

D-STAR Gateway Adjunct Software

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Abstract

The D-STAR Gateway version 2 from Icom Incorporated contains the basic D-STAR networking functionality called out in the D-STAR specification. Software such as D-Plus by Robin Cutshaw AA4RC and DStarMonitor by Peter Loveall AE5PL extend this functionality by adhering to the D-STAR standards and Icom de facto standards. This paper explores this adjunct software and some of the features that allow this software to be used in tandem.

D-STAR Gateway Adjunct Software

D-STAR is a protocol specification created by the JARL (Japanese Amateur Radio League) to provide a concise protocol definition for the transport of digital voice and digital data across RF and non-RF media. The protocol is connectionless and defines encapsulation of audio (Digital Voice or DV) and Ethernet (Digital Data or DD). While the encapsulated portions of the protocol are incompatible, the routing and header information is not and is key to how D-STAR allows very simplistic routing mechanisms for the bit streams without regard for the encapsulated content.

D-Plus written by Robin Cutshaw AA4RC and DStarMonitor written by Peter Loveall AE5PL use this header information (and, to some extent, the encapsulated DV streams) to provide extended services to users and sysops beyond what is available with the standard Icom gateway software. These “adjuncts” do not interfere with gateway operation but rely on the standards-based communication that occurs between the repeater controller and the gateway, and the communication that occurs between gateways.

D-Plus

D-Plus was originally developed by Robin Cutshaw AA4RC to provide “linking” capability to the connectionless gateways in the same manner as amateur radio operators link analog repeaters. While not designed to link to systems like IRLP and Echolink, it does provide the ability to create D-STAR-only reflectors and to create virtual connections between repeaters and between repeaters and reflectors.

Since its inception, it has grown to be a portal for DVDongle users (a USB AMBE codec) and to allow static information such as text, prerecorded AMBE audio, and Icom front panel messages to be generated by individual repeaters. While it is not the purpose of this paper to explore each adjunct in detail, this background will be useful as we explore how its features can be used with other software features to create even greater functionality.

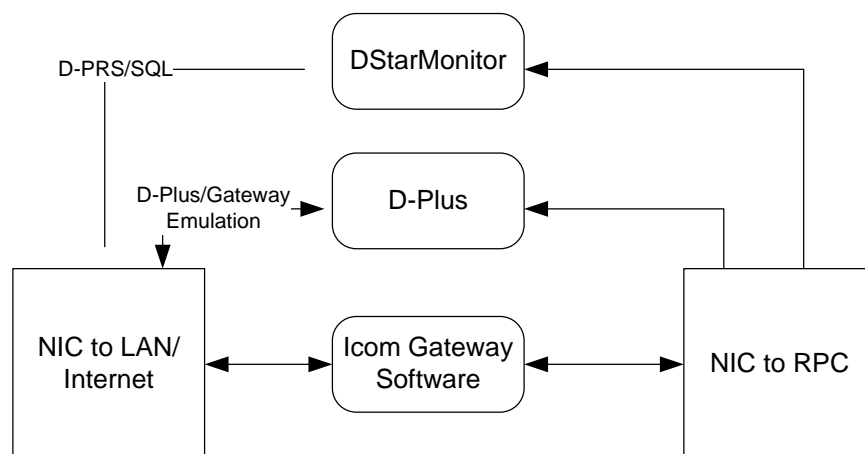
DStarMonitor

DStarMonitor was originally developed by Peter Loveall AE5PL to provide “accounting” services for sysops by capturing useful information from the repeater controller/gateway communications and storing that information in an SQL database. This has become a standard method for creating “last heard” tables on shared sites like dstarusers.org.

DStarMonitor has been expanded to allow populating multiple databases and decoding Icom radio-generated low speed serial data. This decoding of the low speed serial data stream (present or at least available in all DV transmissions) led to integration with javAPRSSrvr to provide D-PRS (Icom GPS information to APRS format translation) functionality. With recent advancements in the D-Plus software, bidirectional D-PRS and other text-based applications (DStarQuery) have also become possible. It is these bidirectional applications that we will look at more closely in this paper.

Software in the Gateway

The software contained in the gateway (that will be discussed in this paper) is best described by the following diagram.



While there are many software modules encompassed by each of the processes show above, we will focus on specific software adjuncts to DStarMonitor and to an adjunct to D-Plus which is not software-based. The focus of this paper is how we work with the current gateway software and within the D-STAR specification to generate bidirectional features for users and sysops beyond what is available with generic, stand-alone software.

Bidirectional D-PRS

D-PRS was originally developed as a translation of Icom GPS information into an APRS-compatible format. When Icom introduced the GPS-A format (essentially an APRS “packet” encapsulated with a CRC), it became possible to use the DV bit stream as a bidirectional APRS transport of the reliability of AX.25 which uses the same basic CRC algorithm. GPS-A has been designed into all current D-PRS translator algorithms and been available to individual radio users as a bidirectional transport. This GPS and GPS-A information is transported on the DV bit stream in the exact same manner as serial data which makes the decoding possible at the gateway. DStarMonitor decodes the “serial data” and presents that as bytes to a TCP port (per repeater) that any software can connect to. DStarMonitor has the capability to start javAPRSSrvr (de facto standard APRS server and IGate) instances for each repeater to translate the GPS information to APRS-IS (APRS Internet Service).

However, due to the timing and format complexity of the repeater controller-gateway communications, it has only been unidirectional (D-PRS to the Internet, APRS-IS) on the gateway. This means that an APRS client user who has that client attached to their D-STAR radio via a D-PRS translator could see everyone locally, have their position seen locally and on APRS-IS, and communicate with other APRS client users locally. They could not, however, communicate with APRS client users who are on an APRS network elsewhere. With the introduction of D-Plus 2.2e, this unidirectional limitation was eliminated, although not directly.

A new “serial interface” has been developed for javAPRSSrvr to take advantage of the D-Plus 2.2e capability to send a text file to a specific repeater. This interface works exactly like the TCP interface currently in-place that listens to the DStarMonitor “serial” TCP port but adds the capability for gated packets (basically message packets from the APRS-IS network to a local station) to be sent to a specific repeater. This interface gathers the entire outbound line from javAPRSSrvr, confirms it is a GPS-A format line that is using the APRS third-party data format (gated APRS packet), and then places that line in a new appropriately named file for D-Plus. For instance, placing a text file named “text-b” in the “/dstar/tmp/” directory will cause D-Plus to tell the gateway software to send a “quiet” DV bit stream to the repeater module B. The D-Plus serial interface knows which repeater to send it to because each javAPRSSrvr instance is only acting as an IGate for one repeater module.

This new javAPRSSrvr interface and the “text file send” capability in D-Plus 2.2e means that an APRS client user on an Icom D-STAR radio can now message with other APRS users world-wide via the APRS-IS network. Those other APRS client users may also be sitting behind a D-STAR radio with D-PRS Interface installed.

DStarQuery

DStarQuery is an application originally developed to respond to a “query” received on an Icom D-STAR radio serial port and send text back out that port. It was quickly expanded to run a program, script, or batch file based on the “query” and return the text that was generated by program. While extremely flexible since it was not restricted to just static text responses, it was limited to sitting behind an individual D-STAR radio because there was no method for getting data back out to a repeater in response to data received by that repeater. D-Plus 2.2e changed that by sending file content to specific repeaters. That file content could be text (for serial data or radio front panel information) or DVTool/D-Plus format containing a complete DV bit stream. It is important to note at this point that there is no

decoding or encoding of the AMBE bit stream in the repeaters, repeater controller, or gateway. All voice bits of the DV bit streams are handled as bits, not encoded audio.

With the advent of D-Plus 2.2e, DStarMonitor was modified to properly update DStarQuery properties files so there can be one unique instance of DStarQuery “listening” to each repeater. When a valid “query” is received, DStarQuery runs the appropriate application or script. That application or script must create a response file and then place that response into the “/dstar/tmp/” directory. This can be a very powerful resource. The scripts that ship with DStarQuery are examples of sending static text files, querying a web site and sending the response, or sending prerecorded voice files. The extension I would like to see is the attachment of a DVDongle (USB AMBE codec) to the gateway and someone writing a text-to-speech application using the DVDongle to create dynamic voice files for playback on the repeater.

Summary

The D-STAR protocol and Icom G2 Gateway give use a very dynamic network environment to work with as application designers. While most of the protocol and Icom-specific enhancements are now well documented, the adaptation of software adjuncts continues to lag behind. Two D-STAR software adjuncts, D-Plus and DStarMonitor now provide a comprehensive toolset to build on giving bidirectional capabilities to virtually any application you might dream up. While not open source, these adjuncts provide public, well-defined interfaces for anyone to write applications to.

This toolset has been used by Peter Loveall AE5PL with javAPRSSrvr and DStarQuery to provide bidirectional D-PRS/APRS connectivity and remote query and command capabilities to the D-STAR gateway on DV repeaters. There are a myriad of possibilities out there that just have to be dreamed up to become reality.