D-STAR

An Introduction to the Japan Amateur Radio League's standard for digital voice and data for Amateur Radio

What Is D-STAR?

- Acronym: Digital Smart Technologies for Amateur Radio
- Developed by the Japan Amateur Radio League (JARL)
  - Open standard. Not proprietary to one particular manufacturer.
- Provide digital voice and data communication capability for Amateur Radio on VHF, UHF, and above
- Ability to communicate using digital voice and data over simplex, repeaters, satellites
- A new voice mode in Amateur Radio allowing local and long distance worldwide communications
- Rapidly growing: Over 12,000 registered Amateur Radio operators and over 500 repeaters with Internet gateways online today

Timeline

- 1999 – Administered by the Japan Amateur Radio League
  - Japanese government funded
- 2001- Open specification published http://www.arrl.org/FandES/field/regulations/techchar/D-STAR.pdf
- 2002 - ICOM was the first manufacturer to adopt and begin producing D-STAR radio equipment
- 2003 – 1st Generation 23 cm repeater
- 2005 – 2nd Generation repeaters (2 m, 70 cm, 23 cm)
- Today – Continues to grow in use rapidly with new gateways and repeaters going online every week worldwide
- Future – Non-ICOM homebrew repeaters, gateways, radios

Terminology & Technical Data

- Digital Voice (DV)
  - 4800 bps data stream
    - 2400 bps voice using AMBE encoding
    - 1200 bps voice Forward Error Correction (FEC)
    - 1200 bps low-speed data (simultaneous short text messages, GPS and other telemetry data)
- Digital Data (DD)
  - 128 kbps possible
  - 150 KHz bandwidth

Terminology & Technical Data

- Uses AMBE IC-based hardware vocoder
  - AMBE = Advanced Multi-Band Excitation
  - Successor to IMBE CODEC, used in P25 Phase I systems
  - Closed source, proprietary CODEC
  - Prominent users of AMBE include Inmarsat / Iridium Satphones, XM Radio (some channels), OpenSky Trunked Radio Systems
  - Manufacturer: Digital Voice Systems, Inc. (DVSI)
- GMSK modulation
  - Gaussian Minimum Shift Keying
  - Used in GSM wireless phone systems worldwide

Why?

- Spectrum Efficiency
  - D-STAR DV mode typically occupies 6.25 KHz bandwidth, where FM occupies 12.5 KHz
- Digital voice / data technologies designed specifically for Amateur Radio
  - We're in a digital world now
- Experimentation
  - Ongoing projects: open source gateway, DV dongle, D-STAR hotspot, homebrew repeater systems, software
- Why not?
  - Something new to try
  - Some emergency organizations adopting D-STAR
  - FUN!

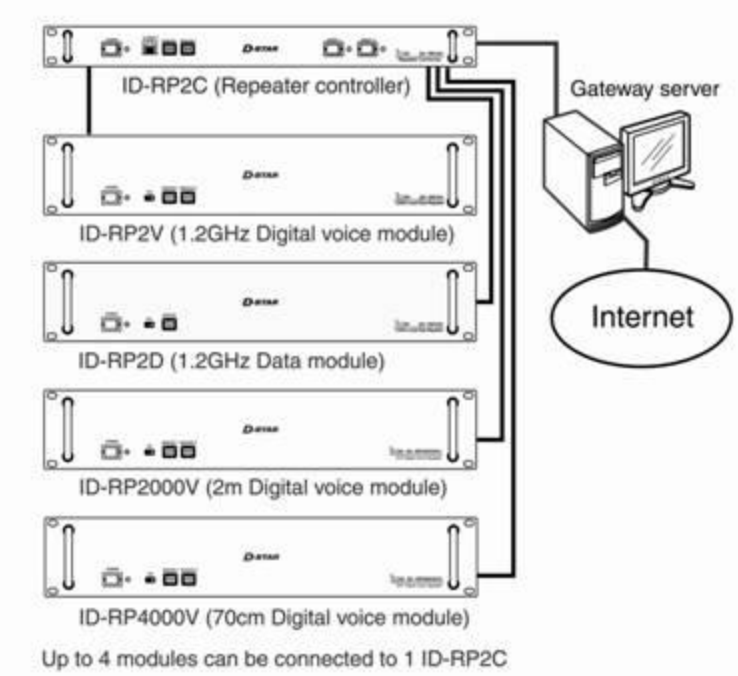
How?

- Radio Equipment
  - ICOM currently the only manufacturer
  - Kenwood (in Japan only)
    - Rebadged ICOM ID-800H mobile
- DV Dongle
  - USB adapter for your PC using the AMBE vocoder
  - Allows user to connect to repeater gateways directly from home computer with a headset
  - Software works on Windows, Mac, Linux
  - Least-expensive means of getting onto D-STAR ($199)

Technology

- Repeaters
  - 2 m, 70 cm, and 23 cm voice (DV) and 23 cm data (DD)
  - Same principles as using an FM repeater
  - No courtesy tones or Morse identification
    - Your call sign is in the data stream when you transmit

Technology



D-STAR Repeater System “Full Stack” and Gateway Server

Technology

- Gateways
  - ICOM Gateway Server Software
    - Runs on CentOS 5.x Linux platform (recommended)
    - Two Ethernet ports: one connects to repeater controller, the other to an Internet connection through a router / firewall
    - US Trust Server run by Texas Interconnect Team, K5TIT
    - Currently 331 registered active / online gateways on US Trust Server
  - Call Sign Routing
    - Think Nextel Direct Connect (push-to-talk)
    - Enter call sign of destination, either individual or repeater, directly into your radio and start talking
    - Core feature of ICOM's gateway software
    - Multicasting - communicate with multiple repeaters in a group at once
  - Reflectors
    - think EchoLink / IRLP conference nodes
    - Hub and spoke model
    - Issue a command to local repeater and "link up" to the reflector
    - Most popular method used today
    - "Set it and forget it"
    - not a native feature of ICOM's gateway software
      - Dplus add-on
      - Developed by Robin Cutshaw, AA4RC

D-STAR Operations

- Settings
  - My Call
  - UR Call
  - RPT1
  - RPT2
  - Message (any text you choose)

Experimentation

- DV Dongle
- D-STAR Hot Spot
- Open-source D-STAR Gateway Software
- Home-brewed repeaters
- Software
  - D-RATS (text chat, file transfers)
  - D-STAR Chat (chat only)
  - D-STAR TV (slow-scan TV)

D-STAR in Kansas City

- Local Repeaters
  - W0CW
    - Frequencies: 443.400 (+ 5 MHz input), 1285.05 (-12 MHz input), 1253.05 simplex (DD)
    - Located in mid-town KC near 31st and Southwest Trafficway (aka, Signal Hill)
    - Very good coverage throughout most of the metro area
  - K0HAM
    - Frequencies: 442.125 (+ 5 MHz input)
    - Located in Louisburg, KS
    - 70cm currently on air; 2m, 23 cm DV and DD in future

Future

- Open-source Gateway software
- Amateur-developed repeater controller
  - "Roll your own"
- Open-source vocoder ?
- D-STAR on HF ?
  - ICOM IC-9100 (HF + 6m + 2m + 70cm + 23cm)
  - Rumored that it will do D-STAR on 10m and above

How Do I Get Started?

- Buy a radio or DV Dongle
- Register on your local repeater gateway
  - Repeater directory on www.dstarusers.org
- Set up your radio / dongle
- Start talking to stations around the world!

Resources

- http://www.dstarusers.org
- http://www.jfindu.net/DstarRepeaters.aspx
- http://www.dxzone.com/catalog/Software/D-STAR/
- http://kcdstar.byrg.net

Questions?

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