What is D-STAR

Excerpts from Wikipedia, the free encyclopedia 1-1-12
Please go to Wikipedia for a more in-depth history and technical explanation.

This document is only meant to help the new ham understand in general what D-STAR is.

D-STAR (Digital Smart Technologies for Amateur Radio)

D-STAR is a digital voice and data protocol specification developed as the result of research by the Japan Amateur Radio League to investigate digital technologies for amateur radio. While there are other digital on-air technologies being used by amateurs that have come from other services, D-Star is one of the first on-air and packet-based standards to be widely deployed and sold by a major radio manufacturer that is designed specifically for amateur service use.

Other non-digital voice modes such as amplitude modulation, frequency modulation, and single sideband have been widely used since the first half of the 20th century. By comparison, digital D-STAR signals offer clearer signals and use less bandwidth than their non-digital counterparts As long as the signal strength is above a minimum threshold, and no multi-path is occurring, the quality of the data received is better than an analog signal at the same strength.

D-Star compatible radios are available on VHF, UHF, and microwave amateur radio bands. In addition to the over-the-air protocol, D-Star provides specifications for network connectivity, enabling D-Star radios to be connected to the Internet or other networks and provisions for routing data streams of voice or packet data via amateur radio callsigns.

The system today is capable of linking repeaters together locally and through the Internet utilizing callsigns for routing of traffic. Servers are linked via TCP/IP utilizing proprietary "gateway" software, available from Icom. This allows amateur radio operators to talk to any other amateur participating in a particular gateway "trust" environment. The current master gateway in the United States is operated by the K5TIT group in Texas, who were the first to install a D-Star repeater system in the U.S.

D-STAR transfers both voice and data via digital encoding over the 2 m (VHF), 70 cm (UHF), and 23 cm (1.2 GHz) amateur radio bands. There is also an interlinking radio system for creating links between systems in a local area on 10 GHz, which is valuable to allow emergency communications oriented networks to continue to link in the event of internet access failure or overload.

Usable range compared to FM

D-STAR has comparable usable range to FM but degrades differently. The quality of FM progressively degrades the further a user moves away from the source, D-Star maintains a constant voice quality up to a point, then essentially "falls off a cliff". This behavior is inherent in any digital data system, and demonstrates the threshold at which the signal is no longer correctable.

D-RATS

D-STAR has the technology and ability to send large quantities of data to emergency responders in the event of a disaster. Served agencies can relate to sending e-mail or Microsoft Word files to someone. The quantity of data sent can be high-volume compared to traditional amateur modes. Voice and even CW are capable of getting a message through albeit slowly, but D-STAR can transfer documents, images, and spreadsheets in reasonable time periods.

D-RATS is a D-STAR communications tool that supports text chat, TCP/IP forwarding, file transfers, and can act as an e-mail gateway. There is also the ability to map user's positions using the D'PRS function of D-STAR. The application is written in Python/GTK and is cross-platform. It runs on Windows, Mac OS X, and Linux. The application was developed by Dan Smith (KK7DS) for the Washington County Amateur Radio Emergency Service in Oregon.

It was in the Great Coastal Gale of 2007 the Washington County ARES group was able to test D-STAR during this series of several strong Pacific storms that interrupted conventional communication systems for up to one week. Primary emergency traffic for the American Red Cross and the Vernonia, Oregon Fire Department was handled by the group using traditional FM voice because the group had no D-STAR repeater equipment available. Once the situation's communication needs became established the D*Chat communication tool was used to send small text transmissions via D-STAR simplex at distances of up to seventeen miles.

The ability for amateurs to send files during this weather event would have greatly increased the capacity for ARES to help during the emergency. Although D*Chat was a useful means of communication D-RATS was developed to help fill the gaps that may have been lacking. Another improvement over D*Chat that D-RATS provides is form support. Users can set up frequently used forms well before they're necessary and when the need comes all that's required is to fill in the fields. In this way, for example, emergency forms from the Red Cross, National Traffic System, or the Incident Command System, such as the FEMA standard ICS-213, can be generated and quickly sent.

D-STAR uses a patented, closed-source proprietary voice codec (AMBE). Hams do not have access to the detailed specification of this codec or the rights to implement it on their own without buying a licensed product. Hams have a long tradition of building, improving upon and experimenting with their own radio designs. The modern digital age equivalent of this would be designing and/or implementing codes in software. Critics say the proprietary nature of AMBE and its availability only in hardware form (as ICs) discourages innovation. Even critics praise the openness of the rest of the D-STAR standard which can be implemented freely. An open-source replacement for the AMBE codec would resolve this issue.

Emergency Communications Concerns

D-Star's performance envelope relies heavily on internet connections. During widespread disasters, D-Star systems (and other modes internet systems such as WinLink) may suffer outages or performance degradation that severely impacts operations. It is difficult to assess the impact or establish D-Star service recovery procedures. As of the fall of 2011, there has been almost no discussion in the ham radio literature regarding actual drills where D-Star systems were tested Comprehensive emergency communications plans used by ARES and other such organizations should address the possibility that such systems may not function as intended during major disasters if a 10 GHz interlinking radio system is not installed to continue the link in the event of internet access failure or overload.

History

In 1999 an investigation was put into finding a new way of bringing digital technology to amateur radio. The process was funded by the Japanese government and administered by the Japan Amateur Radio League. In 2001, D-Star was published as the result of the research and Icom entered the construction of the new digital technology by offering the hardware necessary to create this technology.

In September 2003 Icom named Matt Yellen, KB7TSE (now K7DN), to lead its US D-Star development program. Starting in April 2004 Icom began releasing new "D-Star optional" hardware. The first to be released commercially was a 2-meter mobile unit designated IC-2200H. Icom followed up with 2 meter and 440Mhz handheld transceivers the next year. However, the yet to be released UT-118 add-on card was required for these radios to operate in D-Star mode. Eventually Icom began selling the card and once installed into the radios it provided D-Star connectivity for each of the transceivers. The June 2005 edition of the ARRL's QST magazine reviewed the Icom IC-V82.

The Icom ID-1 1.2 GHz mobile radio was released in late 2004. This was to have been the first D-Star radio, providing full Digital Data (DD) functionality.

The first D-Star over satellite QSO occurred between Michael, N3UC, FM-18 in Haymarket, Virginia and Robin, AA4RC, EM-73 in Atlanta, Georgia while working AMSAT's AO-27 microsatellite (Miniaturized satellite) in 2007. The two operators used a variety of Icom gear to make the contact and experienced slight difficulty with doppler shift during the QSO.

As of late 2009, there are around 10,800 D-Star users talking through D-Star repeaters which have connectivity to the Internet via the G2 Gateway. There are around 550 G2 enabled repeaters now active. Note, these numbers do not include the scores of users with D-Star capabilities but not within range of a repeater, or working through D-Star repeaters that do not have Internet connectivity.

The first D-Star capable microsatellite is scheduled for launch during early 2012. OUFTI-1 is a CubeSat and is built by Belgian students at the University of Liège and I.S.I.L (Haute École de la Province de Liège). The name is an acronym for *Orbital Utility For Telecommunication Innovation*. The goal of the project is to develop experience in the different aspects of satellite design and operation.[4][5] The satellite weighs just 1 kilogram and will utilize a UHF uplink and a VHF downlink.

How the Gateway works

Each participating amateur station wanting to use repeaters/gateways attached to a particular trust server domain must "register" with a gateway as their "home" system, which also populates their information into the trust server—a specialized central gateway system—which allows for lookups across a particular trust server domain. Only one "registration" per trust domain is required. Each amateur is set aside eight 10.x.x.x internal IP addresses for use with their callsign or radios, and various naming conventions are available to utilize these addresses if needed for specialized callsign routing. Most amateurs will need only a handful of these "registered" IP addresses, because the system maps these to callsigns, and the callsign can be entered into multiple radios.

Transceivers—D-STAR and Analog FM Capable Equipment:

- Icom ID-1: 23 cm digital voice and digital data mobile transceiver. Power is selectable at 1 W or 10 W. USB control port and Ethernet connection for data.
- Icom IC-2820H/IC-E2820: 2 m / 70 cm twin band digital voice mobile transceiver. Power up to 50 W on each band. May be purchased with or without D-STAR module. The D-STAR module includes a built-in GPS receiver with accompanying antenna.
- Icom ID-800H: 2 m / 70 cm dual band digital voice mobile transceiver. Power up to 55 W on 2 m and 50 W on 70 cm.
- Icom ID-880H: 3rd gen 2 m / 70 cm digital voice mobile transceiver (50W).
- Icom IC-80AD: 3rd gen 2m / 70 cm digital voice hand held transceiver (5W).
- Icom IC-92AD: 2 m / 70 cm twin band digital voice hand held transceiver. Four power settings up to 5 W on each band. Rugged and submersible design, optional microphone with embedded GPS.
- Icom IC-91AD/IC-E91 + D-STAR: 2 m / 70 cm twin band digital voice hand held transceiver. Power is selectable at 0.5 W or 5 W on each band.
- Icom IC-2200H: 2 m single band digital voice mobile transceiver. Power up to 65 W. Must purchase optional D-STAR module.
- Icom IC-V82: 2 m single band digital voice hand held transceiver. Power up to 7 W. Must purchase optional D-STAR module.
- Icom IC-U82: 70 cm single band digital voice hand held transceiver. Power up to 5 W. Must purchase optional D-STAR module.
- **Repeater equipment:**
- Icom ID-RP2000V: 2 m digital voice repeater.
- Icom ID-RP4000V: 70 cm digital voice repeater.
- Icom ID-RP2V: 23 cm digital voice repeater.
- Icom ID-RP2D: 23 cm digital data access point.
- Icom ID-RP2C: Repeater controller. Can support up to four digital voice repeaters and digital data access points. Required to operate any Icom D-STAR digital voice repeater or digital data access point.
- Inet Labs

Computer accessory:

- DV-Dongle: The dongle is a USB device with the AMBE codec built in. Amateurs can use this with a personal computer's audio system to communicate over the D-STAR network. This is a good option for experiencing D-STAR if there isn't a local D-STAR repeater or if there is a repeater but it's not associated with an Internet gateway. The dongle works along with the DVTOOL software, a simple application that mimics the controls on a D-STAR radio, although the interface doesn't actually look like a radio panel. Note: Now available from a number of amateur radio dealers or by homebrew using documentation at Moetronix.
- DV-AP: A DVAP Dongle (DV Access Point Dongle) is also a USB device that creates a connection to the D-STAR network through an Internet connected computer. But instead of using the computer's audio system, the DVAP Dongle has an antenna and a 10 mW two-meter transceiver that provides short-range over-the-air access using a D-STAR radio (usually a handheld). Note that a D-STAR radio is required. The DVAP does *not* convert an analog FM signal to D-STAR.
- Kenwood D-STAR equipment

Journal

- ARRL: QST *Icom IC 2820H Dual Band FM Transceiver* Vol 91 No 11 November 2007 Page 74, by Steve Ford, WB8IMY does a review on the IC 2820H Dual Band FM Transceiver.
- RSGB: RadCom March 2008 (Vol 83 No 03) review of Icom IC-E2820 transceiver and overview of D-Star.
- CQ-VHF: D-STAR in the Southeastern U.S., Greg Sarratt, W4OZK, (partial), http://www.cq-vhf.com/D-StarWin08.html

External links

- Alabama D-STAR Information
- D-STAR FAQ and Information
- Icom D-STAR information
- opendstar.org
- The Rain Report by J. Maynard, K5ZC
- dstarusers.org
- D-STAR video by the Washington County ARES group