

D-STAR Past Present & Future

R.Bandla (VE3CVG)

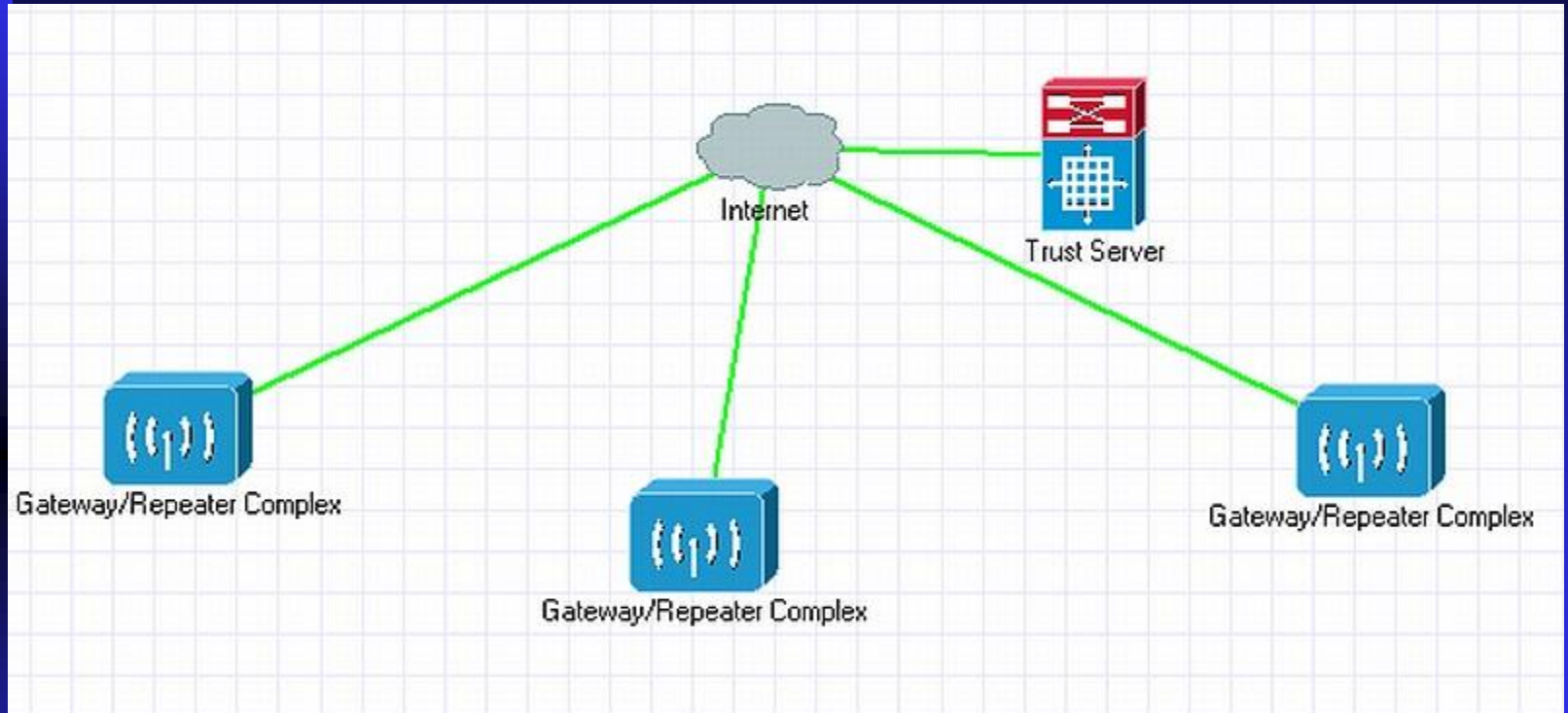
For WCARC

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GMSK & AMBE II

- **Gaussian minimum shift keying** or **GMSK** is a continuous-phase, frequency shift keying, modulation scheme.
 - ◆ **GMSK** is the means of imposing digitized intelligence on an RF carrier
- **AMBE II** is the protocol for digitizing audio, and the protocol for converting digitized audio back to analogue audio.

D-STAR Basic Concept



- Any radio within the network can find any other radio in the network
- Any radio within the network, can make a call on any repeater within the network

D-STAR System - History

- Digital Smart Technology for Amateur Radio
- Developed by JARL and Icom “in a silo”
- Touted as Open Standard but really wasn’t/isn’t
- Key component is the gateway computer which connects hw to network
- G1 technology departed from Linux “open source” philosophy
- G1 network was very fragile!
- G1 software was SOLD by Icom
- Generally poor documentation – cookbook installation worked
- Very heavy network dependence on a central Trust Server
- Heavy dependence on a central team in Texas to get network & Trust Srvr working & keep it working. Poor support from Japan
- Worked (sort of) but many limitations & problems.
- In spite of repeated statements to the contrary, a reasonable knowledge of linux, networking and ethernet were fundamental to gateway deployment
- Earliest radio equipment was lacking adequate memory for effective use.
- It WAS an entry into a digital radio network.

D-STAR System – History 2

- G2 was announced and delivered in 2008
- G2 is still not open source. Steeped in mystery
- G2 represents a major rework by Icom but still “in a silo”
- G2 was not really compatible with G but a very welcome change because G2 D-STAR network works well
- Required a change of OS to CentOS5
- No longer requires a fixed IP
- Many improvements, much more robust
- Lower dependence on Trust Server and the central team
- Door opened a crack for non-Icom software attachments: dplus was developed, dprs was introduced
- New radios with more memory & better organized for D-STAR

D-STAR System – History 3

- G2 Network now over 600 gateways and over 12000 users
- Still requires centrally administered updates
- Still a bit fragile but manageable
- Icom HQ still unco-operative with non-Icom development, although Icom America is tolerant
- Still possible for a single gateway to corrupt database
- Refusal by Icom and the few developers besides Icom to make their software open source
- Increasing frustration and hostility by knowledgeable hams over not being allowed to improve D-STAR
- Refusal by some groups to comply with K5TIT testing requirements
- Quiet (or not-so-quiet) revolt from within led to new alternative gateways

D-PLUS is Very Important!

- Gives the sys admin access to various recordings
- Provides tags for use in scripts
- Basic building block for DV dongles, hotspots and Access Point dongles
- Makes Linking possible



DV Dongle

- Contains AMBE 2 codec chip which translates digital stream to analogue audio
- Allows you to connect to most D-STAR repeaters and reflectors by using a small USB device, a headset, a laptop and an internet connection
- You must have a reasonably current PC. Netbooks work
- Great for travel, home, or office
- Cost is \$200USD from HRO. Pricey but cheaper than a radio
- Software is freeware
- Can connect to Icom-based network or dextra-based network

Hot Spot Development

- Hotspot – basically a GMSK modem for the RF side and a PIC for internet connection
 - ◆ 1) Takes a local received simplex D-STAR signal and sends it via internet to a specified repeater on a gateway, or reflector.
 - ◆ 2) Takes a signal received on a gateway repeater and sends it via internet to the hotspot TX which transmits a simplex D-STAR signal
- Allows a local, limited range, inexpensive, DIY extension to a D-STAR gateway system by a simplex hot spot or a full non-Icom repeater
- No control of functionality from radio other than PTT
- Uses a standard FM transceiver(s) with discriminator and varactor modulator
- With 1 radio you get a simplex hotspot
- With 2 radios + filters you get a true repeater
- Requires: fm radio, \$100 cct board, antenna, computer, internet connection
- Still being refined but operational now
 - ◆ Could use hotspots to improve coverage in Ottawa – all on the same simplex frequency. Hotspot can be installed in your shack using modest antenna and low power radio – 1 or 2 watts or even more

DIY Repeater Using Satoshi HotSpot Board

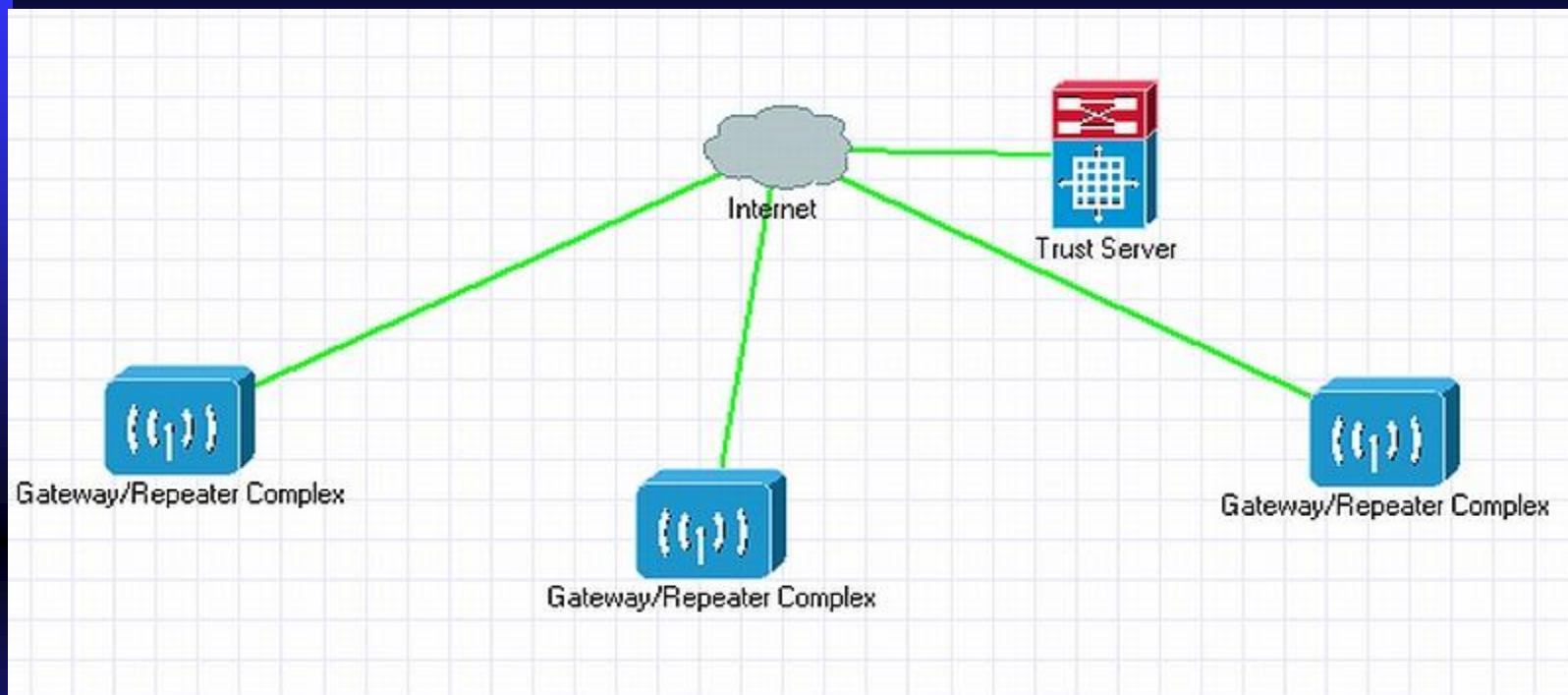


DV-AP Dongle

- Miniature short range hot spot +
- Plugs into USB port of laptop
- Allows user to use D-STAR hand held radio to access the D-STAR network while walking around yard, hotel, office, flea market, etc.
- Available now (sold out until April)
- 2m RF frequency-agile, simplex, miniature transceiver
- Looks like a normal repeater to a radio. Radio can link DVAP to gateway or reflector, echo, get ID message
- Caution – may be prone to RFI from equipment in the shack
- No RX agc so can be overloaded with strong signals (use low power)
- Existing antenna good for abt 100m but may be connected to ext antenna
- Software is freeware. Available for linux, windows, or mac
- Not appropriate for high power



D-STAR Revised Concept (G2)



- Any radio within the network can find any other radio in the network
- Any radio within the network, can call any repeater within the network
- Any repeater can link with any reflector
- Any repeater can link with any repeater
- Any dongle can link with any repeater or reflector

Recent Gateway Development

- Gateway development is in 4 general directions:
 - ◆ Continuing Icom G2, with some improvement. This is an existing significant network by Icom and K5TIT group. Largest ntwk
 - ◆ d-extra based, partially open source, G2 similar but not compatible. This is an existing significant network by KI4KLF
 - ◆ G2 clone by G4ULF, available free now, linux OS dependent, interchangeable and compatible with G2, improvements over G2.
 - ◆ Gx Evolution, probably not G2 compatible, probably OS independent, probably totally open source
- Target for future: open standard, open source, linux, free
- Gateway on a Laptop or even a Gateway on a Netbook is possible now
- The Icom cloak-of-secrecy is unwrapped

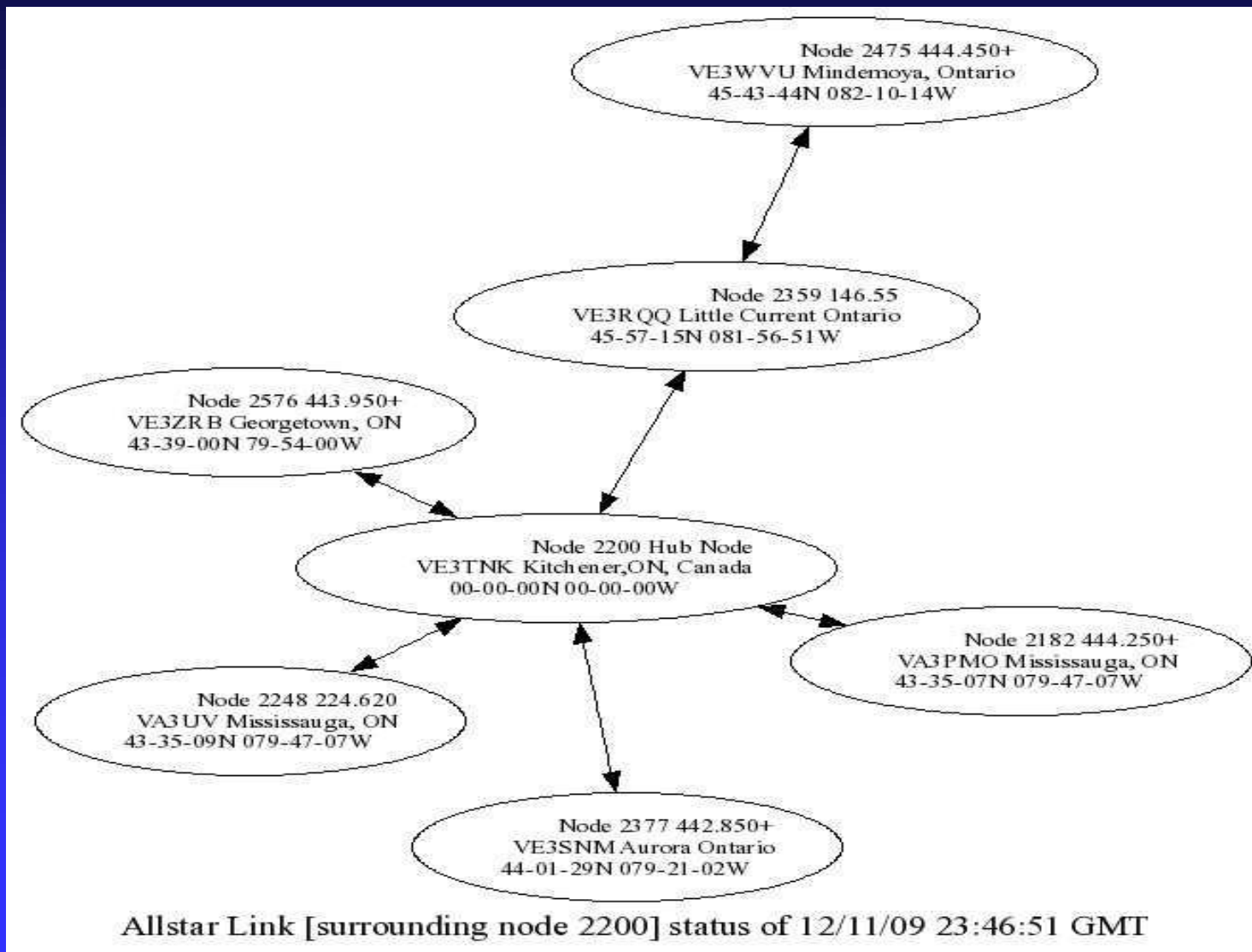
G2 Limitations – not serious

- G2 network has several good web-based monitoring and status tools available to RF users and gateway admins
- DPLUS limitation (author imposed) – cannot link more than one module (repeater) to the same gateway or reflector due to potential looping problem
- No fault tolerance in gateway
- No alarming in gateway
- Possible for fictitious call sign registration and propagation. Each gateway should have inbound database filtering to ensure that basic call sign formats are followed
- Dependency on single Trust Server to synchronize the world
- Slow database synchronization but much better than it was
- Icom development may be over

Multi-Trust or Dextra Network

- Note: All D-STAR Radios work with any architecture
- Multi-Trust is parallel to Icom G2 but not connected together
- Distributed architecture with multiple trust servers
- Open to any technology Icom or not. DIY encouraged and supported
- 3 (or more) trust servers: Europe/Africa, Americas, Mid-East/Asia Pacific/Australia
- Gateways connect to trust servers
- Trust server databases update every 5 minutes through secure tunnels
- Automatic trust server redundancy (under development)
- Gateways require linux and dextra – no Icom G2 software
- Dextra XRF reflectors are similar to REF reflectors in G2 system (presently 4 xreflectors)
- DV Dongles work with dextra system, not as elegant as G2
- DVAP's unknown
- Permit interconnection with non-digital repeaters via asterisk/dextra
- Still developing web based monitoring

Dextra Permits Mixed Technology



Next Evolution Gateway

- Divergence from the existing network architecture with hierarchical improvements
- Probably not compatible with G2 because of hierarchical improvements
- Improved fault tolerance
- Better diagnostics and monitoring
- More sys admin configuration capability
- More sys admin customization
- Better system integrity monitoring
- Migration to smaller platform, netbook or embedded PC. Gateway-on-a-netbook is realistic
- Better accessibility to digital data and voice stream

D-STAR in Ottawa

- Project was initiated in the spring of 2006 by VA3KA & VE3CVG to explore funding D-STAR in Ottawa through a New Horizons federal grant
- Initial cost was \$16K grant + Icom donation + personal donations + hundreds of hours
- Ottawa Amateur Radio Digital Group (OARDG) formed to work w grant
- VA3ODG activated in March 2007

VA3ODG Ottawa

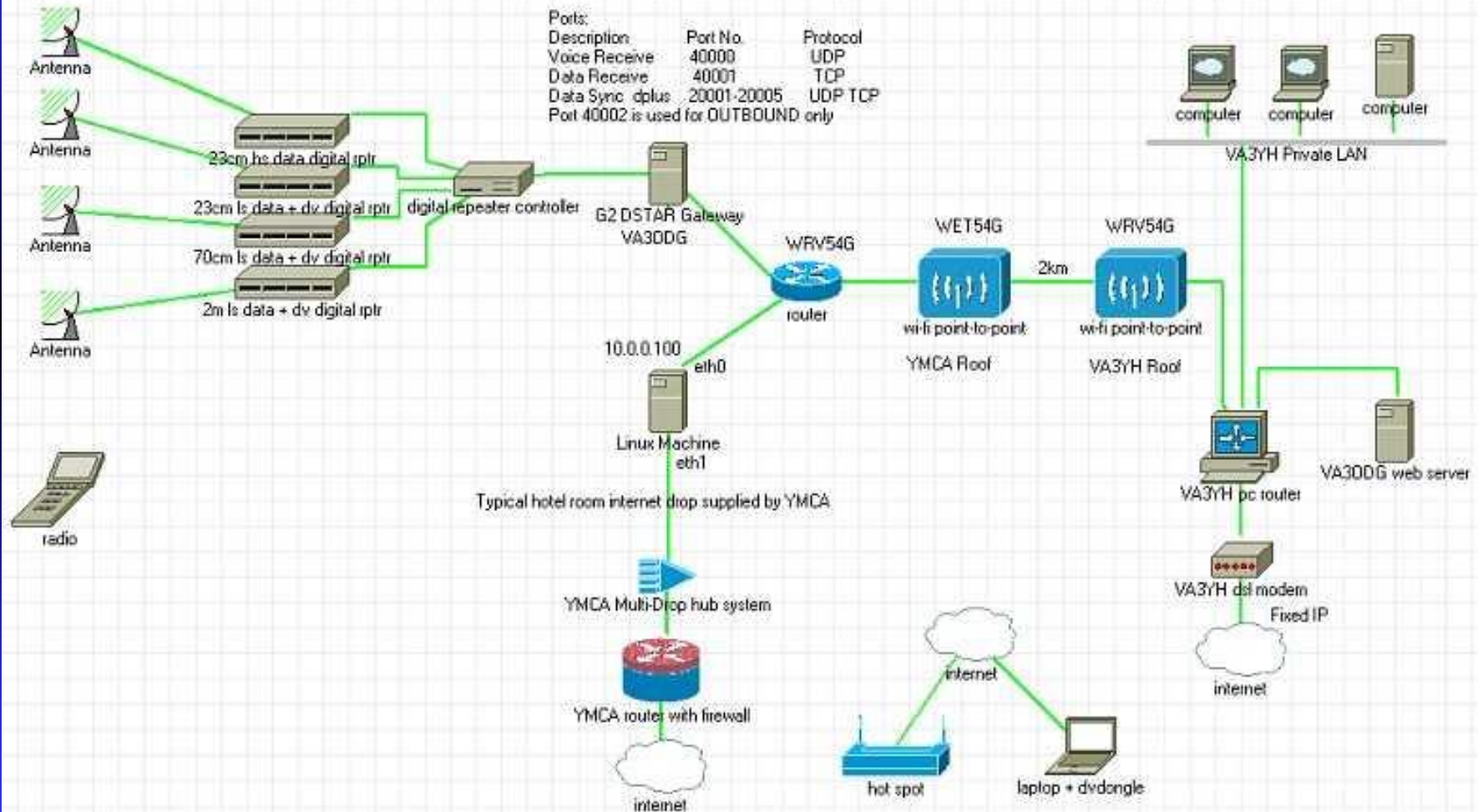
- Digital voice repeater on 2m, 70cm, and 23cm
- High Speed Data on 23cm
- All Icom Technology and uses Icom G2 software in the gateway
- Located in downtown Ottawa YMCA HQ
- Access to radio room and roof
- Free rent (almost)
- High RF intermod area causes problems
- Coverage is reasonably good from the site although some buildings are taller, causing RF shadows
 - ◆ Good mobile coverage within Ottawa. Hand held radio coverage with compact antenna is limited in outlying areas.
 - ◆ VHF better in E and SE
 - ◆ UHF better in W and SW
 - ◆ 23cm DV coverage is good. High frequencies better for multipath
- Gateway computer is 5 years old
- Internet via 2.4GHz wi-fi link from VA3YH

VA3ODG Installation



VA3ODG Configuration

VA3ODG Local Network
(Representative)



OARDG

- Ottawa Amateur Radio Digital Group
- Founding fathers include: Ken VA3KA, Dale VE3XZT, Doug VE3XK, Rick VE3CVG
- Project start up assistance from Eric Meth VE3EI and Icom Canada
- Ottawa Amateur Radio Digital Group – if you are registered on VA3ODG you are a member. No official meetings.
- No membership fees so far
- Backbone team:
 - ◆ Dale VE3XZT site and antennas and countless hours
 - ◆ Ying VA3YH gateway support & free internet feed & countless hrs
 - ◆ Rick VE3CVG overall project manager, and RF support
- Many other generous donors and helpers over the last 3 years
- Some clubs have given cash donations although not recently

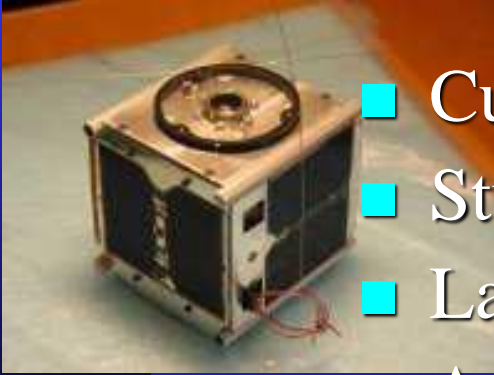
OARDG Finances

- A few people have donated a lot of time and considerable amount of personal \$ to keep the Ottawa D-STAR system going
- We have \$0.00 in the bank at this time
- We'd like to donate \$100 to the Y each year to help offset our power requirements
- We'd like to enhance our internet connection but the cost would be at least \$200/yr (freenet)
- We'd like to upgrade our gateway computer but the cost would be about \$150 for a used system

D-RATS

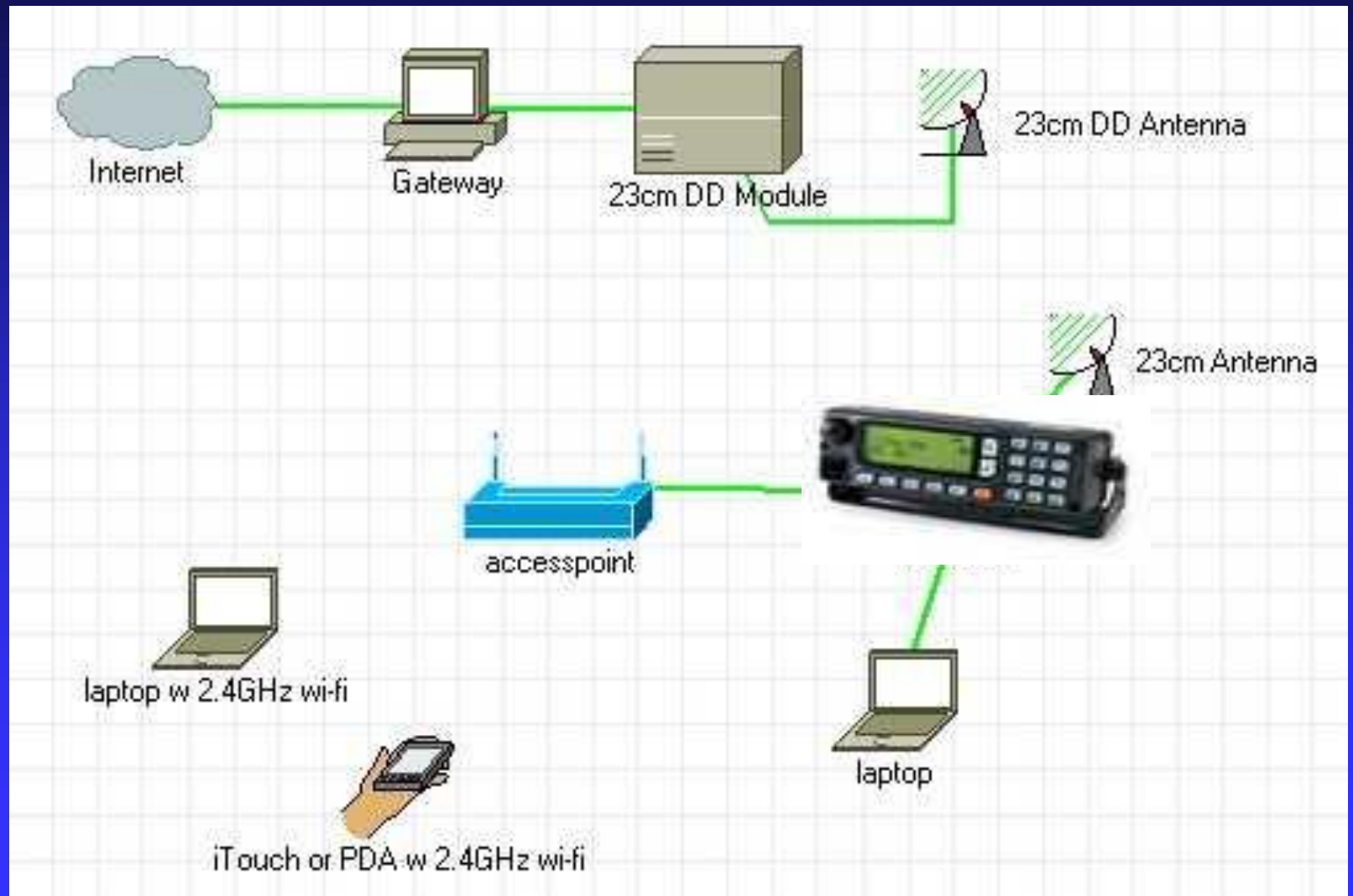
- Elegant and friendly message system which uses the low speed D-STAR data channel
- Simplex or through a repeater
- Has a mode specific for ARRL message format
- Contains built-in gateway to conventional internet email
- Has beacon mode
- Automatic map display and ranging of users
- Built-in tools, data debug, logging
- Now in release 3 and works very well
- Freeware

D-STAR In Space - OUFTI-1



- Cubesat, Nanosat, 10cm cube, < 1kg
- Student project at Universite de Liege
- Launch by Vega in October 2010
- Available to ham-radio operators worldwide
- Comands and telemetry will be via AX-25
- CW beacon
- Life span 1 year
- ON0ULG (presently in JO20so)
 - ◆ Downlink 145.625 MHz, 600 KHz shift
 - ◆ Uplink 439.525 MHz, 7.6 MHz shift

An Application for 23cm DD



What's So Great About D-STAR?

- When the connection is good, it is very good
- User Call Sign Routing is great if you don't know where your buddy is – requires some user radio set up
- Repeater Call Sign Routing is great if you want to talk to a particular city- requires some user radio set up at each end of the conversation
- Repeater or Reflector Linking is really great if you want to connect 2 or more repeaters together to operate as a single repeater – very easy user radio set up at each end. Very large systems are possible with NO degradation of signal
- Low speed data works very well, simultaneous with voice
- DPRS automatically interfaces w APRS network (one way)
- High speed data works well but only on 23cm & ltd range
- Monitor various information via web pages

Limitations of D-STAR

- D-STAR Radios are more complicated to set up manually. Computer programming is a must almost
- Radios are more expensive (about a \$200 premium for D-STAR)
- Repeaters and Radios are generally more susceptible to multi-path interference. The higher the frequency the better the tolerance.
- Interference has more impact than in standard FM
- Either works or doesn't. When it works, its very good. No background noise.

Recent Radio Models

IC80AD

\$450usd



IC92AD

\$520



ID880

\$475usd



What's In It For You?

- D-STAR presents many opportunities
 - ◆ Just operating your radio and talking to the 12000 other users on 600 gateways
 - ◆ EMRG/ARES opportunities
 - ◆ High speed internet access via ham radio
 - ◆ Building/experimenting w/user hardware & software
 - ◆ System support – gateway, antennas, network, applications
 - ◆ Need D-STAR experimenters
 - ◆ AND we need missionaries in all the clubs – to put on seminars/presentations
 - ◆ Need help with hot spot project and with linux software

Canadian Activities

- Canada-wide D-STAR net Friday 2100h
- There is an informal Canadian organization of system administrators that can/will run a Canadian-only network if necessary
- Very high activity in Ontario, Calgary and southern BC
- Existing Canadian dextra network particularly in Ontario (hub of NA activity) led by VA3UV Ramesh
- Experimentation with d-RATS by VA3STL Alan
- 23cm high speed data experiments by Marcin VE3COV and Ying VA3YH

References

- Cubesat info at <http://www.leodium.ulg.ac.be/cmsms/>
- VA3ODG details <http://www.wcarc.on.ca/oardg/>
- Satoshi Site <http://d-star.dyndns.org/rig.html.en>
- W9ARP Hot Spot Site <http://w9arp.com/HotSpot/>
- D-RATS <http://www.d-rats.com/>
- http://www.dvdongle.com/DV_Dongle/Home.html
- G2 Gateway clone <http://g4ulf.blogspot.com/>
- Dextra based <http://www.xreflector.net/>
- Ontario Dextra <http://www.va3uv.com/VE3TNK.htm>
- http://www.florida-dstar.info/d_star
- And MANY more