



NATIONAL CAPITAL REGION D-STAR ASSOCIATION

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D-STAR Basics

Sterling Park Amateur Radio Club

May 1, 2013



NATIONAL CAPITAL REGION D-STAR ASSOCIATION

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In case you're wondering... this says 'NCR D-STAR'

What is the National Capital Region D-STAR Association...?



National Capital Region D-STAR Association

- Local D-STAR repeater groups joining together to promote D-STAR technology
- Working together to provide D-STAR coverage in the National Capital Region
- Come visit us on Reflectors 025B and 025C!

- Participating Repeaters
 - W4HFH (Alexandria)
 - N4USI (Bull Run)
 - W4OVH (Manassas)
 - K4DCA (Reagan National)
 - WS4VA (Stafford)
 - NV4FM (Tysons Corner)
 - W4BBR (Virginia Beach)
 - W4FJ (Richmond)



National Capital Region D-STAR on the Web

2/1/2010

National Capital Region D-Star Association

Welcome News

National Capital Region D-Star Association



This site outlines the D-Star resources that are available in the National Capital Region. NCR is an association of regional D-Star repeaters that have joined together in order to better the capabilities of the Digital Amateur Radio experience in the National Capital Region. NCR D-Star holds a net every Sunday at 7:00PM on reflector REF025B which is available on all regional repeaters on port B.

Watch us grow:

Active National Capital Region D-Star Repeater:

February 2010

Alexandria:
W4HPH A. 1284.60 -12
W4HPH AD. 1253.600
W4HPH B. 442.060+
W4HPH C. 145.380-

Join us on the web at:

www.ncrdstar.org

- Resources
- News
- Wiki



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AN INTRODUCTION TO D-STAR

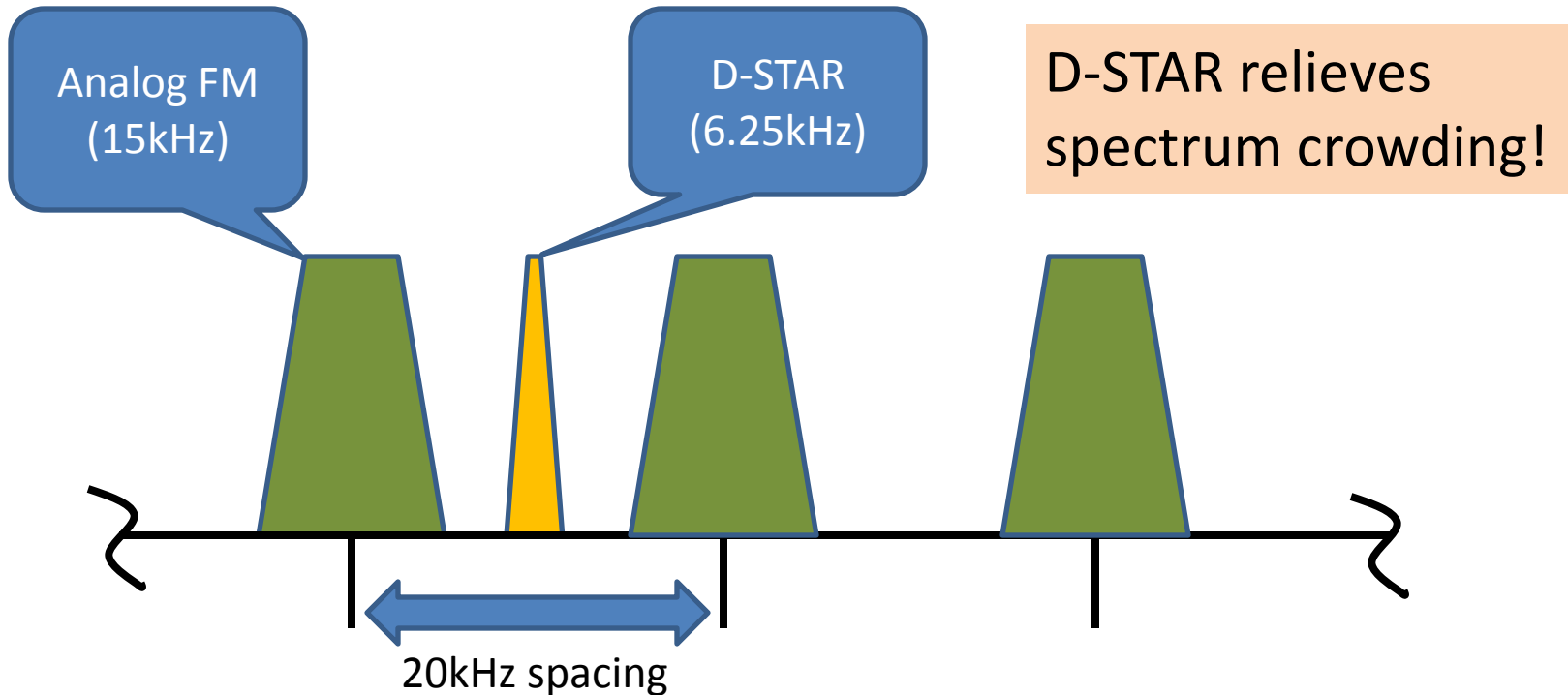


What is D-STAR?

- D-STAR (Digital Smart Technologies for Amateur Radio)
- Simultaneous digital voice and data
- Packet-based (ready for computers and networks)
- “Digital at the source” – voice quality is not degraded by the communications channel
- Less bandwidth than analog counterparts
- Callsign-based routing architecture
- Stand-alone or gateway-enabled architectures



D-STAR Repeater Allocations



D-STAR

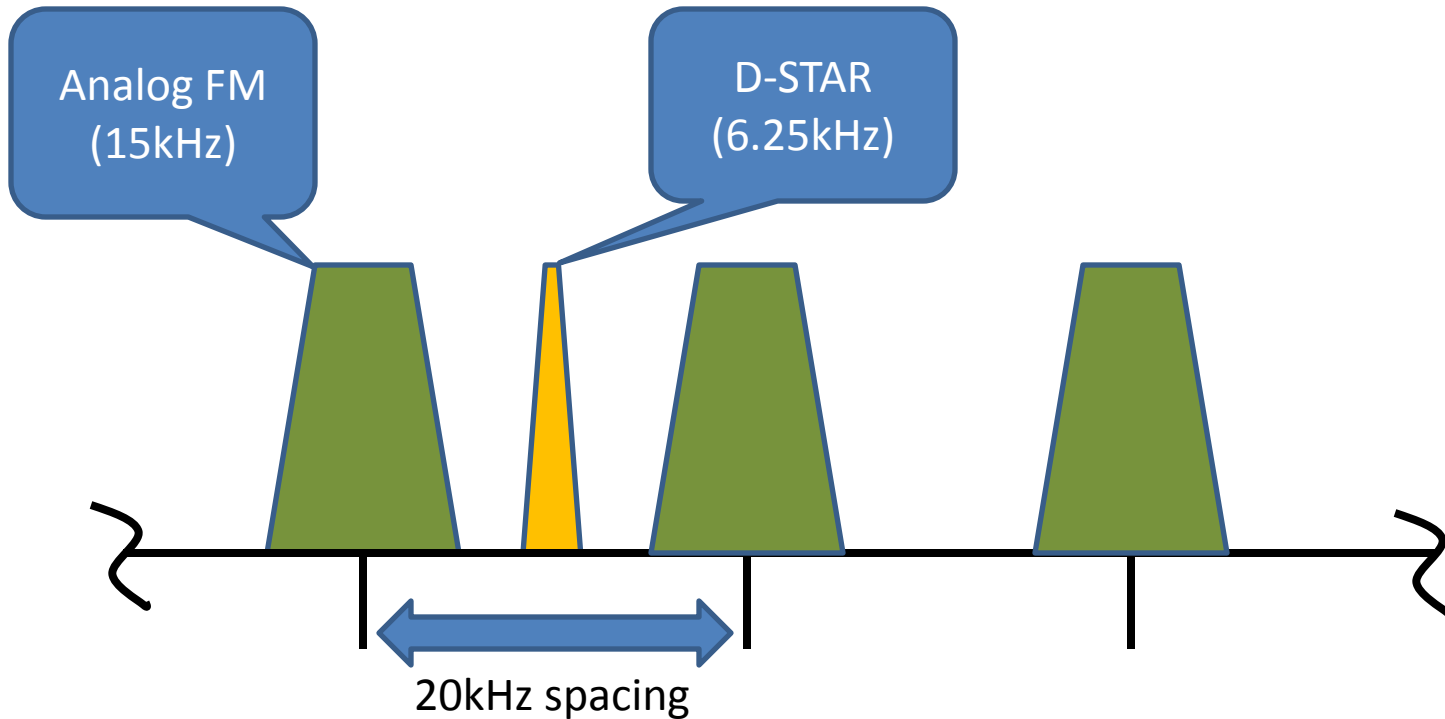
- 6.25kHz occupied bandwidth
- 10kHz channel spacing

Analog FM

- 15kHz occupied bandwidth
- 20kHz channel spacing



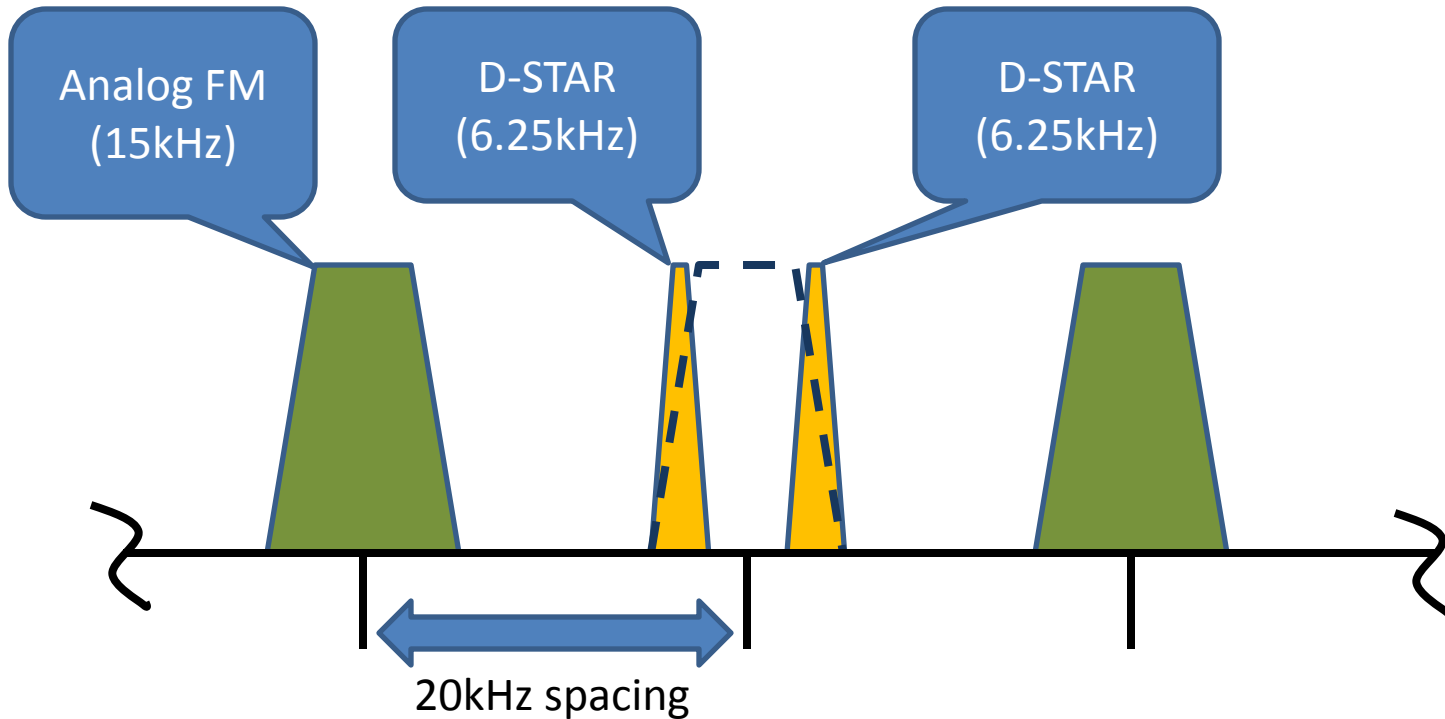
D-STAR and Analog Repeater Allocations



D-STAR repeaters can be allocated between existing FM repeaters



D-STAR and Analog Repeater Allocations



In fact, you can fit two D-STAR repeaters inside the spectrum allocation of just one analog repeater!



D-STAR Specification

- D-STAR is an open protocol –published by Japan Amateur Radio League (JARL)
- Open-source design document
- Google “ARRL DSTAR specification” for more information



D-Star Data Capabilities

- D-STAR offers both voice and data or data-only capabilities
- Simultaneous voice and data capabilities
 - Applies to both 2 meters and 70cm
 - Data rate of 1200bps
- High-speed only data
 - Applies to 1.2GHz only
 - Data rate of 128kbps

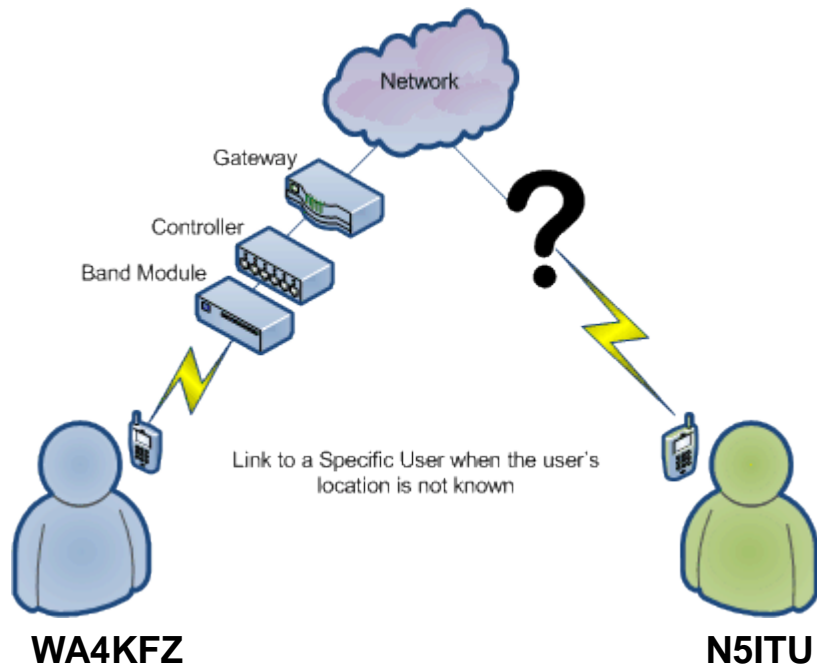


Callsign Routing

- Four key fields are used in D-STAR routing:
 - MY: the 'source' callsign (i.e., your callsign)
 - UR: the 'destination' callsign (or CQCQCQ)
 - R1: the repeater your radio is accessing
 - R2: the gateway your repeater uses



Callsign Routing – the D-Star Calculator



Programming for talking to N5ITU

YOUR:: **N5ITU** ■ ■ ■

RPT1: **W4OVH** ■ ■ B

RPT2: **W4OVH** ■ ■ G

Set Radio To: **442.5125 MHz Offset +5.0000 MHz**

"■" represents a space

N5ITU would:

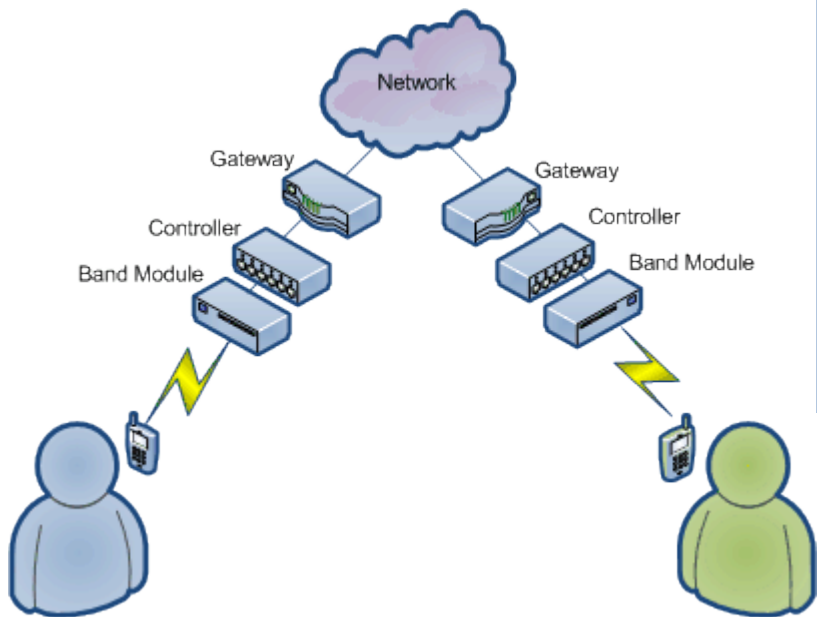
- Set RPT1 to his local repeater module
- Set RPT2 to his local repeater gateway
- Press the RX->CS button and say Howdy!

The D-STAR trust server 'finds' stations at their last known location

<http://www.dstarinfo.com/dstar-web-calculator.aspx>



Callsign Routing – Connecting Repeaters Together



WA4KFZ

- Anyone on the NV4FM_C repeater module
- Station needs to use the RX->CS button to complete the routing path

Programming for talking on W4OVH (port DV B) to NV4FM (port DV C)

YOUR:: /NV4FM C

RPT1: W4OVH B

RPT2: W4OVH G

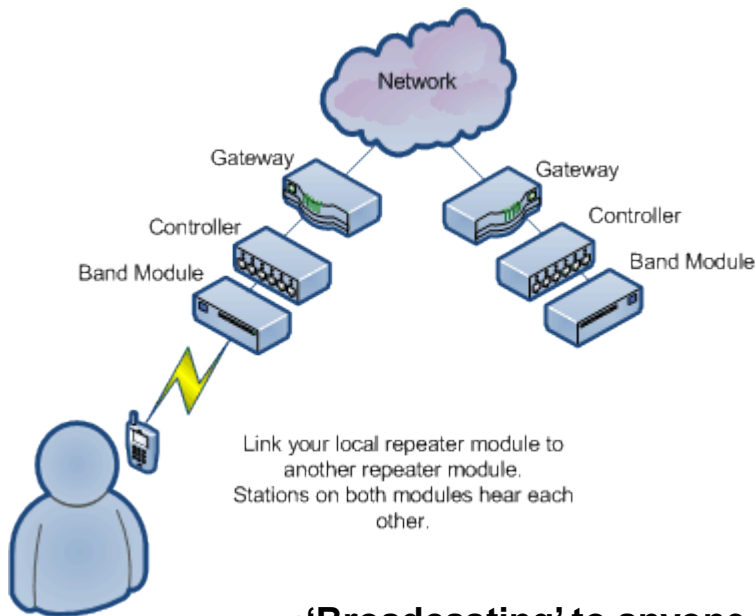
Set Radio To: **442.5125 MHz Offset +5.0000 MHz**

" " represents a space

This is the original Icom source routing method



Callsign Routing – Connecting Repeaters Together



WA4KFZ

- 'Broadcasting' to anyone on the NV4FM_C repeater module
- Stations on both modules hear each other

Programming for linking from W4OVH (port DV B) to NV4FM (port DV C)

YOUR:: **NV4FM ■ CL**

RPT1: **W4OVH ■ ■ B**

RPT2: **W4OVH ■ ■ G**

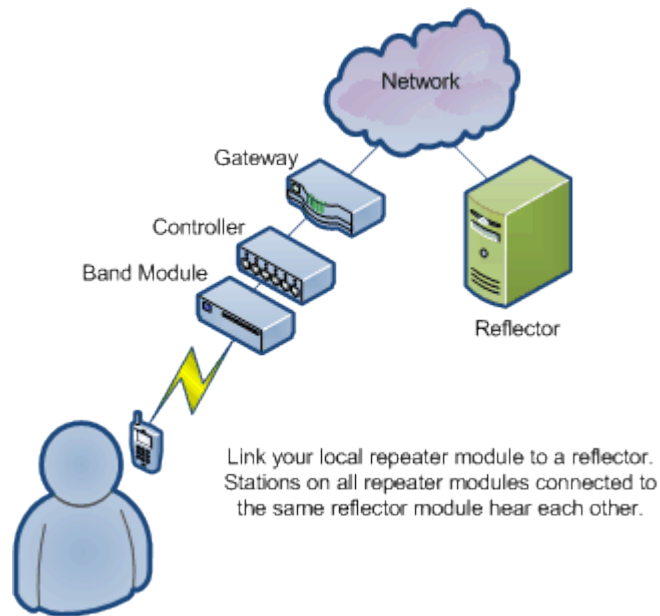
Set Radio To: **442.5125 MHz Offset +5.0000 MHz**

"■" represents a space

This uses the Dplus linking method



Callsign Routing – Connecting to a Reflector



WA4KFZ

- ‘Broadcasting’ to anyone on the reflector
- Stations on all connected repeater modules hear each other

Programming for linking from W4OVH (port DV B) to REF025 (port DV C)

YOUR:: **REF025CL**

RPT1: **W4OVH ■ ■ B**

RPT2: **W4OVH ■ ■ G**

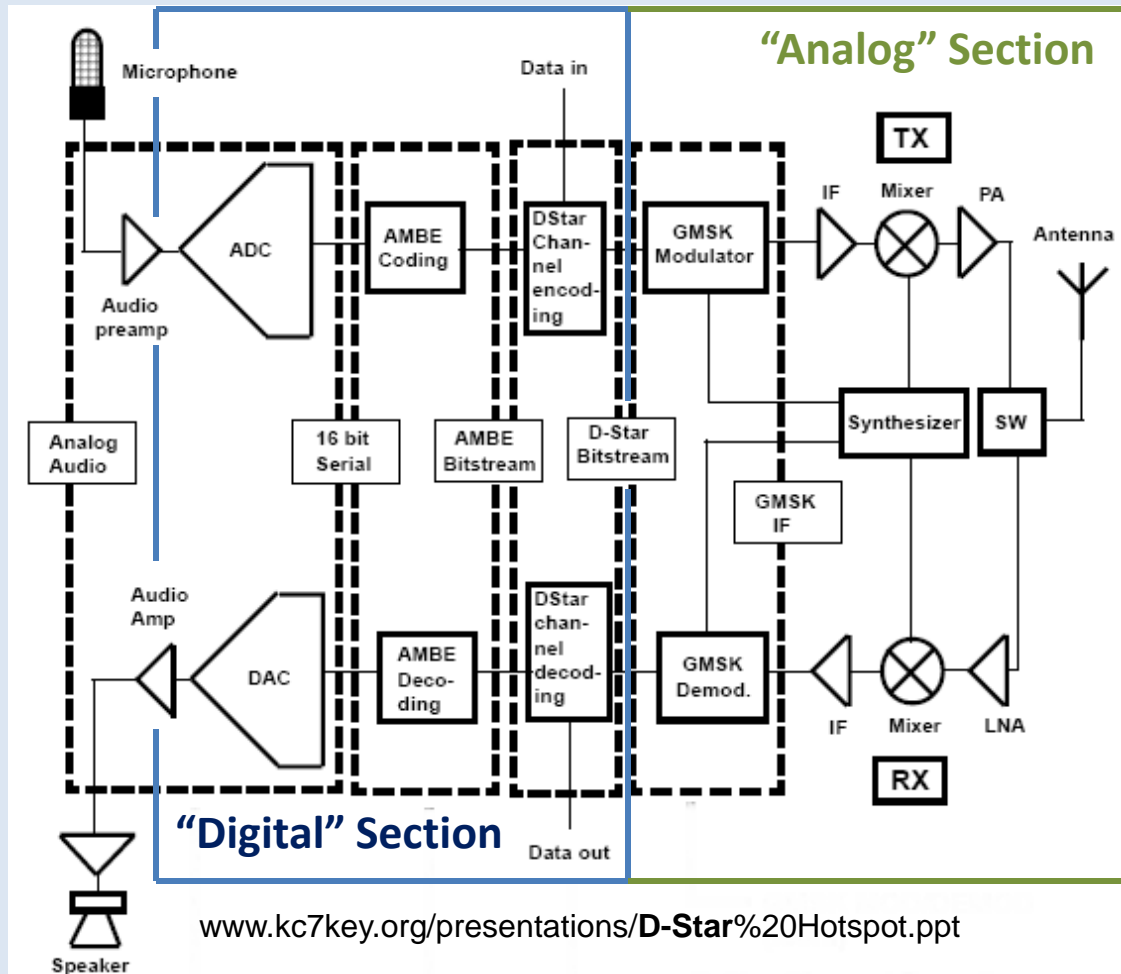
Set Radio To: **442.5125 MHz Offset +5.0000 MHz**

"■" represents a space

This uses the Dplus linking method



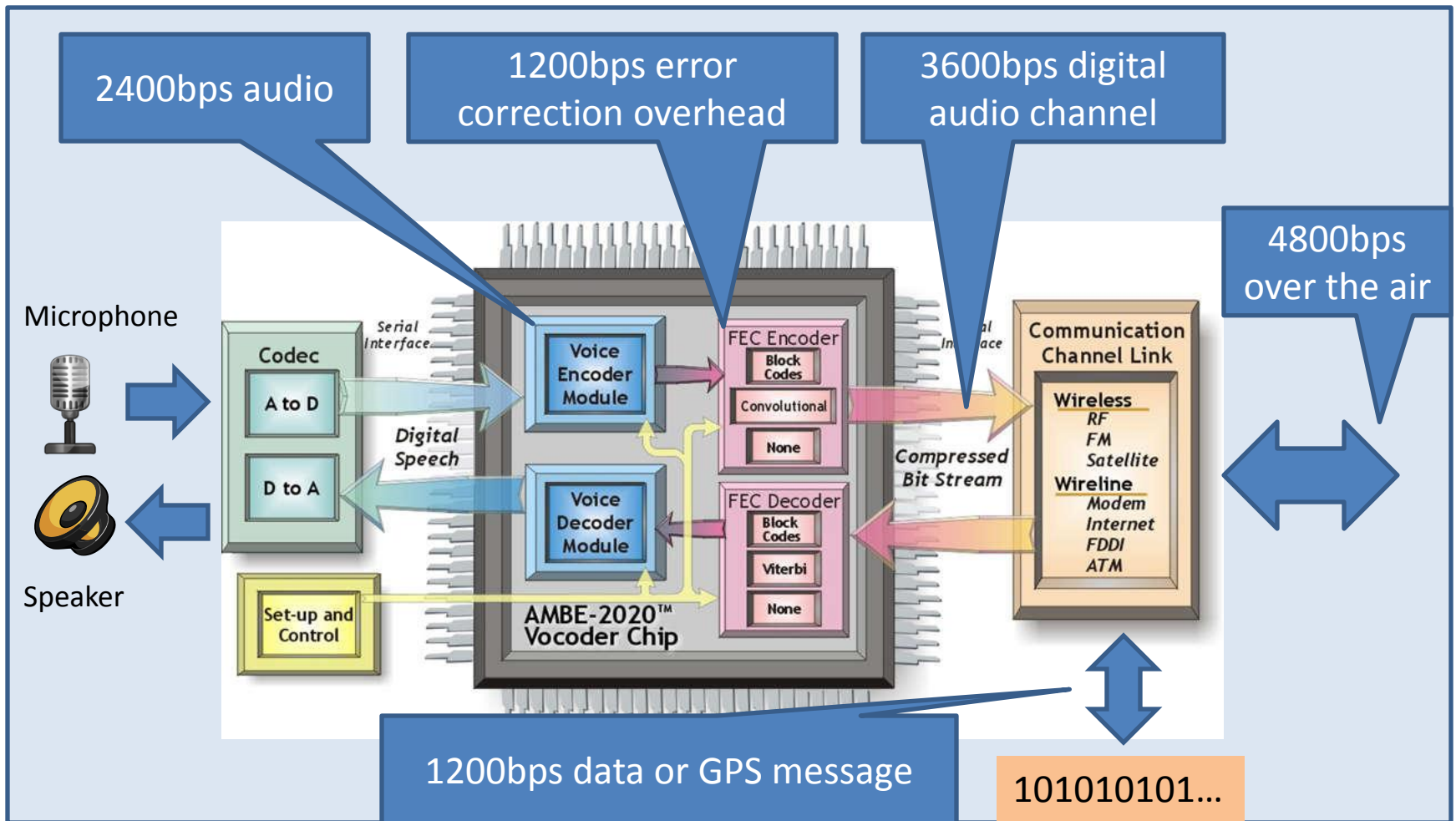
D-STAR Radio Block Diagram



www.kc7key.org/presentations/D-Star%20Hotspot.ppt

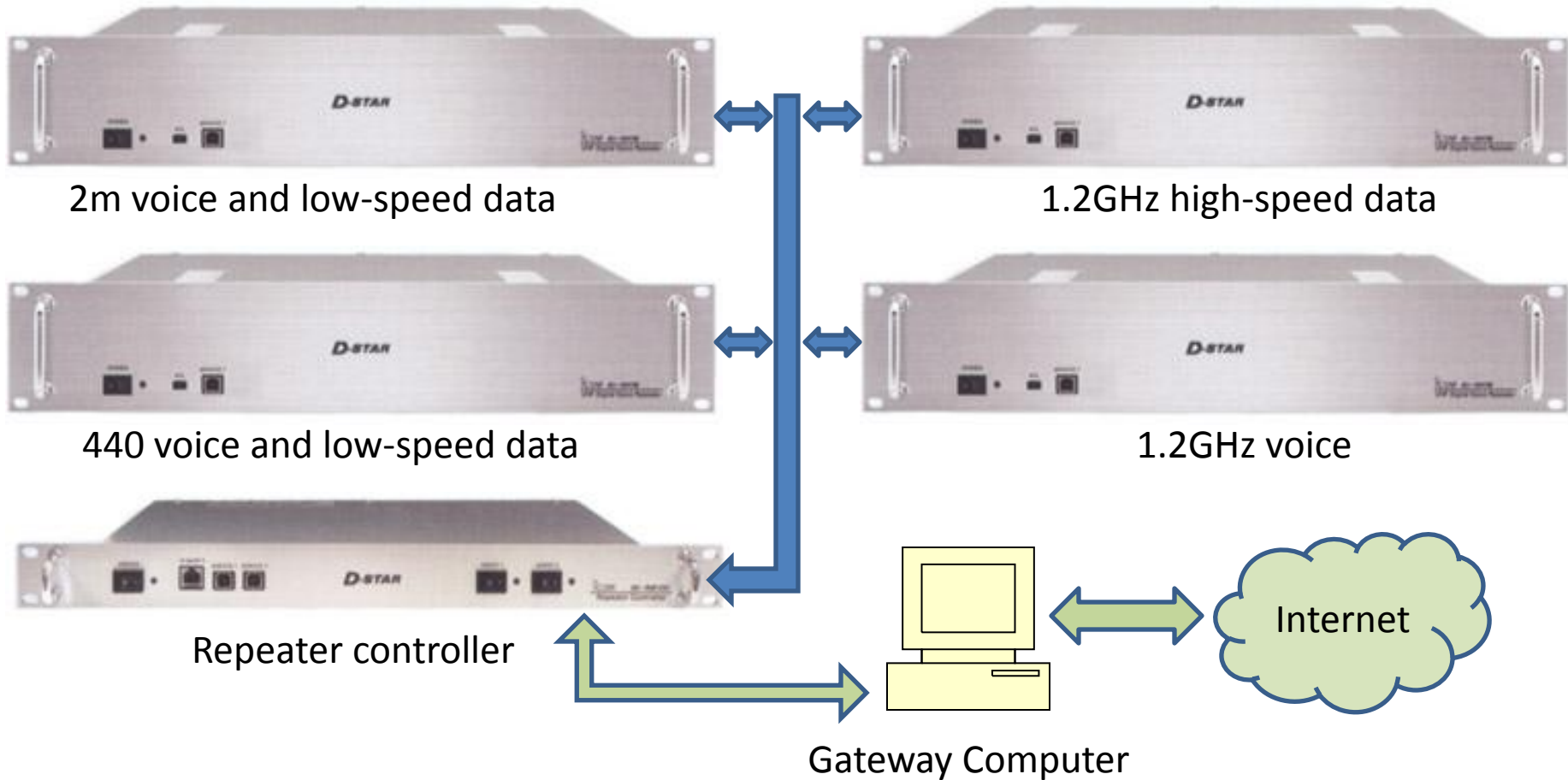


D-STAR Architecture





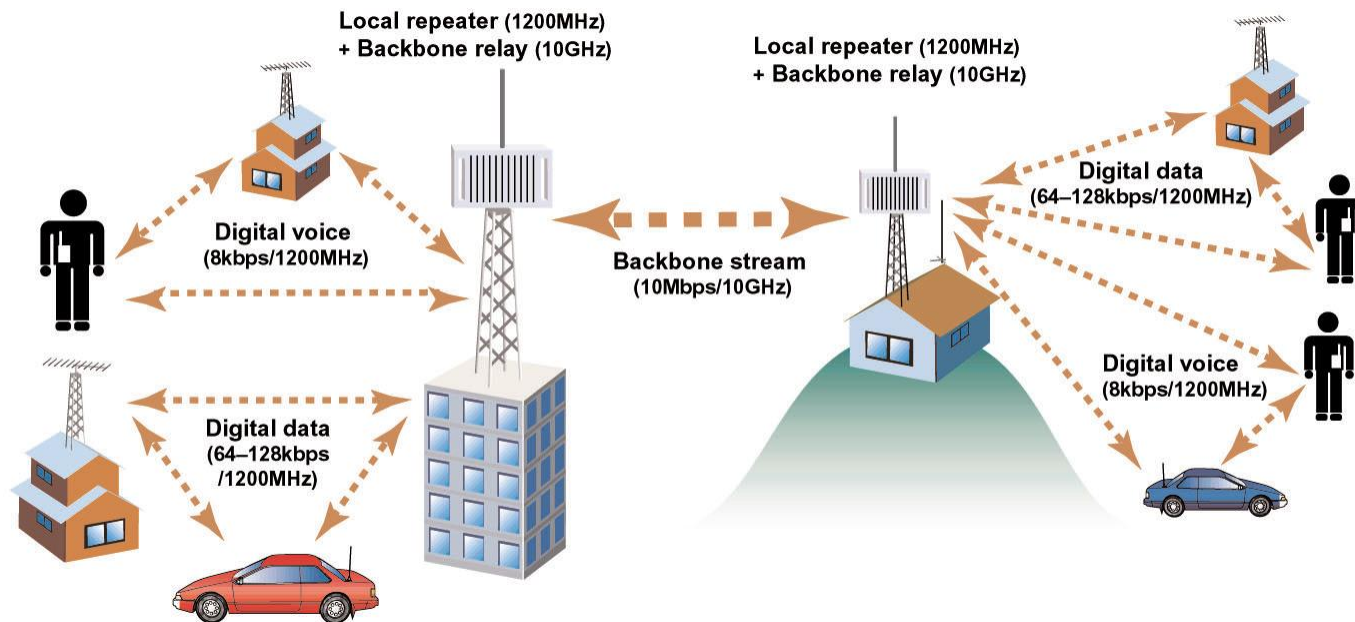
D-STAR Repeaters





D-STAR Backbone

When the going gets tough, D-STAR keeps on going!



Question: What happens if the Internet goes out in an emergency?

Answer: Link local repeaters together over a microwave backbone link!



D-STAR DV Dongle

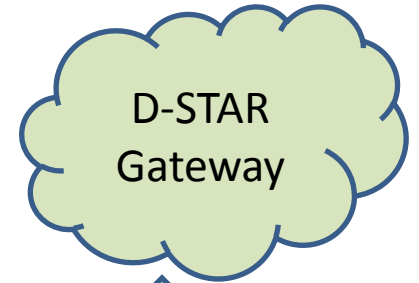
Access D-STAR radios and repeaters from your computer!



Computer
Headset



D-STAR
Gateway



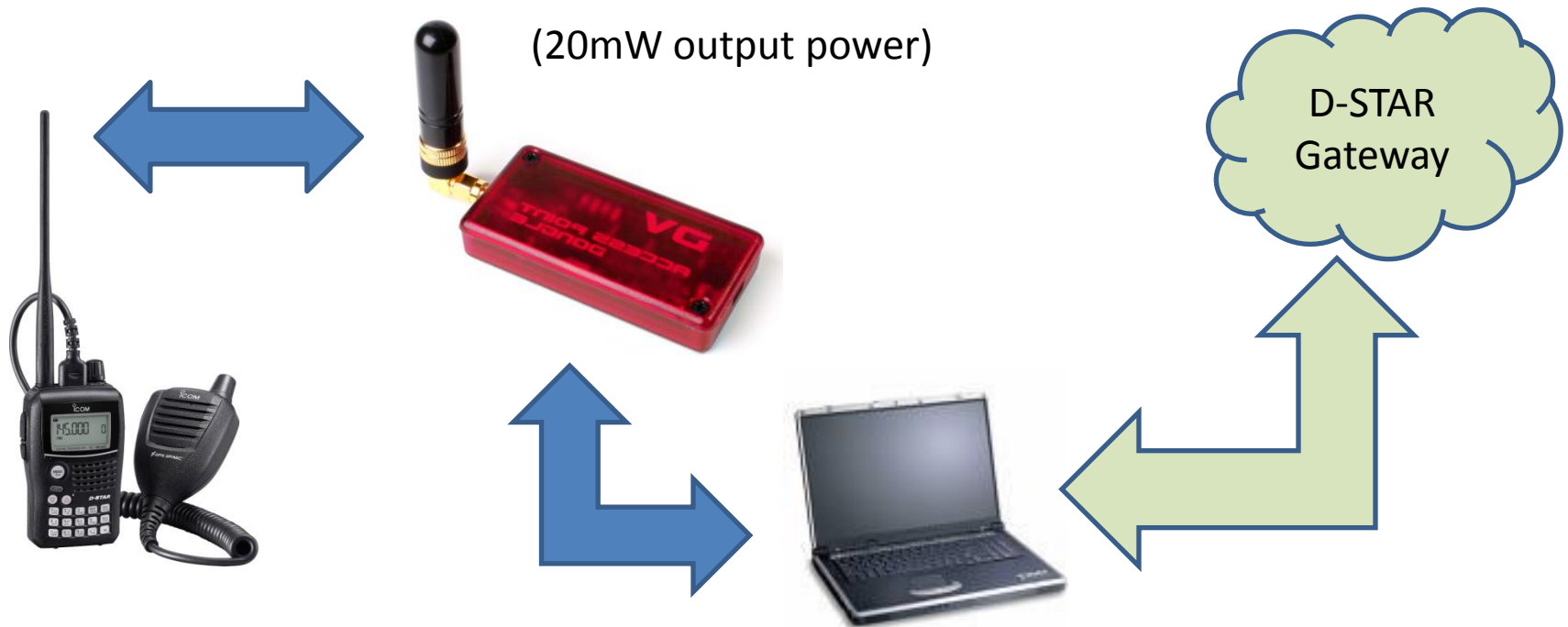
Open-source design platform!





D-STAR DV Access Point

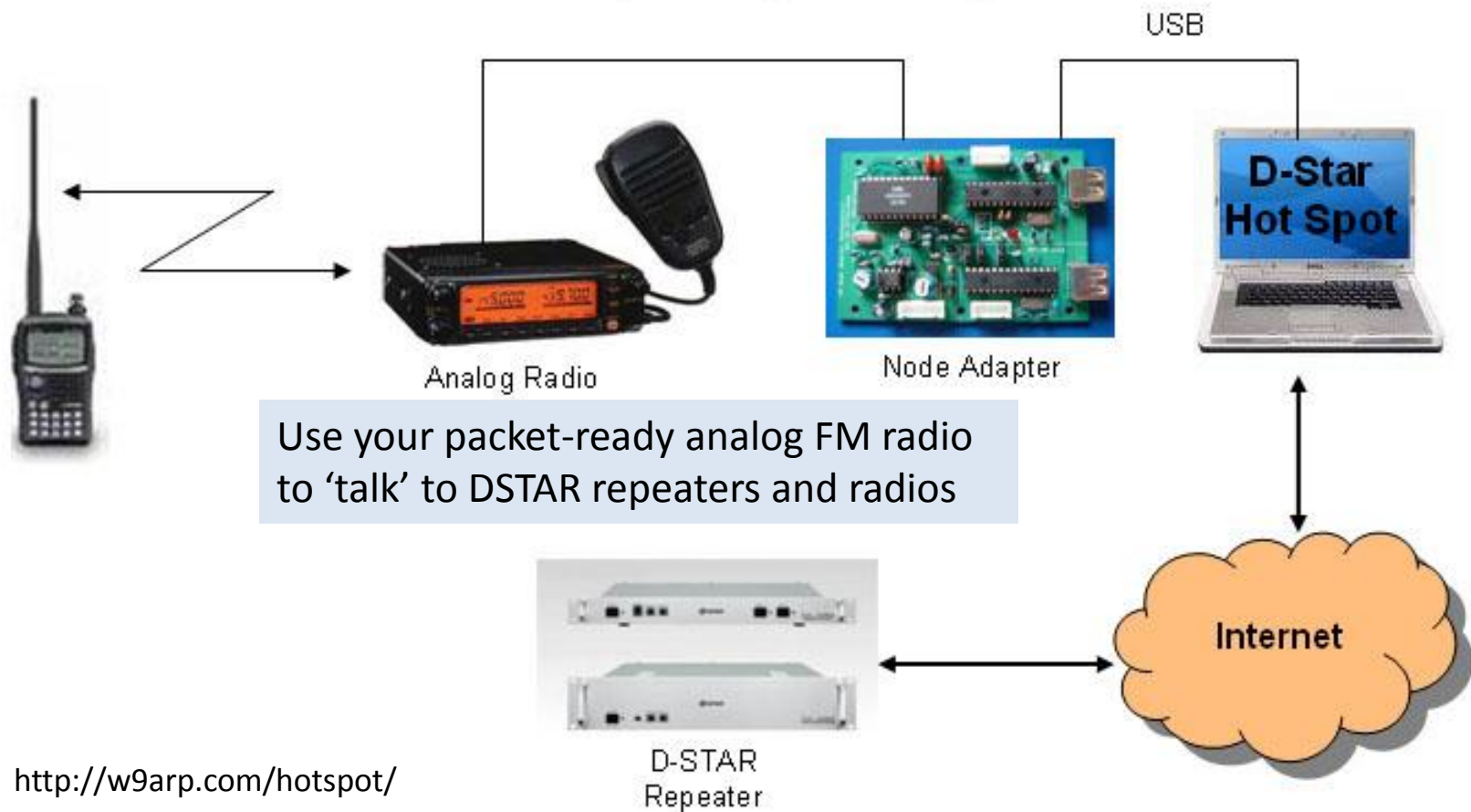
Lets D-STAR radios access the network when repeaters are not available!
A simplex 'digital hotspot' for D-STAR (similar to a WiFi hotspot)





D-STAR Hotspots

D-STAR Hot Spot - System Diagram

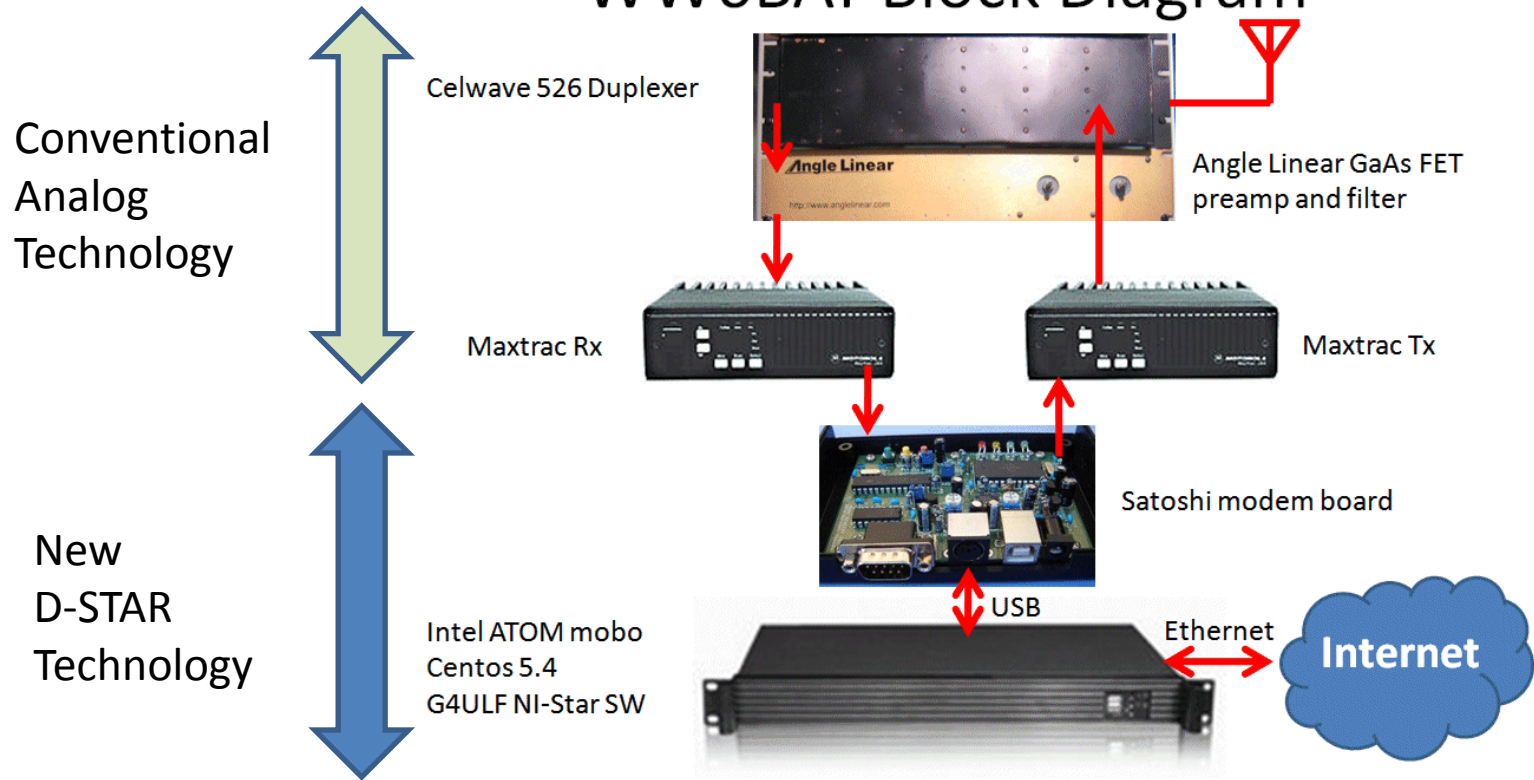




Build Your Own D-STAR Repeater

With D-STAR, you can leverage existing analog radio technology

WW6BAY Block Diagram

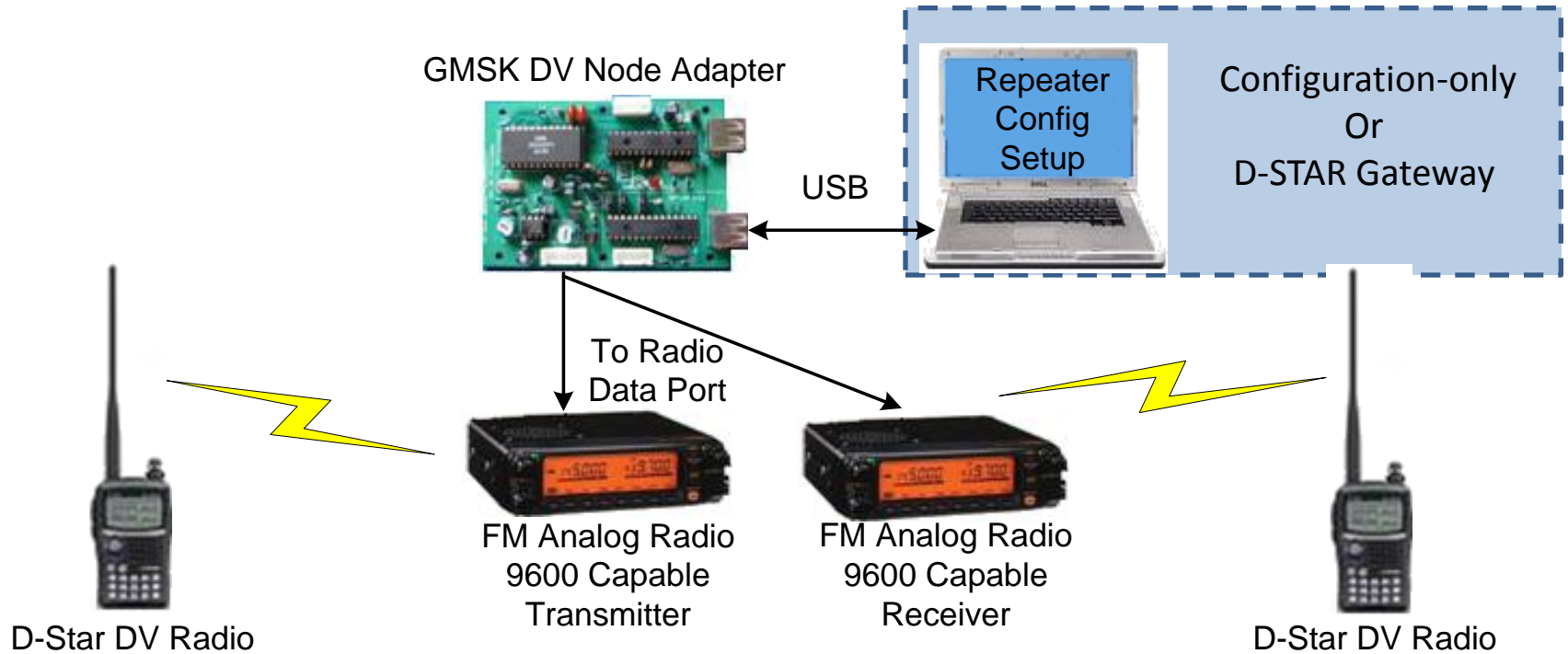


http://www.bay-net.org/ww6bay_dstar.html



Make-shift D-STAR Repeater

D-Star Standalone Repeater Diagram



www.kc7key.org/presentations/D-Star%20Hotspot.ppt



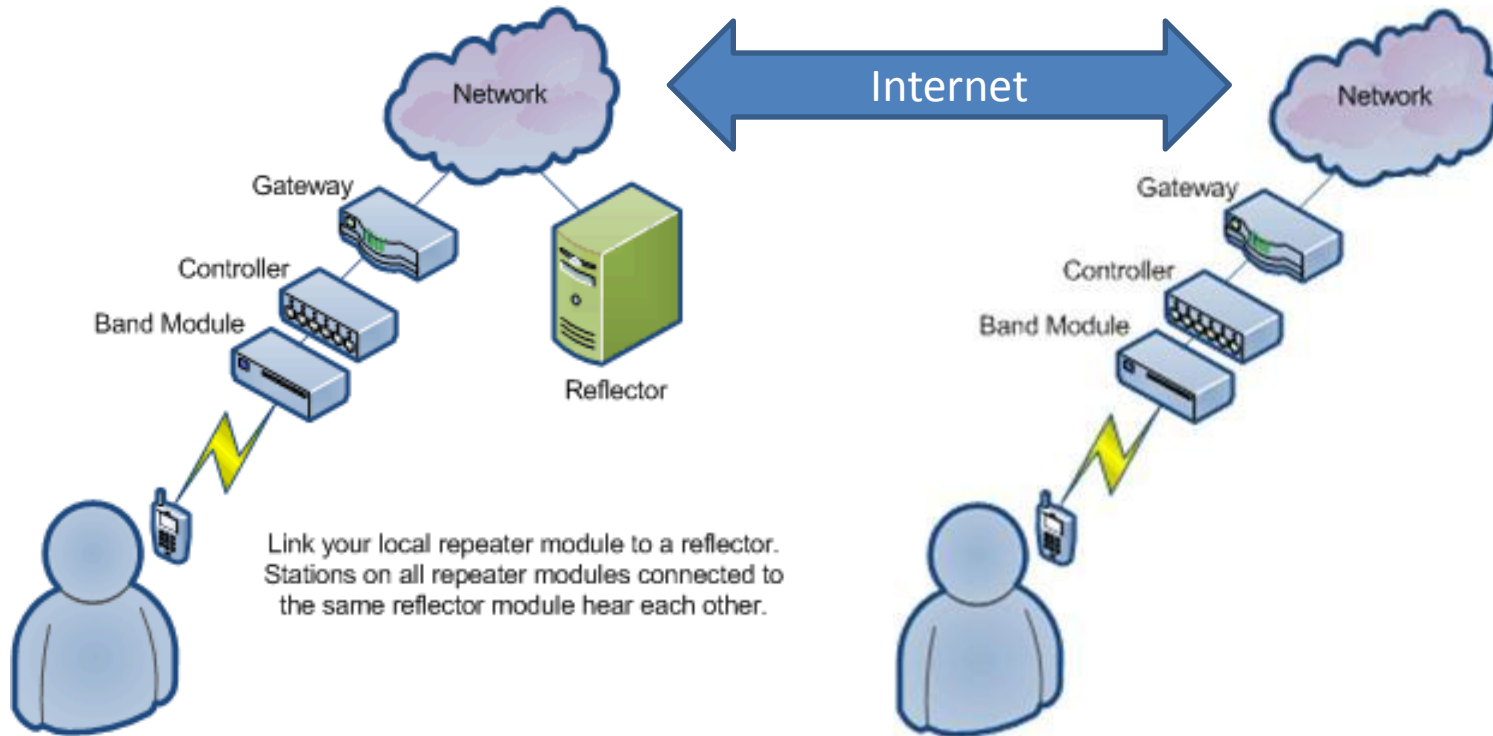
D-STAR Reflectors

- Basically a conference bridge for D-STAR
- Local, regional and world-wide DSTAR connections
- 60+ reflectors currently in existence
- All stations have consistent audio quality!
- Access via repeaters, hotspots, or the Internet (with a DV Dongle)



D-STAR Reflectors

Connect to other D-STAR users – around town or around the world!





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D-STAR PROMOTES INNOVATION!



D-Rats

- A Communications Tool For D-Star
- Instant-messaging style chat
- File transfer capability along with email
- Reflector
- Map display
- Structured forms (templates)
- Winlink 2000 support

Message "D-RATS 0.3.0 Release" received from

	Sender	Recipient	Subject	Type	Date
Inbox	K7HIO	KK7DS	D-RATS 0.3.0 Release	memo	21:17:47 2009-07-23
Outbox					
Sent	K7HIO	KK7DS	Need a status report	ICS213_US_OS	21:16:06 2009-07-23
Trash					

Map

Station

Station	Latitude	Longitude	Distance
Prov. St. Vinc Hosp	45.5094	-122.7716	7.53
WC Fire			
Stations			
WC EOCs			
Washington County ARES			
Misc			

Zoom

Min (X) Max

Track center

Static position

45.5191, -122.8913

<http://www.d-rats.com/>



D-Rats Forms

- Includes form editor to create any form
- Only data is sent
- Fully printable ICS-213, ARRL Radiogram and NTS Forms included

Mozilla Firefox

File Edit View History Bookmarks Tools Help

HICS 260 - Patient Evacuation Tracking Form

Date 01-May-2009 Unit ER

Patient Name L. Smith Age 13 MR# 987654321

Diagnosis Fever Admitting Physician D. Smith

Family Notified YES NO

9. ACCOMPANYING EQUIPMENT

<input checked="" type="checkbox"/> Hospital Bed	<input type="checkbox"/> IV Pumps	<input checked="" type="checkbox"/> Isolette/Warmer	<input type="checkbox"/> Foley Catheter
<input checked="" type="checkbox"/> Gurney	<input checked="" type="checkbox"/> Oxygen	<input type="checkbox"/> Traction	<input type="checkbox"/> Halo Device
<input type="checkbox"/> Wheel Chair	<input checked="" type="checkbox"/> Ventilator	<input checked="" type="checkbox"/> Monitor	<input type="checkbox"/> Cranial Bolt/Screw
<input type="checkbox"/> Ambulatory	<input type="checkbox"/> Chest Tube(s)	<input type="checkbox"/> A-Line/Swan	<input type="checkbox"/> IO Device

10. DEPARTING LOCATION

Departure Room # 123 Departure Time 13:04:00

ID Band Confirmed YES NO Confirmed By T. Smith

Medical Record Sent YES NO

Addressograph Sent YES NO

Belongs With Patient YES NO

11. ARRIVING LOCATION

Arrival Room # Arrival Time 13:04:00

ID Band Confirmed YES NO Confirmed By

Medical Record Sent YES NO

Addressograph YES NO

Belongs Received YES NO

ICS-213 Form

Incident Name: Montgomery Flooding Date/Time of message: 07-May-2009 11:03:55 GENERAL MESSAGE ICS 213-OS

To: KF4LQK ICS Position: LOGISTICS-COMMUNICATIONS

Sender: KD4CAL ICS Position: LO

Subject: MONTGOMERY FL

Message: Les, K4DJL EL from reports 2 to 5 feet of homes are taking off partially blocking reported to K4NWS

Replay:

Signature / Position (person replying): GENERAL MESSAC

ICS-213 Form

Incident Name: Alabama Hurricane Exercise Date/Time of message: 07-May-2009 9:30:19 GENERAL MESSAGE ICS 213-OS

Message: Les, this is a list of D-STAR repeaters in Alabama that are linked up for the Alabama Hurricane Exercise. W4AP Montgomery, WB4GNA Cheaha, W4KCC Tuscaloosa, K4DSO Birmingham, K14SAZ Magnolia Springs Baldwin county, K14PPF Huntsville. Also ARRL HQ is on DV Dongle linked to us via Reflector 002 Module B.

Replay:

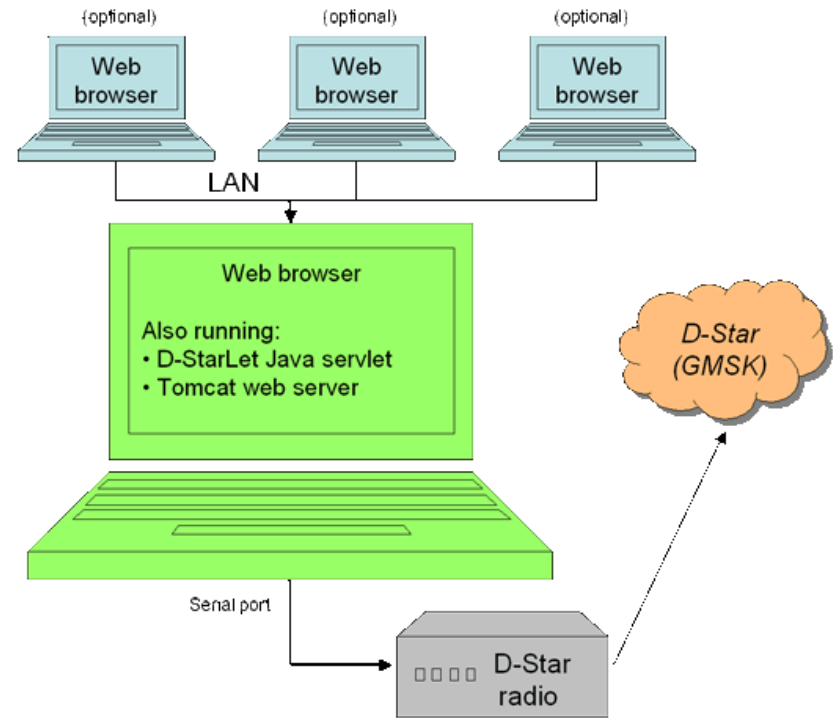
Signature / Position (person replying):

Date/Time of reply: 07-May-2009 9:30:19



D-StarLet

- A web-based text messaging application using D-Star digital data technology
- Multiple computer support (client/server)

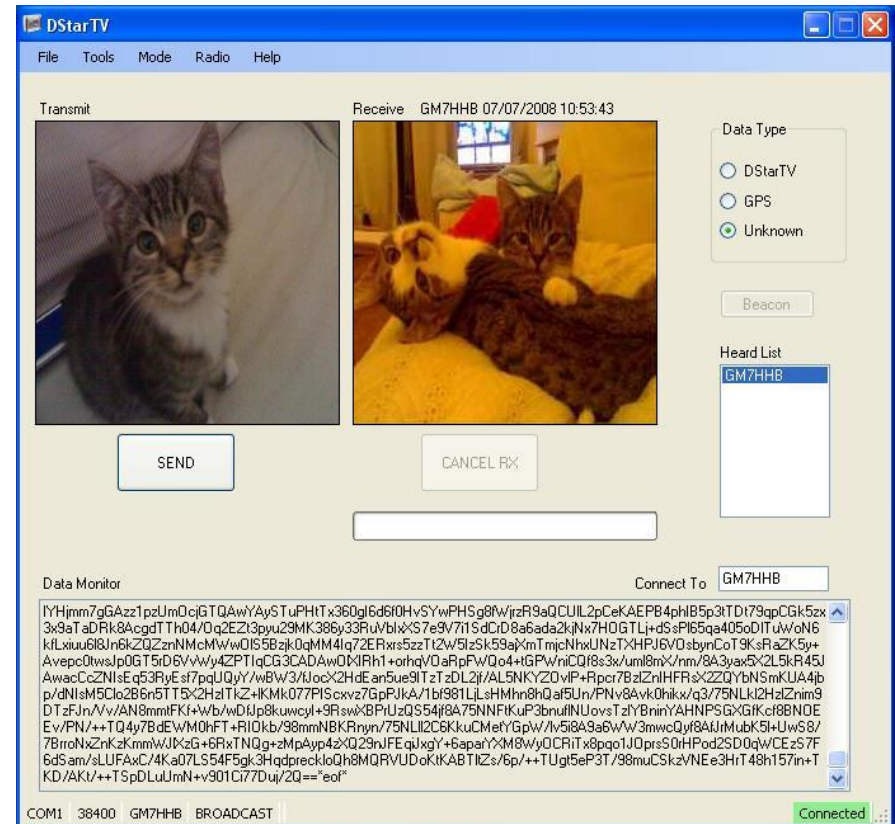


<http://dstarlet.ae7q.net/>



D-Star TV

- DStar TV is Slowscan TV for DStar digital radios
- DStar TV sends images as a compressed jpeg (240x240 pixels)
 - the compression can be adjusted
 - on par with slowscan TV, and as such has about the same transfer rate
- Icom ID-1 DD mode (i.e., 128kbps) for streaming video is available



<http://www.dstartv.com/>



D-STAR and Satellites



OUFTI-1 Nanosatellite
Universite de Liege - Belgium

D-STAR in space!
Scheduled launch: summer 2013

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 in 2007

- OUFTI: Orbital Utility For Telecommunication Innovation
- The **key, innovative feature** of OUFTI-1 is the use of the **D-STAR amateur-radio digital-communication protocol**
- This means of radio-communication will be made available to ham-radio operators worldwide. In the future, it will also be used to control space experiments.



DVRPTR Board

- Digital Voice Modem (GMSK) based on a powerful 32-bit AVR microcontroller
- **All DV functions are implemented in software**
- Open source code
- D-STAR hotspots, repeaters and stand-alone repeaters
 - PC or Raspberry Pi



<http://www.dvrptr.net/index.html>

Open DV: Open Digital Voice Software

<http://opendv.berlios.de/index.html>


FREE STAR* is an experimental approach to the implementation of a vendor neutral, and open source, digital communication network.

<http://www.va3uv.com/freestar.htm>



NW Digital Gateway

- Data rates: 4800-56K+ bps
- selectable modulation:
 - GMSK/FSK/4FSK.
- 70cm band (420-450MHz)
- 25 watts
- One (1) Ethernet jack
- Four (4) host USB ports
- Power and antenna connections
- All radio functions are controlled by software:
 - web browser or custom application



UDR56K-4
Universal Digital Radio
*Ethernet to RF
in a Single Package*



Available Q3, 2013

<http://nwdigitalradio.com/>



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D-STAR COMPARISONS



D-STAR vs. FM

D-STAR

- 6.25kHz occupied BW
- 2400bps digital audio
- 1200bps digital data simultaneously!
- Interleaver/forward error correction
 - rate $\frac{1}{2}$ convolutional encoder
- D-STAR radios support both digital and analog modes

FM

- 15kHz occupied BW
- 1200bps with separate TNC
- No forward error correction or interleaver



KC5ZRQ tests D-STAR against FM

http://www.w2sjw.com/radio_sounds.html



Is D-STAR like Echolink or IRLP?

D-STAR

- “Digital at the source”
- Audio quality is consistent with any repeater/hotspot configuration
- DSTAR is not a computer-only application
 - But it is computer friendly!

Echolink and IRLP

- Echolink and IRLP are analog only
 - Must convert to digital before connecting to the Internet
- Audio quality varies greatly with repeater/node configurations
- Echolink and IRLP are inherently computer-based applications



D-STAR vs. APRS

D-STAR

- GPS position data directly sent as part of 1200bps data stream
- Format called DPRS
- Some radios display position data

APRS

- TNC required to connect GPS to analog radio
- Standard APRS format
- Most radios require a computer display



D-STAR vs. APCO-25

D-STAR

- Uses AMBE vocoder
- Packet-based voice & data
- “flat” architecture
- Any station can connect to any station
 - **The way hams operate!**

APCO-25 (P25)

- IMBE vocoder (similar to AMBE vocoder)
- Packet-based voice & data
- “tree” architecture
- Tightly structured communications hierarchy
- Developed specifically for local, state and federal public safety communications



Summary of D-STAR Basics

- We've only just begun to scratch the surface of digital technology in ham radio
- D-STAR has much to offer ham radio!

Thank you and 73!