APRS

APRS – What does it stand for

I have heard many definitions of what APRS stands for, here are a few:

Automated Position Reporting System

Automated Packet Reporting System

Automatic Position Reporting System

But most people agree that APRS stands for:

Automatic Packet Reporting System

APRS – What is it?

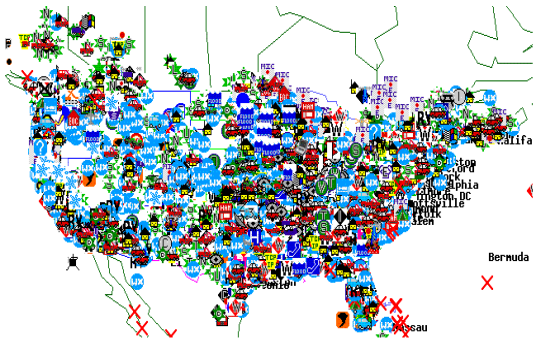
APRS uses a 1200 baud (9600 baud in some locations) Packet Radio transmission to send a position report, from either a moving or fixed location. The data sent usually includes some or all of the following:

GPS coordinates, altitude, heading and speed of the station sending the reports.

The packet can also contain other data such as weather information, tactical messages or system status including operating temperature and battery status.

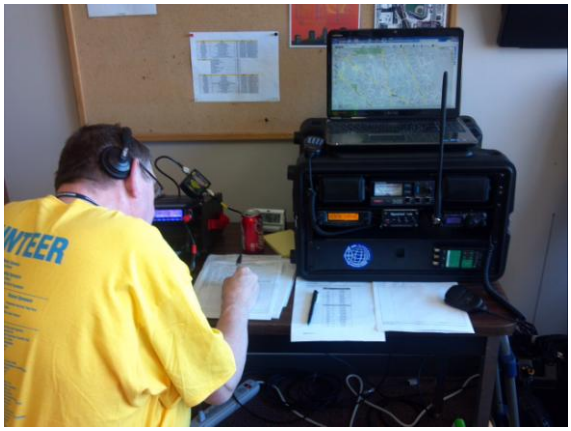
APRS – A short history lesson

Created by Bob Bruninga WB4APR (hence the name APRS), a senior research engineer with the US Naval Academy in the Hawaiian Islands in the late 60's and early 70's, as a way of distributing information between the various islands. But it wasn't until the early 90's that this operating mode really began to take hold. Now there are hundreds of thousands of APRS stations worldwide.



Why use APRS?

Imagine the time savings, and reduction in radio traffic, in knowing where a station is by just looking at a map instead of having to ask for their position over the radio. For instance imagine you are a net control station with several mobile operators supporting a 25 mile race. Instead of asking individual stations for their location when you need something, you can simply look at a map and direct the nearest resource as needed.



APRS – not just for your location

We should also remember that APRS is NOT just for broadcasting your location information using data from a GPS. It can also be used for broadcasting text messages.

What does the APRS packet format look like?

The AX.25 Frame

All APRS transmissions use AX.25 UI-frames, with 9 fields of data:

The AX.25 Frame All APRS transmissions use AX.25 UI-frames, with 9 fields of data:

AX.25 UI-FRAME FORMAT									
	Flag	*Destination Address*	*Source Address*	*Digipeater Addresses (0-8)*	*Control Field (UI)*	*Protocol ID*	*INFORMATION FIELD*	*FCS*	*Flag*
Bytes:	1	7	7	0–56	1	1	1–256	2	1

ftp://ftp.tapr.org/aprssig/aprsspec/spec/aprs101/APRS101.pdf

APRS – Station Types

There are 3 distinct APRS station types, these are:

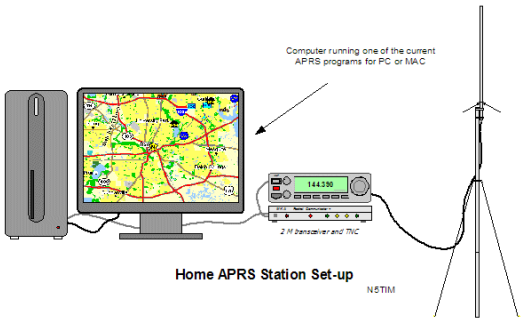
1. Mobile Stations
2. Home fixed stations (IGgates or "fill-in" digipeaters)
3. WIDE fixed "smart" high-level backbone stations (usually the most high powered and or best located of all APRS stations and generally are only used for "digipeating")

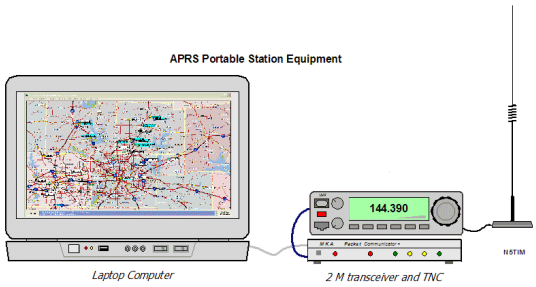
The need for a distinction between home stations and WIDE stations will become apparent when we discuss routing the packets.

What is needed for home APRS?

At a bare minimum you will need the following:

1. A radio
2. A TNC (terminal node controller) or sound card interface
3. A computer
4. Software



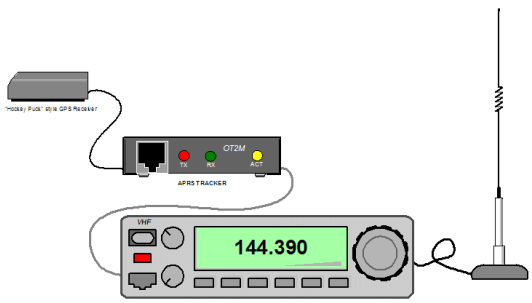


What is needed for mobile APRS?

At a bare minimum you will need the following:

1. A radio
2. A dedicated APRS tracker
3. A GPS receiver (NEMA compliant output)

Many radio manufacturers now offer mobiles and HT 's with built-in APRS functionality



Can I use my cellphone?

Yes, you can use a "smartphone" either an iPhone or Android phone to send APRS packets directly through your phones data connection to the APRS gateway or through a radio.

iPhone: OpenAPRS, PocketPacket
Android: APRSdroid

NOTE: if you are sending your data using the phones data connection remember there will be data charges billed by your provider so having an unlimited data plan would be wise.

So how does the network work?

IGates, Digipeaters and APRS Paths

IGates – stations setup to upload APRS data to the Internet based APRS servers (APRS does NOT depend on IGates to work)

Digipeaters – both Home and WIDE rebroadcast APRS data, similar to a normal repeater used for voice transmissions however they "digipeat" on the same input and output frequency. However home "fill-in" digipeaters ONLY respond to a WIDE1-1 path.

APRS Paths – APRS stations can be configured to use digipeaters to expand their useable coverage area. The TNC or APRS Tracker can be programmed with path settings saved either in the software or non-volatile memory (flash) in the device. This path information is then applied to every transmission and tells the receiving station how the packet should be handled. Lets look at an example:

As an example lets say we configured our APRS device software with the following path setting:

WIDE1-1,WIDE3-3

What this means is the operator wants the first relay station or digipeater (Home or WIDE) that hears the transmission to "digipeat" the transmission.

The transmission would then be received by additional digipeaters and should be re-transmitted by no more than 3 additional "hops", giving a total of 4 hops.

So lets see how this works -

On the first transmission from the station originating the message the packet will contain the routing instructions:

WIDE1-1,WIDE3-3

A station configured as a digipeater (Home or WIDE) that hears the message will look at the routing instructions and re-transmit the received packet but will change the routing instructions in it's transmission to be:

WIDE*,WIDE3-3

Notice the "*" that has been added to the routing instructions. This signifies where in the relay process the message is at.

The relayed transmission is then received by any WIDE digipeater that hears it and that station again looks at the routing instructions and seeing that there are still hops left it re-transmits the packet changing the routing instructions to be:

WIDE*,WIDE3-2

You will now see that the final "3" has been changed to a "2" which means the transmission has been through 1 wide hop so far and now has 2 left to go.

The next WIDE digipeater to hear the transmission will again look at the routing instructions and seeing there are still hops to go will re-transmit the packet changing the routing instructions to be:

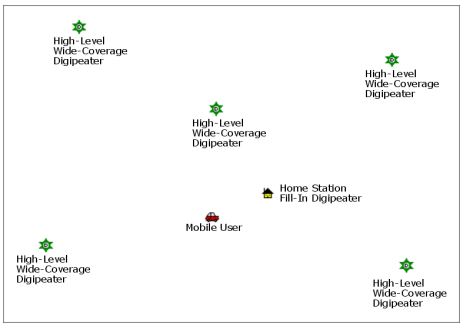
WIDE*,WIDE3-1

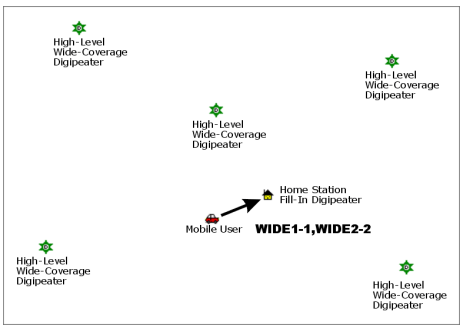
You will now see that the final "2" has been changed to a "1" which means the transmission has been through 2 wide hops so far and now has 1 left to go.

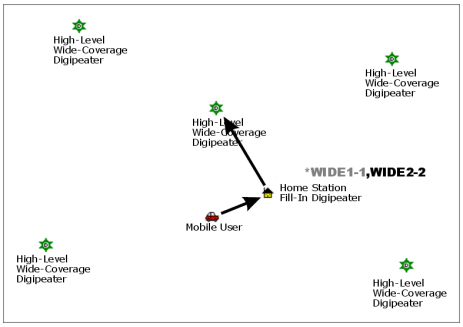
The next WIDE digipeater to hear the transmission will again look at the routing instructions and seeing there are still hops to go will re-transmit the packet changing the routing instructions to be:

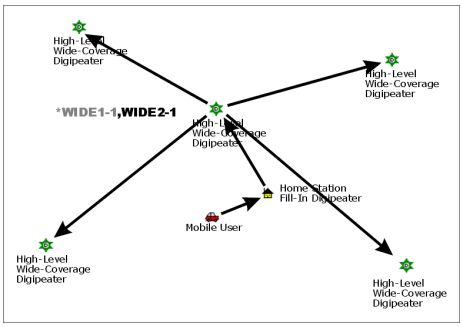
WIDE*,WIDE3*

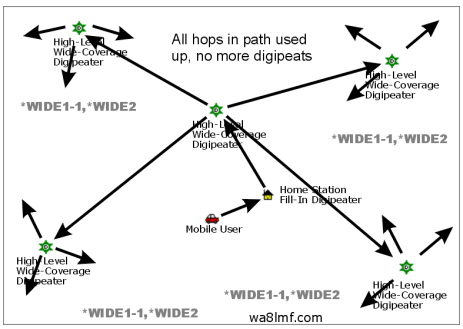
The final digit has been changed to an "*" indicating to any other digipeaters that hear this transmission that there are no more remaining hops.






High-Level
Wide-Coverage
Digipeater
High-Level
Wide-Coverage
Digipeater
High-Level
Wide-Coverage
Digipeater
*WIDE1-1,WIDE2-2
Home Station
Fill-In Digipeater
Mobile User
High-Level
Wide-Coverage
Digipeater
High-Level
Wide-Coverage
Digipeater


High-Level
Wide-Coverage
Digipeater
*WIDE1-1,WIDE2-1
High-Level
Wide-Coverage
Digipeater
High-Level
Wide-Coverage
Digipeater
Home Station
Fill-In Digipeater
Mobile User
High-Level
Wide-Coverage
Digipeater
High-Level
Wide-Coverage
Digipeater


All hops in path used
up, no more digipeats
High-Level
Wide-Coverage
Digipeater
*WIDE1-1,*WIDE2
High-Level
Wide-Coverage
Digipeater
*WIDE1-1,*WIDE2
High-Level
Wide-Coverage
Digipeater
Home Station
Fill-In Digipeater
Mobile User
High-Level
Wide-Coverage
Digipeater
*WIDE1-1,*WIDE2
High-Level
Wide-Coverage
Digipeater
*WIDE1-1,*WIDE2
wa8lmf.com

As one can imagine with each "hop" the coverage area expands. Normally you wouldn't want to configure your station to use 4 hops unless you needed to have the packet travel a long distance such as across the state or states. Usually WIDE1-1,WIDE2-1 is a good general setting to start with.

Here are some suggested APRS path settings:

WIDE1-1,WIDE2-1 - this will produce 2 hops and will take advantage of home digis. Use this in busy urban and suburban areas. Recommended for the majority of mobile operations.

WIDE1-1,WIDE2-2 - will produce 3 hops and will take advantage of home digis. Use this setting for mobile operation in rural areas with low APRS activity only.

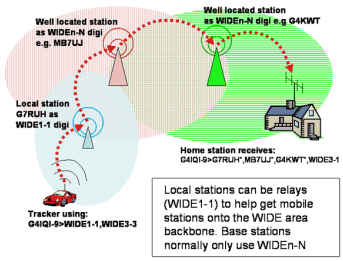
WIDE1-1,WIDE3-3 - this is good for interstate communications and is a rare setting

WIDE2-2 - shortest path string. This produces 2 hops by directly using two high-level digis.

Note: you may see some older documents that suggest using RELAY for the first hop configured like RELAY,WIDE3-3. RELAY is being phased out and it is now recommended practice to just use WIDE1-1 in place of RELAY

Also note: using just WIDE3-3 in the path may not work if only a home station hears the transmission. If a home station hears the packet it will not respond to WIDE3-3.

You can also substitute the callsign of your local digipeater instead of the first WIDE1-1
for example: K8YSE-1,WIDE2-1
But you must be within range of the station for your packet to be digipeated.



APRS Frequencies

Worldwide info:

North America 144.390 MHz Voice Alert = 100 Hz.
Argentina: 144.930 MHz
Australia 145.175 MHz Voice Alert = 91.5 Hz.
Europe, Finland, Ireland, Spain: 144.800 MHz Voice Alert = 136.5 Hz.
Japan: 144.640 MHz (KYUSHU region: 144.660 MHz)
New Zealand: 144.575 MHz
Norway 144.800 Mhz Voice Alert = 123 Hz.
Russia: 144.800 MHz

UHF & 9600 baud
Australia (VK): 439.100 MHz 1200 baud (in selected areas)
France: 144.800 MHz (1200) 432.500MHz. (was SSTV) Voice Alert = 136.5 Hz.
439.700 MHz 1200 baud
Netherlands (PA): 430.5125 MHz 1200 baud
New Zealand (ZL): 432.575 MHz 1200 baud allocated but little usage
Puget Sound, WA: 440.800 MHz 9600 baud
Puget Sound, WA: 144.350 MHz 9600 baud
US Kansas / Missouri: 441.175 MHz 1200 baud (secondary / special event, no infrastructure)
US Kansas / Missouri: 446.175 MHz 1200 baud (primary, with infrastructure)
US Nationwide Proposed: 445.925 (proposed by Bob WB4APR)

NOTE: Not all of these have been fully adopted in some countries.

Kiss Mode

Before we talk about hardware, what exactly is a KISS mode TNC and why do I want one?

When packet radio first got started most computers were not very powerful. Many HAM's wanted to experiment with packet radio but about the only software out there that all systems had was a simple terminal program. It was the lowest common denominator. So when designers developed TNC's they designed them to work with anything that had a terminal emulator on it. As a result they built nearly all of the intelligence into the TNC itself.

As computing power increased many packet programs were developed that offered much more functionality. However, the optimal design consideration was to create a single interface that could run on all TNC's that would look the same to the software programs. At the same time, because of the increase in processing power, it was possible to move some of the data packaging functions from the TNC to the computer. There were a couple of different protocols developed for doing this but the one that received the widest acceptance was "KISS" (Keep it Simple Stupid) mode.

Almost all recent TNC's support KISS mode and most software takes advantage of this. For these programs the first thing the software does is put the TNC into KISS mode. There are a number of advantages to this. First, the TNC is less complicated then past devices there are almost no parameters to set, you just turn it on and let it run. Because they are so much simpler they generally have fewer parts and are less expensive to build.

The downside to a KISS mode TNC is that it cannot be used with a simple terminal program like a conventional TNC can and you must use software that supports KISS mode however most of today's programs do support KISS.

Hardware

APRS Trackers –

- Argent Data Systems (http://www.argentdata.com) – Tracker3 (T3), OpenTracker USB (OTUSB)
- Byonics (http://www.byonics.com) – TinyTrak3+, TinyTrak4, Micro-Trak
- Fox Delta (http://www.foxdelta.com) – FoxTrak, FoxTrak-M
- various radio manufacturers with APRS built in

TNC's (modems) –

- Fox Delta (http://www.foxdelta.com) – Mini-TNC
- Kantronics (http://www.kantronics.com) – KPC3+, KPC-9612+
- MFJ (http://www.mfjenterprises.com) – MFJ-1276, MFJ-1278
- PacComm (http://paccomm.com) – TINY-2 MK-II, PicoPacket, SPIRIT-2, HandiPacket
- TAPR (http://www.tapr.org) – various, mainly in kit form
- Timewave (http://www.timewave.com) – Navigator, PK-232SC+, PK-232/PSK, PK-96/100, DSP-232+
- TNC-X (http://www.tnc-x.com) – TNC-X

Soundcards –

- almost anything will do but you will need to interface your radio to your PC and server software
- BuxComm (http://www.buxcomm.com) – Rascal
- Tigertronics (http://www.tigertronics.com) – SignaLink USB
- West Mountain Radio (http://www.westmountainradio.com) – RIGblaster
- MFJ (http://www.mfjenterprises.com) – MFJ-1275

Software

For Mobile –

none required, usually embedded in the tracker itself but you may need configuration software provided by the manufacturer to configure the trackers internal software

For Home –

- APRS Server Software – if you are using a sound card interface in place of a TNC
  - AGWPE, DireWolf, UZ7HO Sound Modem and others
- APRS Client Software
  - UIView, Yet Another APRS Client (YAAC), APRSIS32, Xastir and others

For Smartphones –

- iPhone: OpenAPRS, PocketPacket
- Android: APRSdroid

Links for WEB based APRS mapping from the APRS Internet Servers –

- APRS Fi – http://aprs.fi
- OpenAPRS – http://www.openaprs.net

Information from the following sources:

http://www.tapr.org

http://www.aprs.org

http://www.aprs.net

http://tnc-x.com/kiss.htm

With special thanks to:

N5TIM: http://www.qsl.net/n5tim/

WA8LMF: http://wa8lmf.net

G4IQI: http://homepage.ntlworld.com/ajmckinnon/index.htm