APRS Network Guidelines

20 Guidelines for Increasing Network Efficiency

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ABSTRACT

The Automatic Position Reporting System (APRS) network is significantly different than regular amateur packet networks used for communication. Virtually all amateur packet radio communication uses the connection oriented form of AX.25 which provides error free communication. However, APRS uses the connectionless form of AX.25 which is an unreliable protocol in which lost packets are not detected. Therefore, to help assure reliable communication, operating practices play an important role. This paper provides a list of 20 guidelines that can be used to help insure efficient use of available bandwidth in APRS networks.

May, 1997

INTRODUCTION

The ability of amateur packet radio to provide error free communication is based on the AX.25 protocol. This protocol has its roots in the X.25 international standard. However, the commercial version does not meet all requirements of the amateur radio community. A critical limitation of X.25 is the protocol's insistence on knowing the source and target address. For amateur radio, this would make it impossible for a station to call CQ since the destination station at the time of transmission is unknown. To solve this problem, the Unnumbered Information (UI) frame was added to the protocol. It allows the transmission of packets without a unique destination address and does not require an acknowledgment.

Well over a decade of packet radio has come and gone, but it was not until fairly recently that the UI packet has given birth to a new type of network. The Automatic Position Reporting System[1] (APRS™) network is built entirely on the transmission of UI packets. Both fixed and mobile stations broadcast their position at intervals from once a minute, to once an hour using UI frames exclusively. However, since there are no acknowledgments for UI frames, lost packets are undetected. In addition, if good practices for APRS networks are not followed, packets are more likely to collide and result in inefficient use of the available bandwidth. Therefore, much of the challenge of reliable communication in these networks is selecting and using good operating practices to accommodate the wide variety of uses, while keeping within the limitations of the protocol.

APRS can report the position of a float in the Rose Bowl parade, the Olympic torch as it travels throughout the United States, or a Boston marathon runner. It can broadcast their position across town, and across the country. However, it would be impossible for the network to support position reporting of the daily commute to and from work for all amateurs.

The APRS networking protocol requires users to cooperate to assure efficient use of the available bandwidth. With these limitations in mind and the need to foster cooperation, the APRS community has developed some generally accepted practices. The guidelines listed below are the results of my operating experience and discussions on the APRS mailing list. An examination will show that many of the guidelines are common sense. However, some are more subtle and require a better understanding of the network.

Lastly, remember that these are guidelines and not rules. For example, a good digipeating path for one station may be bad for another. Factors such as your location and the amount of traffic in your area will play a major role in determining what works for you and your network.

APRS OPERATING GUIDELINES

1. Always use the MINIMUM digipath necessary to maintain communications to minimize channel loading and QRM. Remember, the APRS protocol uses UI frames which does not assure reliable delivery of packets.
2. Fixed stations (e.g., home APRS stations) should not beacon very frequently. Intervals from 20 to 60 minutes are common.
3. Fixed stations which broadcast weather related information may transmit at frequent intervals. The present standard is every 9 minutes.

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[1] APRS is a Trademark of Bob Bruninga, WB4APR

4. Mobile stations (e.g., moving APRS vehicles) may beacon as frequently as once per minute for special events or 3 to 5 minutes for routine mobile operation. Care should be exercised with local network conditions taken into account.
5. When a mobile station changes to a fixed station, such as when the station arrives at its destination, the beacon should be stopped or the rate adjusted to meet the new designation as a fixed station.
6. Use APRS VIA WIDE for your path if you are in a metropolitan area where you can hear a WIDE. Better yet, if possible, specify a unique digi (callsign).
7. Use APRS VIA WIDE, WIDE for regional coverage. In a metropolitan area with an active APRS community, you should get coverage up to 100 miles. Better yet, specify a fixed callsign in place of the second WIDE to get better coverage.
8. Fixed stations may set a path of APRS VIA RELAY, WIDE if the WIDE cannot be reached directly. Then when you find out who your local RELAY is, you should specify a unique callsign for the first digi.
9. If you have information for a national audience, use APRS VIA WIDE, GATE to reach an HF gateway. However, this is for rare occasions. The 300 baud HF data rate limits the number of mobiles nationwide to approximately 20. This path may also be used by long distance travelers with emergency or priority traffic that are near a GATEway.
10. Never use APRS VIA WIDE, WIDE, WIDE since it has the potential to totally saturate a channel with 27 copies of each packet. If you are in a remote area, this may be your only option, so the "never" may be changed to "seldom". Again, use a fixed callsign as the first digi if possible.
11. Although APRS supports keyboard to keyboard contacts, extended use of this communication technique is discouraged, especially on the HF where the information rate is 300 baud.
12. All fixed stations should set the TNC's MYALIAS to RELAY. This will vary between various manufacturer's TNCs, but some form of an alias should be set to RELAY. This is true even for mobile stations.
13. Mobile stations should use RELAY, WIDE or RELAY, WIDE, WIDE as a digipeating path for city wide coverage.
14. Do not enable the GATEWAY function of your TNC unless you are the only GATEWAY near your local WIDE. Before setting the GATEWAY function, local coordination with other GATEWAYs is encouraged. This is especially true when an existing GATE already serves your network.
15. Never digipeat on HF unless both stations attempting to pass data cannot hear each other but are known to be on-line. If you must digipeat on HF, use only one hop. This is typically for emergency or priority traffic only.
16. Whenever possible, use a direct path to chat.
17. If a direct path is not practical, use a specific digipeater callsign in lieu of a generic path such as RELAY or WIDE.
18. When events, information, or data are intended for a specific area, utilize a specific path by designating the exact callsigns of the digipeaters necessary for reliable communication.
19. As APRS popularity continues to grow, the potential for long-range VHF coverage is possible. Ask yourself if your information is of interest to someone a hundred miles away. If not, restrict the path.
20. Consult local experts or experiment to find the best route for your application. Remember these are guidelines and numerous exceptions exist.

CONCLUSION

The intention of these guidelines is to provide a working background for the development of efficient APRS networks. Despite the network's apparent simplicity, some of the practices may not be so obvious, even to the advanced user. Most of the guidelines are straightforward when one understands how the network functions and its limitations. Many others are not so obvious and still others may be the point for further discussion. When in doubt, ask the local APRS expert. If you have access to the Internet, the APRS mailing list is an excellent source of information. All you have to do is send mail to the **aprssig@tapr.org** mailing list where you will typically get an answer within hours from a large group of "Elmers" ready, willing, and able to help you.

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8. Wilson, Mark, "*QST Compares: GPS-Compatible TNCs*," QST, October 1995, pp. 68-71.
9. To join the APRS mailing list, send email to **listserv@tapr.org** with **subscribe aprssig FirstName LastName** in the body of the message.