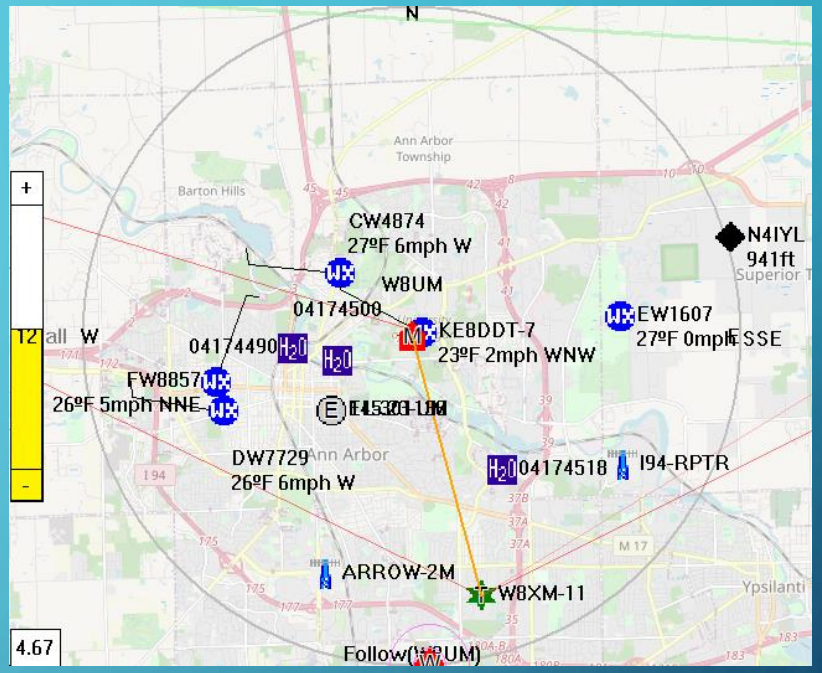
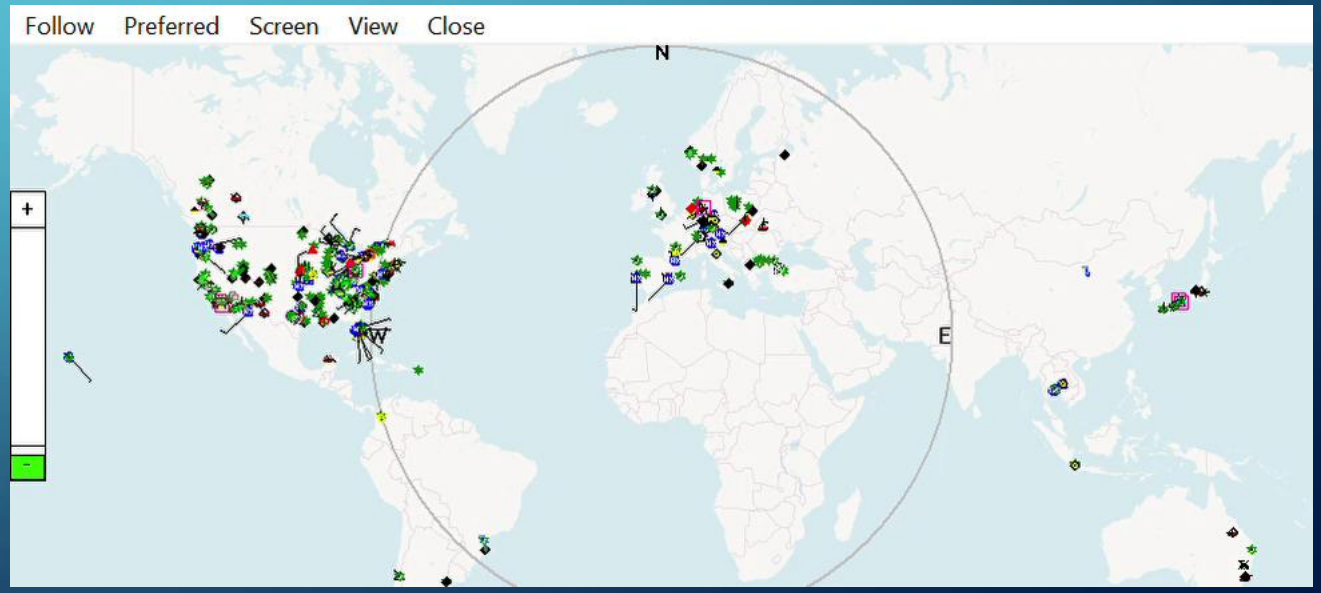
APRS* FROM A TO Z

*APRS is a registered trademark of Bob Bruninga, WB4APR

(AX.25 TO APZXXX)

BUT NOT EVERYTHING IN BETWEEN!





APRS FROM A TO Z

- AX.25 Packet Format (WAY under the covers)
- APRS Packet Format
- APRS Infrastructure
- Getting Started w/APRS
- APRS Hardware
- APRS Uses

- BUT FIRST!
  - WHO IS KJ4ERJ?
  - WHAT IS APRS?

KJ4ERJ – WHO IS HE?

- From the APRSISCE Wiki: http://aprsisce.wikidot.com/kj4erj-story
  - Magazine article in the (19)70s – Likely AX.25
  - Licensed in 2008 thanks to KJ4DXK, W4WCQ, W4SGC
  - Fun with GPS, GeoCaching, and Digital Speedometer (from KJ4DXK)
  - APRSISCE on Windows Mobile – August/September 2008
  - APRSIS32 on Windows Desktops w/OpenStreetMaps – August 2009
  - APRSISMO (TestHost) on Android – August 2013
    http://tinyurl.com/Get-APRSISMO

APRS – WHAT IS IT?

- A tactical, real-time information sharing system using standard protocols
- Developed by Bob Bruninga WB4APR around 1992
- Supported by several major radio manufacturers (Kenwood, Yaesu, Alinco)
- Useful for both emergency operations and standard day-to-day operations
- An example of highly successful integration of RF and Internet technologies

And now, ready to dive straight into the deep end?

AX.25 PACKET FORMAT

- What is AX.25? – Link Access Protocol for Amateur Radio - conforms to HDLC https://www.tapr.org/pdf/AX25.2.2.pdf
- Connected Packet vs UI (Unnumbered Information) – TCP vs UDP
- Station IDs – Callsign-SSID (Secondary Station Identifier)
  - 6 Character call sign, 4 bit –SSID (-0 through -15)
  - NOT WiFi's Service Set Identifier
- Checksum, not Error Correcting – all or nothing
- Address: Destination, Source, Repeaters – aka Path

Flag	Address	Control	PID	Info	FCS	Flag
01111110	112/224 Bits	8/16 Bits	8 Bits	N*8 Bits	16 Bits	01111110

Figure 3.1b. Information frame construction.

APRS PACKET FORMAT

- Humanly Readable TNC2 format
- SrcCall>DstCall,Path:Payload
- Payloads include:
  - APRS101.pdf

- Position reports, including Objects
- Telemetry & Definitions
- Messages (& acks)
- Weather
- Capabilities & Status
- Queries

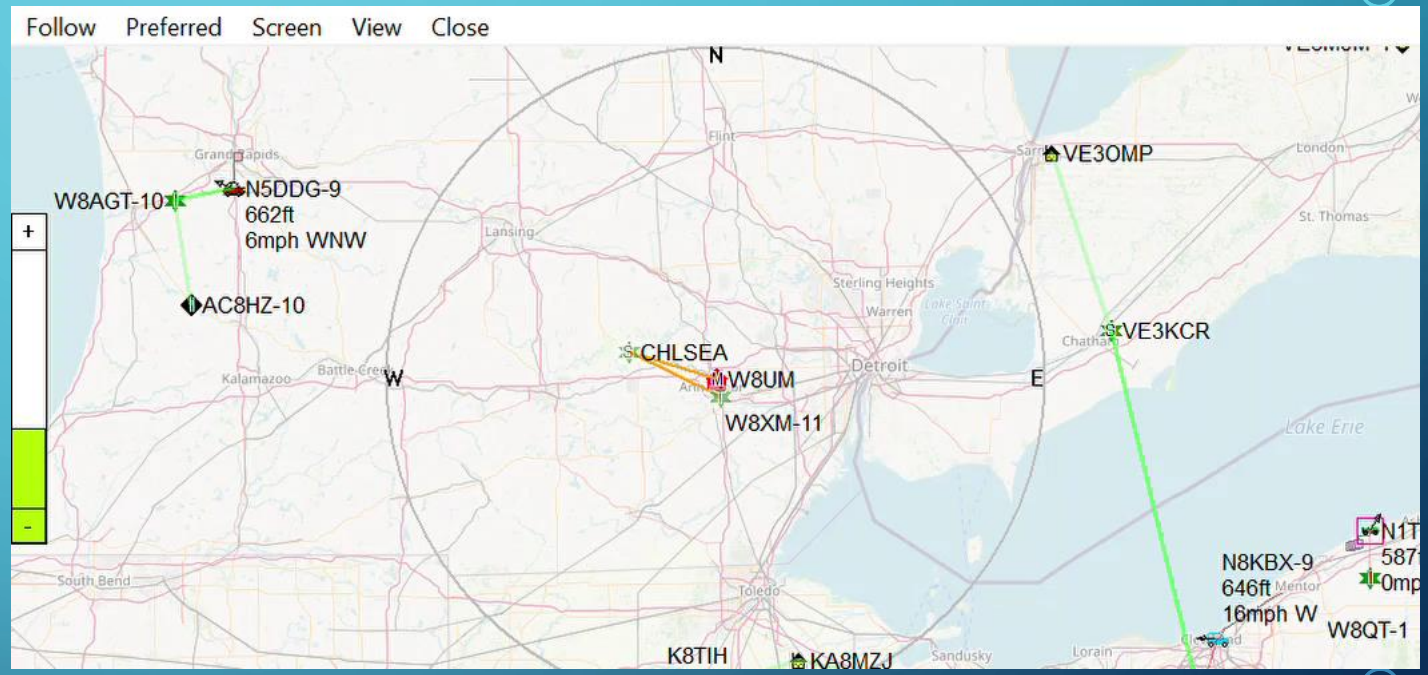
- SQ3GOK-9>UR0P90,WIDE1-1,qAR,SP3KWA-4:`.;+1S>>/`"5j}Ania Antos Robert ZIMOTKI 2016_#
- HS5NFP>APESPG,TCPIP*,qAC,T2THAI:!1954.25N/09948.55E&PHG3260F/Chiangrai APRS Group
- F1BIV-1>APU25N,TCPIP*,qAC,T2SWEDEN:=4849.61N\00219.73Eo/PHG2130 - Qth:Paris 14e - VHF&IP {UIV32N}
- JH1HWT>API31,DSTAR*,qAR,JP1YDS-A:!3555.76N/14036.56E[/
- K1CKK-2>APN383,qAR,N1RCW-2:!4145.79NS06959.43W# W2,MAn APRS DIGI ORLEANS MA
- TG9AOS-9>Q4SW0R,WIDE1-1,WIDE2-1,qAR,TG9AFX-3:`v>jlq k/`"EB}_%
- W3GXT-1>APOT30,WIDE2-1,qAR,N3GXH-1:>
- N2MH>TQ0Q6W,K2PUT-15*,WIDE2-1,qAR,WB2ZII-15:`f*Tng6u\`"4g}442.600MHz C141 +500_%
- WA5ETK-9>APT311,AMA39*,WIDE3-2,qAR,KE5KUL:!3514.16N/10149.88W>179/052/A=003575/Gene - Chevy Aveo Mobile
- CA2DMR-7>APRS,DMR*,qAS,Xe3ra-10:=2954.91S/07114.02W[000/000/A=000440DMR ID: 7302003
- DB0FBG>APND13,WIDE2-2,qAR,DG1JLA-3:;439.025- *111111z5055.75N/01320.91Er1750 R30k DB0FBG Freiberg/Sa.
- EA5AHQ-10>APDW12,WIDE1-1,WIDE2-1,qAR,EA5IIE-10:!3925.89N\00036.40WSPHG1260APRS RX 144.800 + APRS SAT 145.825 ISS Estacion Espacial Internacional

OVER-THE-AIR FORMAT

- AFSK – 1200 Baud on 2m – 1200hz 2200hz tones w/bit-stuffing
- FSK – 300 Baud on HF – 200hz separation
- PSK63 – http://www.crosscountrywireless.net/aprs_messenger.htm
- WSPR - http://hojoham.blogspot.com/2016/05/wisp1-telemetry-revisited.html
- Still no Error Correction, mostly just Checksums…
  - **ALL** of a packet must be received **PERFECTLY** before **ANYTHING** will be recovered from it.
- http://robust-packet.net/ - SCS Tracker / DSP TNC

APRS INFRASTRUCTURE – The RF Side

- Digipeaters – Digital Repeater
- Fixed & Mobile Stations
- Simplex range ~½ FM voice
- Digipeat Duplicate Detect
  - Partially broken in D700/D710!
- UIFLOOD vs UITRACE



- `W4MCA>R8RX1T,WC4PEM-14,WIDE1*,WIDE2-1,qAO,KJ4ERJ-12:`m.Yn{j>/`"43}_%`
  `W2XYZ-9>R7PU5S,NI4CE-10,WIDE1,WC4PEM-10,WC4PEM-14,WIDE2*,qAO,KJ4ERJ-12:'n2[l -/]CALLSIGN@ARRL.NET=`

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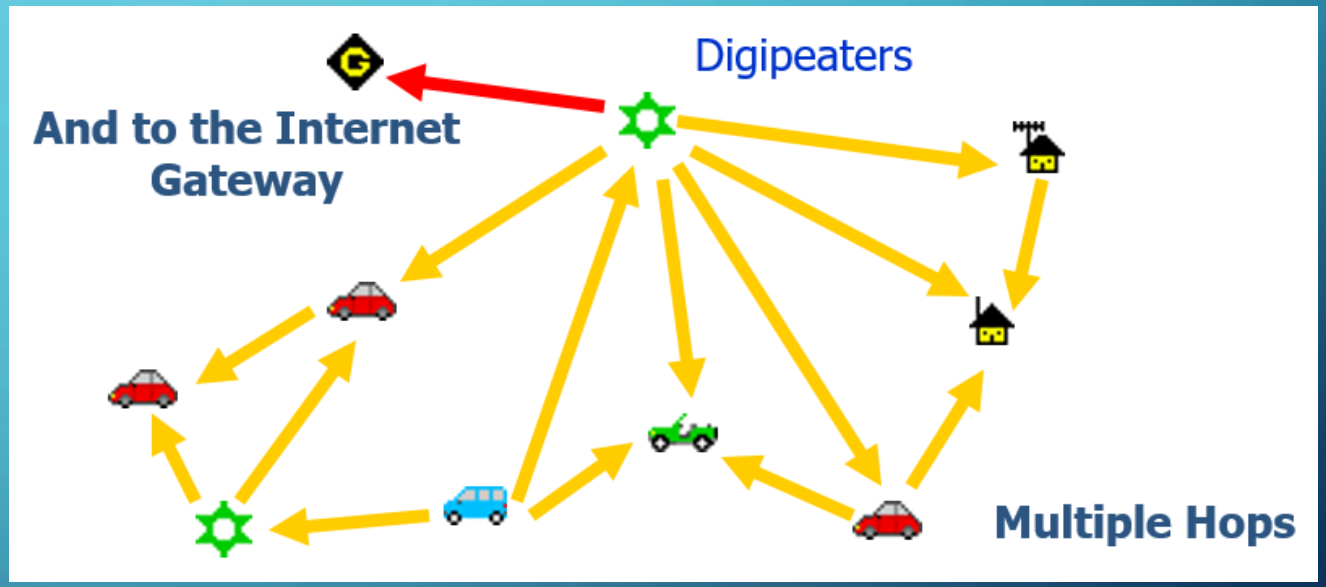

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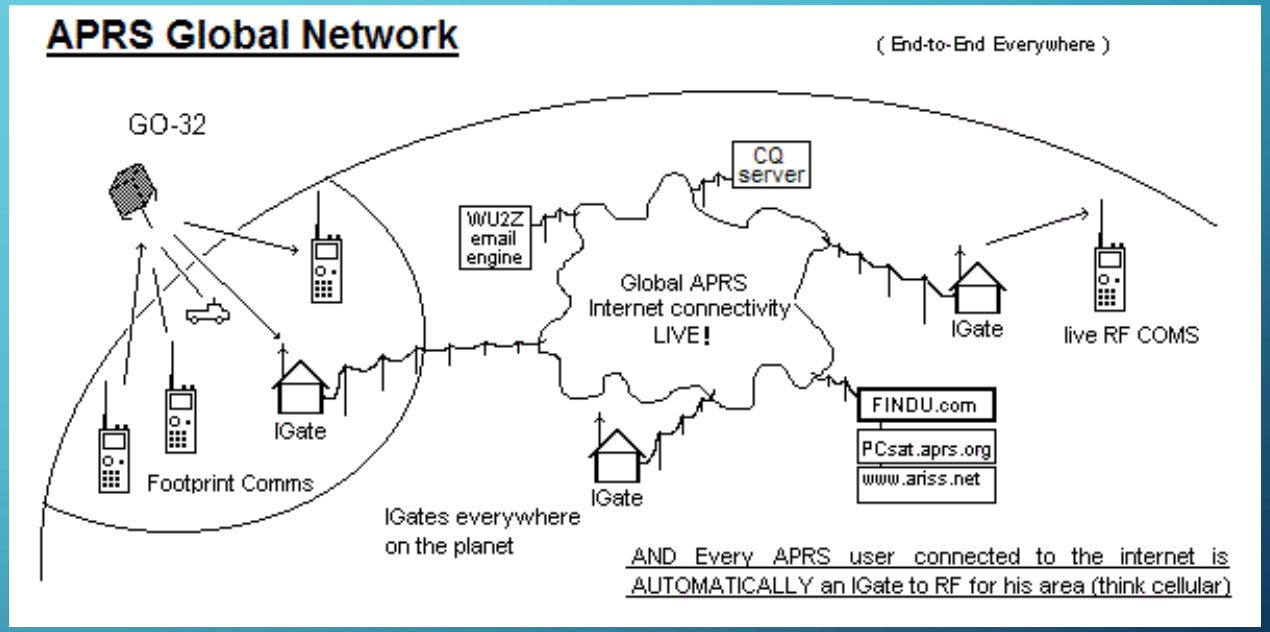
APRS-IS INFRASTRUCTURE – The Internet Side

- RF meets the Internet
- IGates feed APRS-IS Servers
- Servers distribute globally
- Not "smart", just a packet relay
- Realtime, no buffering, no storage
- Duplicate Suppression – Cannot use APRS-IS to evaluate RF coverage!
- Messages & "Courtesy" Posits gate back to RF – And sometimes more!



APRS ON THE WEB

- http://www.aprs.org/ - Bob's specification site
- https://aprs.fi/W8UM - Arguably the most user friendly and useful
- https://www.aprsdirect.com/sid/3187/time/60 - Another map-based site
- http://www.findu.com/ - APRS data archiving site
- http://aprsisce.wikidot.com/ - My own APRS client support Wiki (shameless plug)

GETTING STARTED

- CALLSIGN-SSID
- SSID Recommendations
- Path Recommendations
- APRS-IS Passcode

STATION IDs – CALLSIGN-SSID

- Up to 6 Character Call Sign
- 2 (Alpha)Numeric –SSID
  - -0 should be expressed as just CALLSIGN
  - -0 through -15 inclusive required for RF (AX.25) usage
  - -XX or Anything goes on the APRS-IS (or non-AX.25 RF)
  - Yaesu APRS Radios cannot message with non-AX.25 –SSIDs
- Each concurrently operating “thing” needs a unique –SSID!
  - No matter if hardware or software or anything in between

-SSID RECOMMENDATIONS

-0	Your primary station usually fixed and message capable
-1	Generic additional station, digi, mobile, wx, etc
-2	Generic additional station, digi, mobile, wx, etc
-3	Generic additional station, digi, mobile, wx, etc
-4	Generic additional station, digi, mobile, wx, etc
-5	Other networks (Dstar, Iphones, Androids, Blackberry's etc)
-6	Special activity, Satellite ops, camping or 6 meters, etc
-7	Walkie talkies, HT's or other human portable

-8	Boats, sailboats, RV's or second main mobile
-9	Primary Mobile (usually message capable)
-10	Internet, Igates, echolink, winlink, AVRS, APRN, etc
-11	Balloons, aircraft, spacecraft, etc
-12	APRStt, DTMF, RFID, devices, one-way trackers*, etc
-13	Weather stations
-14	Truckers or generally full time drivers
-15	Generic additional station, digi, mobile, wx, etc

ADDITIONAL -SSIDS

- INTERNET-ONLY Recommendations
- Some APRS-IS Servers don't pass SSIDs > 2 characters
  - javAPRSSrvr per Pete Lovell, AE5PL

-63	PSK63 HF stations
-tt	APRS TouchTone users (DTMF)
-ID	RFID
- A- Z	D-Star (That's <space>A through <space>Z)

KJ4ERJ-*

- AX.25 Compatible
  - -0 APRSISCE/32 Version Monitor
  - -1 APRSIS32 IGate (w/-7)
  - -2 Kenwood D72
  - -4 Kenwood D74
  - -7 OT2m w/HT
  - -11 D700 Mobile
  - -12 APRSISMO/TestHost on Cell Phone
  - -14 APRSISMO IGate (w/TH-D74)
  - -15 APRSIS32 ANSRVR/SATSRVR ISS/PSAT Object injector
- APRS-IS Stations
  - -AP APRSIS32 Usage Monitor
  - -AL APRSIS32 Full Feed
  - -TS APRSISMO Test Instance
  - -LS Lightning Strike Object injector
  - -TD The Energy Detective
  - -F1 APRSISMO on FreedomPop Phone
  - -E1/E2/E3/E4 ESP8266 IoT Instances
  - S1 ESP8266 Server Remote Reset
  - S5 APRSISMO on Samsung 5 IGate
  - -HW/MB HotWater/MasterBath!

PATHS AND ALIASES

- Service request for digipeaters
- Between Src>Dst and :Payload
- Can be empty for simplex only!
- NOGATE or RFONLY
- TCPIP* or TCPXX* (obsolete)

- RELAY,WIDE – Obsolete
- WIDEn-N (New Paradigm)
  - WIDE1-1,WIDE2-1
  - WIDE1-1,WIDE2-2
  - WIDE2-1
- SSn-N (State-wide Coverage)
- HOP7-7
- Explicit CALLSIGN-SSID

APRS-IS PASSCODE

- From http://www.aprs-is.net/connecting.aspx (emphasis their's)

  passcode=computed passcode for your callsign. -1 is used for receive-only. **It is the responsibility of each software author to provide the proper passcode to their individual users on a request basis.** This is to aid in keeping APRS-IS restricted to amateur radio use only.

- E-mail your name and callsign to passcode@homeside.to
- Please do not propagate the use of web-based passcode generators as they don't validate anything
- Passcode is only necessary for the APRS-IS, not for APRS over RF

APRS HARDWARE

- APRS-capable Integrated Radios
- Integrated Trackers
- Terminal Node Controllers – TNCs
- Sound Card Modems

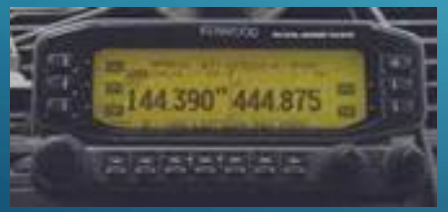
APRS INTEGRATED RADIOS

KENWOOD

D7/D72/D74

(Now with BlueTooth!)

D700/D710/D710G



YAESU

VX8/FT1DR/FT2DR

FTM-100/350R/400DR

ALINCO

DR-135 w/Internal TNC

EJ-41U Or better T3-135

INTEGRATED TRACKERS/IGATES

SAINSONIC

AP510 – 1 Watt Tracker

BYONICS

MIcroTrak Ready To Go (10 watt)

MicroTrak All In One
10 watt Tracker

MTT4B/BT
8 watt Transceiver

MICROSAT

WX3IN1+/Mini
Fully Functional IGate

AX.25 MODEMS (Modulator/Demodulator)
(not true TNCs)

MOBILINKD

Direct BlueTooth-linked

BYONICS

TinyTrak 3 (Deaf Tracker)

TinyTrak 4
(w/TT4BT)

ARGENT DATA SYSTEMS

OpenTracker+/USB

Tracker 3 Family

TERMINAL NODE CONTROLLERS (TNCS)
(WHERE PACKET MEETS APRS)

KANTRONICS

(Venerable) KPC-3+ & More

Standalone Operations

Provides Connected Packet & BBS too

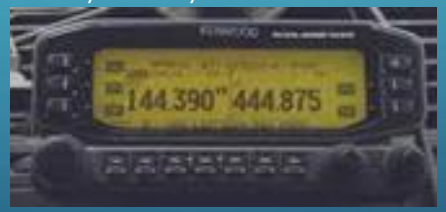
(NMEA-only Tracking, I think)

KENWOOD

D7/D72

Not the new D74

D700/D710/D710G



OTHERS?

SOUND CARD MODEMS

AGW Packet Engine Pro

http://www.sv2agw.com/ham/pepro.htm

Multi-Port, Multi-TNC w/shared access

Defined the "AGW" program interface

AGWPE free version

UZ7HO's SoundModem

http://uz7.ho.ua/packetradio.htm

Dual Port

Mutli-Speed

Local monitor w/Waterfall

AGW-like TCP/IP interface

DireWolf:

DECODED INFORMATION FROM RADIO EMISSIONS FOR WINDOWS OR LINUX FANS

https://github.com/wb2osz/direwolf

Local monitor

Digipeater, APRStt gateway, IGate

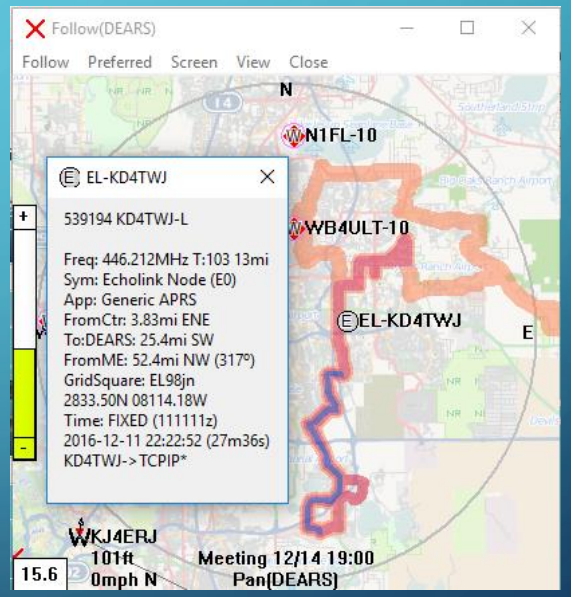
Virtual TNC for APRS clients

Multiple concurrent decoders w/offsets

FX.25 Forward Error Correction Supported

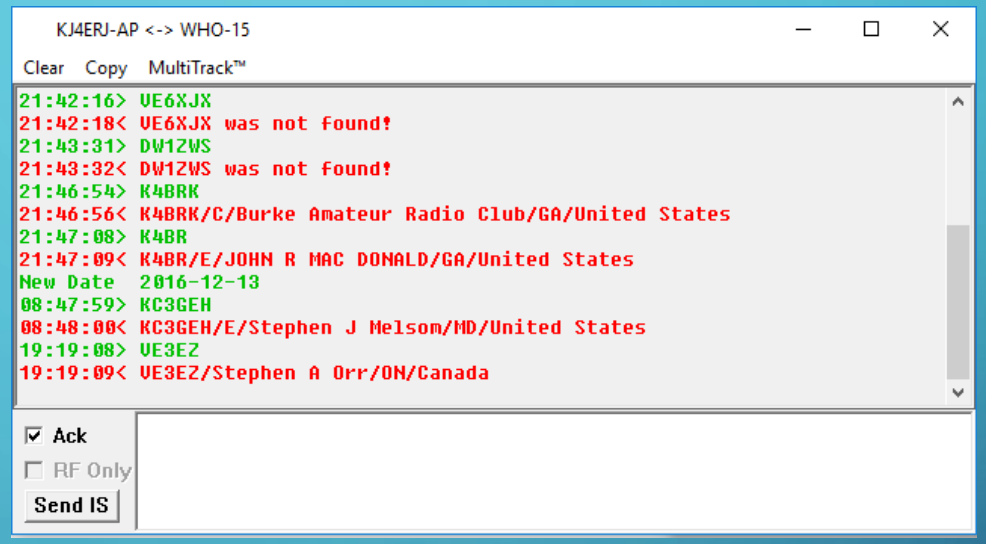
APRS USES

- Tracking – Reduce voice traffic in public service events
  - Provide remote direction assistance
    - Off-roading in compound
    - Road-tripping to Dayton
    - Causing concern when out of range!
  - Meet spouse for dinner!
- Local Information Initiative
  - http://www.aprs.org/localinfo.html



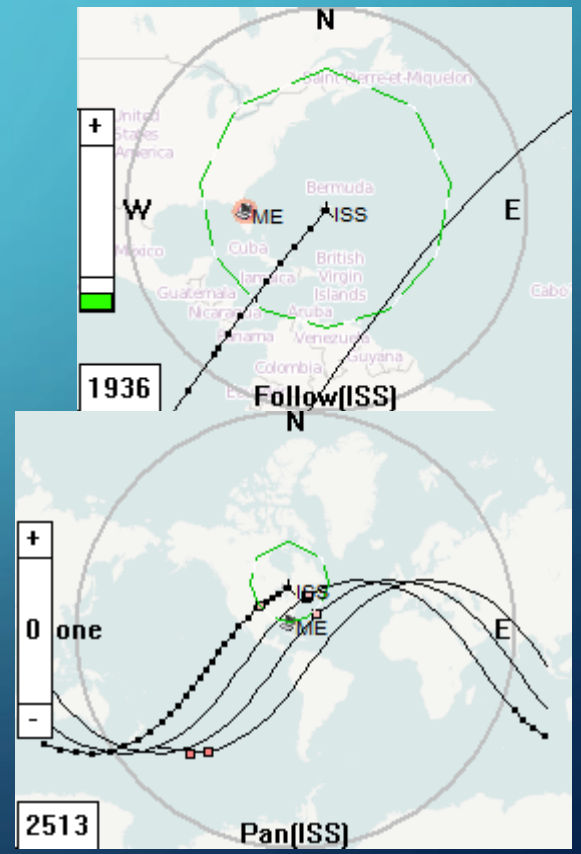
APRS USES

- Text Messaging
- Information Services
  - QRZ
  - WHO-IS/WHO-15
  - SATSRV - http://aprsisce.wikidot.com/doc:satsrv
- Satellite Tracking – ISS & PSAT objects w/footprints!



ISS WITH FOOTPRINT

11:25:19 New Chat Between KJ4ERJ-AL and ISS on 2016-12-14
11:25:20> x
11:25:20< SE^17 SE^18 ENE LOS 5m11s (*2-11:25:20)
11:25:35> KJ4ERJ-12
11:25:35< SE^15 SE^15 ENE LOS 4m47s @ KJ4ERJ-12 (*2-11:25:35)
11:29:00> Y
11:29:00< ENE^5 ENE LOS 1m22s (*2-11:29:00)
11:29:08> KJ4ERJ-12
11:29:08< ENE^4 ENE LOS 1m14s @ KJ4ERJ-12 (*2-11:29:08)
11:30:14> z
11:30:15< ENE^0 ENE LOS 7s (*2-11:30:15)
11:30:22> x
11:30:22< ENE^0 ENE LOS NOW! (*2-11:30:22)
11:30:29> t
11:30:29< AOS 1h26m (1756z) NW^28 (*2-11:30:29)
14:42:52> u
14:42:53< AOS 4h47m (15 0030z) NE^12 (*2-14:42:53)

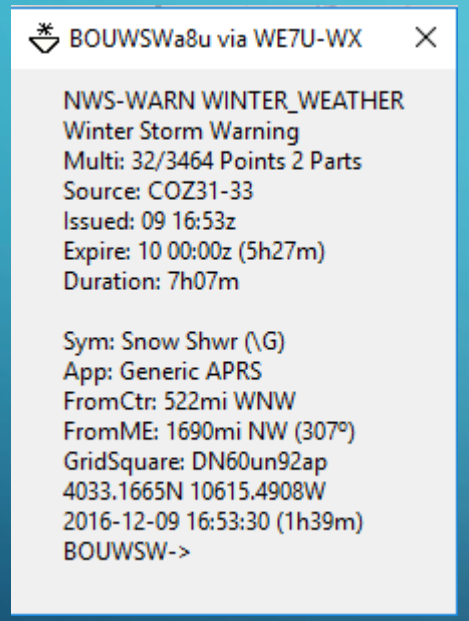


APRS USES

- Contact/Announcement Services
  - CQSRVR/ANSRVR
    - http://www.aprs-is.net/cqsrvr.aspx
    - http://aprsisce.wikidot.com/doc:ansrvr
  - EMAIL-2 - http://www.aprs-is.net/email.aspx
  - Or just watch your APRS radio screen and QSY directly!
    - http://www.aprs.org/info/freqspec.txt
- National Weather Service alerts & locations
- Remote System Control via Authenticated Messaging

NWS WEATHER ALERTS

- Weather on 12/9/2016



NWS WARNINGS (POTENTIALLY LIFE THREATENING)

From http://wa8lmf.net/aprs/get_nws_shapefiles.htm

- As of mid-July 2009, the original **WXSVR** that injected the NWS alerts into the APRS Internet System to make the NWS shape file feature work shut down. A replacement server, **AE5PL-WX**, is now online providing this service. Shapes and symbols for severe weather WARNINGs should appear on maps just as before, however the operator of the new weather server has opted to vastly reduce the volume of traffic inserted into the APRS Internet System. This is to reduce the local radio channel congestion when these bulletins are retransmitted on RF. AE5PL-WX only transmits ***WARNINGS*** (severe weather actually in progress) but not the ALERTS and WATCHES sent by the old server.
- As a result, you will never see the yellow ALERT areas and orange WATCH areas that formerly appeared on UI-View maps. Only the far less numerous red **WARNING** shapes will appear, and for shorter periods of time.

NWS WATCHES

From http://wa8lmf.net/aprs/get_nws_shapefiles.htm

- **UPDATE AS OF SPRING 2011:** Another source of the NWS alerts, that duplicates the full feed of the original WXSVR is now available. "FireNet" is a separate server system operating in parallel with the standard APRS-IS. It provides the full APRS-IS feed, plus hundreds of other objects of interest to SAR groups, disaster incident commanders. EOC managers and others. FireNet includes earthquake epicenters, forest fires, stream and river water gauges, and the full NWS weather feed.

  Just insert **firenet.us** port **14580** into your APRS software server login setup, instead of a "normal" APRS server. In Ulview, this would be added to the APRS server list in the "APRS Server Setup" dialog by using the keyboard "Ins" (Insert) key and entering **firenet.us:14580** and then checking the box to enable the new entry.. The standard port 14580 **user-defined filter commands** work on FireNet . More details on FireNet are here: **http://info.aprs.net/index.php/FireNet**

- Ed Note: firenet.us should NOT be used on an IGate as the primary APRS-IS connection!

- Enough with the details already!
- How do I get started to use APRS?

APRS EXPERIMENTAL – APZXXX

- APZTED – The Energy Detective – KJ4ERJ-TD
- APZLUA – ESP8266 – KJ4ERJ-E*, KJ4ERJ-S1, KJ4ERJ-HP
- APZMOW – KJ4ERJ-RB

QUESTIONS?

- There's no such thing as a stupid question unless you've asked it before and are expecting a different answer.

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THANK YOU!