VK4TUX for his help in integrating ICOM G2 and G4KLX software seamlessly

How to Access XRF & DCS Reflectors



- Linking to another REF is normal: Unlink, then link (see MDARC D-STAR web pages)
- Linking to XRF or DCS reflector: First unlink, then issue a URCall link, e.g. XRF005BL using URCall, or send DTMF tones
- You can program normal memories or use DR mode

What about CCS7 Connections?



- First unlink (URCall = U in position 8), hit PTT
- If user's radio has DTMF keys, enter 7-digit #
- Or, use URCall memory to send C + 7-digit #
- If your friend has been heard recently on a CCS7-enabled DVAP/Dongle/Hotspot or ICOM Repeater, the system will link the repeater to that
- Call your friend and mention you are using CCS7
- To unlink the CCS7 connection, set URCall to CA – Simple!

In Conclusion



- Digital Voice is a lot of fun
- This is the **Golden Age of Digital Voice** and all DV modes work well
- D-STAR is extensible, and you can do that on your own systems with Hotspots, Access Points, Dongles and more
- And now W6CX D-STAR users also have access to the new linking
- Go for it!



More Info

- Start with the MDARC web site
 - On main page, Under W6CX Repeaters, click on D-Star
- If you don't have a radio, get:
 - A D-STAR radio, or
 - A Dongle like DV3K, ThumbDV, Star*DV
- I'll be happy to help
 - jim@k6jm.com
 - www.k6jm.com/dstar