Building on D-Star DV

Jim Moen – K6JM
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Pacificon
My Topics Today

• D-Star and Homebrewing
  – Most Hams buy their D-Star radios (I have two)
  – Still room for homebrewing & experimentation

• Homebrew Solutions:
  – **HotSpots**: Extending the reach of the D-Star Network
    • Ideal for locations without RF access to D-Star repeaters
    • Inexpensive hardware, free software
    • Supports DPlus, but is not full D-Star (no callsign routing)
    • This technology is stable and easy to put on the air
  – **Digital Voice Adapters** to add DV to analog radios
    • Several choices available
    • Both hardware and software based
HotSpot Block Diagram

- Extends access to DPlus-linked DStar Repeaters and Reflectors
- RF handled by analog FM radio
- D-Star radio is needed to communicate
- GMSK Modem does not decode or encode the DV payload, it just passes it from and to the internet
Why HotSpots?

- If your QTH has no RF access to a D-Star repeater
- Or (like my QTH) is in a multipath shadow
- Your D-Star radio can link to DPlus Repeaters and Reflectors
- Analog Radio must provide access to discriminator and to direct FM modulator (9600 Data Port normally works)
- PC runs DVAR Hot Spot software (Mark McGregor, KB9KHM)
- GMSK Modem interfaces the PC and the radio
- Architecturally like DVAP, but somewhat greater power/range
- HotSpot can be configured as DPlus Repeater (Rich KC6OBJ Sunday 8am Salon 1)
D-Star’s Protocol

- D-Star contains both voice and data for total of 4800 bps
  - 2400 bps Digital Voice
  - 1200 bps FEC on Digital Voice
  - 1200 bps low speed data

- Header is not encrypted
- GMSK modem sees header fields & passes them to PC
- DV Payload created by codec in AMBE chip
- HotSpot GMSK modem passes DV payload as a stream of bits without decoding

Note: 11 Voice & Data Frames/Packet - 1056 bits
GMSK Modem

- Also called Mini Hot Spot (MHS) or Node Adapter
- TX, generates gmsk audio for analog FM transmitter
- RX, demodulates audio for processing by PC
- Decodes the gmsk protocol (headers, routing info)
- Does NOT decode or generate Digital Voice stream
- So you need a D-Star radio to use it
- Inexpensive (kits approx. $80, built $130)
GMSK Modem Sources

- Satoshi Yasuda 7M3TJZ/AD6GZ

- Fred van Kempen PA4YBR

- Mark Phillips G7LTT/NI2O

My NQSMHS from G7LTT
HotSpot Software

- Software: DVAR Hot Spot by Mark McGregor KB9KHM is frequently used for HotSpots
- Available in Files section of gmsk_dv_node Yahoo Group
- Also can download from www.dutch-star.eu/software/
Successful HotSpot Builder
Warren KØTMU 82 years young
HotSpot Lessons

• Kits are fun. Have a mentor to help you
• Built boards are not much more expensive
• Start by registering your hotspot “terminal”
• Lots of support at “gmsk_dv_node” group
• HotSpots can link to other HotSpots
  – Router (allow incoming UDP on port 20001 and port forward 20001)
  – Configure DVAR to accept incoming
• Check out www.k6jm.com/dstar for details
Digital Voice Adapters

Purpose: Add D-Star Compatible DV to many analog radios via 9600 Data port

Why?
- Some people like to homebrew
- Use HF radio: D-Star on 6 & 10 m
Different DV Adapters

- **DUTCH*Star HSA & DVA**
  - DVA has AMBE chip, basic operation
  - Plans for full service controller
- **GMSKClient s/w & DVDongle & GMSK modem**
- **DStarClient s/w & DVDongle & soundcard**
  - Both clients require PC, but no internet connection
- **FunkAmateur DV Adapter 2.0**
  - Uses ICOM UT-118 D-Star card
  - Full service controller
- **Satoshi DV Adapter v1.04 (no longer available)**
Adapter vs. HotSpot?

- HotSpots pass DV Audio between internet and analog radio without decoding
- So HotSpots don’t have AMBE codec chip
- Adapters create standalone D-Star compatible radios
- Must have AMBE chip to decode/encode Digital Voice
DUTCH*Star Hotspot Adapter and DV Adapter

Example: Adapting analog radio to DV

Analog Radio
DUTCH*Star HSA & DVA

• HSA - full function Node Adapter GMSK modem
• DVA - pairs with HSA, has AMBE chip to encode/decode DV

• Opportunities:
  – Adapt analog radio to DV (radio needs 9600 Data port, VHF/UHF or HF)
    • Access D-Star repeaters and simplex radios with VHF/UHF radio
    • Simplex D-Star on 6 & 10 meters with HF radio
    • Talk to new ICOM 9100 with D-Star option
    • Basic control; future products will include separate control terminal
  – HotSpot with built-in DV (no D-Star radio needed)
  – Repeater running software like StarGate, with built-in DV

• Availability: Beta testing underway. Release date/price not announced
• See www.dutch-star.eu/products/hsa/ for more details
Soundcard Digital Voice Adapter for Analog Radios

- Transmit & Receive D-Star digital voice using analog transceiver
- Application: **DStarClient** by Jonathan Naylor, G4KLX (Windows, Linux)
  Available from Files section of “dstar_development” Yahoo group
- Analog radio with 9600 Data port (VHF/UHF or HF)
- Interface from PC soundcard to radio: simple direct connect
  Avoid PSK31-type interfaces with isolation transformers & filters that remove low audio frequencies used by gmsk
- Sound“card” #2: Cheap is best
  Avoid those with audio filters (USB sound fobs are ideal)
- DV Dongle provides access to AMBE codec chip used to encode/decode DV
- Very sensitive to which USB sound fob; very touchy adjusting sound levels
- Cost: If you already have the PC and analog radio, incremental cost is the DV Dongle
- Bottom line: Not as stable as GMSK solution but it’s cheaper and it works
GMSK Digital Voice Adapter for Analog Radios

- Transmit & Receive D-Star digital voice using analog transceiver
- Application: **GMSKClient** by Jonathan Naylor, G4KLX (Windows, Linux)
  - Available from Files section of “dstar_development” Yahoo group
- Analog radio with 9600 Data port (VHF/UHF or HF)
- GMSK modem same as used by HotSpot
- DV Dongle provides access to AMBE codec chip used to encode/decode DV
- Easier to setup than soundcard interface, more stable solution
- Cost: GMSK modem & DV Dongle
- Bottom line: More stable interface to analog radio
Summary

- We are in a golden age of D-Star innovation and development
- New hardware and software are allowing build your own D-Star tools
- Homebrewing/experimentation are fun and can be relatively inexpensive
- This stuff is easy - We can all do it
- Lots of support available
  - See my website at www.k6jm.com/dstar
  - Yahoo Groups:
    - gmsk_dv_node
    - dstar_development
    - DVDongle
    - K6MDD
  - Vendors’ sites:
    - GMSK modem: Fred van Kempen PA4YBR  www.dutch-star.eu
    - GMSK modem: Mark Phillips G7LTT/NI2O  www.gmskhotspot.com
    - GMSK modem: Satoshi Yasuda 7M3TJZ/AD6GZ  d-star.dyndns.org/
    - DVAR Hot Spot:  www.w9arp.com/hotspot/
    - DVDongle:  www.dvdongle.com/
    - FunkAmateur DV Adapter:  www.dstarradioclub-international.com/