



National Capital Region D-Star Association

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D-STAR Basics

TAPR DCC 2011
September 17, 2011



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



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 Repeaters
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



National Capital Region D-Star Association

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AN INTRODUCTION TO D- STAR

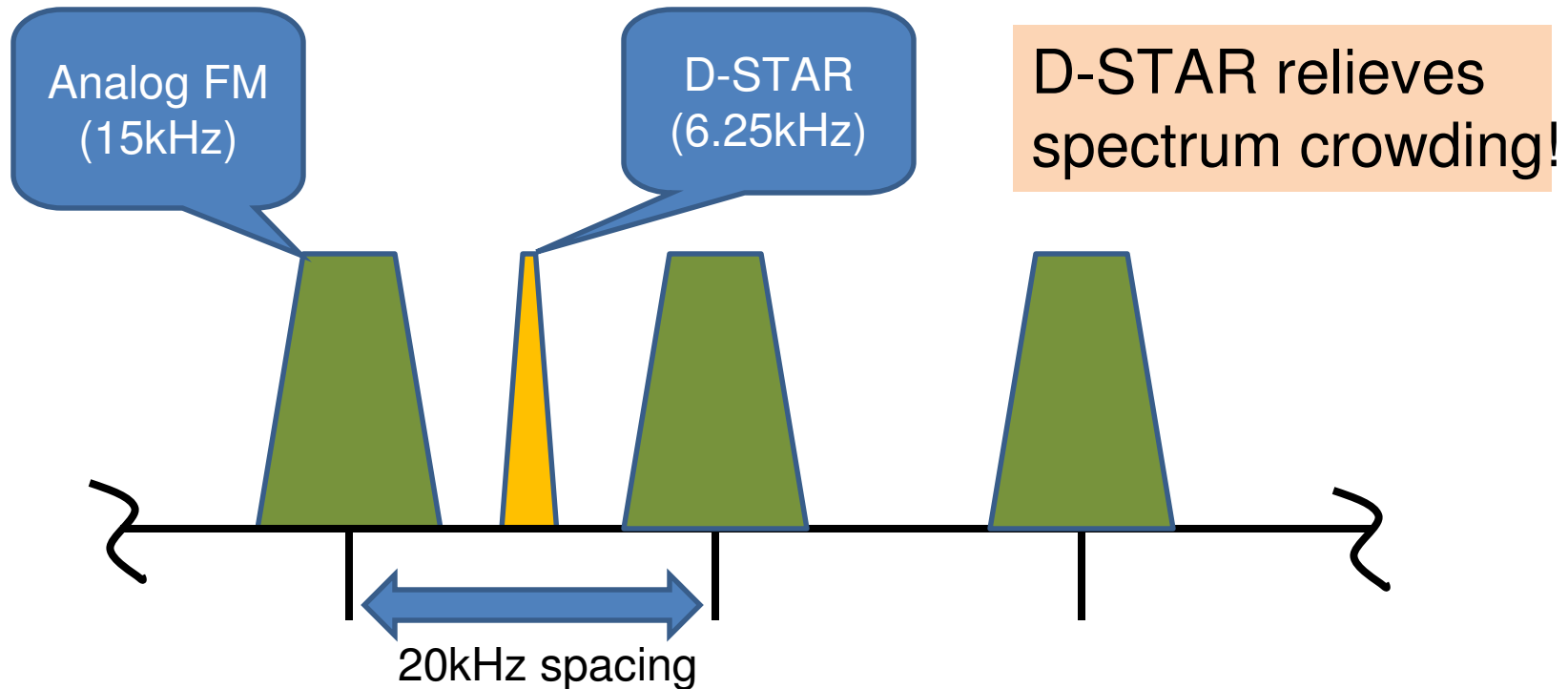


What is D-STAR?

- 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

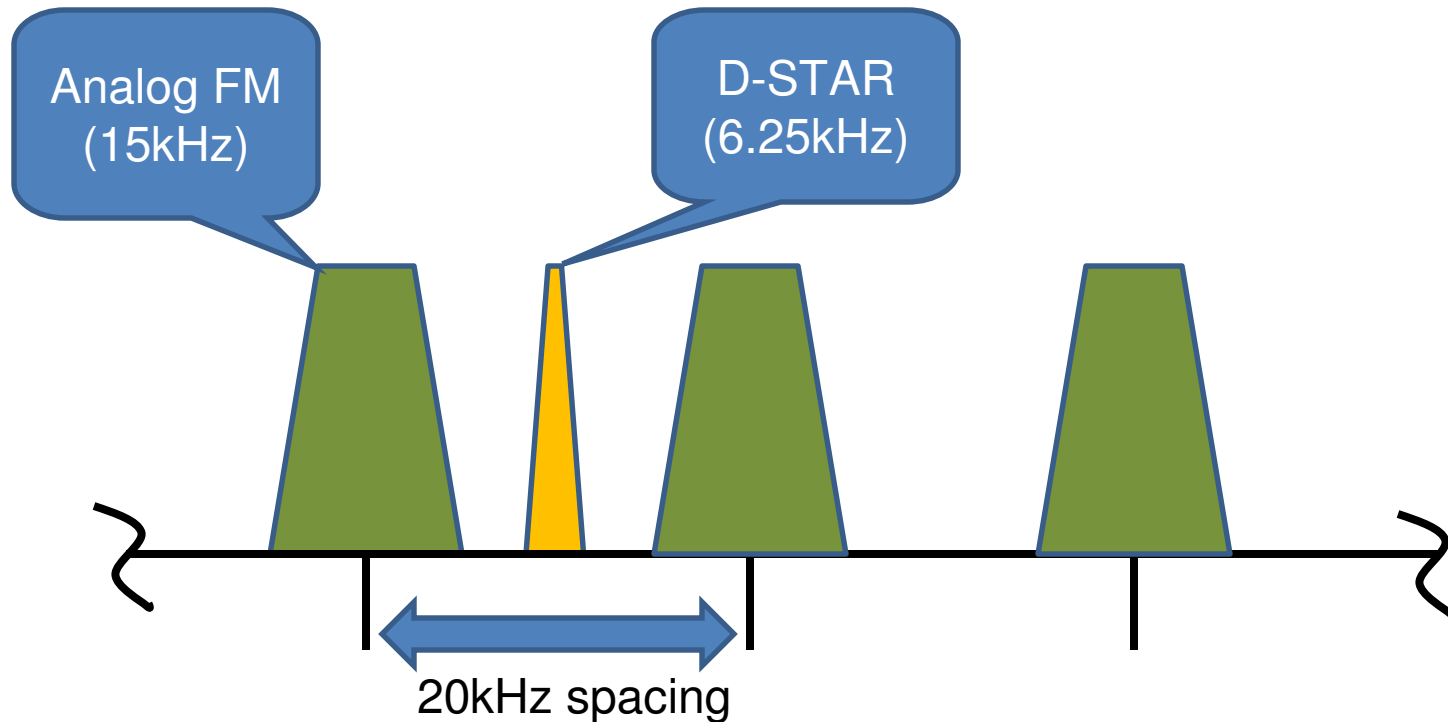
- 6.25kHz occupied bandwidth
- 10kHz channel spacing

Analog FM

- 15kHz occupied bandwidth
- 20kHz channel spacing



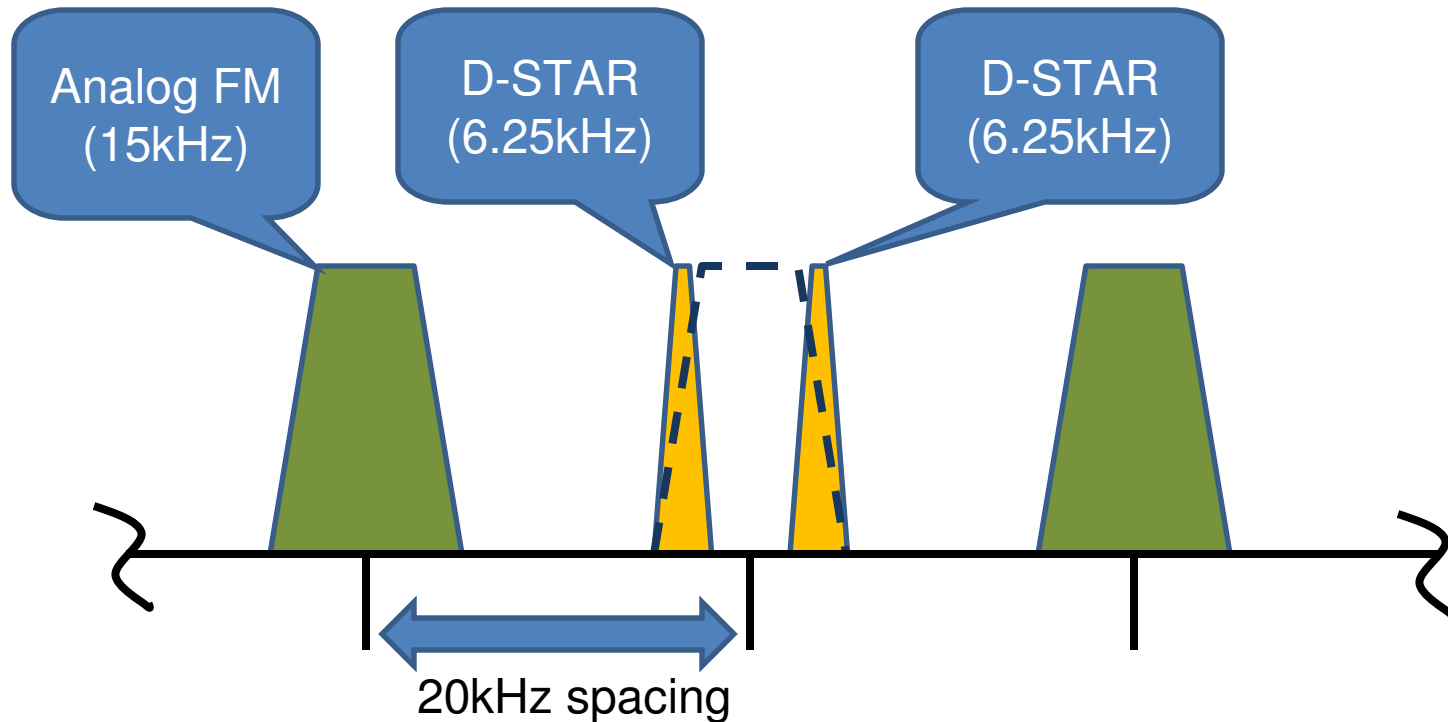
D-STAR and Analog Repeater Allocations



D-STAR repeaters can be allocated between existing FM repeat



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

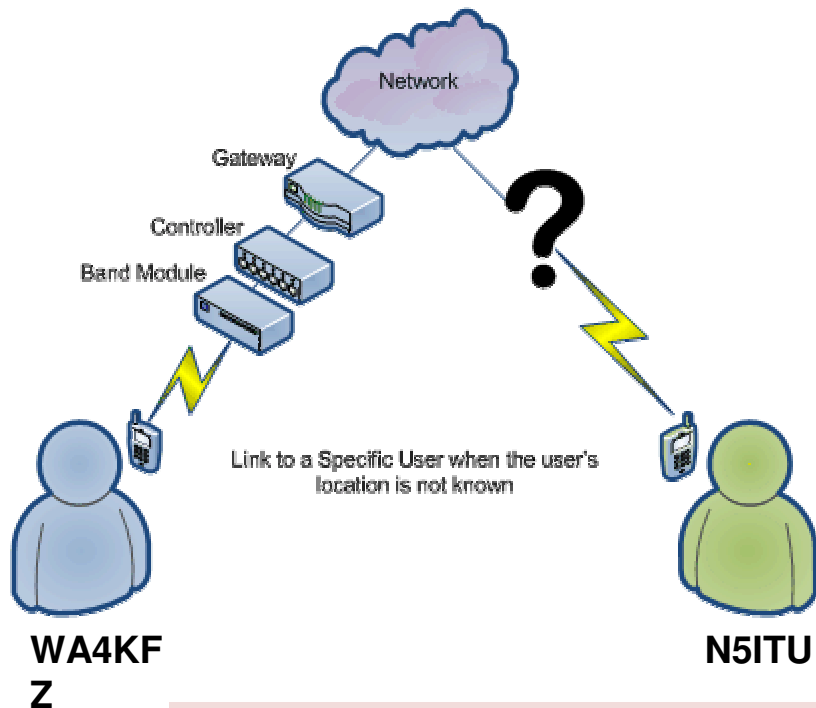


Callsign Routing

- 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:

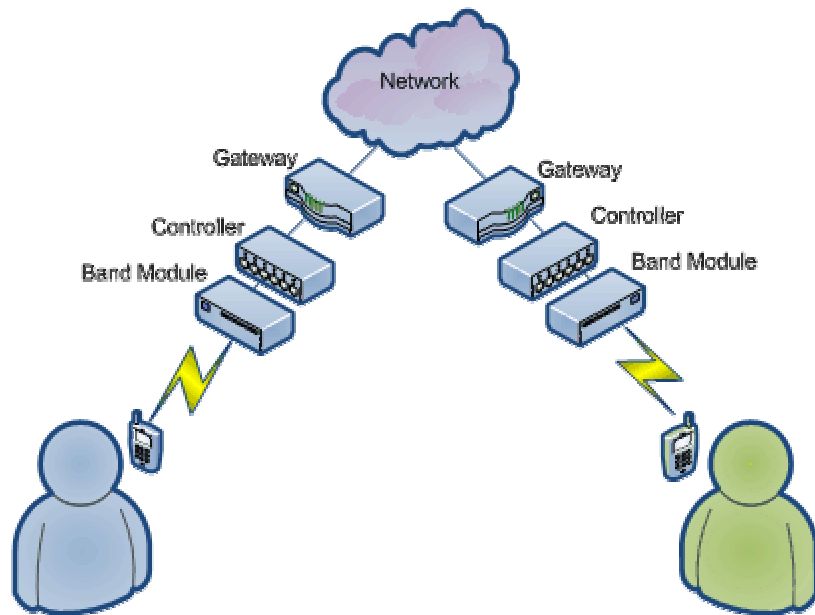
- Set RPT1 to his local repeater module
- Set RPT2 to his local repeater gateway
- Press the RX->CS button and say Howdy!

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



WA4KF
Z

- 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

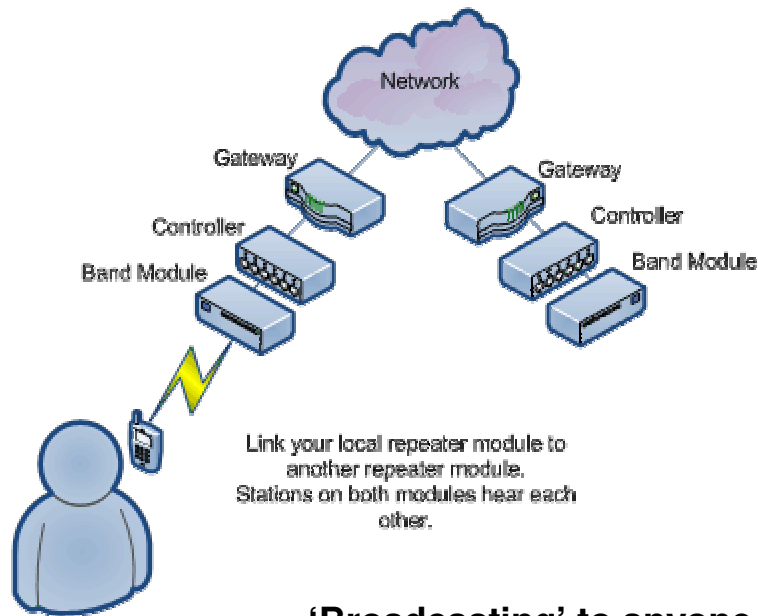
Set Radio
To: 442.5125 MHz Offset +5.0000 MHz

"•" represents a space

This is the original Icom
source routing method



Callsign Routing – Connecting Repeaters Together



Link your local repeater module to another repeater module. Stations on both modules hear each other.

**WA4KF
Z**

- ‘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**

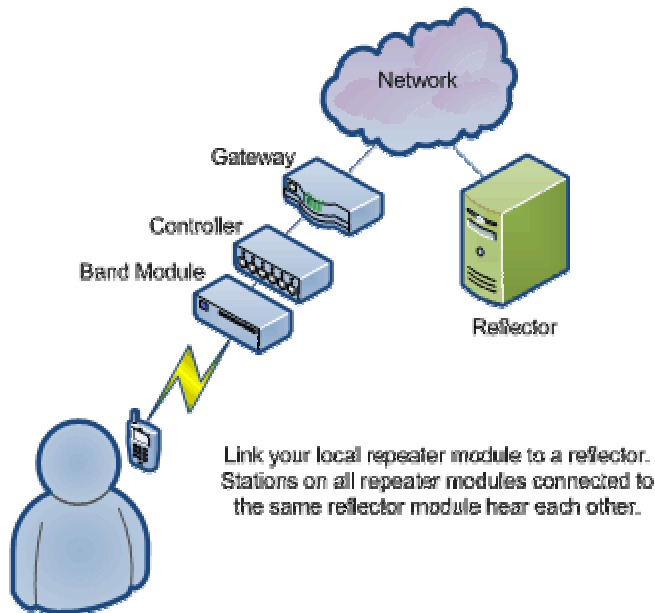
Set Radio
To: **442.5125 MHz Offset +5.0000 MHz**

" " represents a space

This uses the Dplus linking method



Callsign Routing – Connecting to a Reflector



**WA4KF
Z**

- ‘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**

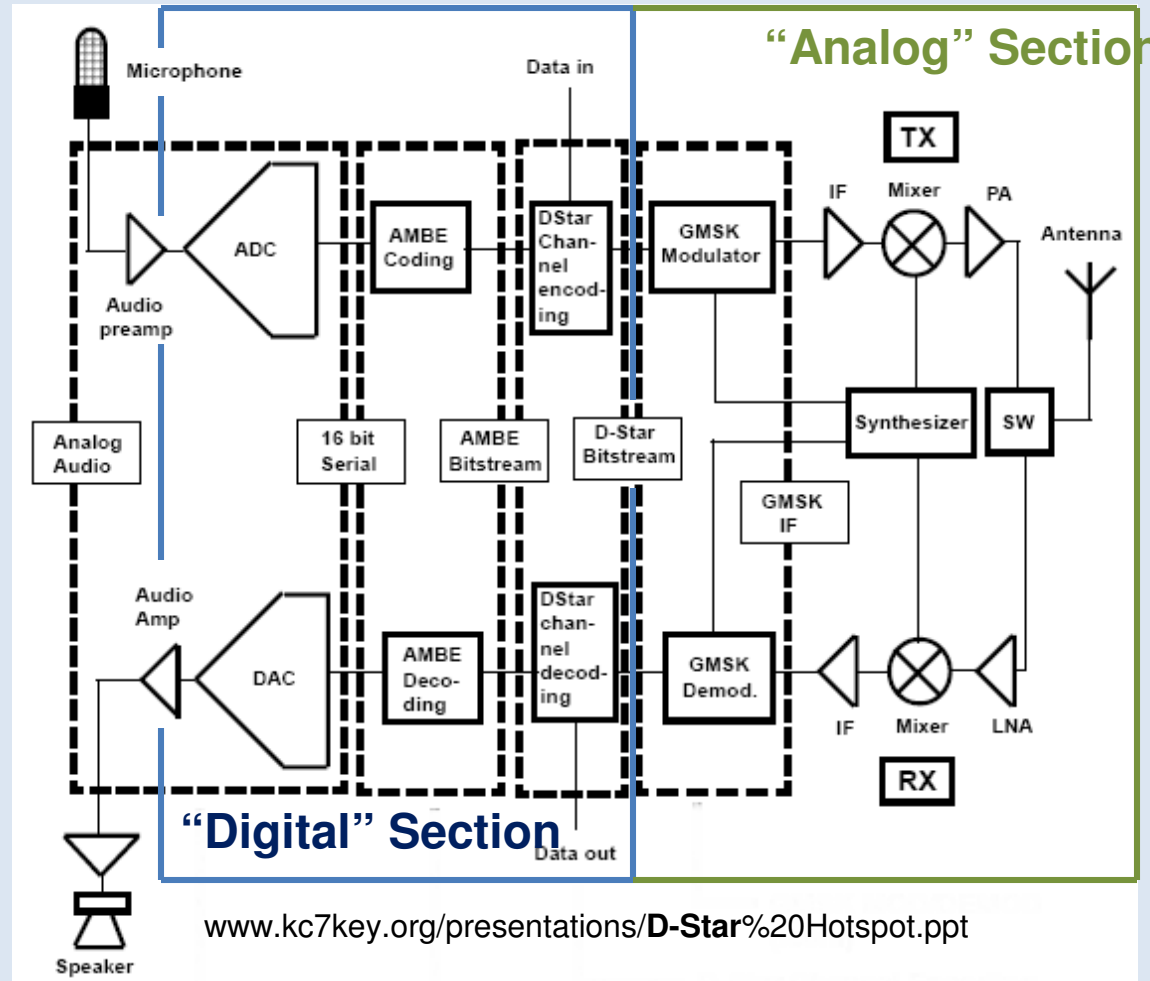
Set Radio
To: **442.5125 MHz Offset +5.0000 MHz**

"●" represents a space

This uses the Dplus linking method

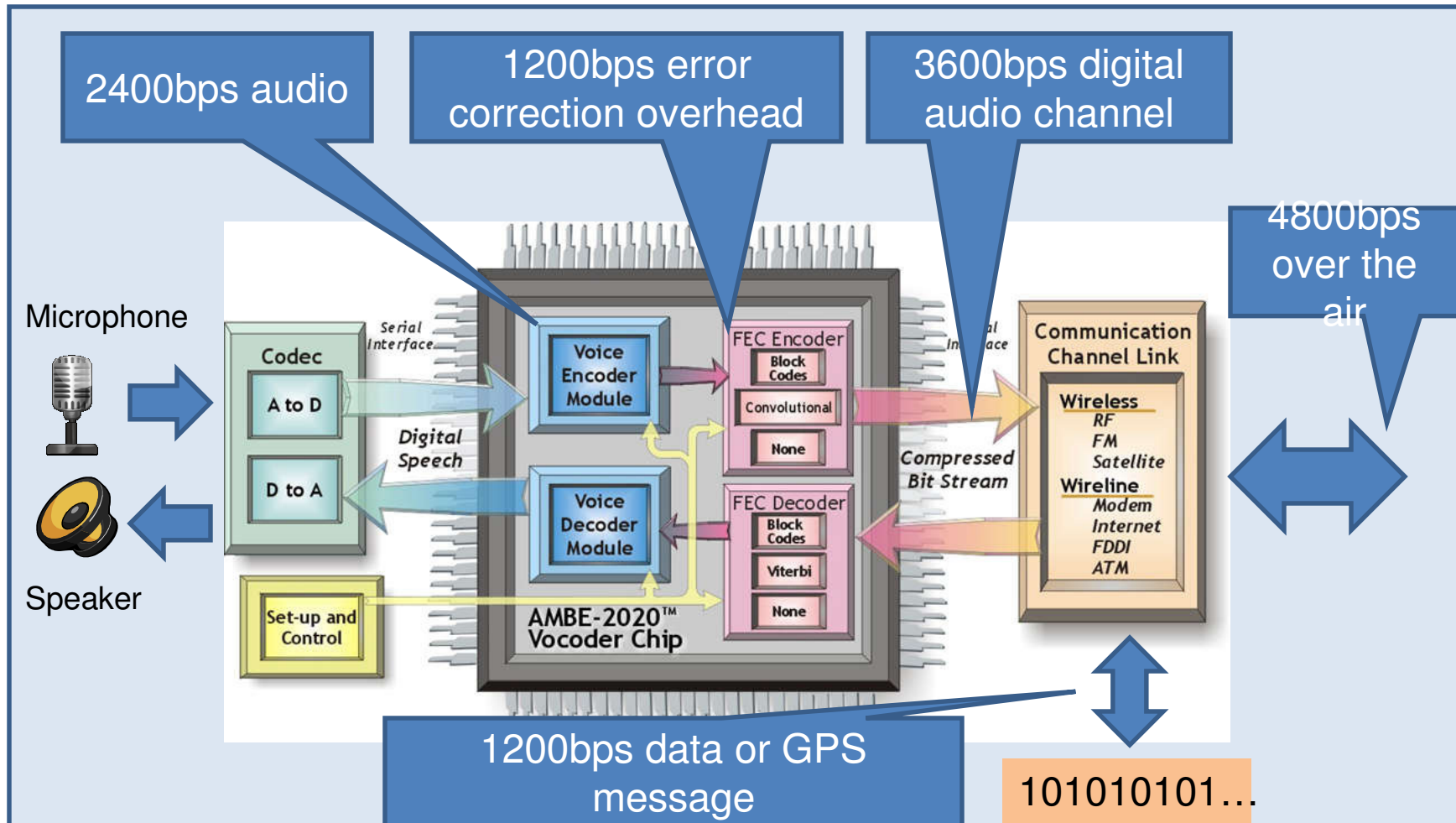


D-STAR Radio Block Diagram



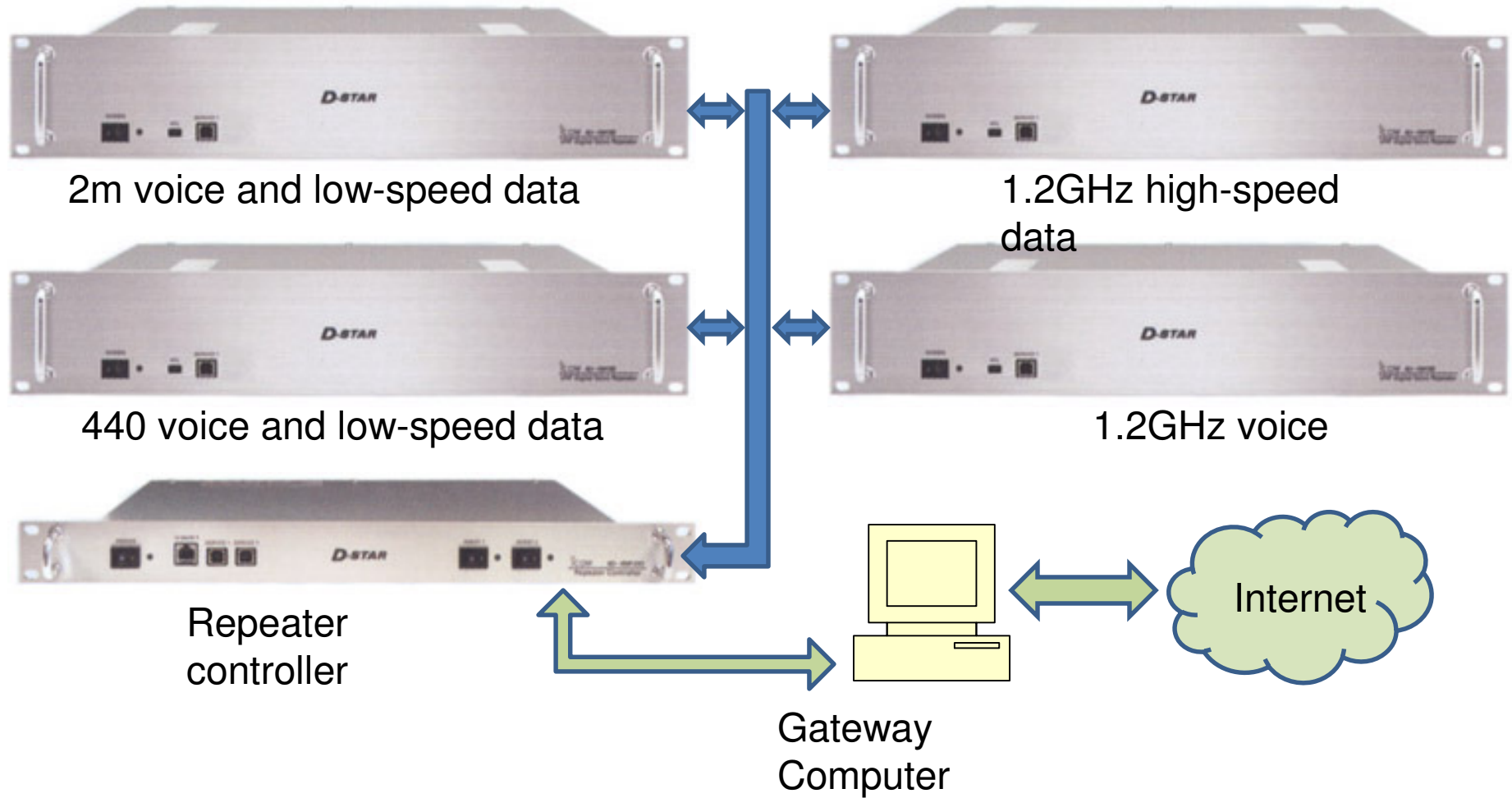


D-STAR Architecture





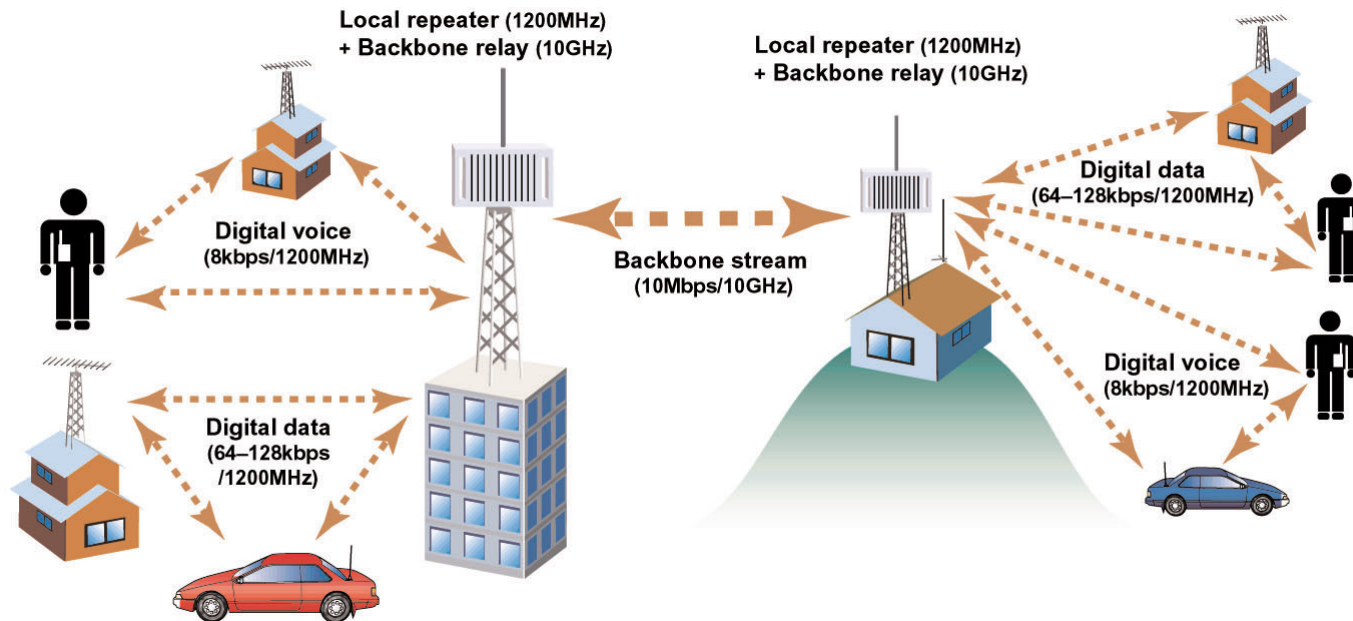
D-STAR Repeaters





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



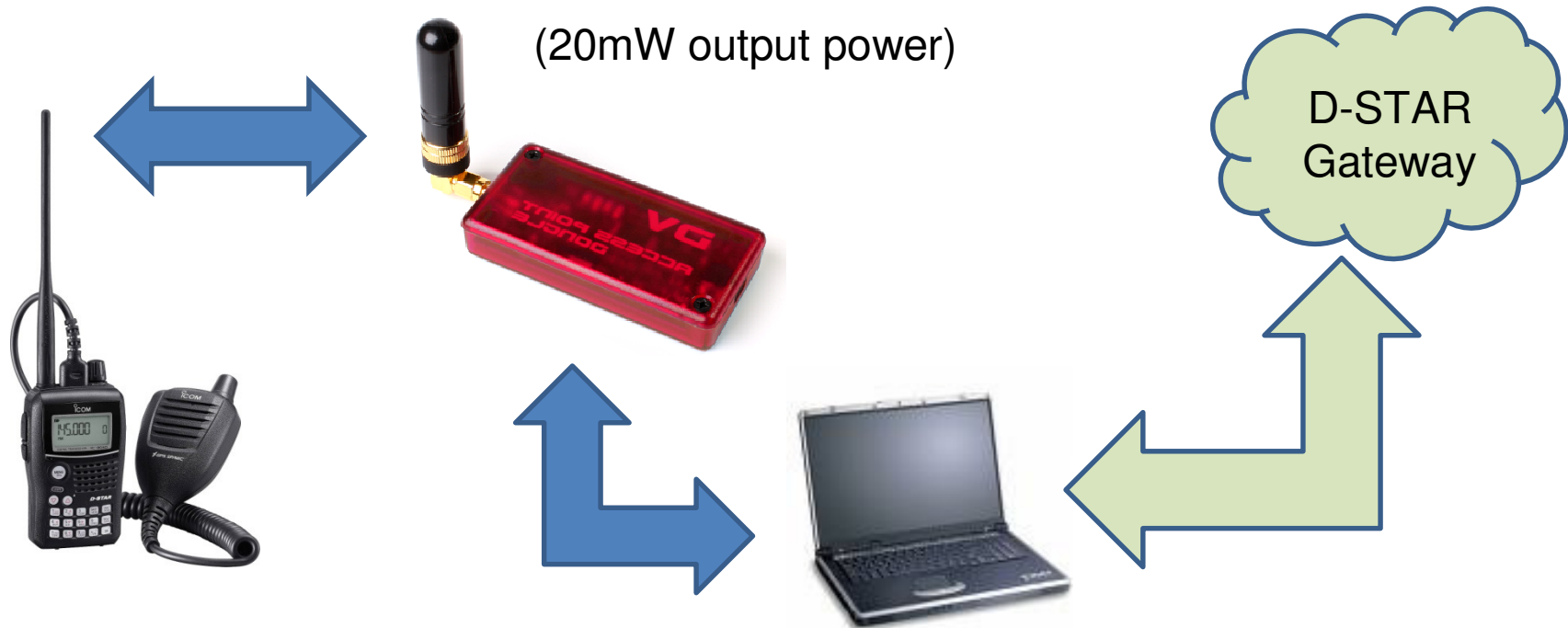
Open-source design
platform!





D-STAR DV Access Point

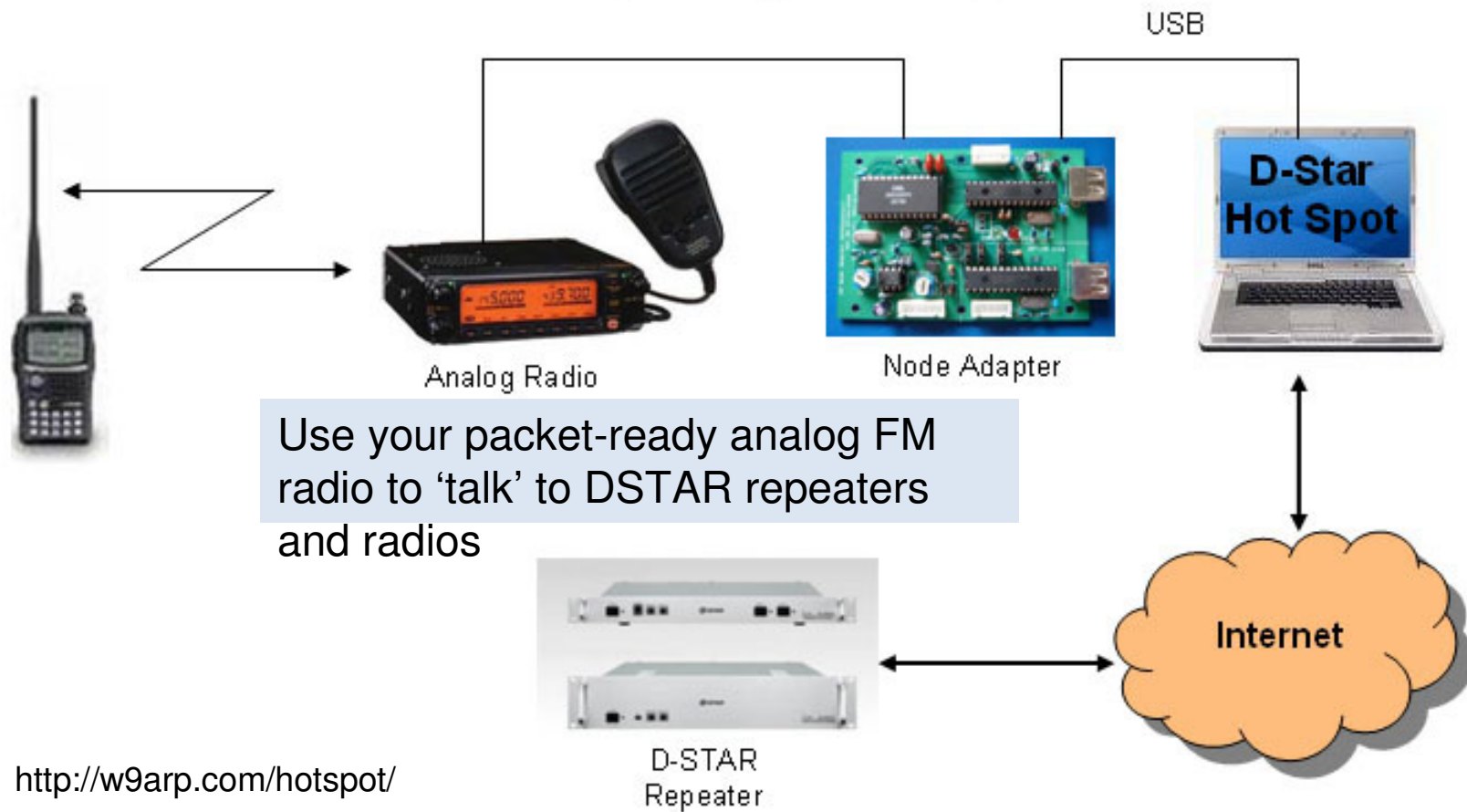
Lets D-STAR radios access the network when repeaters are not available!
A simplex 'digital hotspot' for D-STAR (similar to a WiFi hotspot)





D-STAR Hotspots

D-STAR Hot Spot - System Diagram



<http://w9arp.com/hotspot/>

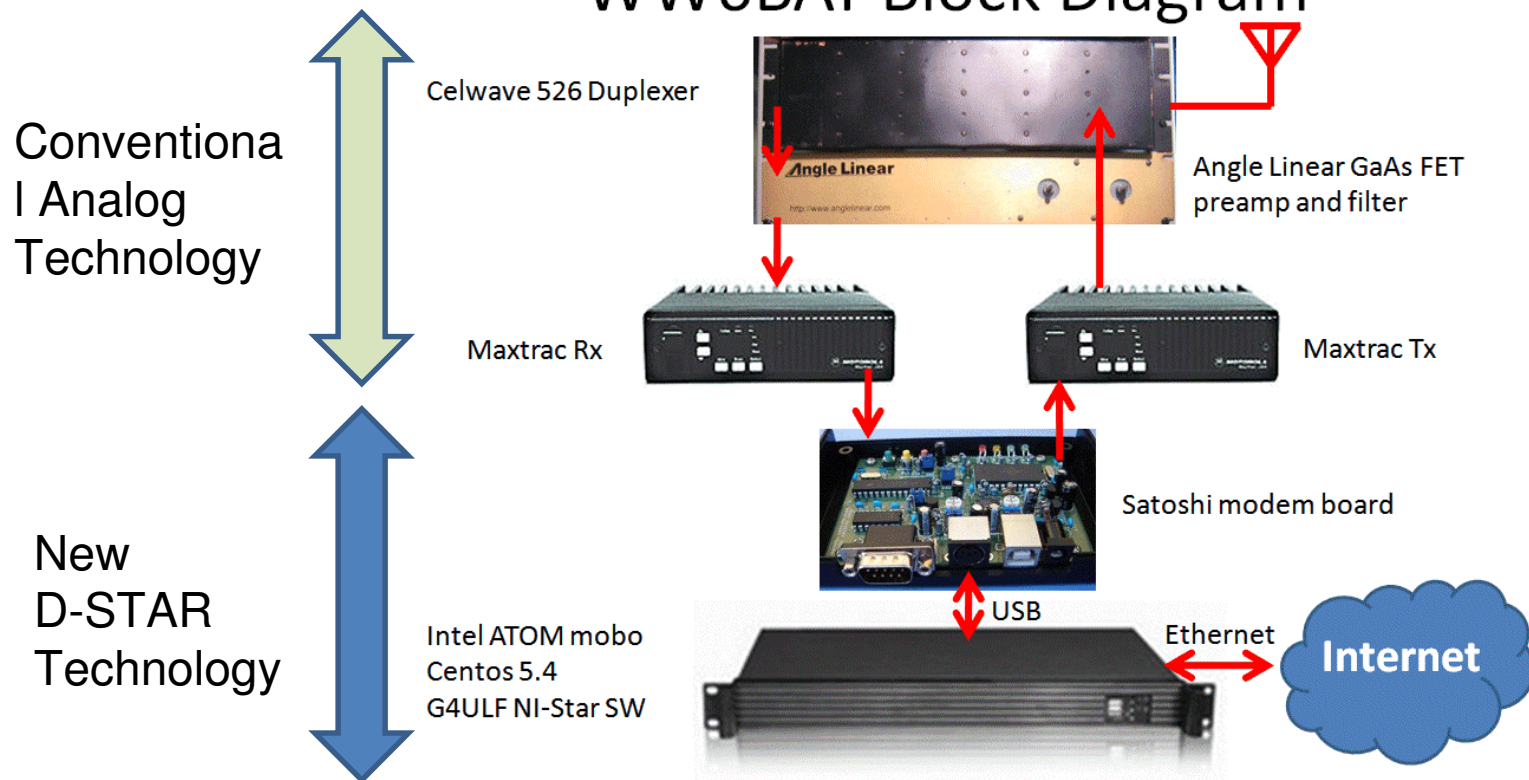
(Satoshi Yasuda, 7M3TJZ/AD6GZ)



Build Your Own D-STAR Repeater

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

WW6BAY Block Diagram

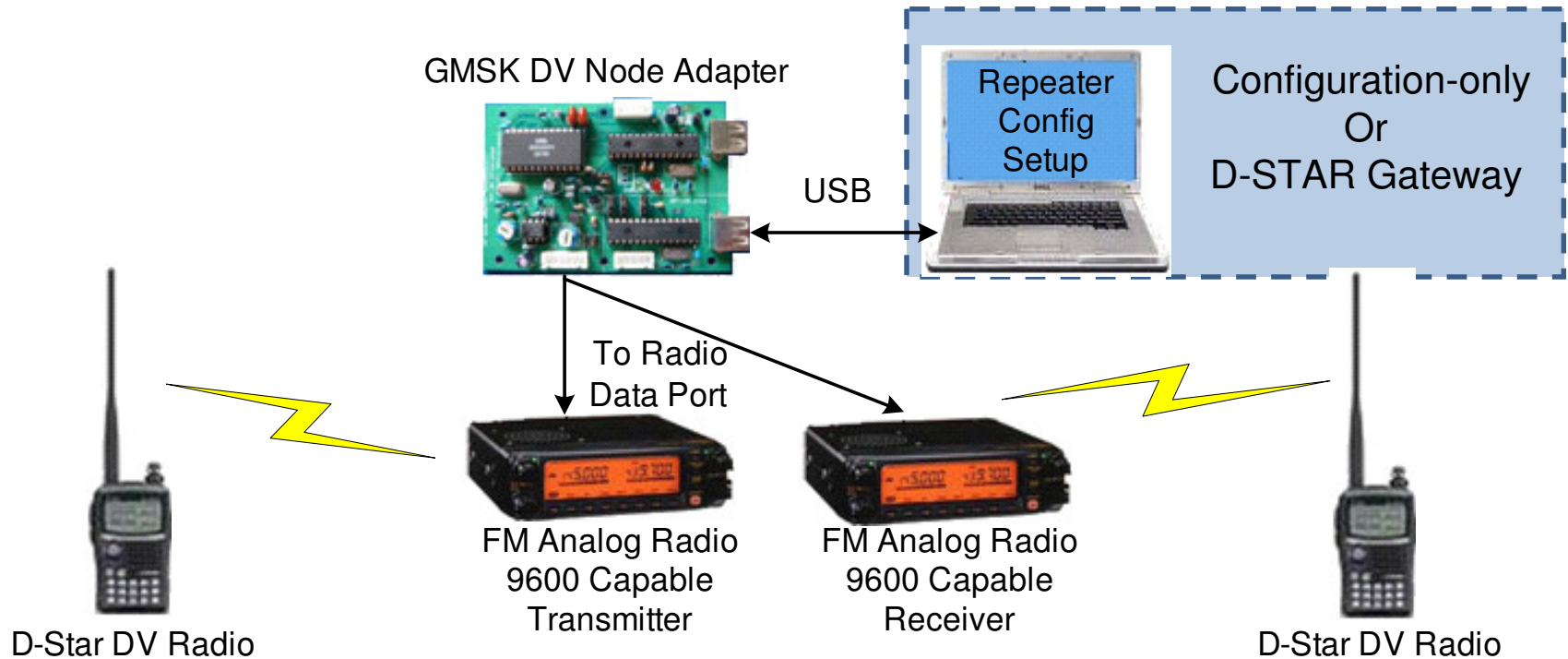


http://www.bay-net.org/ww6bay_dstar.html



Make-shift D-STAR Repeater

D-Star Standalone Repeater Diagram





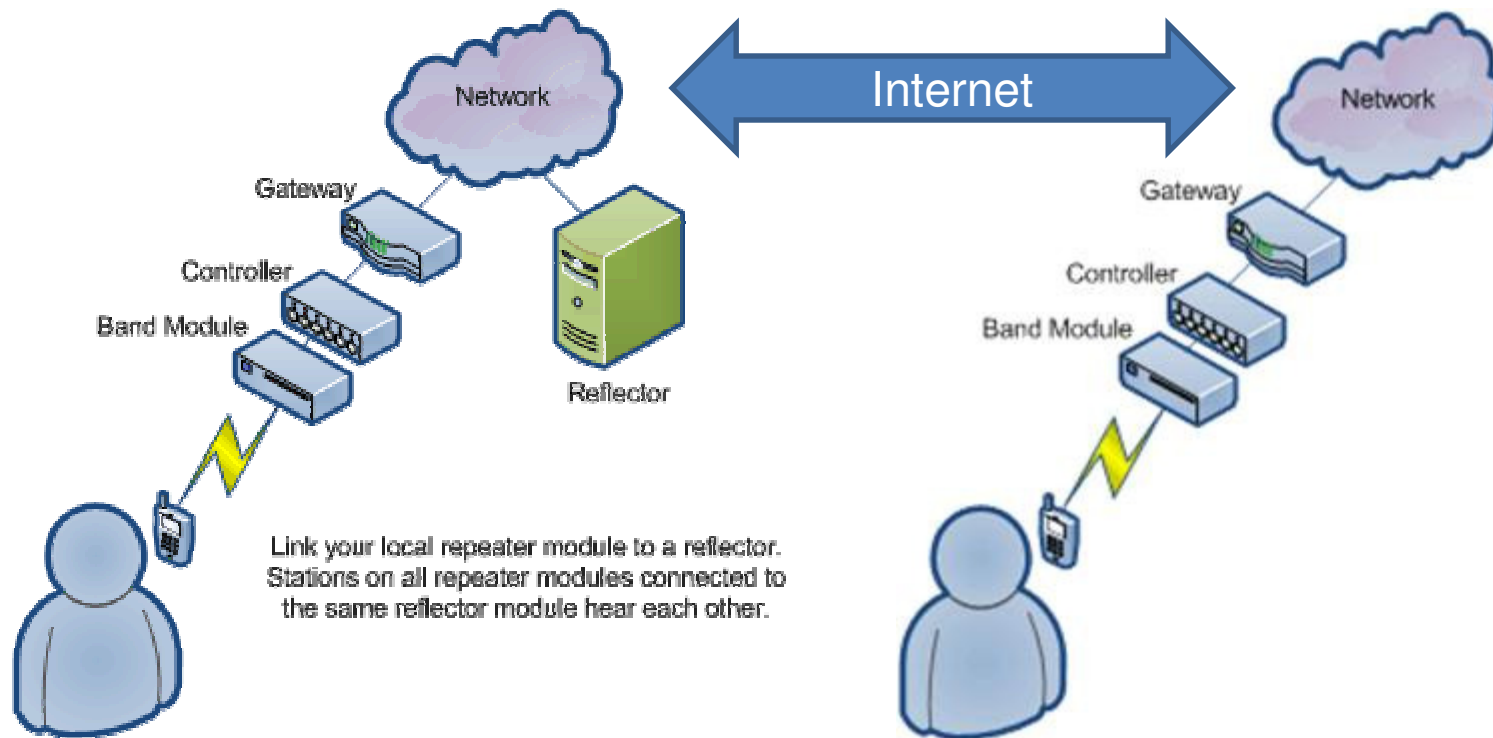
D-STAR Reflectors

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



D-STAR Reflectors

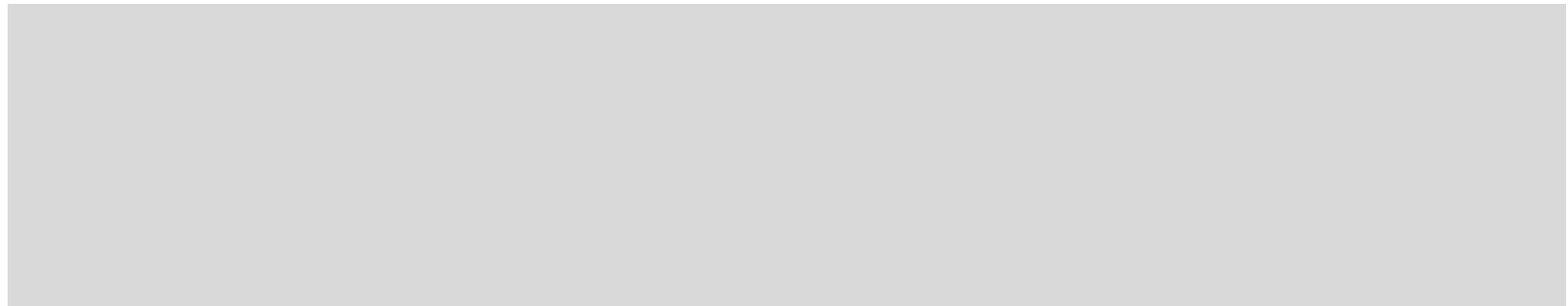
Connect to other D-STAR users – around town or around the world!





National Capital Region D-Star Association

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**D-STAR PROMOTES
INNOVATION!**



μ SmartDigi™

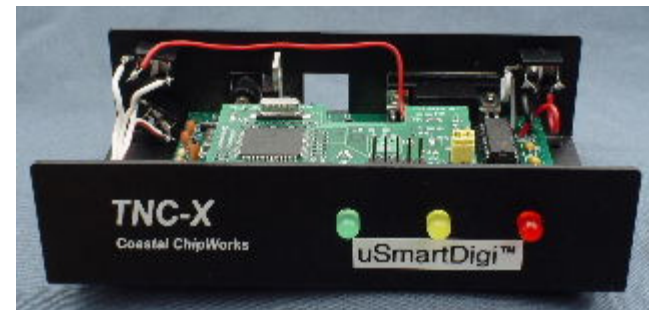
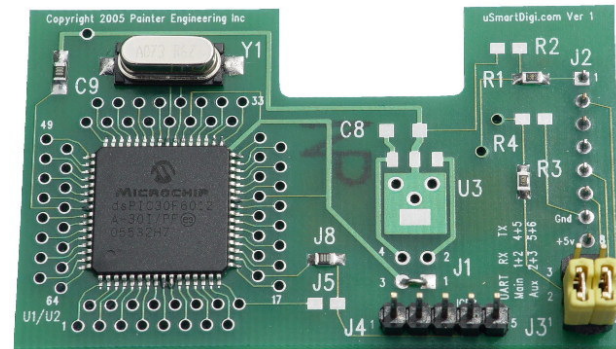
➤ μ SmartDigi™ APRS®

Digipeater

➤ μ SmartDigi™ D-Gate™ D-STAR Gateway

➤ A postage-stamp-sized DSP microcontroller embedded in the TNC-X eliminates the dedicated laptop or PC

D-STAR DPRS and APRS – talking together



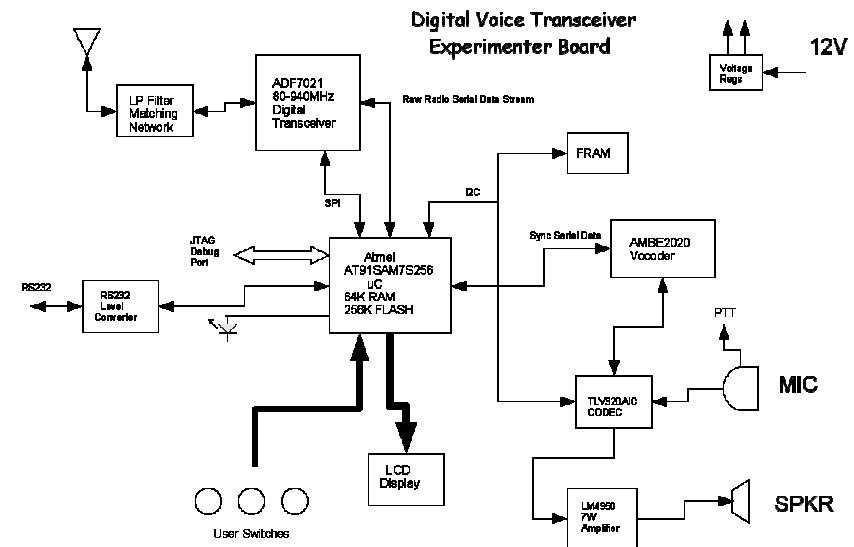
<http://www.usmartdigi.com/>

<http://www.tnc-x.com/>



D-STAR Digital Voice Transceiver Project

- AMBE 2020 voice compression chip
- ADF7021 single chip VHF RF Transceiver
- 20mW RF output



<http://www.moetronix.com/files/vhfdvxpaper.pdf>



D-Rats

- A Communications Tool For D-Star
- 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					
Outbox	K7HIO	KK7DS	D-RATS 0.3.0 Release	memo	21:17:47 2009-07-23
Sent	K7HIO	KK7DS	Need a status report	ICS213_US_OS	21:16:06 2009-07-23
Trash					

D-RATS Station Map

Show	Station	Latitude	Longitude	Distance
<input checked="" type="checkbox"/>	Prov. SE Vinc Hosp	45.5094	122.7716	7.53
<input checked="" type="checkbox"/>	WC Fire			
<input type="checkbox"/>	Stations			
<input checked="" type="checkbox"/>	WC Fire's			
<input checked="" type="checkbox"/>	Washington County ARES			
<input type="checkbox"/>	Misc			

<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

Belongings With Patient

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

Belongings 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

Replies:

Signature: Position (person replying)

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, K4SAZ Magnolia Springs Baldwin county, K14PPF Huntsville. Also ARRL HQ is on DV Dongle linked to us via Reflector 002 Module B.

Replies:

Signature: Position (person replying) Date/Time of reply: 07-May-2009 9:30:19



D*Chat

- A simple D-Star keyboard to keyboard chat application for Windows by NJ6N
- Connect your computer to your D-Star radio and chat with another ham

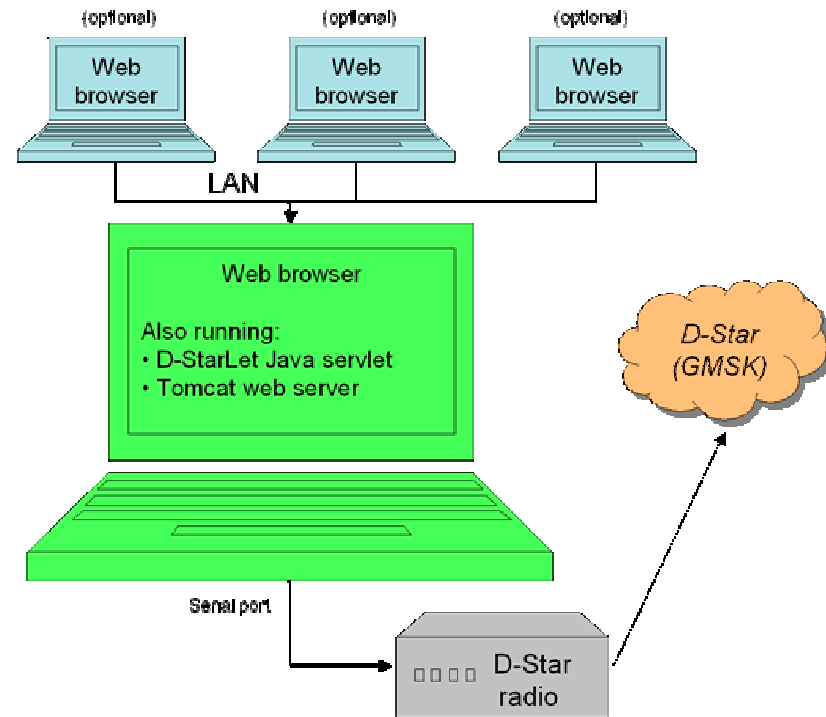


http://nj6n.com/dstar/dstar_chat.html



D-StarLet

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

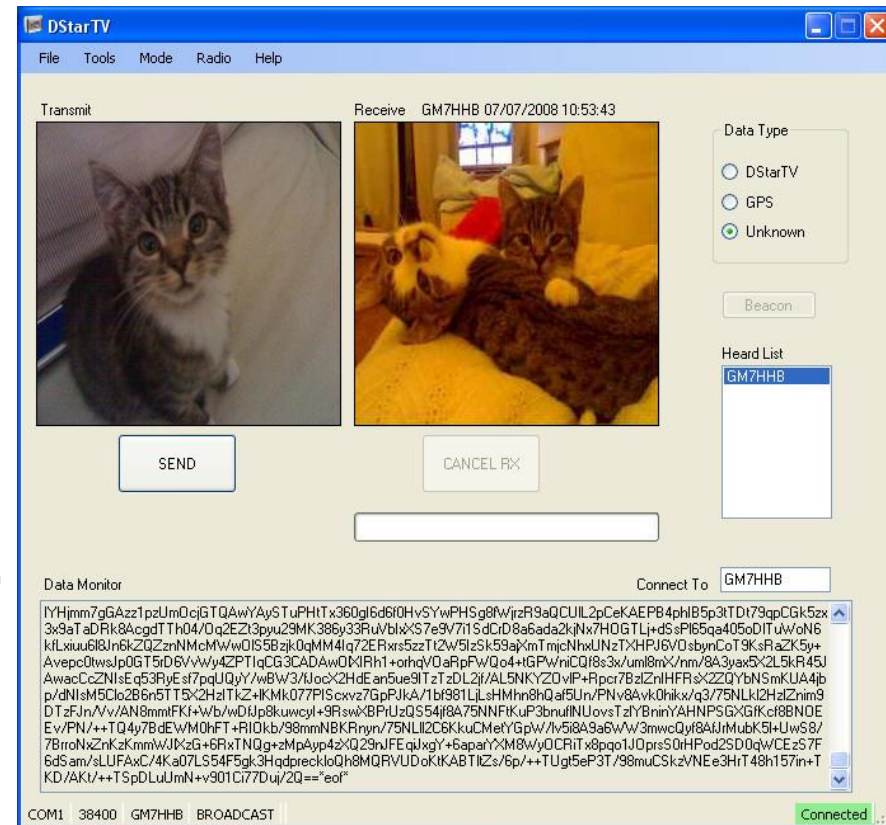


<http://dstarlet.ae7q.net/>



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 -

D-STAR in space!
Scheduled launch: early 2012

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.



National Capital Region D-Star Association

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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!