How APRS Works: A Simplistic Explanation of a Complex System

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Prologue

I have simplified the concepts contained herein. While factually correct, there are additional aspects that can modify and amplify the information or the way APRS works. It is up to the reader to decide if they want more detailed information.

What is APRS?

APRS stands for Automatic Packet Reporting System. It is a special way that ham radio operators can send messages and share information using their radios. APRS is a digital communication system based on AX.25[3], a communication protocol. Like all computer languages and protocols, it has grammar, structure, and rules.[1]

How Does APRS Work?

APRS sends small bits of computer data through radio waves. Your radio works with a computer or special device called a TNC (Terminal Node Controller) that changes the computer information into radio signals and back again.[1]

When you send an APRS message, it goes out on the radio frequency and other APRS stations can receive it. These stations can be other ham radio operators, or they can be special gateway stations that connect to the internet.[1]

APRS is delivered in real time, and if your device is not on, you will miss the message.[1] How far a message will travel depends on normal radio signal travel, your radio and antenna, and how you set up your APRS equipment.[1]

The "path" the packet is sent on will decide if the packet stops locally (1 Hop), regionally (2 Hops), or possibly around the world (3 Hops). A **hop** is a single retransmission of a data packet by a digital repeater, or "digipeater". Also important is whether that packet is picked up by an iGate (which sends radio signals to the internet) or a Digipeater (which sends signals between radio and internet).[1]

Just remember that many radios, Digipeaters, and iGates may hear the same message and forward that message on, based on how the path is set up.[1]

The Four Main Types of APRS Messages

APRS has four main ways to send information: Beacons, Bulletins, Text Messages, and Bots. Each one works differently and is used for different purposes.

1. Beacons

Beacons are like automatic announcements that your radio sends out on its own. A beacon can be set to automatically send over the air at fixed times without you having to do anything.[1] The most common type of beacon tells other people where you are located.

For example, if you have a GPS connected to your APRS radio in your car, it can automatically send out your location every few minutes. Other ham operators can see on their computer or

radio screens exactly where you are driving! This is really helpful for emergency workers, people on road trips, or during special events like parades.[1]

Beacons can also share other information like the weather at your location, how fast you are traveling, or which direction you are going. Some people set up weather stations that automatically beacon the temperature, wind speed, and rainfall in their area.[1]

The same radio may beacon one time a minute or one time an hour. If you are in range and your radio is on, you might get up to 60 beacons an hour.[1]

2. Bulletins

Bulletins are messages that go out to everyone in an area, not just one person. Bulletins are simply messages sent to call signs that start with BLN followed by a number or letter. Any grouping starting with BLN with a maximum of 9 characters is a valid Bulletin name.[1] Think of bulletins like announcements on a school loudspeaker - everyone can hear them.

Ham radio clubs often use bulletins to tell people about meetings, emergency situations, or important news. For example, if there is bad weather coming, someone might send a bulletin that says "SEVERE STORM WARNING - TAKE SHELTER NOW." Everyone with an APRS radio in that area would see this message.[1]

Bulletins are sent whenever the author chooses them to go. A rule of thumb is every 20 minutes, but some people send their bulletins every 4 hours.[1] What's different with bulletins is the ability to turn them off or filter them to only a few types. There are standard bulletins, and the major ones are BLNx, BLNxNET, and BLNA through BLNZ.[1]

In fact, many radios and smartphone apps allow you to adjust/mute ringers, vibration, reception and other aspects of APRS. What you can adjust is unit/software dependent.

3. Text Messages

Text messages in APRS work a lot like text messages on your phone, but they go through ham radio instead of cell towers. You type in who you want to send the message to and what you want to say.[1]

You can send a message to just one person by typing their ham radio call sign (like W1ABC-xx) and then your message. The APRS system will try to deliver your message to that person. When they get your message, their radio can automatically send back a receipt to let you know they received it.[1]

These messages are great for staying in touch with other ham operators when you cannot talk on voice radio, or when you want to send exact information like addresses or phone numbers that might be hard to understand over voice radio.[1]

Text messages are just sent. You cannot block text messages - you just have to ignore them if you don't want them.[1]

4. Bots

Today, we also have mailing lists in APRS, commonly called Nets. These are run by a computer program called a Bot.[1] Most Bots will just take a message and send it out to everyone on their list.

I created a special Bot that has "Store and Forward" abilities[2]. This means if you miss the message, it can be sent again at a later time.[1] This happens either when the Bot hears that your radio is on the APRS system or at a scheduled time.

Bots are different because you can subscribe and unsubscribe. So, if you no longer want the text messages, they stop.[1] You can also, on my program, turn the Store and Forward feature off or on.

Why These Different Types Matter

Each type of APRS message serves a different purpose:

- Beacons work automatically to share your location and other information
- Bulletins send important announcements to everyone in an area
- Text Messages let you talk privately with one person
- Bots create mailing lists where people can join or leave as they want

This variety makes APRS very useful during emergencies. When hurricanes, earthquakes, or other disasters happen, regular phones and internet might not work. But ham radio often still works, and APRS can help emergency workers know where people are and what help they need.

APRS is also fun for everyday use. Many ham operators enjoy tracking their friends' travels, sharing weather information, or just trying out this neat technology.

Conclusion

APRS makes ham radio more powerful by adding computer smarts to regular radio signals. With its four main features - Beacons that automatically share information, Bulletins that send announcements to everyone, Text Messages for personal communication, and Bots that create smart mailing lists - APRS helps ham radio operators stay connected and share important information quickly and easily.

The best part about APRS is that much of it works automatically. Once you set it up, your radio can share information and receive messages without you having to do anything. It is like having a smart radio that knows how to send text messages and share your location all by itself!

Whether used for emergency communication or just for fun, APRS shows how creative ham radio operators can be in finding new ways to communicate with each other around the world.

Footnotes:

1. Information from the provided APRS technical document
2. Github: https://github.com/wspivak/APRSBOT-SF
3. AX.25 Link Access Protocol for Amateur Packet Radio https://www.ax25.net/AX25.2.2-Jul%2098-2.pdf

Additional Sources:

- Wikipedia - Automatic Packet Reporting System
- Trail Roster - APRS Automatic Packet Reporting System
- HamRadioPrep.com - Beginner's Guide to Using APRS for Ham Radio
- APRS.org - APRS: Automatic Packet Reporting System
- APRS.fi - APRS Bulletin Information