APRS

Presented by Ron Huss, KC8YVF

What is APRS?

- APRS stands for <u>Automatic Packet Reporting System</u>
- It was developed by Bob Bruninga, WB4APR which uses amateur radio to transmit position reports, weather reports, and messages between users.
- The system was designed to support rapid, reliable exchange of information for local, tactical real-time information, events or nets. The concept, which dates back to the mid 1980's.
- Uses 144.39 MHz for North America

What do you need

- 2 Meter radio
- TNC
- GPS (for mobile positioning)
- Computer
- APRS software
  - UI-View (Windows)
  - WinAPRS (Windows)
  - MacAPS (Mac)
  - XASTIR (Windows, Mac, Linx)
  - APRS Point (Windows)
  - X-APRS (Linx)
  - APRS/CE (Windows CE devices)

Equipment

The two images below should give you an idea of the kinds of information available to the mobile operator on his APRS radio. On the left is the Kenwood D710 radio showing the station list, and on the right is the attached GPS with map display showing the location of other APRS stations.

Other Equipment
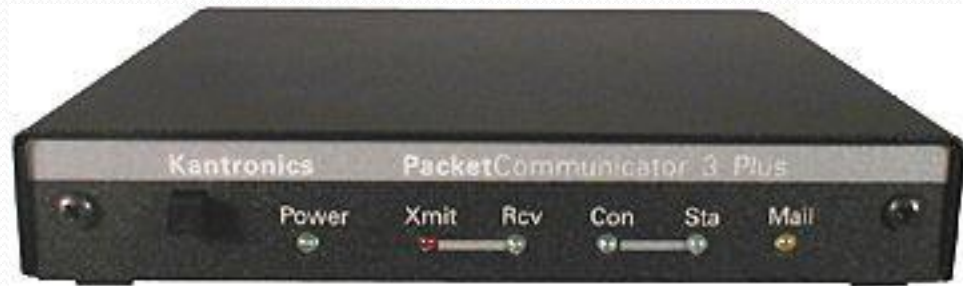
How does it work

- An APRS station broadcasts (beacons) a single packet of information to all stations in range.
- This packet usually contains GPS co-ordinates and other information.
- The packet may be received and decoded by any station that can hear it and has suitable software or hardware.
- Digipeater (Digital Repeater) stations can also hear the packet and rebroadcast it based on rules in the digipeater software and commands that are integral to the packet.
- Packets that need to travel long distances can also be routed across the public internet.
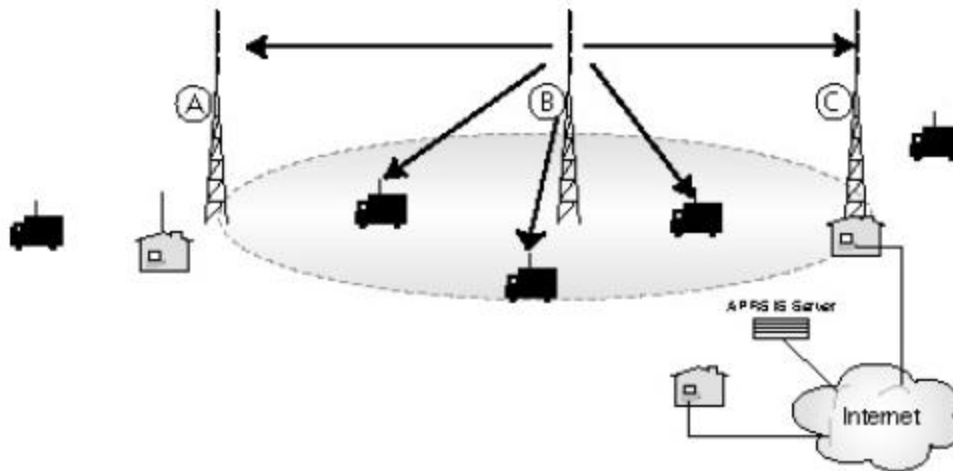
Step one - local

- An APRS station beacons and is heard by every other APRS Station in direct range.
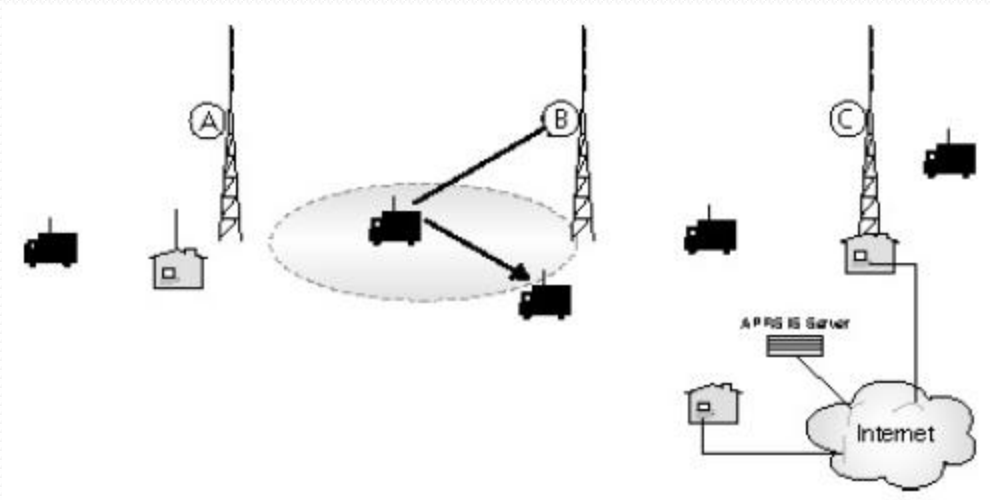
Step 2 – getting out

- The packet is re-broadcast by every digi than can hear it. The packet is heard by every other APRS station in direct range, including other digi.

Step 3 – extending the range

- The packet is rebroadcast by every digi that heard the first digi. The packet is heard by every APRS station in direct range of this second set of digis, including the first one.
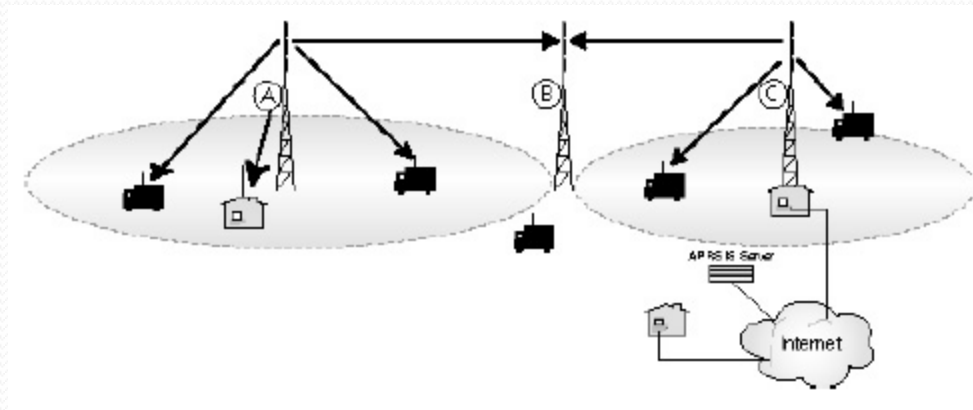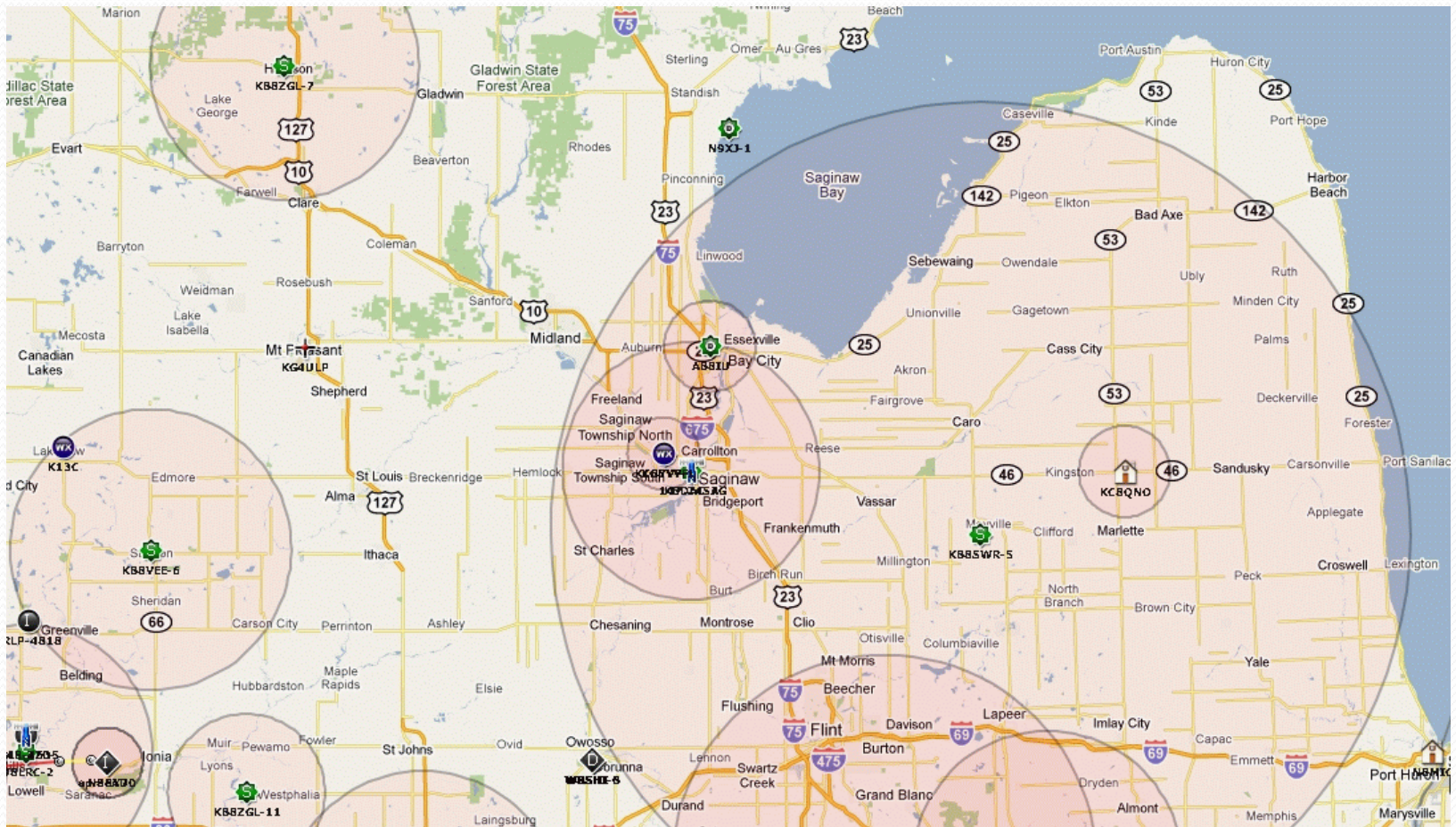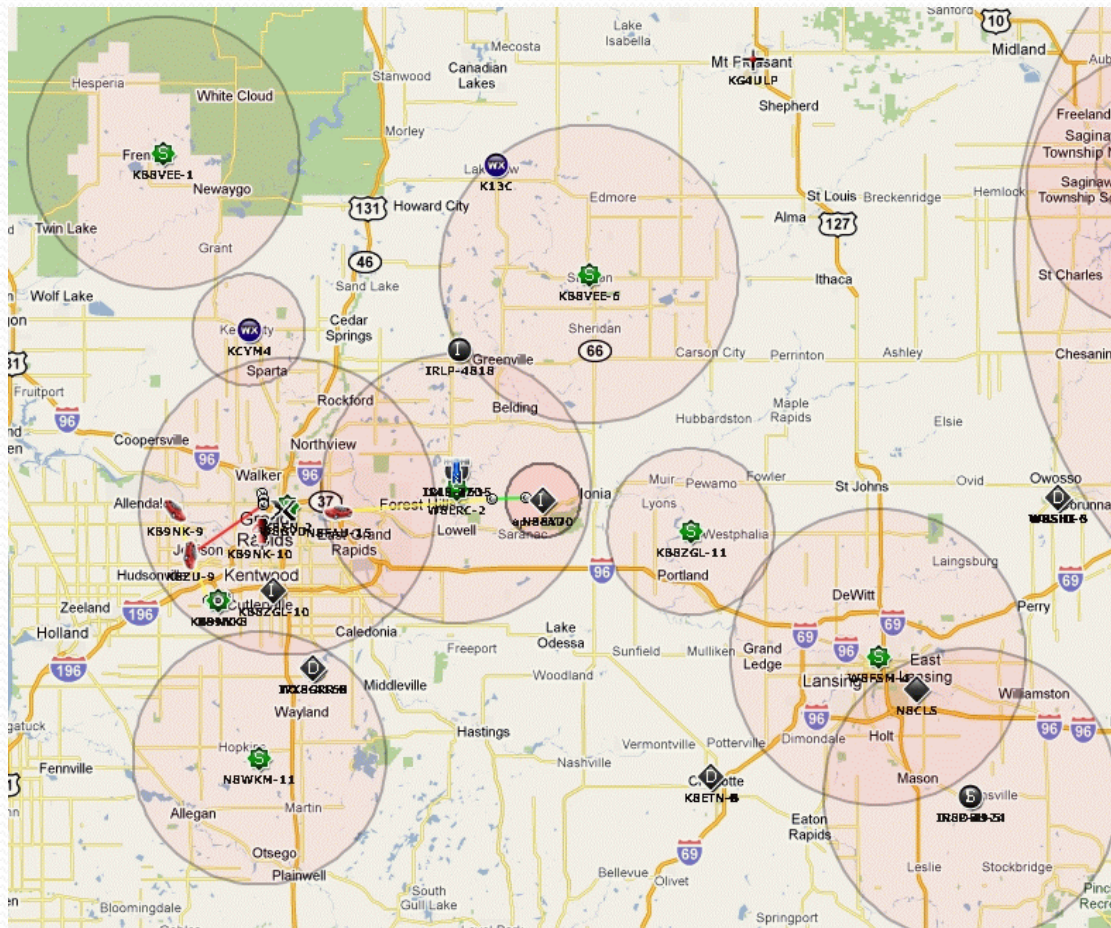
Step 4 – covering the distance

- The packet is again rebroadcast by every digipeater in direct range of the second set of digis, including the original digipeater. The new WIDEn-n paradigm (i.e. the use of WIDE2-2 etc) is intended to control this process
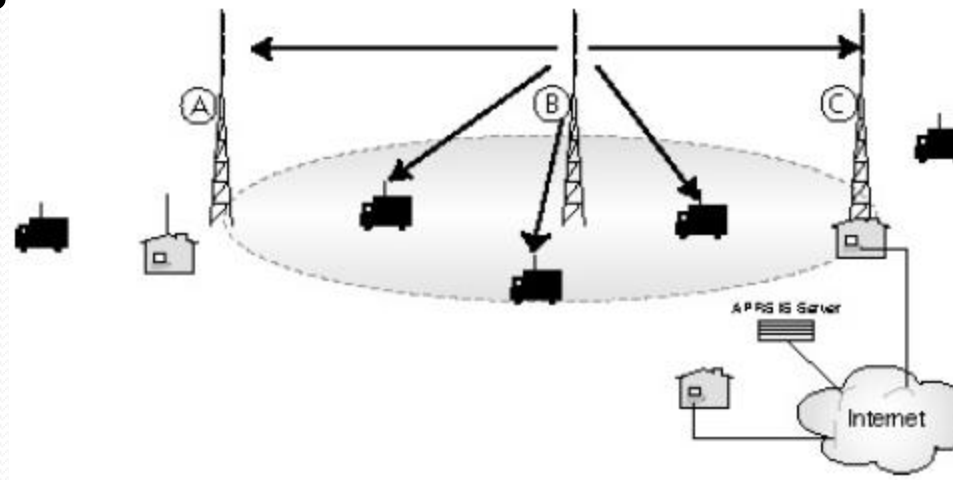
Saginaw Valley Coverage Map

West Michigan Coverage Map

Beacons

- Stations that expect to be moving very slowly over a large area should beacon occasionally (walking/offroading).

- Stations that are moving rapidly over a small area should beacon more often.

- If you expect be tracked on a high-resolution map and the person(s) tracking you needs to know exactly where you are, then it makes sense to beacon faster.

Smart Beaconing

- The main goal of Smart Beaconing is to talk only when there's something useful to say.
- Invented by Tony KD7TA and Steve KA9MVA in 1998, it is a process of adjusting APRS/GPS beacon rate according to speed and direction.
- If you speed up, you beacon more frequently, if you slow down you beacon less frequently.
- If you turn a corner, you beacon
- The Byonics TinyTrack 4 and Kenwood TM-D710 have this feature built in to their hardware.

Station Types

Station Types

- **Digipeaters**

- A digipeater is a station that re-transmits the packets that it hears. There should only be a few digipeaters in a given area, i.e. they should have relatively little overlapping coverage.
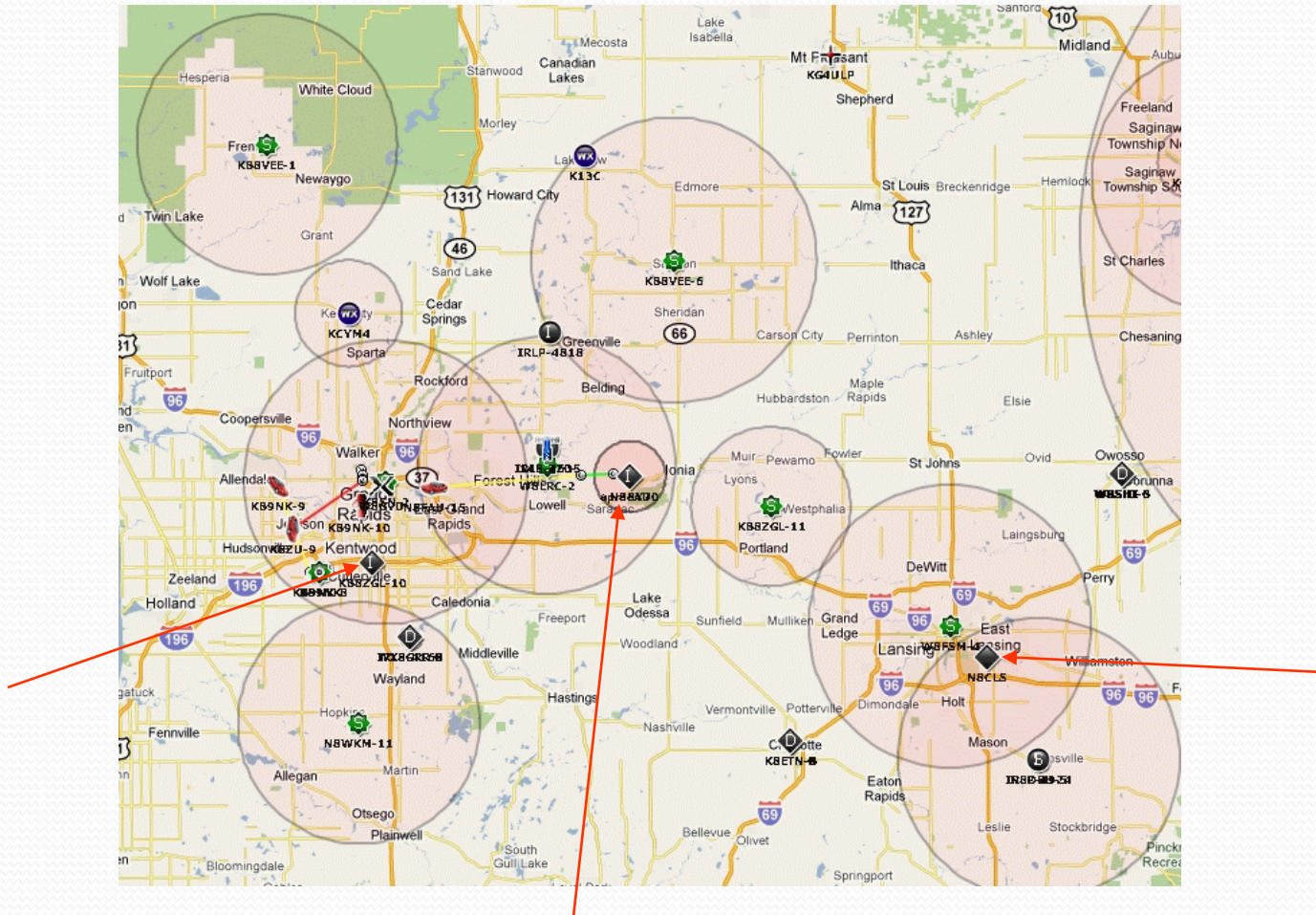
Digipeaters
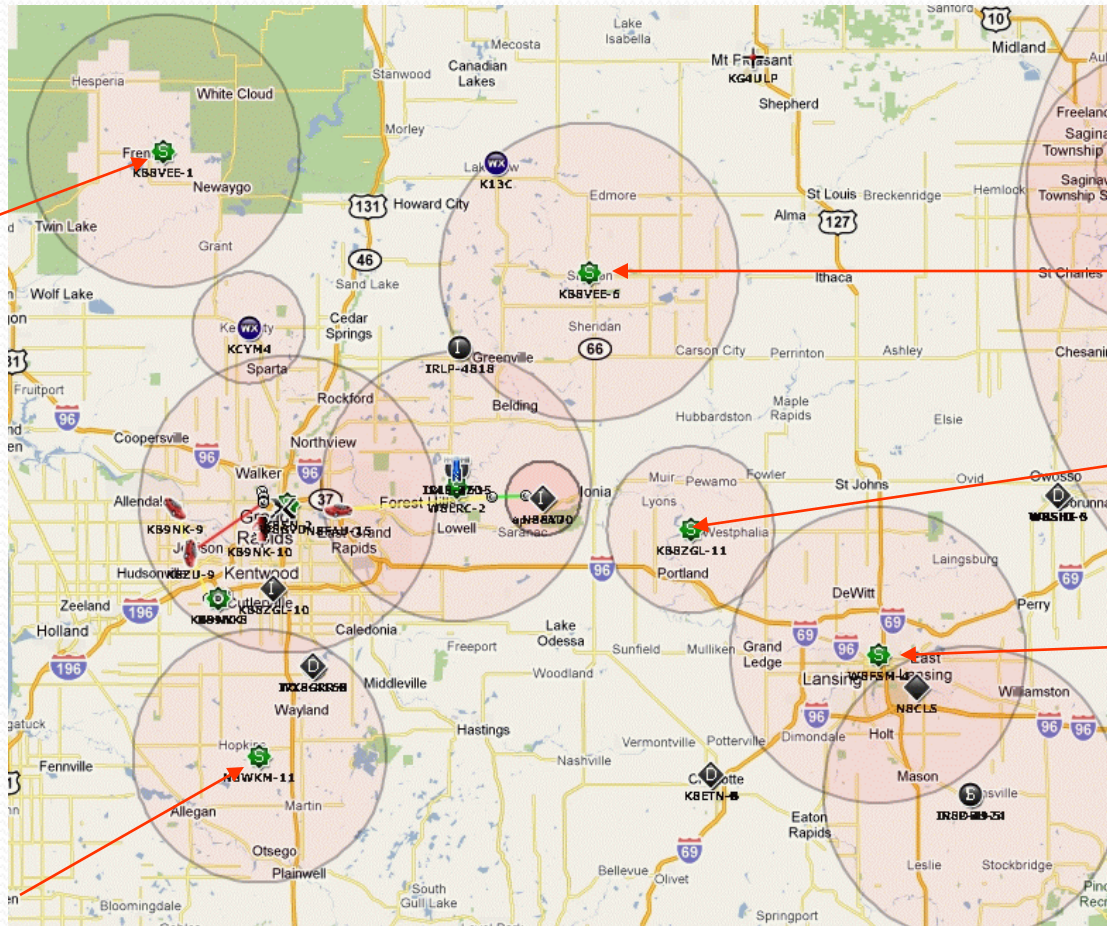
Station Types

- **Internet Gateways**
- An internet gateway relays packets from radio to the internet and vice versa.
- It can be combined with a digipeater and / or a fixed station and would require a computer and internet connection.
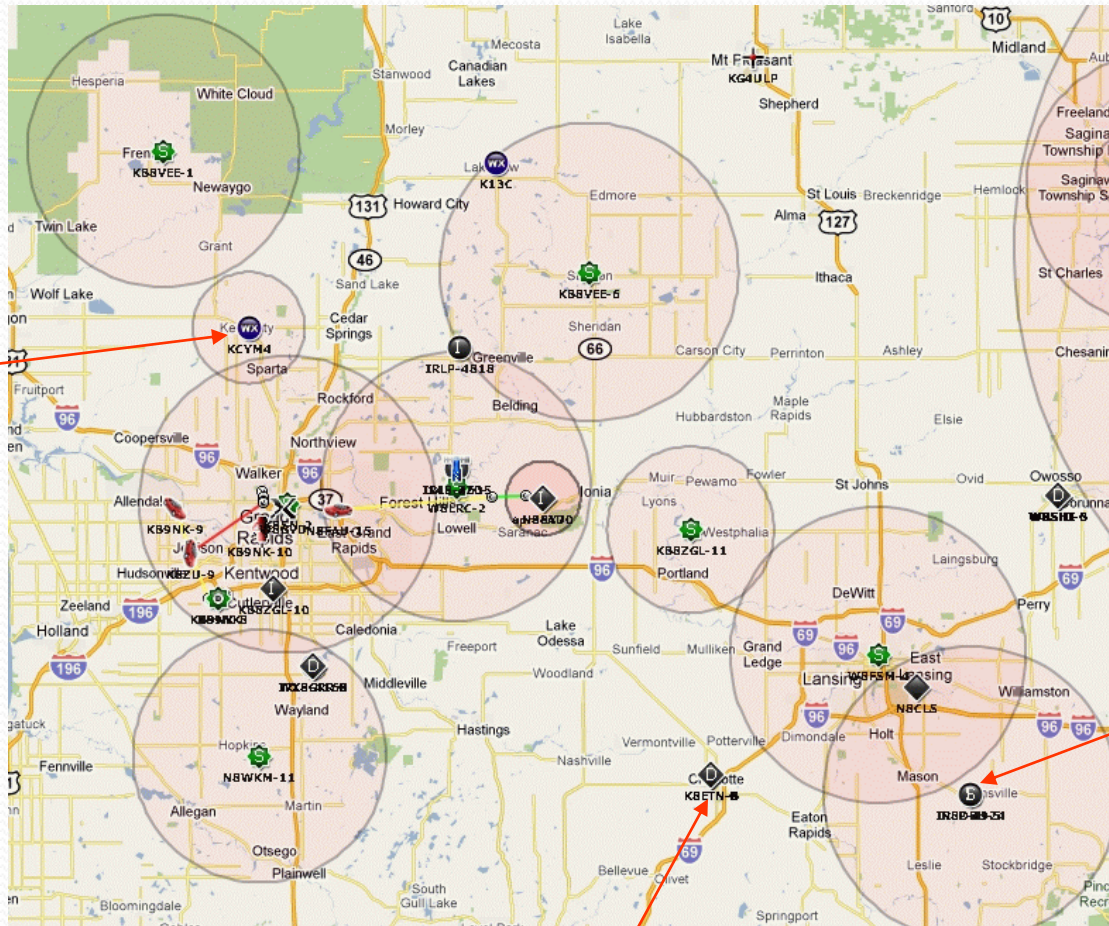
Internet Gateways

Station Types

- **Fixed Station**
- A fixed station transmits APRS packets, but remains in one place. It can be used to monitor an area or to transmit local information objects.

Fixed Stations

Station Types

- **Trackers**
- A tracker is an APRS station that is capable of transmitting a packet containing location information.
- They are usually small and portable for moving between vehicles.
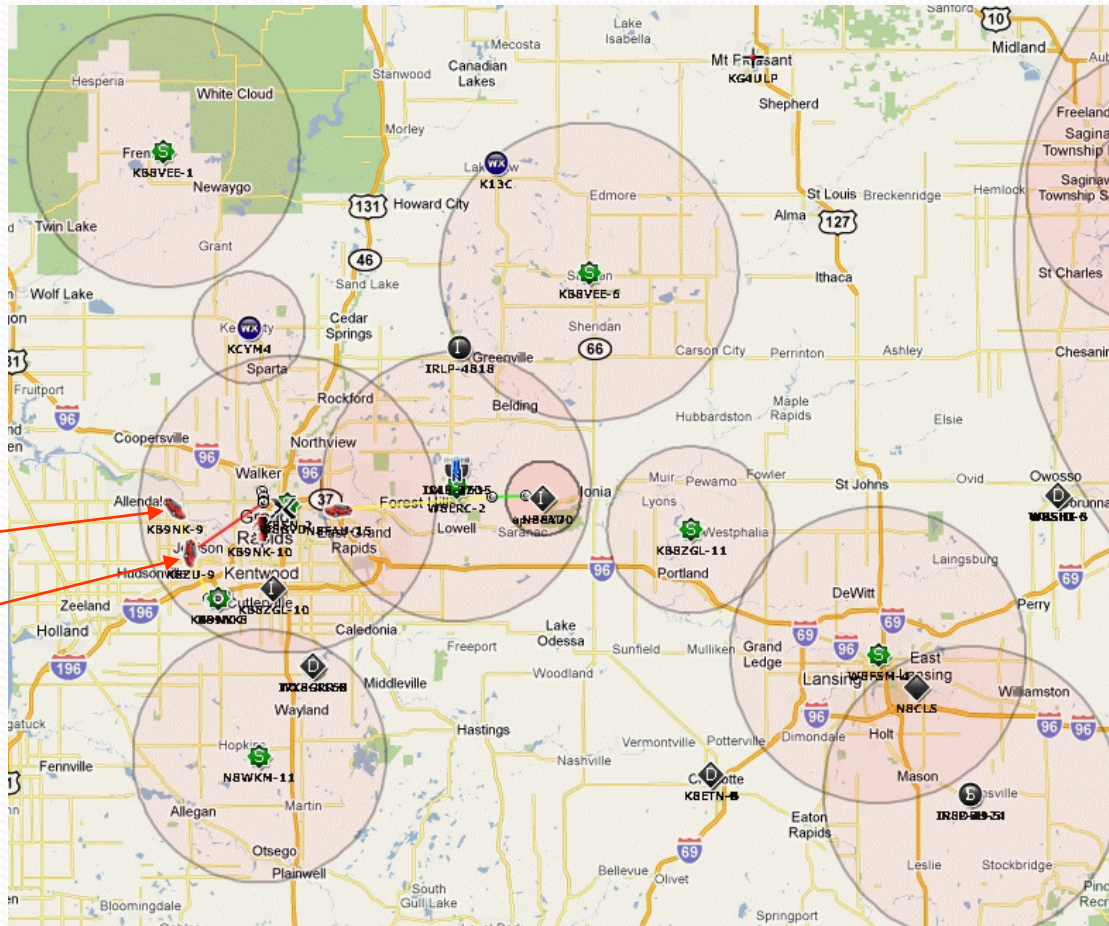 - Examples are the Byonics TinyTrack, the opentracker, the Kenwood TH-D7.

Station Types

- **Mobile Station**
- Usually a tracker semi-permanently fixed in a vehicle. This can include a computer or a suitable GPS for display purposes (e.g. Kenwood TH-D700/710)

Mobile Stations

Station Types

- **Passive Stations**

- A passive station only listens to APRS packets, but doesnt transmit anything.
- Generally used with a computer just to see other stations.

Configuration

Configuration Information

- You will need to know the following information to configure your APRS station be it software or hardware:
  - SSID (Secondary Station IDentification)
  - Latitude and Longitude
  - Unproto Address
  - Beacon Comment
  - Beacon Rate
  - Status Text
  - Status Rate (dealt with above)

SSID

- In Packet Radio you can have up to 15 Secondary Station IDentifiers (SSID's), an example is K8DAC-1 through K8DAC-15.

- K8DAC without an SSID extension, is considered the 0 (zero) SSID, thus it is possible to have sixteen different stations/calls on the air at the same time using our single call sign.

- That's where the numbers in the call sign come into play. The added dash numbers (-1 ... -15) are used to distinguish the various station(s) or node(s).

- So, your SSID uniquely identifies your station. It consists of your callsign at a minimum and is transmitted every time you beacon.

- It is very useful when you have more than one station operating simultaneously (mobile/home/portable).

SSID
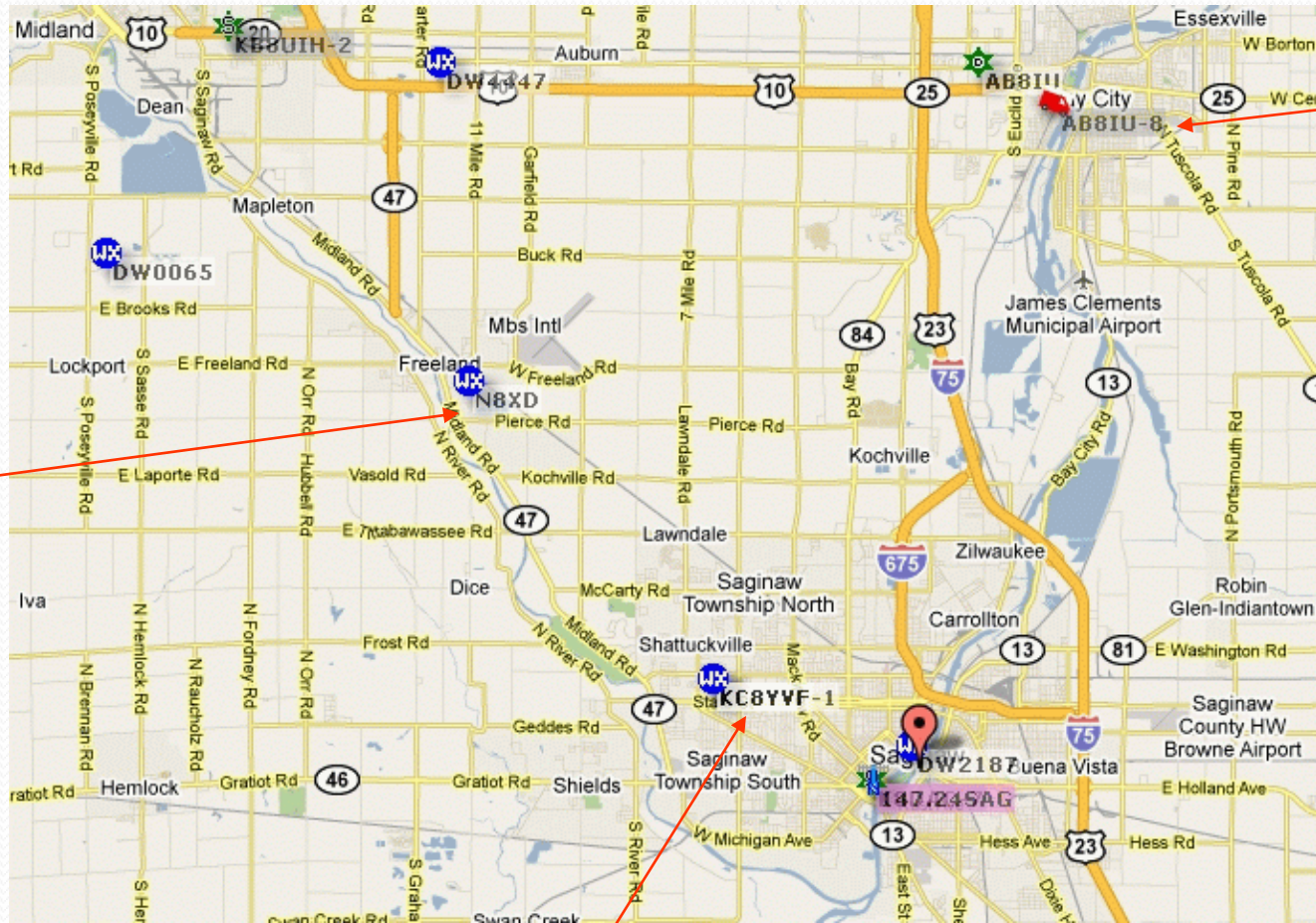
SSID Numbers

- -0 Home Station, Home Station running IGate.
- -1 Digipeater, Home Station running a Fill-In Digi, Wx Digipeater
- -2 Digipeater [#2 or] on 70CM
- -3 Digipeater [#3]
- -4 HF to VHF Gateway
- -5 IGate (Not home station)
- -6 SatGates & Special function Station.
- -7 Kenwood D7 HH
- -8 Secondary Mobile station.
- -9 Primary Mobile station.
- -12 Portable Units such as Laptops etc.
- -14 Trucks
- -15 Mobile HF station.

Latitude and Longitude

- Latitude and longitude coordinates are angles that describe your location uniquely on the face of the earth.

- If you have a GPS connected to your equipment you will not have to enter this manually.

- The standard settings to use with a GPS are NMEA Out or NMEA In/Out at 4800 baud.

Unproto Address

- This is the how your paths should be and how digipeaters should be configured.
  - **Fixed Station** WIDE2-1, this should get a packet one hop through the nearest Digipeater and onto the nearest Internet Gateway.
  - **Mobile Station** WIDE2-2, as the network expands this should get a packet two hops from (for example) a fringe coverage area into an area with an Internet Gateway.
  - **Special Event Stations** WIDE1-1, this should keep the traffic fairly local.
  - **Digipeaters** None, keeps traffic local

Recommended Wide Settings

APRS User Recommendations under the New n-N Paradigm

WB4APR

1) RELAY, WIDE, TRACE, TRACEn-N and SS are obsolete, Use at your own risk.

2) Use WIDE2-2 for fixed stations   (3-3 is ok for areas far-far from any city or mountains)

3) WIDE1-1,WIDE2-1 for mobiles   (WIDE1-1,WIDE2-2 is ok for areas far-far from any city or mountains)

4) Use WIDE1-1,SSn-N for selected non-routine State or Section nets or when human's are present for large area emergent needs.   (will not work reliably during transition period)

5) Use DIGI1,DIGI2,DIGI3... for point to point communications

    (but realize success becomes vanishingly small beyond 2 hops)

Warnings:

A) Never use WIDE1-1 beyond the first hop

B) Never use anything other than WIDEn-N on a Balloon or aircraft.   (N=2 should work well)

Beacon Comment

- The beacon comment is a piece of text that goes out with each beacon.
- Can be anything you want, as long as it is short
  - Monitoring 146.520
  - Hi from Bill at "Your email address"
  - Your web page

Status Message

- The status message is a text message that is transmitted with your beacon, but not necessarily every time you beacon. Generally you can set your station to transmit your status once every n beacons (where n > 1).
  - On duty
  - On station
  - En Route
  - Committed
  - Emergency (be careful of using this message)

Using APRS

So what can you do with it?

- Post Disaster Management
  - Damage assessment
  - Liaison tracking
  - Site talk in
- Search and Rescue
- Public Service Events
  - Bike Rallies
  - Parades
  - Walk-a-thons
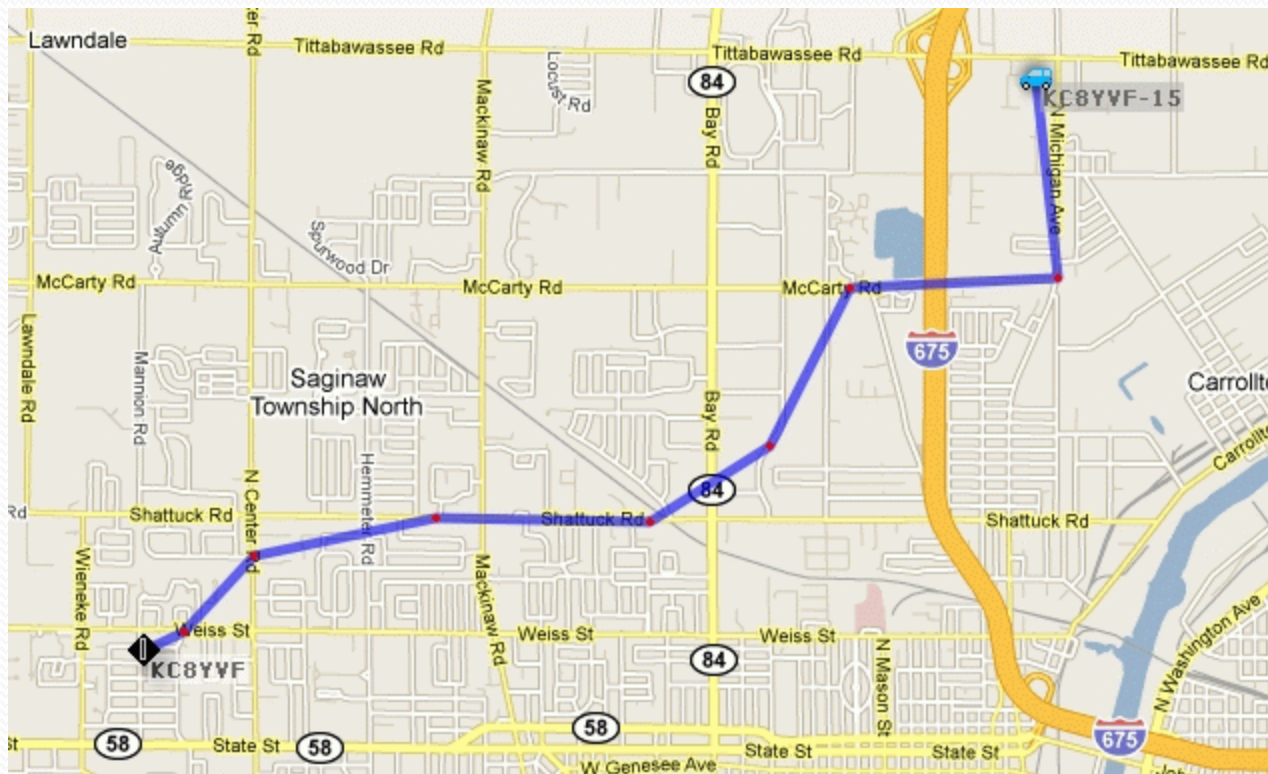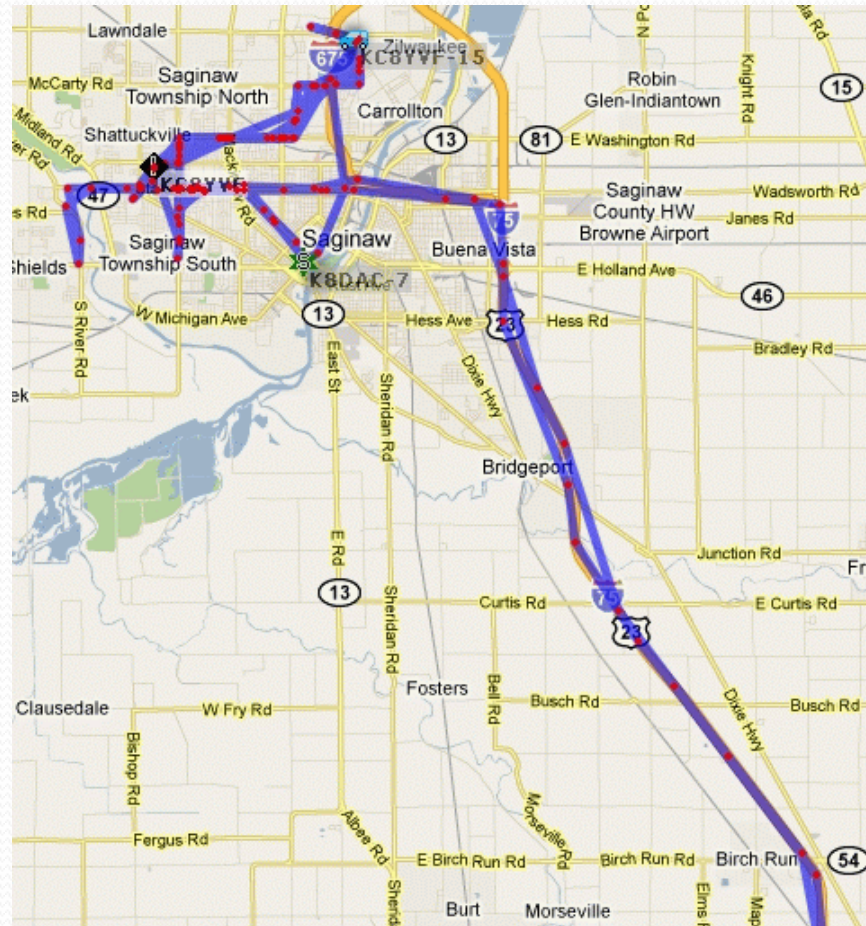- Repeater Advertising
- Vehicle Tracking

Vehicle Location

- Tracking vehicles for the MS-150 Bike-a-thon

Vehicle Tracking

Tracking gone Wild!

Email?

- Can you send email using APRS?
- Yes you can!
- By using a compatible radio you can send email that can be <u>received</u> by anyone.
- This is a one way only operation as you can not receive email via the radio.

Sending Email over APRS

- The TH-D7 display is shown below... In this case, it is sending an Email.

- Just press the MSG button, select INPUT on the MSG Menu, enter EMAIL as the address, and make the first text of the message be an email address followed by your message.

- In the example below, an **EMAIL** to **A3XYZ@AMSAT.ORG** says *OK in OceanCity with HT & whip!*
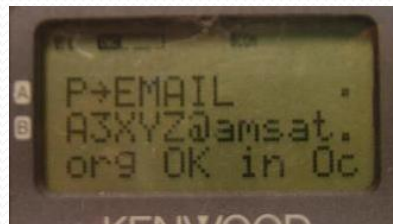
Messaging over APRS

- Another feature of APRS is the ability to send and receive messages.
- You can create and send messages between radios or from radio-to-internet or internet-to radio.
- Radios like the Kenwood TH-D7 or TM-D700/710 have the ability to create and send messages directly through the radio.
- This can also be done using a external TNC and computer.

Messaging using UI-View
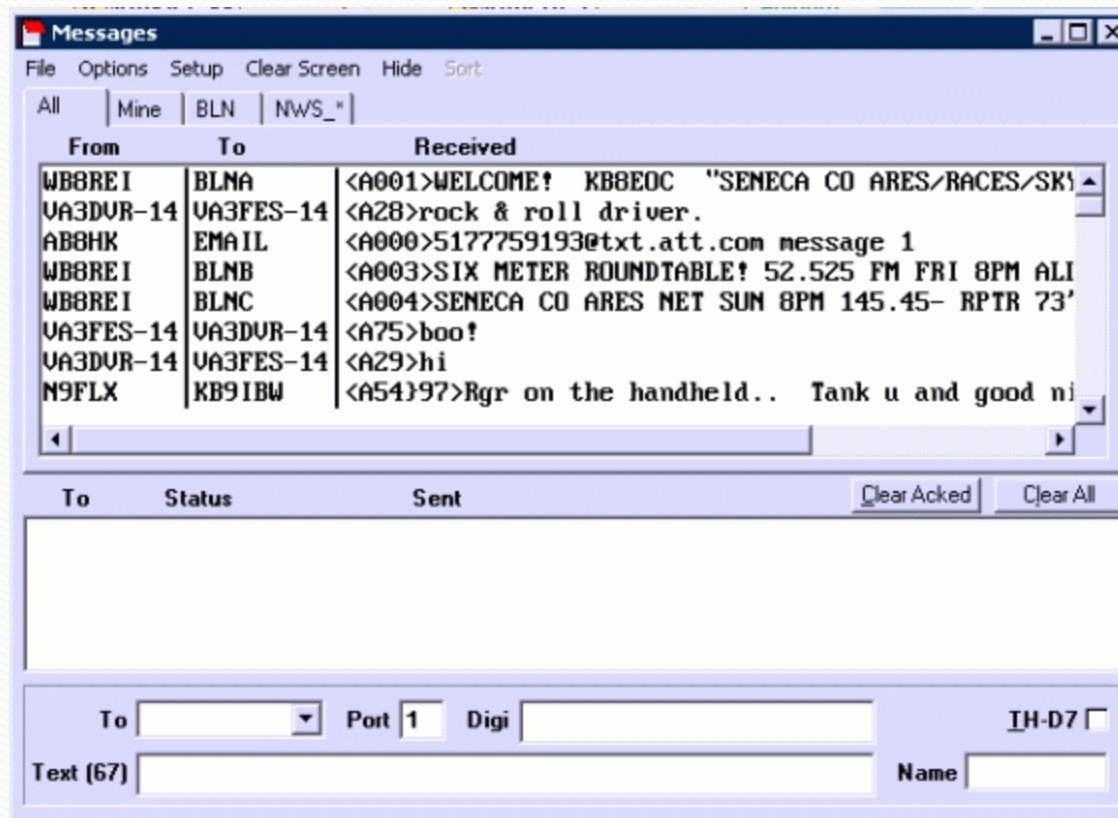
Messaging using Radio

- Messages display on the Kenwood TM-D700

APRS° Displays

List of APRS° stations (up to 40) for browsing & selecting

APRS° details of another station as displayed on the TM-D700A

Text messages can be sent to a selected station

Instant Messaging

- Another aspect of the APRS network is the ability to send and receive Instant Messages.

- Programs like UI-View have this ability, but are lacking in features.

- An add-in program called IU-Instant Messenger written by Andy Pritchard fills the void that UI-View lacked.

- This program can be used along with UI-View or as a stand alone application.

- It allows some one on a computer with no radio attached to send messages to a mobile station through the internet via a gateway onto the APRS network to the mobile station and back.

UI-Instant Messenger

Lower Michigan APRS Stations

Weather and APRS
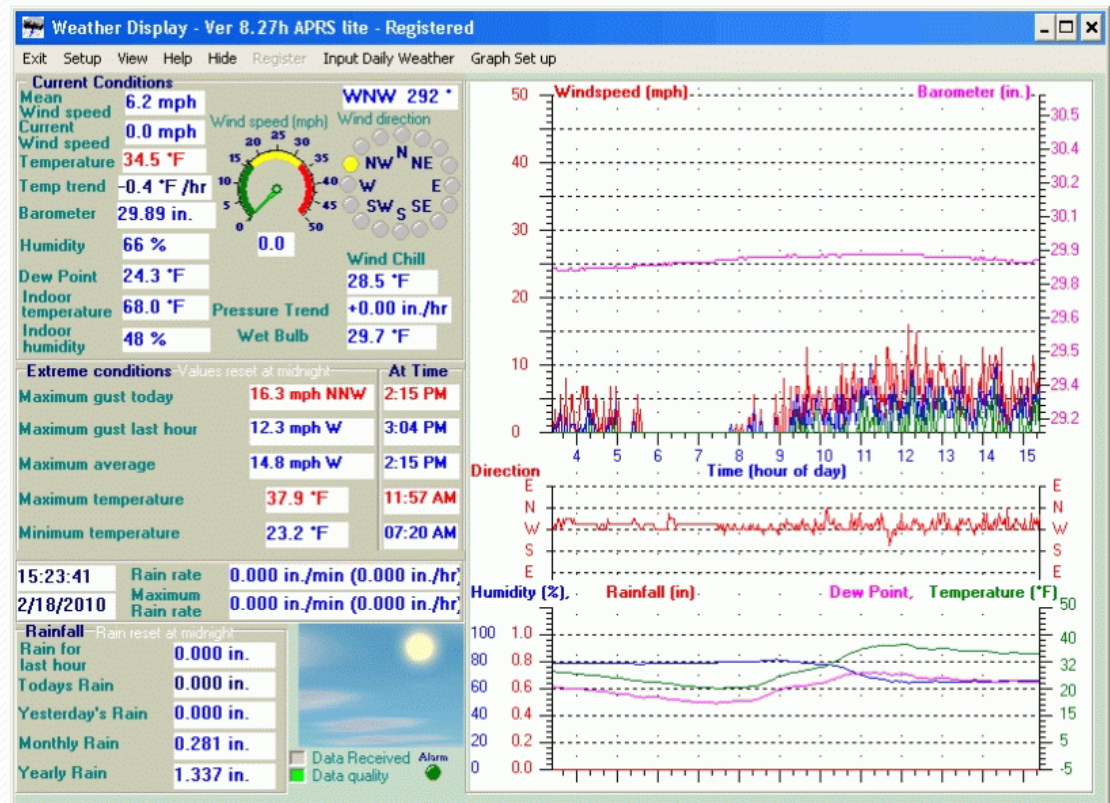
Weather and APRS

Weather Station

Weather Data

- Weather Data is collected by the station and displayed on the computer software.
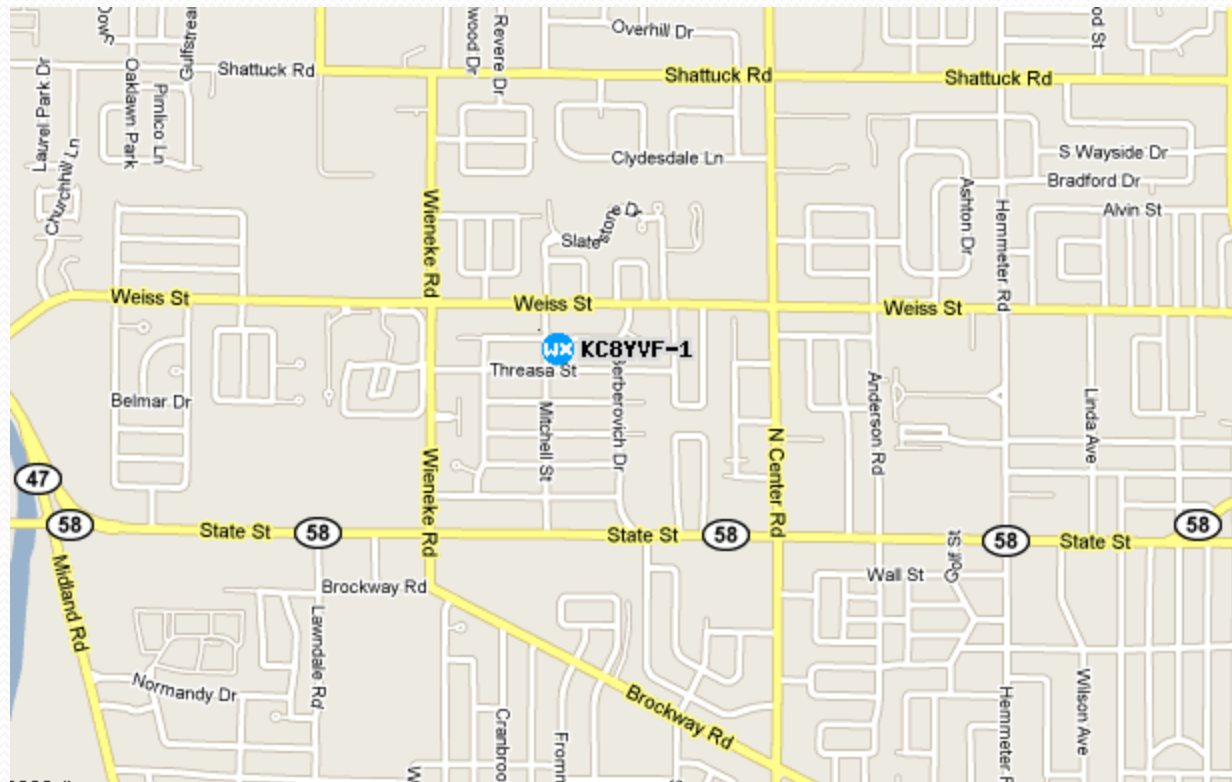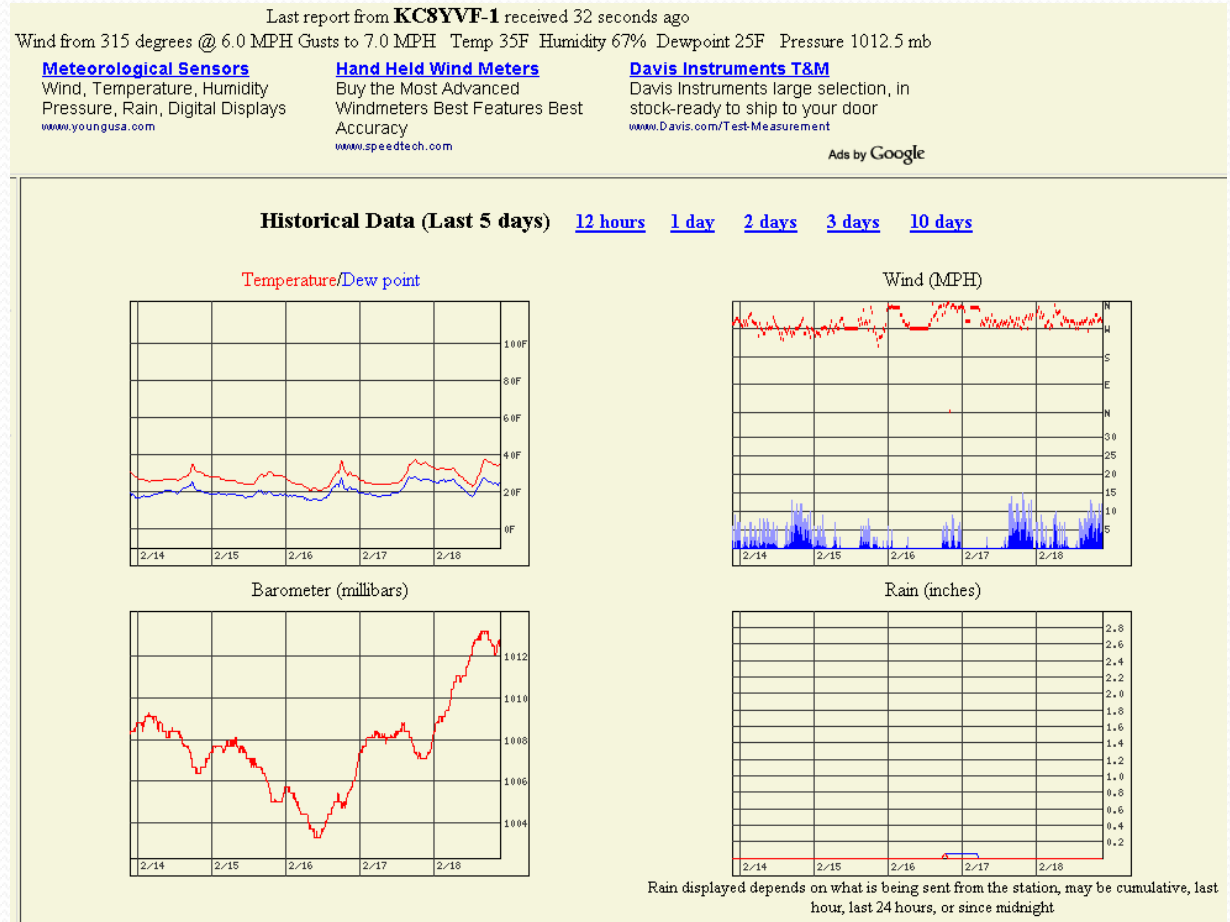
Weather on APRS

- The APRS network displays the station SSID.
- In this case KC8YVF-1

Weather Data

- Weather data is uploaded to the Internet via the internet gateway and displayed on pages like Findu.com

Last report from **KC8YVF-1** received 32 seconds ago
Wind from 315 degrees @ 6.0 MPH Gusts to 7.0 MPH   Temp 35F Humidity 67% Dewpoint 25F   Pressure 1012.5 mb

Historical Data (Last 5 days)   12 hours   1 day   2 days   3 days   10 days

Temperature/Dew point

Wind (MPH)

Barometer (millibars)

Rain (inches)

Rain displayed depends on what is being sent from the station, may be cumulative, last hour, last 24 hours, or since midnight

Weather Display on Kenwood

- The weather information is also sent through the APRS network and picked up by mobile or fixed stations.
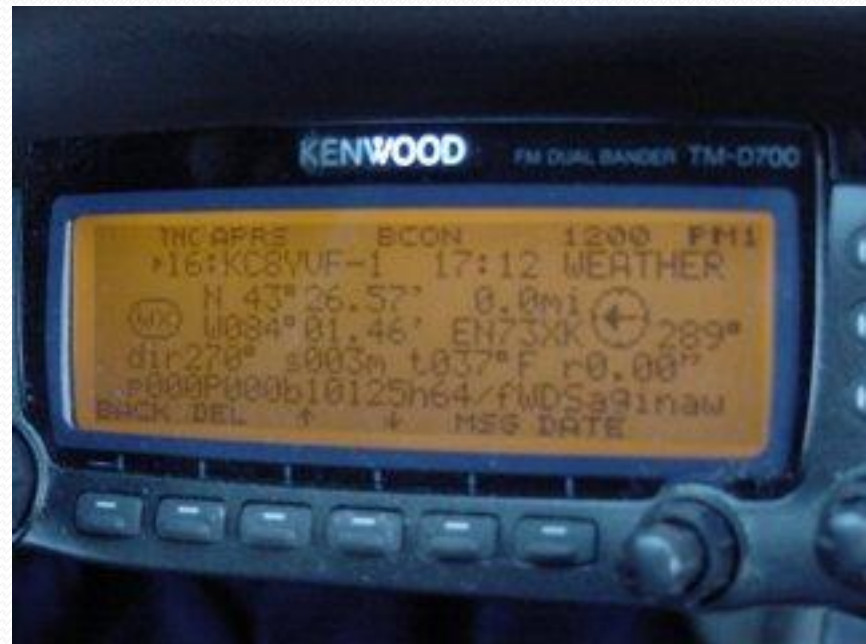
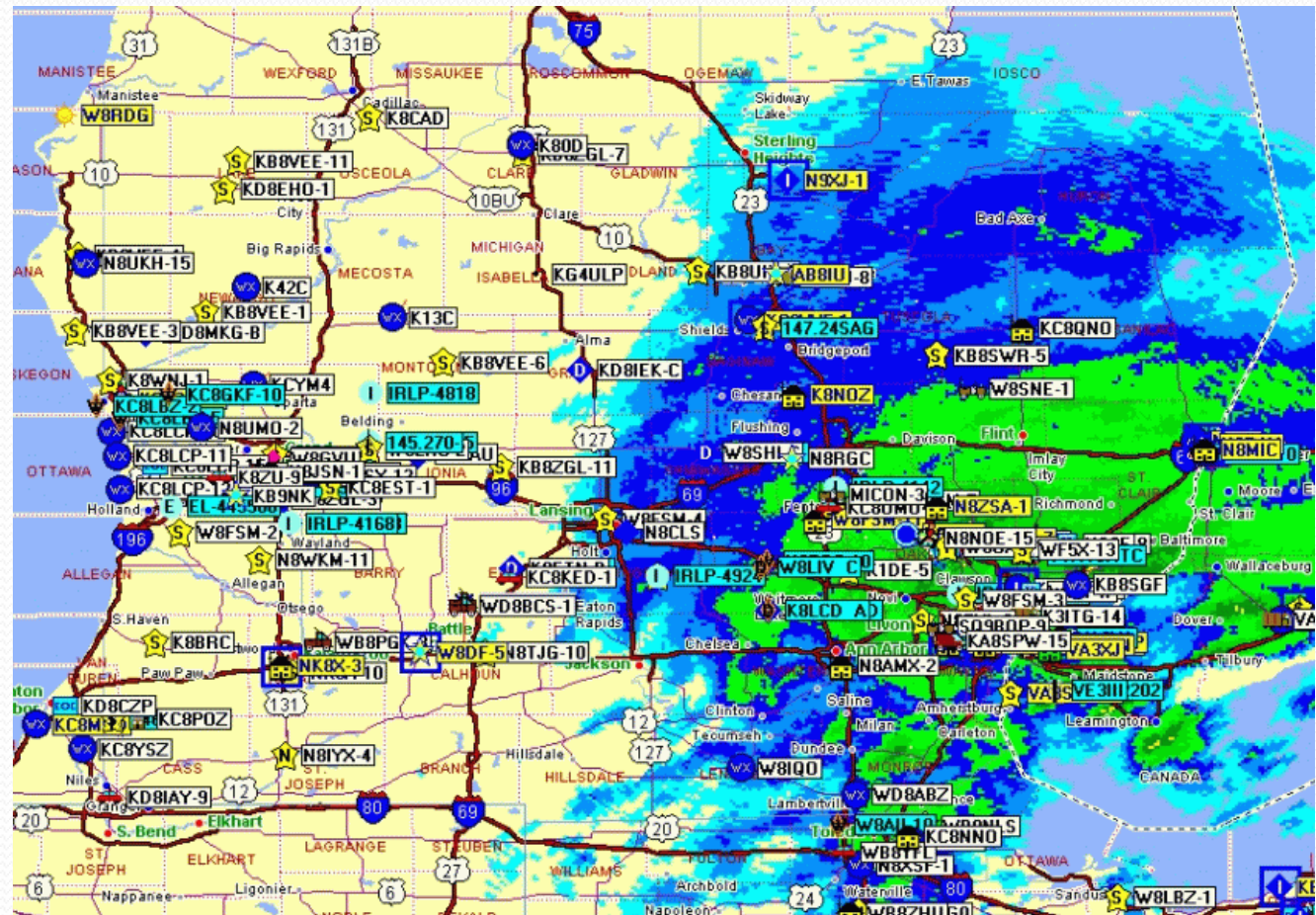# Uses for Weather Data

- Weather data can be used for many proposes.
  - Public Service Events
  - Field Day
  - Fire scenes or other disasters
  - Skywarn

Weather Radar Overlay

- Here is weather radar displayed over the APRS map.
- Using programs like UI-View.

References

- http://www.aprs.org/
- http://www.openaprs.net/index.html
- http://aprs.fi/
- http://www.findu.com

- Acknowledgements:
  - John Ronan – An Introduction to APRS
  - Bob Bruninga

Questions

The End